With that we will now begin. I am pleased to turn the webinar over to Dana Ashford-Kornburger. Dana is the national nutrient management specialist in the ecological sciences division at Washington DC headquarters of USDA NRCS. She provides national leadership for nutrient utilization and management as it relates to policy development. Prior to her current position she worked for NRCS in the field, area and state level as well as an agronomist for USDA NRCS. Dana is a certified crop advisor and a member of the American Society of Agronomy and the Soil Science Society of America. Her education includes a Bachelor of Science from the University of California at Davis and a Master of Science degree in Agronomy and Soils from Auburn University. Dana you may now begin.

Thanks for that, Jennifer. It's a pleasure to be here to moderate the webinar. We have a great topic for you today. We're going to talk about yield monitor data. I get lots of questions about this topic, specifically about cleaning yield data. It is a treat today to have Dr. Terry Griffin to share information and his expertise on improving the quality of yield data. Dr. Griffin is an associate professor and cropping systems economist at Kansas State University. He specializes in farm management and agricultural technology. Dr. Griffin has received some prestigious awards for his achievements in advancing digital ag such as the Pierre C. Robert international precision agriculture Young scientist award, the conservation systems precision ag researcher of the year award and the precision ag award of excellence for researchers. He is the past treasurer of the international Society of precision agriculture and in addition to presenting across North America, Dr. Griffin has delivered presentations across the globe including Africa, Australia and Europe. If you are on Twitter I invite you to join and follow Dr. Griffin at @spaceplowboy. It is a memorable handle that I always get a laugh out of, it's catchy so I hope everyone will follow him. Before we kick off the webinar today, let's do a quick poll question to see who the audience is.

Please pick the occupation that best reflects what you do out there today. I know Dr. Griffin and I were laughing at how hard it is to do these virtual webinars without seeing the smiling faces.

We have 91 people who have joined in.

Great.

It's interesting to see who we have.

A good amount of NRCS folks as well as others. Other government agencies, often that is the partners at the soil and water conservation and resource conservation Districts pretty good mix, Terry.

We have one academic and I can see who that is, looking at the list.

Great. We also have a couple farmers on, I'm always excited about that. I think this is a topic that will definitely resonate with the farmers out there and hopefully for the NRCS folks, assisting customers. I think
with that I will pass it over to you, Terry, to get started. Thank you for taking the time to give the presentation. And as Jennifer mentioned, we will stop halfway through to answer any questions you may have. And hopefully we will have some Q&A time at the end.

So the audience, any good questions you want to post those and we may even stop and handle those along the way. This is a live webinar and I would rather have a discussion then an hour of lecture, if that's okay with you.

Sure.

Jennifer, thanks for getting us on. I am Terry Griffin and my contact information is on the slide. My email address at Kansas State University and my Twitter handle. I do invite you to follow me and I try to Tweet out relevant material about farm management, precision agriculture and whatever else kind of strikes my academic interests. So, in economics, we are concerned about the benefit to cost ratio and I will throw this up here and ask that while we discuss yield monitor data, I want you to think about the benefits and the cost of using that data, processing that data, my hope is I will help you to reduce the cost of data management while improving the benefits from using farm data, yield monitor data in particular. When I got to Kansas State University five years ago, I started working with the Kansas Farm Management Association. And this is a long-term relationship between the University and KFMA. We have data that goes back to the 1970s about production and finance at the farm level. Five years ago we started asking another set of questions. We ask “farmer, what technology do you have on the farm?” And, “when did you start using it?”, “if you stopped, when was that?” So this is the data as of about 2019 and a few things on this I want to draw your attention to is variable rate seeding and yield monitor but in the context of fertility. In Kansas, our adoption numbers are still below one fourth of all farms in KFMA and this reflects USDA ARMS survey statistics that the Economic Research Service reports. And I want to draw your attention to the adoption level of a combine harvester with GNSS, another way of saying GPS. With less than half of farms that tell me they have a yield monitor on their combine. So what does that mean for us?

