The history of N rate recommendations in Minnesota: What farmers should know

Show Notes / Transcript
Advancing Nitrogen Smart, from the University of Minnesota Nutrient Management Podcast: "The history of N rate recommendations in Minnesota: What farmers should know"

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(Music)

Jack Wilcox:
Welcome back to episode 13 in our special series Advancing Nitrogen Smart from University of Minnesota Extension. Today, we're talking about the background and history of nitrogen recommendation rates in Minnesota. I'm Jack Wilcox in extension communications. I'm joined as always by Brad Carlson, Extension educator, and Dan Kaiser, Extension nutrient management specialist.

Brad, when farmers are thinking about the N rate they need to apply, what's some background information they might want to keep in mind?

Brad Carlson:
Well, one of the things that we've looked at over the last several years is looking at overall fertilizer cost. It's a study I've looked at. We've actually gotten a lot of mileage out of it. It's been on blog posts and some of our nutrient management podcasts and stuff I presented in the winter for quite a long time. A large percentage of farmers in Minnesota have used the MNSCU system for their farm records.

And one of the services they receive for that is their cash flows. And so they keep track of how much they're spending on various crop inputs and and other aspects, and then they can come up with a crop budget that breaks down what these expenses are on a per-acre basis. That information is annually put into a database that's accessible to the public. It's called Finbin. And what I've done for many years now is gone into the Finbin system and queried the southeast, south central, southwest, and west central Minnesota, so primarily the corn producing parts of the state.

And then I have excluded manure users because when we're talking about economic data, it can be kind of weird as far as figuring out how the price or cost of manure is actually attributed. So we just kinda threw that out to only look at commercial fertilizer. And what we've discovered consistently is that the most profitable farms are spending way less money per acre than the least profitable farms are on fertilizer. A lot of the searches you can do in that Finbin system is based on profitability class. So you can look at the differences between the farmers who made the most money and the farmers who made the least money or lost the most money and look at what the differences are in their expenses.

And we've seen very consistently that those numbers have run anywhere from from 15% to over 30%, and in some cases, over the last decade as far as the least profitable farms greatly overspending on fertilizer. And because I think a lot of people's inclination is like, well, these are really big farmers who are getting a price break. They're getting better deal on their costs and so forth. The area that we see a lot of these price breaks, most evident is on seed cost. And so when I look at the difference in seed cost between the most profitable and least profitable, those are only running anywhere from only about a half a percent to just a little over 10% difference.

So, it's a pretty interesting trend that the least profitable farms are greatly overspending on fertilizer. Now we don't really track what that's on, you know, as far as whether they're using expensive fertilizers, whether they're adding in multiple application costs. I mean, there's a number of different things that could be happening, but I think everybody realizes that one of the things on the list is just simply applying too much fertilizer. And so I think it's something a lot of farmers need to keep in mind that when you're buying fertilizer, you don't need you know, you're basically just flushing your money, and so that we do think that's a pretty significant factor in this phenomenon.

Dan Kaiser:
And as Brad, you said here, I mean, we just don't know where that money is being spent. Is it nitrogen? Is it phosphorus? Is it potassium?

I mean, we really don't know, but when it comes down to it, when it’s nitrogen, a lot of the discussions with water quality, really rate is the biggest elephant in the room when it comes down to a lot of the discussions, because everybody looks at rate and rate reductions in terms of helping reduce water quality issues. But you know, looking at profitability, we know looking at our recommendations where they're at right now, we've tried to tie profitability into that. I mean, it isn't a perfect system, but at least we can try to adjust for some factors like fertilizer price fluctuations in some of the recommendations.

Brad Carlson:
You know, and one of the problems, Dan, with coming up with the overall rate is we do know that it fluctuates. It fluctuates from year to year. It fluctuates even within fields, from field to field and so forth. You know, there's reasons for that, and that's actually one of the objectives

of our whole nitrogen smart series is to examine what those reasons are so that farmers can use the best science to make those decisions. You know, ultimately, the problem is we don't know what the exact correct rate or the exact correct best practices are until after the season.

