Agricultural Modeling Team (AMT) Meeting

July 12th

09:00 AM – 11:00 AM

Meeting Materials

Summary of Actions and Decisions

Decision: The AMT approved the June 2024 meeting minutes.
Action: Tom will work to clarify mineralization rates for the group.
Action: Tom will incorporate AMT feedback to further test modifications to the manure application curves used in CAST.

Meeting Minutes

Statement of purpose:

To evaluate the crop yields manure applications and data sources in CAST and discuss potential alternatives for Phase 7.

Decision items:

1. Approve the June minutes

   Decision: The AMT approved the June 2024 meeting minutes.

Announcements:

- None

Introduction/Recap: 09:00-09:15 [15 min (Tom Butler, EPA)]

Tom provided a quick recap of AMT progress in June.

Crop Yield trends 09:15- 09:45 [30 min (10 min presentation 20 min discussion) (Joseph Delesantro, ORISE)]

Joseph Delesantro, ORISE, discussed progress being made to improve long term crop yields. This included multiple potential approaches for estimating yields from the Five-Year Census of Agriculture using correlations to crops with existing annual yield data. Informational Update.

Discussion

Scott Heidel (in chat): Survey and census seem lower than modeled.

Olivia Devereux: I have a couple questions for the implication of this. We are dealing with county level data coming in, and we know that some farmers are going to be applying more than other farmers within that same county, so we know it's not a farm scale model. So, we're looking at what is happening on average across the county, and I just don't understand how this affects that. We look at crop rotations and corn, beans, wheat, and not every farmer is on the same rotation schedule. So, it's not like 1993 was all corn and 1994 was predominantly all wheat. We

know that. Does this help address the rotation issue of row crops with small grains, or not, or does it have no effect? Knowing that it's a county scale model and we're not dealing with individual farms with different management, different BMPs of course, but not different nutrient applications, how does this smoothing and averaging work? What is the implication?
Joseph Delesantro: This is county scale, and the model is actually fit at the growth region scale because, if we're just trying to fit the model to the data at the county level, the census responses can be wild at the county level. This is doing a fair degree of averaging. What we're presenting here is what we expect that average yield to be in that county based on the yields of the growth region. So, we're accounting for the effects of weather at the county, but we're fitting this at the growth region, taking into account the averaging of the yields across that. I don't think there is really the potential or the goal in this work to be capturing any sort of farm level variation. But we hope that that is averaging out at some degree at the county level where CAST is ultimately operating. In terms of the crop rotation, I don't really see how this would affect that.
Olivia Devereux: That was helpful, and it gets at, with the crop rotation, that this just really isn't targeted to address that, and it doesn't need to be. I just wanted to understand a little bit deeper.
Nicholas Moody (in chat): What about the consideration of inputs and crop price related to trends?
Joseph Delesantro: The way I think about this being most useful is that, as one crop's yield is increasing dramatically, and maybe another crop's yield is not, we're making sure that we're capturing that difference in space. So, one county is growing a bunch of a crop where the yield is dramatically increasing and the next county is growing a different crop where the yield isn't changing, then this allows us to better split that nutrient application saying that, ok, that county with a lot of corn and that very dramatically increasing crop yield is likely to need more nutrients.
Alexander Soroka: I noticed in the earlier period of the record that our model points, survey yield data, and census points are relatively tight clustered but, as the magnitude of yield is going up, it looks like we have a little more variation in between the model data and survey yield data. I was wondering if you see that at multiple sites and any idea why we have greater variation in the last 10 to 15 years?
Joseph Delesantro: Great observations and this is that topic that Tom and I are going to do some more analysis on and talk to the USDA about because, the short answer to your question is no, not really sure what this is about. I want to make very certain that I didn't make a mistake somewhere and then we'll take this to NASS and just say, hey, what is going on here, regarding where the survey and the census disagree. The estimated annual yield, the modeled year, generally tracks well with the census. It's being fit with the census. On this plot, we do see that we have some higher yields towards the end here and we think that might be reasonable because we know through some analysis that Mark Dubin did, that some of the last handful of census years have actually captured slightly lower yields. This is not the case that the modeled is slightly higher than the census across all crops. But what is fairly consistent, is that the survey seems to be a little lower than the census in the past 15 years at a lot of crops and counties.
Alexander Soroka: Just to follow up on that, if we're looking at the difference between the model point and the survey year points in the beginning of the record, they look like smaller differences, but that might just be that the yield is smaller. Whereas, later in the record, the