Farm data is collected across, not just Kansas but the United States and most of the globe, developed nations, Canada, Australia, Europe. Developed nations I should say as well as some nations that are developing. It is a good time to ask a question, here of the group, if that's okay. Dana,I would like to know how you have used farm data in your professional row. I get the question a lot about what is the value of farm data? This is where I spend most of my research efforts and it kind of depends on how do you use that data? It's like a cell phone we all have one and we carry around. Is a valuable? Yes. In particular if you use it and how you use it. Okay so for the NRCS folks, a large percentage of them routinely use it for planning. Crop consultants about 35% are using it to make recommendations to farmers. Only a handful of people say they have collected but never used the data and some say they don't collected at all. And never use yield data for planning about 8%. Those figures line up well with other surveys we see but I do want to mention that for the CCAs we have today, Dana, we have CEUs scheduled for this webinar.

We do and hopefully at the end, Jennifer can remind us of the process, there is a quiz at the end folks can take to get their credits.

So you are here for yield monitor data. So managing yield data is one of the most interesting things to me was when I was working on my PhD I was evaluated what happens if we conduct an on farm experiment, an on farm trial where the farmer managed field-scale experiments. And we processed yield monitor data differently than unprocessed as we may have cleaned it with our best efforts or somewhere in between. I was asking the question what are the implications are one of the cost to us if we do not clean the data so the conclusion was we need to begin with the best data possible when we are doing analysis. And, by then, we are flagging the monitor data that has been erroneously measured. If you ever opened up a file of yield monitor data then you can see a large proportion of it is sort of obviously measured incorrectly or at least the measurements themselves are not reliable. And we need to find a way to flag those and, also need to be able to relocate some

observations because of flow delays. So, the yield monitor, the way I understand or try to explain when is it is calibrated, hopefully, that's another discussion altogether, if the monitor is calibrated, it is calibrated for a certain set of circumstances. And if the machine is being operated beyond those circumstances, faster or slower, uphill, downhill, then the measurement sensor may not be able to be reliable. It may not take good measurements and we are going to think about those combine harvester dynamics when we are discussing quality. When I was in grad school I remember that a tool that came out of USDA called Yield Editor and I believe it was January 2004. At that time I was trying my best using tools to manually clean my data for research, it is tedious and not repeatable but I couldn't go back and start all over and come up with the same set of data because I didn't do a good job of tracking of how I manipulated the data. The USDA ARS Yield Editor came out of the came out of the Columbia Missouri ARS office and Scott Drummond was largely the author behind the tool. It made my life so much better I could clean data quickly or more quickly and I could do it in a repeatable way, every time I went back to it output that I put in to it. Some software has embedded Yield Editor but it's not all done so far. It takes about 30 to 45 minutes for me to clean the field. It's not instantaneous and it does take a little bit of time even with practice. And the newest version that came out a few years ago, version 2, automates several settings that we are going to discuss and the human interaction is more passive, we are not relying solely upon our own human capital but we still need to devote some time and human capital, in order to make the most of this software.

If you've not downloaded the software it's an easy I usually just Google “USDA ARS Yield Editor” and it will take you to an ARS website and all it requires is for you to enter your email address and is a free download. And is free to use for anybody. There is a link that we have provided on the registration or through the webinar redirect link for today. So, one of the questions I do like to answer initially is, so what? Why does it matter? Why does quality of data matter? This is part of my research in the value of farm data. One fact is portion of yield monitor data comes off the combine or cotton picker has been measured erroneously, and recorded points into the data set. And, the yield sensor is not able to make accurate measurements under certain circumstances and we need to be able to remove those. So, as I mentioned, some of my analysis for my PhD was I was comparing unprocessed and deliberately cleaned yield monitor data, especially from on farm experiments that I was evaluating for my dissertation. And I assumed that clean data is better than data that is not processed. I would perform analysis of the experiment with clean data and with uncleaned, unprocessed data. There are 10 parameters that the Yield Editor provided. we used to clean the data. And the result was this. When we use unprocessed yield data, sometimes arrived at the same farm management recommendation as clean data but when we tallied up all the studies, only 30% of the studies led us to have the same farm management recommendation. Meaning, 70% of the time we would come to a different farm management decision whether we used cleaned or unclean data. About that time, since 2005 and 2007, I had worked on documenting some of the processes of handling yield monitor data and acquiring it from the yield monitor back then, flash media. And getting into a format ready for yield editor and then processing it, cleaning the data and then exporting the data into something useful for GIS, geographic information systems, or farm software. This is a protocol, last updated in 2007 and this is the link and is provided by today's web portal. I've been wanting to update this for quite some time. I just need to find the incentive and the time to make that happen. This is a good little paper document that people still rely upon, as a blueprint for handling yield monitor data. So, Dana, would now be a good time to ask the level of experience with dealing with yield monitor data?