And so, you know, you have to use the best information that's available when you're making a decision looking forward. You know, one of the things, I guess, we struggle with a lot kind of as an industry is that that rate is frequently used to mask bad practices. You know, we've talked about the fact that rate is only one of the 4 R's. And if you're using, for instance an incorrect fertilizer type, such as urea with an incorrect fertilizer timing, such as fall application. So if you're using that product in that timing application, you know, you're setting yourself up for a problem.

And so I'll occasionally hear people say, well, I did this practice and you don't recommend that, but it turned out fine. Well, then when you ask enough questions, you find out, you know, they apply to 30% higher than necessary rate. Well, sure. I mean, if you end up losing a third of your fertilizer, which I don't think anybody thinks that's a good idea, but you applied 30% too much, well, then it may look alright. You know?

And so, you know, occasionally, rate is used to mask bad practices, and and I think everybody's gotta be kind of aware of that that that that you can't just simply use the rate to compensate, you know, and say, well, I wanna apply, you know, this product at this time of year, and I'll I'll just apply whatever rate is necessary to do that. That's kind of getting us in a lot of trouble.

Dan Kaiser:
Me being around agriculture and growing up a lot in the nineties, I mean, we always had that kind of thought of insurance nitrogen, and I think one of the things right now we need to think about is what practices we're doing in that whole insurance nitrogen component is we need to be careful because with the scrutiny on environmental issues there, we need to be looking at trying to at least set ourselves up as best we can, and that's really what we're trying to do with a lot of the stuff we're talking about at Nitrogen Smart. Just walk through and just look at what options we have because we know there's a lot of scrutiny out there, especially with the recommendations we have. The reason we are set up the way we are with our recommendations is that we can defend it because the recommendations are based on actual data, and I think that's really important from the especially from the public standpoint because, you know, then we could show where these numbers come from instead of a lot of the older recommendations, especially a lot of the yield goal based recommendations. You just can't - looking at what we have now - can't defend a lot of those things.

So that's kind of an issue with it with, with the rate side of it is, Brad, I mean, you hit it right on the head is we really don't know and we know what the rate's gonna be within a given year and we know there's going to be differences from field to field that just having a starting point

that's at least low enough where we can make adjustments is really key because once the nitrogen's out there, we really have no way to take it back unless there's a plant out there that actively take it up.

Brad Carlson:
Well, one of the aspects relative to some of the environmental stuff, Dan, and, you know, you and I work with, with farm groups and and we work with state agencies. And, you know, we know that there's a lot of pressure related to environmental issues right now. And I hear a lot of conversation from farmers that I deal with, farmer leaders, some of our better farmers in the community who are really concerned about whether there's people out there who just simply aren't using good practices and it's costing the industry as a whole. And I know there's been a lot of peer pressure, good peer pressure to kinda clean some of this stuff up.

You know, one of the problems though with the rate of fertilizer is, there's really no way of knowing how much is going on. When an anhydrous tank is rolling across the field, when a spin spreader is going out there, you don't really know how much is being applied. And so, the peer pressure thing really, doesn't work from that standpoint. And so we really just need to kinda get into everybody's psyche as far as being in tune with this stuff. You know, the other thing I think we have to also kind of address is that there's been this long standing, almost, I don't know.

We can call it biased, but it's sort of in the consciousness of a lot of farmers, though. The U of M is too conservative. Like, you take their recommended rates, and you actually always need more than that, that they've, you know, they've constructed these rates to, you know, to to you know, they're in the pocket of the environmentalists or something of that sort. You know, really, if you look at the rate trial data, the majority of the time, our rate recommendations are accurate. I mean, when we've talked about the fact that those rates do vary from 1 year and one field to the next as far as what's actually necessary out there.

And so it's really not a situation of, you know, we're trying to be real conservative and, you know, there's, you know, the average farmer just needs to put more than that on. There's reasons to put more than that on, but you should actually have a reason. You know, not just simply because you think that we're conservative.