yield is quite larger, but the ratio between the two may be the same. It could be worth looking at. We may just have higher metabolism at play so you can have greater swings.
Mark Dubin: The yields have a lot of effect based off the rainfall. Another thing to think about is laying over precipitation trends over the data. That might give you some feeling about the variations. Maybe we see more volatility in the last few years than we did earlier. We already knew that some of the census years were droughts, so we see those pretty depressed yields from those. The other thing is that the ag census differs from the survey in that it does include a larger percentage of the population. So, the survey is going to be a more limited group of people that are being interviewed or questioned. NASS has always said the census is the stronger of the two. So, just a piece of information that we sort of looked at before.
Nicholas Moody (in chat): What about the consideration of inputs and crop price related to trends?
Joseph Delesantro: We do take some data from the survey economic layer as a predictor. We don't necessarily use all of these predictors. So, these are sort of optional predictors and then we use this Bayesian information criteria method to select which of these possible predictors are included in the model. But, there is a column for oil/gas prices, and so we do use that as a potential predictor. We also use some of the price received data. This is not at the county scale, of course. I think maybe this is state or might even be national, but we do use that as well. So, those aren't necessarily helping to predict spatial trends, but they should capture some of those economic impacts in time. I will say that these sorts of economic predictors here are not often chosen by the method as significant predictors. The model is checking to see if they have predictive power.
Nicholas Moody: Any consideration of localized fertilizer prices and the effect on trend lines? I know that's more of a year-to-year type consideration.
Joseph Delesantro: No. If there's a good source for that data, going back to 1950, that would be great. I don't remember seeing that in the survey, but it is a big sprawling data set, so I'll go check to see if there is fertilizer in there.
Patrick Thompson (in chat): How are nutrient losses correlated to application rates?
Tom Butler: That's something that comes a little bit after this. So, this isn't necessarily explicitly talking about the application. It's talking about the yield attracting application. I'll go through a little bit more the actual application process, and I want to talk a little bit about some loss terms later and that might get at your question. Joseph's part is a building block that allows us to get there, though.
Ken Staver: Tom, just to circle back to where we started and why we started- we have this fertilizer data that is an absolute amount of fertilizer, and losses are partly determined by the difference between application rates and crop removal. If we're going to have fertilizer, yes, the yields attract fertilizer, but all the fertilizer is going somewhere. So it's not like, if the yields are lower, we just attract less nitrogen. If we have a fixed bucket of nitrogen, it's going somewhere. We're in this cycle of the fertilizer numbers are going up and the yield numbers didn't seem to be where they should be. That's really why we started down this path. So that's why it's really important that we get the yield right because, otherwise, if we're underestimating yield, then we're basically having this excess nitrogen that ends up in the model generating higher losses.
Tom Butler: You made some really good points there, Ken, and I'm not going to dispute what you're saying in terms of the importance in crop yields. In terms of what we are talking about for application, yes, the yields are drawing those, and so this definitely has a role to play in that. But

the actual application rates and the processes are something that I'm going to talk about kind of a little bit differently from this.

Ken Staver: The question that Patrick asked about the effect of applications on losses, it's the effect of the difference between applications and grain uptake. That's the effect that drives losses, right? So, its not the application rates. If yields are high enough, more application doesn't make yield go up.

Gary Shenk: It's not exactly correct that we add up all the inputs and add up the uptake and we just look at the difference. Each additional pound of manure fertilizer increases the export, and each additional pound of uptake decreases the export. It's related to the balance. We don't just look at the balance. We have imports related to export and uptake related to the export, negatively. So, your basic point is the same, just that one nitpicking part.

Ken Staver: One final point of clarification. So, the difference between the orange line and the red line is just, in the red line, you go to the three highest yields in the last 5? That's the difference between those two lines?

Joseph Delesantro: You could think about it conceptually. Mathematically, it is done with a residual weighted regression method. But, yes, conceptually, that's correct.

Manure Applications in CAST 09:45-10:30 [45 min (20 min presentation 25 min discussion) (Tom Butler, EPA)]

Tom Butler, EPA, shared some potential improvements to the application of manure to the land use of grain with manure. Potential changes were shared and discussed amongst group members. Informational.

Discussion

Ken Staver: The only thing that I think seems useful to point out is the inorganic is a one-to-one nitrogen unit based on crop need. When you're using organic sources, there's an extra chunk of N going in that system that's not plant available. When you look at total N applications, because people are really getting in on this mass balance thing now, when you're going with the organic sources, you're getting higher N application rates for the same amount of plant available N. You want to make sure you are talking about plant available N versus total N.

Tom Butler: That's a great point, Ken. Just to reiterate, in terms of this infographic here, we talk a lot about applications of plant available but that does come with more than that because 100% of manure is not plant available, it is a fraction. So, you end up applying more versus that fertilizer. If you are thinking about this balloon analogy, here, in terms of that application, we only have real data for certain times. I just want to make a comment that when you apply the fertilizer, we don't necessarily have a fixed amount of fertilizer for years after which we have the data. In phase 6 data, we currently have through 2020, but we're in 2024. So, we take the relationship that is given here by our application in the last year that we have known data and, when we get updated yields, we carry the relationship of that application forward. So, that's kind of why we are not necessarily doing a crop growth model. It is, again, to highlight that it's not necessarily based off a fixed amount forever. If we don't have that data, we need to use the relationship from the last year that we have a known source of data.