I think it is helpful to find that what people are using yield monitor data for.

Remember, the third poll question has appeared.

70% said you are using yield monitor data and is curious to know how you are using that data.

We have a few more people that joined us, I am noticing we have 101 participants signed in right now.

I'm happy to see a lot of management planning and the yield monitor data.
Yes, Yield Editor tool will be one that is available for NRCS personnel. And we, I say we, in our courses at Kansas State University in Agronomy Department, and the Department of Biological and Agricultural Engineering, we have labs like when you were in college, if you went to college you had labs in chemistry or whatever. We will have agronomy and engineering labs where the students will work on yield data and process it through Yield Editor. We also offer through Extension some workshops in Kansas, the Kansas Ag Research Technology Association (KARTA), will cosponsor workshops on training farmers and
other agricultural practitioners, how to use Yield Editor.

When you're filling out the poll, I will remind us for a few more seconds, we will leave it open but you can check multiple options. If you use yield monitor data for one of these, go ahead and check the other or the additional items as well so we can get a better look at that as well, if people are using yield monitor data for multiple things.

The results are interesting. We have some reports from USDA ERS, Economic Research Service, that suggests that on farm experimentation is one of the top three uses of a yield monitor. It is sort of a replacement for the more tedious weigh wagons and so forth, some of the experiments that farmers are conducting.

About 25%, that's a good chunk of participants that are doing that. I see that as being one of the beneficial ways of using this data, is kind of doing your on farm evaluation.

That's what I find interesting is only for real-time yield monitoring, you know, there is some anecdotal suggestions that people have shared that says they watch it while they are on the combine, harvesting the crop. But that's kind of where they stop. But no one selected that. About 31% has said “I have never used yield monitoring data”.

There is no one willing to say they have never used the real-time yield monitoring I have heard there are farmers we've interacted with that same they use it while they are in the field to eye up the areas but then after that, are not using the data.

Jennifer can you adjust my audio I got a note that says I'm quiet. Or do I just need to talk louder?

Talk louder.

I appreciate the feedback, I am at a disadvantage. When I am on the speaking circuit I'm used to looking at people's faces and eyes and I can tell if they are asleep, if I am with them or if I need to change the way I am presenting. I am here in the room by myself and I cannot see any of you so I am at a disadvantage. If any feedback you can provide is beneficial and I will try to make use of to improve your experience.