Dan Kaiser:
When it comes to technology, you look at a lot of the studies that are going on out there when you compare the the MRTN, or the maximum return to nitrogen approach that we currently use, is that if you look at the economics of it, the economics are pretty good compared to some of the other options that are out there. So it's interesting because everybody thinks they have their new best way to manage nitrogen and coming up with a new system, but when it comes down to it, I mean, looking at just that database or having data to generate your recommendation still seems like a good practice to do it just based on comparing it to some of these other things that are being utilized. So, you know, we know

there's variability. The issue though is how do we manage that and how do we assess that? And that's one of the difficult things with nitrogen is that it isn't easy to go in with technology and to help us really figure out rate decisions and adjusting rates in season because of some of the the things that we have going on with our soils here that can impact, particularly, residual nitrate.

And I think that's really the big thing with a lot of the technology and the sensors out there, while we've had a lot of failures of that is we just can't see the differences in our crop early enough where we can catch it where we haven't lost some yield. So that's one of the bigger problems with some of this stuff is that we haven't found that key piece of technology that can help us make some of these rate changes to our recommendations. And, until we get there, I mean, we're really relying on looking backwards and what's happened the previous years, try to compile a bunch of that data together and at least give the growers a start a starting point to start from and then make decisions on plus or minus what you think is happening in your field in terms of your nitrogen availability.

Brad Carlson:
Well I think it's important for farmers to realize that we're trying to stay on top of the technology, that we are evaluating this stuff, constantly. And if we are as open as anyone is as far as, this stuff being advisory on nitrogen rates. And so if we find something that we think that will work, we're gonna be all for it because it's gonna help us really kinda tighten things up. But, you know, I know that, you know, some of the stuff we did a few years ago was looking like some of these crop models. We're actually starting to get a better idea of what we needed for an overall nitrogen rate.

That being said, in most cases, it was telling us to even apply less than what we recommended, but they were accurate. You know, I think the thing is, some of this stuff may be coming back with the ability of artificial intelligence to start using some of our databases, and kinda looking at climate and some other datasets to make more accurate predictions. You know, we are not so stuck on a one rate situation. I mean, if we find this stuff to allows us to variable rate based on conditions, soils, whatever, we're gonna be on top of that, and that'll be fine with us.

Dan Kaiser:
Yeah. And it's interesting when you start getting some of these systems that actually recommend less N and whether or not growers are willing to apply less because I think a lot of them have a target in their mind what they really wanna be applying. And when some of these things come back and say they need less, how much do they trust it? Because that's kind of the problem with it, and I've been caught in some of my studies where you're looking good until you get towards the end of the season when it's too late to apply and then things start to run out. it's difficult.

So that's the main thing is we're making decisions ahead of what we know what's gonna happen environmentally and that's really a major problem with nitrogen. We're putting it on in the fall. We have no idea what May, June, July are gonna look like next year. And even in the spring, we just don't always know what's gonna happen. So it's you know, until we can accurately predict that, it becomes kind of an issue where we have to try to manage things as good as we had, and it's really more of a risk mitigation issue in the end.

Brad Carlson:
So if we look at what's actually happening out there, the last really good dataset that I've seen from National Ag Statistics on nitrogen rate in Minnesota, was it's getting about a decade old, so I guess that it'd be good to get maybe some newer data on that. That was actually collected via survey. I know the Minnesota Department of Ag does some things. It's kind of a little more focus-groupie kind of a situation, you know and and so there is that but anyway. If you go back to that last NAS report, we saw that roughly 70% of the corn and soybeans were kind of above what the U of M recommendations are. However, they weren't really significantly above.

We've seen those rates creep up in that amount of time as far as what our recommended rates are. Really, it was only about a third of the acres that were actually higher than or significantly higher than what we recommend today. So it wasn't that bad. The corn on corn is even less than that. You know, in general, we're seeing most of the application rates corn on corn are probably in line with what we recommend.

Obviously, there's some that's not. It's interesting to note though that we survey outcomes for attendees of our nitrogen smart programs. And consistently over the last decade when we've been doing these programs, about a third of the attendees are reporting that they're reducing their application rate by about 30 pounds an acre. And so, the 30% number is curious because that's kinda what the ag statistics says was over fertilizing. And I think it's important for everybody to recognize we are not stressing that people should be lowering their rates. We're stressing that you should figure out what you need to do, what's most appropriate for your farm, and do accordingly. If you come to the determination that your rate's too high, then lower it, you know, by all means. But that's not the key message for us. And so it is interesting that about a third of the people attending these programs are going home and saying, you know what? I think I'm putting on too much, and then they're reducing their rates.