Bill Keeling: I'm just wondering how this works with, say, soybeans. Soybeans still have a need for nitrogen. It may not be supplied via manure or fertilizer, but the need is not zero.

Tom Butler: You are absolutely right, and I'll talk about that. Give me one slide. Great question, though.
Nicholas Moody: What about the consideration in the dry year where yields are down but there's also increasing volatility because of nitrogen gas off to the atmosphere rather than being lost to surface water or anything. Is that being considered?
Tom Butler: I'm going to kick to Gary. Gary does a lot of that with the modeling side for those physical properties.
Gary Shenk: The management model is weather averaged. So, the fact that there is an average amount of volatilization for weather, is taken into account in the overall balance of what's applied and what comes out. When the dynamic model is running to load the stream model, it doesn't explicitly account for that I don't think. The overall process that you are talking about is accounted for in general, because we have some volatilization which occurs that subtracts from the mass balance, but we don't necessarily have that year to year. We just weather average.
Tom Butler: Does that touch on your question?
Nicholas Moody: It touches on it a little bit.
Tom Butler: If you need more, please feel free to email myself. I can get you in contact with Gary or whoever else offline.
Bill Keeling: I keep hearing mass balance but, if I'm not mistaken, we are not really accounting for years two and three residual nitrogen, or phosphorous from year one manure application. In the real world, that does happen.
Tom Butler: Yeah. I understand that to be correct. I'd wait for Gary to be sure.
Bill Keeling: I just don't see how you can do a mass balance if you're not truly accounting for the true residual, for what's applied in year one is not utilized all in year one.
Ken Staver: The phosphorous deal is a little different, and the one thing that the model tries to do, and this is fairly new, and it's been a struggle because of the availability of comprehensive high-quality data, but the model tries to deal with soil phosphorous levels. So, it's trying to capture some of what you are talking about if soil P levels are going up, it's a thing that accumulates over the long term. So, it's not down to the year-by-year basis but, on the longer term, bringing in the soil P levels captures the long-term mass balance effects.
Bill Keeling: Except the P levels we have are based on very limited and sketchy data in Phase 6. Half a dozen samples over twenty years and that's what is used to determine a county's total P load. It's a bit thin. I was thinking residual nitrogen and the mass balance of nitrogen, more so than phosphorous.
Tom Butler: Data is good when we can get it, and I know Olivia here has put a lot of effort in to try and get that and there's a pretty specific method of using information with a statistical framework to try and fill those gaps. More data would be better. In terms of the nitrogen, I want to try and reiterate that, when we talk about CAST, we are talking about long-term average behaviors. So, I think we are trying to accomplish some of that, and we talk about loading rates and other aspects for nitrogen, to encompass some of the history for things like a grain with manure land use.
Bill Keeling: As I understand it, we're not really dealing with residual nitrogen. If you calculate a plant available nitrogen for year one, you're providing excess organic nitrogen that will be utilized in subsequent crops as residual N, so I'm not sure we're really capturing a mass balance currently is what I am trying to say. Will we be in the future?

Gary Shenk: That's a reasonable point, and I remember a conversation in the AMS and, essentially, the idea is that we are simulating the long-term effect of a given state of management. So, if you're in the 2020 scenario, you have some percent of the manure that was applied this year, some percent of the manure that was applied last year, and then two years ago, let's say. So, I think its all in how we calculate the plant available from manure. If we say that the plant available nitrogen for manure is 50%, does that mean that 50% is available this year, or 50% is available ever, essentially? So, if we add up the first three, or four, or whatever it is years of plant available and call that plant available of manure, then that is a reasonable way to model this. So essentially the plant available from manure is plant available from what was applied this year, last year, and the year before. I don't actually know how we came up with our plant available fraction. Is it just this year, or is it the past several years? If anyone else knows that that'd be great. But that's something to find out for sure.

Ken Staver: The way it's thought of in nutrient management world is, it's in this year because you are having to meet this year's crop need. But, if manure was applied last year, then your nutrient management plan is supposed to account for a much smaller fraction of last year's application. But it gets more complicated because, often times, you rotate into soybeans, so that second year N is just compensatory for N fixation. The second year's mineralization, the soybean crop is there, so there's no application anyways for the crop, but there is available N that the soybeans use. So, the bringing in the mixing of grasses and legumes is sort of where the whole mass balance thing and fixation thing really gets complicated. In year two the model should be reducing N fixation because of the second-year mineralization of organic N, but we don't do rotations that way. In continuous corn you can do it that way in a very sort of precise way. I just think one of the things about having these manure land uses is the point that there are effects of long-term manure use that you end up with this release of inorganic nitrogen associated with long term organic applications. Part of it is being picked up just with that general higher loading factor from manure acres. So, it's not a precise approach, but it's kind of like accounting for it in some way. It needs higher management because those systems tend to have more N being released not just right away, but long term.