Okay so if you go to use yield data, one of the things it needs that is required to make it work is the file format has to be very specific and is referred to as ag advanced file format, this was the same as the Greenstar file format if you remember the days of JD office software. But this is what it looks like you have the columns and you may have more than that but you have to have at least these 10 and has to be in this order. Latitude, longitude, flow delay, the flow reading is in pounds per second. The GPS time, logged interval, the number of seconds in between recording the measurement, the next is distance is where the combine or cotton picker has traveled in inches, the swath is in inches, eight is moisture. The bolded words are required. But the other ones need to be there at least as placeholders. Moisture is one we can use, if it is available. Number nine is header status and number 10 is pass number. You may have more than this ,I will show you the example of what this will look like if you look at one of the sample files that come with the software. And that's kind of how it looks like, it doesn't make a lot of sense to humans but the computer can decompose this. In about, let's see, I believe this is column 10 where the arrow is, these ones, the rest of these columns are extra they don't expect to hurt anything. They may be useful to say that this is a soybean field because that is one of the questions that you will need to tell the computer that the software is checking. So, again, both of these together, the first set of numbers are the longitude, let me bring my arrow here, this is right here, latitude would be the set of numbers separated by columns of the third number is 2.92 and that is pounds per second, that is actually what is reported by the sensor that goes into the log data. And the next number is GPS time and so forth. So the data has to be in this format, to work with Yield Editor. And I strongly, strongly recommend getting data that comes directly from yield monitor that has not been processed by other farm management software, or any other means. Because, we want to have full control over the cleaning process, and not be cleaning data that may have already been partially even incorrectly cleaned, prior to. This is what the screen looks like, this is a screenshot from yield editor. There are three tabs, this is the first one that says load/import file and the second one where you spend most time and filtering, mapping and editing treatments you are happy with that you will spend a few moments on the last where we export the Deva data out and send it wherever it needs to go next, the farm information software or even more advanced GIS software that I suspect that the NRCS personnel will be interested in. Remember earlier when I said it would be nice to know what crop we are talking about? If you are a farmer you know exactly what field this came from but if you are an analyst who has never been in that farmers' field, then you may be sort of at a disadvantage like I usually am.

There are some needed inputs. Here, I need to click on soybean here. A big reason for this is the software needs to know how many pounds per bushel, we need to use when we are calculating with moisture and getting it to market moisture. We will click on the type of crop and adjust the density if necessary come in the market moisture. And then hit import and it will show you the data. It will give us one final preview of it. We will go through filtering page when we are ready. Which is this one.

Terry, before the mapping we did have a question come in about can Yield Editor work with other flow units?

Flow unit.

Like in pounds per second, especially may be related to different perennial crops like nut crops or is this pretty much focused on grain crop?

My experiences are only for grains we've done this with cotton picker, the cotton data as well as grain crops. So this Yield Editor software was designed around combines and cotton pickers. I have never used it for, vegetables, we played with peanuts and tomatoes and those are kind of measured in all those

units, boxes per acre. If you get the data into that format, that we had just discussed, I do not see why it would not be useful. But it would have to get into that format.

Okay great, thanks

All right and so this is what the mapping part looks like. This is unprocessed yield data and I will go back and forth to show the process and the unprocessed map. Some of this is very visual, meaning it will be subjective to the user. And that being said, there is not necessarily a correct one way of doing this. When we have labs at the University, students are usually expected to have one single answer or one single right way of doing something and they get frustrated because we don't necessarily have a correct set of parameters for any given field. What we are trying to do is improve the quality from unprocessed to something higher. And especially to something that is more repeatable. There is not a universal right way of doing these things. I will bring it back in, to arrow. These are the parameters we will play with. The first is flow delay and we can enter a number here. This is a negative for this is seconds. If we put a checkmark in this box and hit apply filters which is F10 or you hit this button here, it will tell us how many observations are deleted in the red box. And just know that if you sum up all the data you will get a number higher than what you actually delete because two different filters or parameters can flag the same observation for deletion. If you add all the numbers up you won't necessarily get the same number that you actually delete. Moisture delay, flow delay for the reason we have flow delay is that if you ever look at this data in particular, there are some jagged edges. And that is due to the time that the crop is harvested, to the time it hits the sensor plate, it takes time to do so. The machine is moving through the field and this is an important setting to get correct because it could be an on-farm experiment. The harvester is entering, leaving the treatment whether it is fertility rates or even the environmental factors like the soil mapping unit. The flow delay needs to be correct so that the observation is correctly tied to all those factors. Start and end pass delays are the areas in the field I'm in where the machine is entering and exiting the field. Max or minimum velocity is as it sounds I have a good example I will show it a little bit about how cool we can map the speed, not just the yield but we can map the speed. And smooth velocity is one of my favorites, especially for farms that are relatively new to yield monitors. Smooth velocity is actually asking the question, is the machine speeding up or slowing down by more than 5% between two recorded observations in the same transect? If the machine is speeding up or slowing down, but more than that, it's assuming the machine, the sensor cannot make an accurate measurement so we will flag that for potential deletion. The minimum swaths width is what it sounds like we have to ensure that we have a few swaths or not below a certain threshold.