Dan Kaiser:
That's one of the things with environmental issues, when we start talking about loss to tile lines, it doesn't matter if it's a 100 pounds, your optimal rate, 150 or or 200. I mean, generally, if we're at or near that optimal rate within a field, we know that typically that there is little risk for greatly increasing the loss, particularly ground and surface water. That's what a lot of the data tells us. I mean, if the plant's gonna utilize it, it really will if you look at the risk for loss, will be less.

And that's one of the things when it comes to the rate with corn is that we know that there's no penalty for over application. So that's where it makes it challenging because a lot of other crops, we have to manage things tighter to the best to make sure that we're not reducing quality or yield. I mean, sugar beets, potatoes, small grains.. Cotton. I mean, it's I mean, most other crops, nitrogen will adversely affect the crop if we over apply it. So with corn, that's just not the case. You can put on as much as you want and, you know, typically, your yields are gonna plateau out at a certain point, but you're not gonna increase it, you're just gonna be spending more on nitrogen.

So when it comes down to it, N rate, a lot of times, is used to compensate for other factors and source and timing. Those are really two things, I think, that are the major challenge, because looking at it, we know that not all sources are the same. So if you put fall urea versus fall anhydrous, it's likely gonna take a lot more nitrogen to raise the same crop if you even can with fall applied urea. It's why we don't recommend it because there's more loss pathways for it. So, you know, many times, growers might bump the rate up just because of some of those issues, but that's one of the things we need to really start thinking more about because you want a lot of extra scrutiny and that's what's gonna happen especially when you start talking about having to increase your rates to an audience outside of the farm, or a lot of farmers. When you start talking about increasing rate because of the different practices you're using, it just becomes more of an issue.

Brad Carlson:
Well, in another area, Dan, and this I remember earlier in my career, I used to hear this a lot. We recommend using a nitrification inhibitor with fall anhydrous applications. You know, I used to have farmers say all the time, well, what's the cost of that per acre, and how many pounds of nitrogen can I buy with that same amount of money, not be fooling with a nitrification inhibitor? And and and I know those decisions were made a lot in the past, but I think you're also acknowledging if you're doing that, you know, whatever that extra rate of nitrogen is, that's the amount of nitrogen you're writing off. Like, oh, I'll just lose this amount, and that's getting us in trouble. You know? And so that's not a trade off that should be made anymore either.

Dan Kaiser:
Yeah. And when it comes down to it, if you look at it, and that's where we get a lot of this data, we a lot of times we're measuring residual nitrate after the crop is off the field, and a lot of times that excess nitrogen, you can measure it somewhere in the soil profile 1 to 1. With what you over applied to what is still there, and that's where a lot of the risk comes in because there's nothing there to take it up and when we get a lot of our tile flow starting in, you know, late April to May to June, since even with corn in the ground, it's not taking up much nitrogen at that point. We know we're gonna have a lot of that nitrate being flushed out if we've got a significant amount of drainage that's pulling that nitrate through the soil profile to the tile lines.

Brad Carlson:
So we think about how we come upon the exact rate that we're going to apply. It's really just a math equation. You know, what you're looking at is the residual like you just mentioned, that carryover nitrogen. That's normally not a thing. However, it can be. You know, if you sample it and it's there, it really is there. Then it's a question of is it still there by the time the crop needs it, and that's a different conversation for a different day. Adding in mineralized nitrogen out of the soil, which can be very difficult to predict, however, also a very real factor. I mean, when we look at on average that we're growing about 70%, 75% of our crop, with no nitrogen applied, you get about 75% yields on average in a lot of the corn soybean fields.

We know that the mineralized nitrogen supplying a very significant amount of nitrogen, not a number that you can just simply add to the equation but it exists. Fixed nitrogen, maybe not such a big deal. Maybe we'll get into a situation in the future where we're using more cover crops, so that could be something. Atmospheric deposition isn't really a big deal either. Probably about 10 pounds an acre is falling out of the sky, probably either with thunderstorms in the, in the summertime. Otherwise, there can be a little bit on dust, that's coming down with the rain and so forth.