Gary Shenk: My opinion is that we want to be able to account for all the inputs, all the plant available nitrogen, and all the uptake. That's kind of the first thing. Then making sure that we get it into the right land uses and get the rotation correct is important, but secondary. If we are applying manure to the field and some of it is used now and some of it is used by a different crop in a different year, accounting for everything that is ever going to be available from manure seems to be the important part of the mass balance to me.

Olivia Devereux: I think Gary's point is really good to refocus us on the issues that are going to matter most in terms of the model estimated loads. But, I realize that most of the people on this call have an agricultural background as a farmer, working with farmers, on farms, on individual farms, and with the soil, and not so much looking at it modeled from a county or growing region scale. I'm not sure that thinking about it from a farm scale is ever really going to work when you take that mental paradigm of a farm scale and try to apply it to a growing region. But, I did want to kind of delve into the question asked a few minutes ago about estimating N mineralization rate. I used the Mid-Atlantic Nutrient Management Handbook. I also used the Penn State agronomy guide and all other kinds of resources. All of the DCR nutrient management guidelines. It had in here estimating the N rate fertilization in tables 9.8 and 9.9 if anyone still has this book, and it looked at the mineralization rate and what it is over a period of multiple

years as Bill Keeling alluded to. You really need to know what year it was applied and, if you're working with a farmer on nutrient management plan what year it was applied, how long it's been there, and the rate changes over time. Bill can correct me, but what I did in the model years ago was I took the mineralization rate over a three-year period, and I just took year two knowing that we have an annual model, and every year is independent from the prior and future year. So, to take an average condition, I went with year two. Although, Gary's point is more critical that this is not so relevant because we're looking at it at a larger scale. We're really looking at estimating runoff and we're not modeling farms.
Tom Butler: Bill is that helping you understand or is it getting us to a better place as a group?
Bill Keeling: It wasn't so much for my understanding as it was to make sure the subject was discussed and put into the record.
Tom Butler: Ok, we will make sure we have a record of what's being discussed here.
Ken Staver: What about the year two?
Olivia Devereux: Well, Ken, the nutrient management guidelines and recommendations for all the states show the rate of mineralization for manure. They've got year one, year two, year three. To choose an average condition knowing that each year in the model is independent from any other year, I picked year two mineralization rate. Not year one or year three where it slows quite a bit in year three, is faster in year one, year two is in the middle.
Ken Staver: So you're saying that CAST, for manure, takes the year 2 mineralization fraction? Is that what you're saying?
Olivia Devereux: That's what I did years ago and that's what went in Phase 5 and then for Phase 6, the AMT could've made other decisions, but I believe that did not change. Jessica has a much better record of memory than I do. It's in the documentation and I can look and see if it changed, but I don't think the mineralization rate did, but that was the original source of that information.
Alexander Soroka (in chat): I have always wondered that. Thanks, Olivia!
Ken Staver: I'm kind of stunned if we are using year two mineralization because that's a really much smaller fraction than the year one. That doesn't sound right.
Bill Keeling: I would agree with Dr. Staver. I would think you have to work up some kind of temporal weighted average to do what Gary's saying, which would put more weight on year one.
Olivia Devereux: Great! Then this group can do that! That's wonderful. That could be the next decision point is to change that mineralization rate.
Tom Butler: That could very well be what we do. I'll make note of that, and we can keep that one for discussion.
Ken Staver: I think we need to find out what it is. We many not need to change it. I am going to be floored if that's what it is.
Olivia Devereux: I'll be honest, Ken, I can't imagine that the model is that sensitive to the mineralization rate. The group can change that and that's their prerogative, but I can't imagine it's going to make that much difference in the estimated loads. It certainly would make a difference to a farmer, but I can't imagine there's much sensitivity to that in the model.
Ken Staver: It makes a big difference in how you're using inorganic N on that manure acre because you're only getting a very small amount of N out of your manure if that's the case.
Tom Butler: I appreciate these comments. I will make an effort to go offline, find out what that is, and I'll email the group in the recap email about our mineralization rate, and we'll try to get to the bottom of that there.