For maximum yield, it is a trick question is, I asked them what part of Kansas are you from? And what is the maximum expected yield from your home county? But then I asked them what is the minimum yield? And that's more baffling. What is a minimum corn yield in your place in the country? And zero is a logical yield. So the point there is I don't want to remove observations just because they have zero yield for instance a very low yield, 10 or five bushels. I want to have a reason that the machine could not make an accurate measurement to flag observations for deletion, not just because they are high or low. And the STD filter is standard deviation, this is saying that an observation has really high yields or low yields then we will flag those. I'm not a big fan of doing that, unless there is a reason that the machine cannot make accurate measurements at a very fast or very high or very low reading. So I will go back and forth and as I do this I would like for you to look at, in particular, this area and it's going to do what I call go in and out of focus. Out of focus come in focus. Out of focus, in focus. So the idea is that once that gets to be in focus, then we have reason to believe that the flow delays are set correctly. And it does take some time. We can zoom in on this. There is some good news. In the most recent version of

the software, there is an automated routines that has removed some of the requirements for humans to interact and replace these with algorithms. They are working pretty good and we will see one of those in the moment. This field is on to show this quickly you can see that the start and impact delays at the end of the field, there is about three or four or five passes in the same direction instead of alternating direction on every pass, this farm took four or five passes in the same direction and kind of did a race tracking formation. The reason I want to show that to you, is that if they had not done that, I would not have been able to discern the proper flow delay for this particular field. Some farmers have told me that they believe that if they want to get the best accuracy farm data, yield monitor data, then they need to rethink how they harvest or even plant the field meaning, they may need to run machines in a different direction, East and West versus North and South because of slopes and other train attributes. So, I think that's a good place to take a mid-presentation break. We've been at it for about 40 minutes almost. Dana, is there any pressing questions are things I need to do?

We do have a question. One is are you assuming a constant bushel rate? Bushel weight, sorry.

Let me put that in and that is a very front, there is 56 pounds per bushel for corn. Keep in mind that we are not measured, this machine does not measure yield in bushels per acre, it is measured in pounds per second. That's what is getting recorded. We don't sell or we don't market corn by pounds per second. And if we're going to convert that into something we know and we did assume that the pounds per bushel is a constant for the entire field, although, the point is me that it may not be true, given different things. One important thing is, we haven't covered it much. I mentioned earlier moisture. There is a setting, let me go back one. If you look here, where is my pointer? This is adjust for moisture and what it will do is, if the crop is moisture is lowered then the market moisture, it will adjust bushels upwards to bring it up to market moisture and then that would be something I would use if I were trying to do and on farm experiment and try to measure apples to apples but if I am cleaning farm data for the purposes of farming, for records, that is something I probably would not check. I think I went deeper than the question. Yes we do assume that the pounds per bushel remains constant throughout the entire field.

Okay, one other, maybe quick question before we move on. What is the key factor in yield data quality if you can only do one thing, what would it be?

I've got to break the yield monitor per the manufacturer's recommendation.

That is starting off on the right foot.

If it is not calibrated we have very little confidence the rest of this will be beneficial.

In your discussions with farmers and other folks, what percentage do you think are getting that good regular cooperation? I've heard horror stories of farmers running their yield monitor set for the wrong co-op crop and you're trying to use that data and it's just impractical. So what percentage do you think are doing good regular calibrations?

I asked that question and this is a good group to ask this question, in extension readings I always ask that question. A high percent of everybody in the room greatest her hand and I do a great job of it and I quit asking that question years ago and replace it with this, “what percent of your neighbors are calibrating their yield monitors correctly?” And of course the confidence goes down really quickly. So, I

don't know. Too bad we can't do a poll on that. What does the audience think, does anybody want to raise their hand, if you want to try to try men? -- If you want to chime in.