And then subtracting off the loss processes as far as the denitrification. First of all, you have to have nitrification and then following that, there's either leaching or denitrification. And so what we're trying to do is avoid stuff on that end of the cycle and account for the stuff on the front end. And then from that, we can start coming out what our actual rate is. Now we know that the percent organic matter in the soil does correlate to how much nitrogen the soil is able to supply.

However, we can't actually come up with a real number on that as far as, you know, making a recommendation based on soil organic matter. You know, the problem with that is the places where we tend to see the highest levels of soil organic matter are the wettest parts of the field which are most prone to nitrogen loss. And so, it's not just simply a factor of calculating out the percent organic matter and then saying, well, the soil can supply this amount of nitrogen. Now, on the flip side where the organic matter is really low, we can typically reliably say that we need more nitrogen applied in those areas.

Dan Kaiser:
And that's one of the things, if I'm in a field that's well drained, he probably could make some generalizations on organic matter. The areas that are probably higher on organic matter would probably take less in, but, I mean, you hit the nail on the head, Brad. If you look at where our real high organic matter fields are, those are depressional areas that's they're wet and saturated that really favor denitrification, and it's really the reason why they're high organic matter is because you don't get a lot of breakdown of the organic matter because they're anaerobic or they lack oxygen most of the year. So that's one of the reasons that we don't factor that in.

And I wanna go back to your comment on fixed nitrogen. Sometimes this will come up with our MRTN recommendations. Growers will ask how do I take my soybean credit off of that recommendation? And the thing is you don't need to. If you look at our recommendations, we have separate ones for corn following soybean or corn following corn. And that perceived soybean end credit is already built into the system because we're conducting experiments on fields under field conditions. So a lot of these pluses and minuses are factored in already to that rate recommendation and all those studies that went into it in the calculator itself. So you don't need to know a lot of this, at this point.

I mean, maybe, as you said before, we can utilize some of these things with AI at some point. It could help us better generalize or generate different rates to get into that concept of variable rate nitrogen at some point, but we're really not there. I know there's a lot of criticism because of the fact that we're just recommending one number, but if you show me anybody out there that can be any more accurate, I would be surprised. Because, especially here in Minnesota, the, the some of the tools and the options we have, they just aren't as good as I'd like to see for being able to generate a variable rate recommendation to try to factor in a lot of these different components for determining changes in nitrogen need across the field within a given year.

Brad Carlson:
Another area that's worth discussing here when we talk about overall rate are some of the soil health factors. I know that there's some of the proponents of soil health. Some of the stuff has been greatly embellished. And, I mean, you've heard people say, oh, if I get my soil health in check, I don't even need to apply nitrogen fertilizer. I think that's baloney.

We do know, though, that compaction causes problems that restrict root growth. It restricts access to the nutrients in the soil. So the lack of compaction, getting your soil better with better structure, better aeration, better root growth, root exploration of the soil profile is going to benefit a lot, including the increase of soil organic matter and so forth. You know, again, unfortunately, we're probably not in a situation where we can just, you can't assign a number to soil health and therefore, that's very difficult to correlate that to overall crop needs either. I mean, if we were able to do that, maybe if we had a number for a soil health factor, maybe we could start correlating to what the crop response is to fertilizer rates but we don't have that.

You know, again, Dan, we've talked about this a couple times. Ultimately, AI might help us with this just simply by analyzing actual yield data. If you're able to collect enough other soils data, you know, maybe it's going to be able to start making some correlations there, and we can start dialing in on this.

You know, I think the key, though, and this is something I talk about a lot when we do our variable rate nitrogen talk is, in a lot of cases, what you're going to discover is we're applying enough nitrogen most of the time in most places. And so what really stands to be gained

here is reducing the rate, not increasing the rate. And so a lot of the time, that's actually what we're going to end up talking about in the long run, when we get better technology is actually putting on less, not putting on more.

Dan Kaiser:
Yeah. No-till every once in a while will be brought up because I know North Dakota has some recommendations where they recommend less N for no till. We don't do that here, because we don't have the data behind it. A lot of that data in North Dakota was western North Dakota where they have moisture issues, so there could be some interactions with moisture retention in the no-till impacting mineralization out there. But, if that is the case, I mean, it's something that takes a while and that's one of the things with these soil health factors. It isn't something you're gonna see immediately. It's gonna be a long term investment in some of these practices, I think, before you start seeing some of the benefits of them.