Ruth Cassilly (in chat): Model documentation: Section 3.2.6.2 Mineralization of Organic Nitrogen https://castcontent.chesapeakebay.net/documents/P6ModelDocumentation%2F3TerrestrialInputs.pdf

Manure Applications and How They Work

Dave Montali: You could look at these graphs and say what if your county was an excess manure county, this is what would happen. Once you got past 120, there's still much more manure, so it would continue on to pasture and other hay at that accelerated rate, but also still going on to the group one stuff, too, well above the need. Right? That need being not only the agronomic need, but the agronomic need for acres covered by nutrient management and some elevated need for the acres not covered by nutrient management plans.

Tom Butler: It's effectively saying that, when you have those acres, you have to do something with that manure afterwards and this is to meet that need. There is a multiplier for non-nutrient management acres and so that would be applied using these curves. These curves are how the application of manure would happen. This is talking about the behavior after you meet that crop goal and, again, you're probably not going to meet that just with manure. You are probably going to have some element of inorganic fertilizer. That's talking about the disposal sequence where it's not necessarily throwing away manure, but that increased application rate to that other hay and pasture is essentially where a lot of that manure would end up going.

Ken Staver: On the legumeHay/soybeans curve, is this crop need meaning you are totally displacing the need to fixed N in those crops? So, you're putting on enough manure to not have any fixation?

Tom Butler: Well, it's based on the crop need, so I believe that does encompass fixation. What I'm trying to say here is maybe there's a county or two where you would not have fixation.

Ken Staver: I don't even think there'd be any counties that, if you were going to limit N fixation in alfalfa and soybeans, you would have enough plant available manure N to do that. I don't think that exists.

Tom Butler: I can look in CAST and see if there's some scenario, but I suspect you would be right. We would very infrequently get to this. It would be almost unheard of. Again, you would need to kick on and meet your crop goal for that group one and you'd need more than 75% of your manure nitrogen to meet your crop need for grains in all these category ones, before you even started to put on to soybeans. These behaviors after this curve, there has to be something to say what happens in an extreme scenario. This was the agreed upon way to do it. I don't know that it has ever gotten there. I would have to look through and ask people and run scenarios like that and try and make that happen. I don't know offhand.

Ken Staver: The other thing is, we still have this odd situation of having acres that have really small amounts.

Bill Keeling (in chat): In reality once a row crop is planted it does not get manure or biosolids applied. At that point in the year organic sources are applied solely to grass lands.

Tom Butler: There was a file that talked about the timing of when things were applied. That was a discussion that was brought up in Phase 6. This group saw that. It actually came out of discussions from here, essentially took that away, and said that if a crop was eligible for manure, it could get manure whenever. So that was something that the partnership actually voted on and, in the last year or so, said that, on an eligible land use, it could get manure whenever.

Bill Keeling: That was an agreement for Phase 6 and we're talking Phase 7 now, right?

Tom Butler: Yeah, and we could undo that and go back to what was done. That is something that is open for debate.
Bill Keeling: Well, I would argue that if you're doing something that's illogical, or we end up with an illogical result, or you have to make the model something illogical in order for the model to work, then something is wrong. Applying manure to standing corn doesn't happen. There's a point in the year where either biosolids or manure, if you've got to put it down on the ground, you're looking for grass, pasture, hay. That's the only place you are going to have to go.
Tom Butler: Bill, I recognize that. I think Ken made a good point as to how much manure you would need to start to get there and that, maybe, you'd only have enough manure in a county specifically to talk about touching 30% of that crop need, and there's no more manure to go on anything else. That could be the case and it goes to the specifics of each county, and I think that could be something we discuss.
Scott Heidel (in chat): That is also why we implement animal waste management systems and manure storage. It is about timing of applications.
Tom Butler: Scott is also speaking to that same point you had, Bill, so maybe this is something we want to reevaluate as we do other changes. Again, maybe it would be using that same file that we had before, if that would be something people are interested in.
Olivia Devereux: I think Bill's point gets at those crop curves and, they're not curves they have an inflection point. Why they have the inflection points they do is because of when you can apply nutrients. Maybe those should be adjusted to better fit Bill's comment.
Tom Butler: Maybe I'll reach out offline, Bill, to see if there's a better way to deal with that. I'll loop in people if they are interested.
Curtis Dell (in chat): Dairies often have enough manure storage capacity to store manure over the summer until it can be fall applied to next year's corn crop.
Tom Butler: Thank you, Curtis, I think it does speak to maybe wanting to tweak things a little bit.
Dave Montali: So, from a non-agricultural expert, I would think that a shift of more manure to corn, accompanied by a decline in double crop, is maybe what some folks think is more realistic. My question is what about silage and what about small grains? Is part of the problem perceived that too much of our manure was going on those land uses and that this helps that? Frederick must be a situation where there's not very much manure. When you look at all these, you see a substantive decline to silage and small grains. Is that change doing what we wanted?
Ken Staver: I'm going to jump in here and say no. The silage part is a problem. Small grains and some other things, that's probably valid, but you grow silage where you have cattle. Where you have cattle, you have manure, and the manure goes on the silage ground. We had a little bit of discussion about the two manure systems we have that are dominant. The two big manure systems are poultry, broiler litter, or even layer litter that are kind of storable. Then we have the dairy systems, and they have storage for the summer, so you have fall applications and that's usually on silage ground. A lot of times it's on silage ground. I think I know enough about dairies to know that silage ground gets manure probably more than any other crop area in dairy dominated systems. So, it doesn't look good to me to zero out manure on silage.
Tom Butler: We selected grains to be specific, but what if we put grains and silage together? Would that erase the differences? Would that make them more exaggerated? What do people think?
Gary Shenk: It might be helpful to go back to the slide you were just showing and imagine silage increased and then it would completely go away in double cropped and pasture. That's the likely