These represent different pounds per second, pounds per acre, what are the units that are representing on the maps you've been showing?

Those are in bushels per acre, those have been converted, if you're familiar. Let me go to the map. There is a legend on this next slide. This is the legend on the right-hand side and you see the colors. Let me go back one. So this is on processed yield data, a grain field for Kansas, one we use for the workshops with farmers. The legend is in bushels per acre and it says yield. If you look at this legend, also let me bring my arrow back in. We have moisture we can display moisture we can display velocity we can display the flow in pounds for second but if we don't want to look at bushels per acre, which is yield, we can do it in pounds per second or it is actually measure that would be let's go to the next one, this is moisture and this is what the moisture map looks like. Notice that there is some transects that are pretty wet some transects that are wet and 16%. The green area about 13% and the blue about 10%. 11% moisture. Let's look, I promised earlier that we would look at miles per hour maps on velocity but let's look at that. So most of the field is 4 1/2 miles per hour but there's a couple of passes over here that were about six and I think at the bottom, is six. So, acquiring or inquiring with the farmer I wanted to know what was going on if there was a thunderstorm coming. And the farmer got a little bit red in the face and said they had one of their family members trade-off operating the machine for that part of the field. So this is a different operator's behavior showing up through the velocity part of the data. And is showing up on not only the yield but also the moisture, due to the speed with which it was going through the field.

I was going to say a teenager took over the driving. [ Laughter ]

It was a generation in the opposite direction.

We did have another question that came in while we were wrapping up the yield monitor calibration question is how is the yield monitor calibrated as a maintenance effort and how often should be recalibrated?

My way of getting out of answering that question as I tell people or refer them to the manufacturer's recommendation. I have seen some extension recommendations on, once for wet corn and once for dried corn and once again for soybean. You can also find documentation that suggests that if you're doing an onfarm experiment you would have to do for that particular experiment and even use a hybrid which may be more than what some farmers are interested. Again, I always refer back to the manufacturer's recommendations and some of the technology has a continuously updated calibration, that sounds good. Although, when it comes to me, I have seen different calibration factors for the same field and that causes me some hesitation on how to handle that properly.

Okay I think I will let you go through the rest of the slides we will get to the other questions.

I want to show this, this is the new part that came out with the version 2 of Yield Editor. And it asks us do we want to automatically control for flow delay and moisture delay? I nearly always say yes to flow delay. The moisture, the one time I wouldn't use that would be for a cotton picker because there is a moisture reading usually but is constant for the whole field. My experiences if we check that with cotton picker data it will never finish running so we have to restart the computer. So just be cognizant if you're

using cotton or green. So all of these settings are the things we are talking about before but now instead of the human interacting with the map, we are becoming more passive and letting the algorithms take over. And it will try to find an optimal solution. If not, it will give us the map here is the optimal that we found something useful. If it has red or yellow around it like this one then it would be telling us that it does not have a statistical confidence in the results. So the way you run this is like the filters you want to be automated. And click on run auto filters. Wait a few moments. A couple of seconds and then you will have your results. I'm going for the second time I will slip through the next few maps of the same field and talk about the third tab real quickly. So when you are done with your mapping you click on the third tab to save and export. The three of these will be collected already, yield and the coordinates in meters. I usually will also put a checkmark next to longitude and latitude, decimal degrees because I usually go back into the GIS and I do want it to be projected into meters at that time. And everything else, I leave alone and I hit export data and it will send it out as a CSV, file format. Sometimes you may be interested in the regional pounds per second grain flow or some of this other data bit but chances are, you are using this with your original data that came from the yield monitor, and the farm information software format from the software so you are adding this layer that comes out at yield editor is the clean yield data. Researchers, there may be a few online here, nearly always I will be concerned about exporting the clean points. If I am an inquisitive scientist, engineer, I might just want to look at why observations were deleted and we have that option here, to look at only deleted observations as well. So, to wrap up the practical applications of this, is that yield data would be improved by cleaning it, removing observations that have been measured incorrectly. It's going to take you 30 to 45 minutes per field so it is not going to be completely costless. There will be a time costs. And there is a lot of work and transferring a lot of the subjective human interaction to more of a passive automated algorithm. The way I view that is great because if you have a wind field and you have 30 minutes, not a big deal but what happens when you have 1000 fields or 5000 fields and you're an analyst? An algorithm can do this a lot more consistently and quickly then you as a human could do it.