Brad Carlson:
Yeah. And on that same token, when we look at just other climate factors and how they impact the overall rate needs of the crop, We know that obviously the amount of nitrogen supplied to the crop through mineralization like you're just talking about is climate dependent, whether you're in there out in western North Dakota or whether you're in southern Minnesota. Those factors are important. However, again, we don't have the crystal ball to tell us exactly what the year is gonna bring us in the spring when we're making that rate recommendation. So it's very difficult to take that into account.

I think the thing that's worth noting is if we have a cold year and we mineralize less nitrogen because we've had cool conditions, you can't fertilize your way out of a poor growing season. So, that's probably not worth worth thinking out a lot about. Total precipitation, of course, affects the loss processes, something that we've discovered, you know, painfully in a couple of years. We get great levels of precipitation in June when most of the nitrogen is nitrate and we can either leach it or we might denitrify it if we pond. Again, those are very difficult things to predict like you've been saying, Dan.

Really all we can do is kinda react to them when they're happening in season and kinda go off of our averages. I guess it's important to remember that a lot of the application techniques that we talk about such as split applying or avoiding application until spring and so forth are techniques which will mitigate some of that. That'll keep more of the nitrogen in the ammonium form instead of the nitrate form, or just simply delay its presence at all to try and avoid some of those loss times.

Extreme wet and dry conditions also impact if you get soil compaction. It's gonna make that a whole lot worse. Again, you don't fertilize your way out of soil compaction. You need to manage that some other way. Another factor that happens in some of these dry years we've had the last few years is to recognize if the nitrogen's all in that top 8 inches of soil and it’s bone dry, we're not getting a lot of nitrogen movement into the plant. That's because we're

not getting water movement into the plant. That water when the nitrogen is in the nitrate form, it's moving into the plant through water diffusion. When there's no water up there, we're not moving it in, so there's not a lot you're gonna do about that. Adding a higher rate, just would have increased the amount of nitrogen present that still isn't gonna get into the plant, and so you can't fertilize your way out of a drought, either.

You know, as far as length of growing season, you know, we've had people suggest that as it gets if the climate keeps getting warmer, you know, we're gonna adjust some practices. It's hard to see that really because the days start getting shorter and even if it avoids freezing earlier in the year, we haven't really been able to make any great changes in our crop growing season.

And then I think one of the last climate factors we've already talked about this once is following a drought year, a dry year, we do expect to see residual soil nitrate that's built up and retained in the soil profile, provided it stays relatively dry. It doesn't saturate until next year when the crop is growing. You could take a soil sample and take that as a credit.

And some people say, well, you've got you know, you just talked about a lot of these different factors. Well, show me the data so we can make a reliable recommendation based on some of that stuff. I mean, the problem with it is, you know, we can quantify this stuff, every year, we can you know, you do a rate trial and explain why it was this or why it was that, but it's always backwards-looking. You know, ultimately, describing why something happened in a backward sense is not the same as making a prediction looking forward. And so, you know, ultimately speaking, you know, that's kind of where we want to be headed with some of the technology is to be predictive in nature. But at this point, we really haven't haven't been able to do that.

So let's kind of wrap this up by kind of we've talked about all this background information and let's just do a little bit of a history lesson on how we make our rate recommendations. If you went pre-1974, we use that old equation of 1.2 times the yield minus some nitrogen credit and that's your rate to apply.

Astonishing that we've got people still using that. You know, some people occasionally will say, oh, you guys are way behind as far as technology. Well, who's way behind if somebody's using a 1.2 times yield math equation that we abandoned in 1974? That was replaced in south central and southeast Minnesota in 74 and and the entire state, it was dumped in 1982. And, you know, one of the things we talk about some of our other nitrogen smart classes is the fact that the actual amount of nitrogen on a per bushel basis in grain has gone down to almost half that amount. I mean, we're looking at, like, 6 tenths of a pound of nitrogen per bushel grain, not 1.2. And so if you're using that formula, it's a recipe for grossly over fertilizing.