outcome of doing that, which I don't know anything about on the ground, but does that make sense Ken and others?
Mark Dubin (in chat): I fully agree with Ken that silage is connected to cattle production and manure applications.
Ken Staver: Well, it makes more sense. Manure ends up going some places you wouldn't think it would go just because of timing issues, the way a particular farm is structured, and all these things. There's not going to be counties that have silage and don't have cattle, I don't think. I just don't think silage ground should be zeroed out to move it all to places where you can grow corn. There are lots of counties where you grow corn and there's no cattle. That's a different situation, but that would be closer to reality I would say.
Dave Montali: Should some of your test counties include known dairy counties and/or known manure excess counties to say, if we make those changes, here's what's going to happen in those kinds of places?
Tom Butler: Yeah, Dave, that's a good point. Stueben was our kind of dairy county. There's beef there, too, but it's pretty heavy in the dairy. That's why we picked this one. We can test and show you whatever counties. We can give data, I can make graphs like this, for any counties we want. It would come down to if we wanted to go to switching things differently than grain. But, to your point, we can show whatever. It's not a problem.
Cassandra Davis (in chat): Stueben is a dairy county
Bill Keeling (in chat): What I saw predominately in VA was silage and alfalfa were seen in association with dairies.
Mark Dubin: I fully agree with Ken and, looking at the suite of things, probably silage should be a first priority for putting manure down on because it is associated with livestock production, followed by the harvested grains, but I think we need to do sort of the reverse order from what we saw Frederick county was removing it.
Ken Staver: In the broiler dominated counties, there's going to be almost no silage acres. So, it isn't going to make a big difference where there's not many cattle. I would agree with Mark that it would make more sense to prioritize silage, which isn't a huge land use. In some counties its almost none, but it would make more sense to actually make it to get manure first.
Curtis Dell (in chat): Fully agree with Ken on priority for manure on corn silage ground on dairies.
Tom Butler: So, we might be talking about making this line silage, putting in another line for grain, and keeping these here?
Dave Montali: I liked your simplified method of just putting grain and silage in the first line. When you said that, that should solve the problem. That's something to test, I guess.
Jess Rigelman: I was going to agree with Dave if what Ken says is for the most part true, and these systems of dairy versus poultry are somewhat mutually exclusive, putting grain and silage in the same line, it will sort itself out.
Tom Butler: Maybe we try testing them together as grain and silage, rather than just grain, knowing that they're different enough that they won't occur in the same place.
Ken Staver: We do have everything in the watershed. We have counties that are mixed, we have some counties on the shore that I think have two or three dairies and a lot of broilers. So, in the big picture does it matter? I don't know. But, if you are going to separate them, it would be the land that most consistently gets manure. I would say that would be silage ground.
Curtis Dell (in chat): Corn probably highest priority for manure regardless of whether grain or silage.