Starting at that time in the late seventies, we went to this yield goal system where we simply looked at what the productivity of the soils were far as the expected yield, and then we just put the numbers into a table. You just simply look them up, you know, as far as rate recommendations were concerned. And those changed a little bit from year to year.

We dropped the term yield goal in the year 2000 because too many farmers were using that as, like, this is what I'm shooting for. And that was not ever what the recommendations were intended to be. It was expected to be more of this is realistically what you're going to get for yield. So we turned that, from yield going to expected yield in 2000, but that whole system was dumped 20 years ago now.
So the MRTN system came into place in the year 2005. And the reason it exists is, well, for a few things. It wasn't so much that there was different rate recommendations between the states, because we know that the climate and the soils are different between states, and so you expect differences between the states. But probably a bigger problem was the states were using different methods to determine what their rate recommendations are. And there started to be a lot of questions like, well, Iowa does it this way and Minnesota does it this way and Wisconsin does it this way. Who's correct? Maybe if you did it the way they did it, you'd come up with a different number and so forth.

So there was an effort made to use the same methodology across the states in the north central region in order to come up with our rate recommendations. Also at that time, 2005, those probably were the first time ever there was a big run up in nitrogen prices and we were getting questions from a lot of people whether there should be adjustments made in our rate recommendations because of fertilizer prices. So this system incorporates economics into it and, because it is using real data, it adjusts on an annual basis. And so we have actually seen the results of the MRTN method, the recommendations produced by that system, increase over the years as the data increases.

Dan Kaiser:
That's one of the things too with the yield factors. I mean, I know it's still out. There's some growers that still use it. If you look at the 0.5, 0.6, in many cases, if you multiply that out, it comes within the generally profitable range of what we have for the MRTN, so you're really no better. It's kinda what I mentioned before is everybody has their own secret and it generally is no better than what the MRTN has.

And the other thing too is if you try to use that for variable rate, you mean, say you've got eroded hillside with poorer yields versus a lower area with higher yields, what you're gonna end up doing is probably grossly over fertilizing the higher yielding area versus and under fertilizing the lower yielding area because that's one of the things that it comes down to, a lot of people will focus on what's called nitrogen use efficiency, which is generally that same factor of pounds of N per bushel that when it comes down to it, we tend to get greater NUE with higher yields.

I mean, it just tends to happen with that and it isn't, again, that there's a direct correlation between maximum yield and nitrogen requirement. I think a lot of times, actually, it's the opposite. Some of the lower yielding areas probably need more and the higher yielding areas need less and that's what we're looking at now. I think, moving forward. I think it just makes makes more sense to kinda look at it that way, but it's I think it's a little counterintuitive to what other people think just because a lot of people have it ingrained in their minds, I produce x, I remove x and it it should need more than if I produce y, which is less. So that's one of the things, again, looking at the data, it's really not as much of a function of the maximum you can produce.

Brad Carlson:
Yeah. It kinda goes back to what we talked about a little earlier about the ability of the soils to supply nitrogen through mineralization. So in a lot of cases, what you're finding out is that your excellent soils - your best soils are able to produce more corn than your poorer soils. Every farmer knows that. And so you can't just simply pour fertilizer on and equalize those yields out. Your best soils are your best producing, and it's oftentimes, independent of the nitrogen rate you apply.

So this kinda, this kinda gives a broad overview of where we've been with determining nitrogen rates. We've kinda brought it up to the point where we're discussing the maximum return to nitrogen. That in its great detail is going to be the subject for a future podcast. And so I think, hopefully, that we gave you all a little bit to think about when you're determining nitrogen rates, understand a little bit of the history and the background of what all goes into determining the total nitrogen rate you apply.

Jack Wilcox:
Brad Carlson Extension educator, and Dan Kaiser Extension nutrient management specialist thank you very much for the information.

Do you have a question for either Brad or Dan? Send an email to nutmgmt@umn.edu. Thank you for listening and we look forward to seeing you next time.

Advancing Nitrogen Smart is proud to be supported by the farm families of Minnesota and their corn check-off investment through Minnesota Corn.

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