Mark Dubin: I agree with Jess that, if you have one production system versus another, it evens it out. Like Ken said, we have a lot of mixed counties, so I think that's where you'd see more of a difference. We would be really prioritizing the corn silage first in the applications and then following with the rest of the corn grains on that. Where it's one or the other, yes, but probably the majority of counties would be mixed.
Bill Keeling: I think I am more or less mirroring what Mark just said. What Dr. Staver said is probably correct for Virginia and Eastern Shore, but it's not so much for Shenandoah Valley and/or Piedmont areas where we do have dairies, hogs, and other things. It's much more mixed as Mark would say.
Joseph Delesantro (in chat): Increasing the Value of Animal Manure for Farmers (usda.gov) "Corn acres received more than 410,000 tons of manure nitrogen, 81 percent of total applied nitrogen." It is not clear if Corn= grain + silage.
Joseph Delesantro: It's just a reference that might be useful to people showing, nationally, that the vast majority of manure goes to corn. I think it's something like 79% of total manured acres, nationally, are planted with corn is a quote from that. But it's not clear that they split out grain from silage. So, I might assume that corn encompasses both grain and silage, but it's never explicitly stated.
Ken Staver: Just to be clear, I'm not pushing to separate corn and silage on the manure thing. I just don't think silage should be zeroed out to meet a certain level of corn for grain. So, putting them together, I don't have any real heartburn with that. If you do separate them, they should be flipped from what you had it, not that way. But, if you want to put them together, that's probably good enough.
Olivia Devereux: I have a question for the agronomy experts on the call. How often do farmers switch from growing corn for grain versus corn for silage? I just don't know how that works, and I'm curious if they flip back and forth or, if they're growing one, they kind of stick with that.
Kate Bresaw: I can answer for what happens here in Pennsylvania. Essentially, there's a certain number of acres throughout the operation that rotate around whether they're going to be grain or whether they're going to be silage. It really depends every year. They'll fill the silo and then the rest is shelled.
Mark Dubin: I was going to say the same thing. It's really dependent on the yield. Silage is going to come first; it's going to be harvested earlier. So, whatever is left would go to either a high moisture grain or grain from there. It varies by operation, by year.
Bill Keeling (in chat): Same. Once the silos or bunkers are full the rest goes to the grain market.
Tom Butler: Curtis, you had made a comment. I was wondering if you could talk a little bit from your perspective on the prioritization of putting them together.
Curtis Dell: Going along with what everyone said, all the dairies in Pennsylvania, your silage ground is going to be the first priority for manure. You fill the bunkers first and then whatever you can't cut as silage, goes to grain. So, it seems to me like grain corn and silage corn don't need to be different categories because corn is going to be the first priority for manure. Back when we had this discussion in the AMS, and we first introduced these curves, that was the whole idea was to get that priority. For the most part, corn is what demands the most nitrogen. So, the curves were a good approach to getting that priority to get the manure over to corn. I think version 5 did an even application of manure across all crops. The AMS decided that wasn't really practical and we needed something to prioritize manure going to corn.

Tom Butler: Thanks for that perspective, I think that's really valuable. Maybe that's the direction we go in terms of testing this out so we can see what it looks like.
Mark Dubin: Curtis, correct me if I'm wrong, but I think the original intent from the AMS was that silage would be with the grain corn, not separate, correct?
Curtis Dell: I think so, yeah. I think we are just thinking about it as corn. I don't think we were thinking about separating them out. Corn is what we grow a lot of and needs the most nitrogen.
Mark Dubin: I agree, that's what the actual intent was for the AMS, so maybe we're correcting an item that got overlooked.
Tom Butler: I think this gives us at least a path forward and some homework to do offline.

Nutrient Spread Slopes for Manure N

Ken Staver: One thing I thought we were trying to deal with was, it doesn't seem to me that the purple line should go at zero percent. Where the purple line is down at the far left, it doesn't exist in reality in the counties. When you actually run the scenarios, that doesn't happen. We shouldn't have acres that get 5% of their N met by manure. We have too many manure acres if that's what's happening.
Tom Butler: Yeah, and we improved that by almost a factor of two, when we adjusted the acres with plant available nitrogen. So that's made that better, at least that was the intent.
Ken Staver: In your bar graphs, there weren't any super low numbers, right? I do see some in some of those other land uses where you have 5% applied for acre. Somehow, our manure acres should be less. I know it's not a farm scale model, but it's just noise in the model to have acres that get 5 pounds of their N application from manure. It's just nothing-it's dirt on the floor or something. It has to do with how to calculate manure acres and the manure acres ought to be calculated relative to how much manure N there is, and there should be some baseline for amount that a manure acre gets.
Gary Shenk: That's not covered by the lines that we were just looking at. That purple line must be on the one-to-one line because everything else is drawn relative to it. It's just an illustration of what gets manure relative to what goes on grain manure. So that purple line has got to be one-to-one the whole way up, it's just the definition of this plot. What determines the acres of manure is that plant available to manure to acres plot that we have moved to. That's a different calculation than what we are looking at here. I was thinking the same thing that you were that we don't have these tiny little bits going here and there, but Joseph actually found research to say that this does happen.
Joseph Delesantro: I have to go back and find this paper but, on average, something like 20% of crop yield is met by manure, and so that means that the minimum manure could be much lower. That might not be the exact number, but it was essentially that the number of the average crop need that's met by manure was lower than at least us on the modeling team had expected from the literature. The second thing is sort of a fact of the math. We are doing this work to concentrate the manure onto fewer types of crop, but you do end up with the situation still where you have a little bit of extra manure after you've put it on crops A&B. So, you might have a little bit that gets moved over. Usually this happens with specialty high, and so you can get a very small percentage of manure relative to crop need planted to specialty high, and that might not be realistic. But mathematically, we would need a solution in terms of what we do with that remainder. We can't just get rid of it. So that's part of the challenge there.

Tom Butler: Thanks Gary and Joseph. Ken, I think that this is a direction we are headed to try and solve those. Is it maybe we're not doing quite enough, or maybe once we do this new test we can see a little bit different result?
Ken Staver: It seems to me in the right direction. The only other comment I have, since biosolids are on your graph, is that spreading biosolids is a commercial endeavor- the haulers and the spreaders. That's state reported data, too. They have permits, it's all sort of well nailed down. There are biosolid acres that they get a pretty good chunk of nutrients out of biosolids. It might not make any difference in the long haul, but acres that get biosolids, get biosolids, they don't just get a little sprinkling. We just have to figure out a way to calculate the manure acres so that it all is reasonable.
Mark Dubin: To follow up with Ken's comments there, there are municipalities that own or lease farms for the sole purpose of applying their biosolids on and that's where it goes. So, I have to agree with Ken that it is an element we need to represent even though it is small.
Tom Butler: Yeah, and there's another set of curves for biosolids so we can walk through those at some point here if we really need to.
Dave Montali: I remember way back that, when we talked about biosolids, we provided information about the land use type that they were being applied to. My recollection was that it was largely pasture and grasslands in our state. So, the question I have is, that information that may have been provided state by state about where the biosolids may go, is that just kind of thrown out and the biosolids just get put in the manure pot, or is there a separate protocol?
Tom Butler: I will say that there is a separate way they are applied. They have their own application curves. How far it goes beyond that, Jess has raised her hand and will speak to.
Jessica Rigelman: That information was used to create the curves, it's not used directly. So, it is a whole separate set of curves and biosolids gets applied first. That set of curves is different than these other curves in the fact that it's basically just a proportion. I think you're right, pasture/hay gets the higher proportion, but it's not that it goes on pasture until you reach a certain point, it is a pasture gets 50%, row crops get 10%. I'm making the numbers up, but in general, that's how biosolids are done.
Dave Montali: Fair enough, thank you.

Action: Tom will work to clarify mineralization rates for the group.
Action: Tom will incorporate AMT feedback to further test modifications to the manure application curves used in CAST.

Industry Data collection 10:30-10:55 [25 min (15 min presentation 10 min discussion) (Mark Dubin, UMD, Paul Bredwell, U.S. Poultry & Egg Association)]

In an effort to improve the data sources used in CAST for Phase 7 we will hear about a potential plan to collection relevant information directly from the poultry industry. Informational.

***Note:** Previous discussions ran over time and this agenda item will be moved to the August meeting.

Recap/Closing 10:55-11:00 [5 min Tom Butler, EPA)]

Action Items:

- Discuss: crop yields update, manure application improvements, and potential industry data for Phase 7.

Adjourn – 11:00

Up Next:

Office Hours: Friday, August 9th, 2024, from 8:00 - 9:00 am.
AMT Meeting: Friday, August 9th, 2024, from 09:00 - 11:00 am.

Participants

Thomas Butler, EPA-CBPO
Caroline Kleis, CRC
Kate Bresaw, PA DEP
Cassie Davis, NYS DEC
Curtis Dell, USDA-ARS
Elizabeth Hoffman, MDA
Kristen Bisom, WVCA
Emily Dekar, Upper Susquehanna Coalition
Gary Shenk, USGS/CBPO
Clint Gill, DDA
Scott Heidel, PA DEP
Eric Hughes, EPA
Ashley Hullinger, PA DEP
Jessica Rigelman, CBPO
Arianna Johns, VA DEQ
Joseph Delesantro, ORISE Fellow EPA-CBPO
Bill Keeling, VA DEQ
Ken Staver, UMD,WyeREC
Tim Larson, VA DCR
Mark Dubin, UME/CBPO
Pat Thompson, EnergyWorks Group
Dave Montali, Tetra Tech, WV, MWG
Nick Moody, VADCR
Olivia Devereux, Devereux Consulting/ CBPO
Ruth Cassilly, UMD CBPO
Alex Soroka, USGS
Tamie Veith, USDA ARS
Tyler Trostle, PA DEP

**Common Acronyms
AgWG- Agriculture Workgroup
AMT- Agricultural Modeling Team (Phase 7)
BMP- Best Management Practice
CAST- Chesapeake Assessment Scenario Tool (user interface for the CBP Watershed Model)
CBP- Chesapeake Bay Program
CBPO- Chesapeake Bay Program Office (houses EPA, federal partners, and various contractors and grantees working towards CBP goals)
CBW-Chesapeake Bay Watershed
CRC- Chesapeake Research Consortium
EPA- [United States] Environmental Protection Agency PSC – Principals' Advisory Committee (CBP)
STAC- Scientific & Technical Advisory Committee
TMDL- Total Maximum Daily Load
WQGIT- Water Quality Goal Implementation Team