In this particular version of the software is a good combination of both. Data yield monitor data that is not properly process that has removed erroneously measured ports and really useful to identify subfield areas that would benefit from detailed management analyses. If we are looking at on process yield data we are not quite as able to identify the subfield areas. When we are improving the quality of the yield monitor data, it may necessitate a different behavior of combine harvester operator for the direction of harvest, which may imply that we need to change the direction of planting as well. Yield monitor data has value, the quality of the data is very important. The ARS Yield Editor tool is wonderful, it's made my life better. The value of the data depends on how you use the data. The first step is making the best of small data, we've heard about big data we are focusing now on small data, one field at a time. And there are management decisions we want to make in a sound matter requires the data be cleaned of erroneous points. So I think we have a few minutes for questions, Dana, I would like to turn it back over to you.

You actually may want to go back to a couple of those side that you skipped because we have a question related to how do we address the hold and the date of, that is created when you're doing the cleanup? Within the field when utilizing the clean data for surface generation analysis?

That's a good question, this is a field in Kansas, the holes on the left are caused by incorrect flow delay. And when we used the automated filter for flow delay, it robbed the map on the left which I will show you the entire thing here. This is what they thought was the optimal flow delay, 13 seconds. And I started working with it myself I thought well, let me see what I can come up with. I do believe that the best flow delay is a -2 and looking at the field in particular the southern part, it had more areas filled in

then when we were using the incorrect flow delay. In this case we didn't lose points we actually retained those points and had more accuracy. But going through the point earlier, the question was okay what if we do have big holes in the data? And we are trying to incorporate a smooth surface, doing or what do we do then? There is some good options out there. There is some good research that suggests we can use satellite or aerial imagery to fill in missing places within a field. It's not perfect but it could be argued that that is better than nothing. But, I do feel the same way that the person asking the question, that is really dangerous if we just take a hole in the field and guess what is by taking the averages from the nearest points when they are that far away.

Yeah weird so another question that came in is, this goes to the exporting option, does each output field become a column heading in an Excel file?

The file in this case will have five headings. Column eight would be this and this is longitude and then latitude and decimal degrees and then this calm would be yield. We had to get a new column for everyone that you select but if you open that up in excel you will look at that.

I know we are at the top of the hour, we have the ability to continue with a few more questions, so if you have questions, get those in. Just as a reminder for anyone who wanted credit, if you came into the webinar you follow the instructions you can also get there from the link in the today's link where it says webinar redirects. Make sure if you are a CCA, get the credits, go to the link after we are done. We will go a few minutes over and I appreciate anyone who is interested, to hang out. One of the other questions is, is there software to create a yield model based on the cleaned up data?

The cleanup data can go up into any of the farm software platforms that you've been using. As well as we can make a map and enter those as well as GIS such as the GIS one we use in my classes, are either Quantum GIS which is an open-source free to use software. Or we use the commercial ESRI ArcGIS or ArcPRO or with that GIS software can bring in the tabular data as XYZ, X would be longitude, Y would be latitude and Z would be yield. Anything can be done in other platforms that
you regularly see at farm shows.

Okay a couple more questions, for the delay, assume a constant harvest of ground speed or does it try to account for the changing that we always get when we're driving over the field?

That uses the instantaneous ground speed that is recorded usually, those are recorded initially gear driven but I think there is some optical ground speed sensors that -- you think of the geometry of that we start with pounds for second and we need bushels per acre. So we convert how far the machine has moved, during the interval, the login interval would be one or two or three seconds. And we consider how far it moved, the distance in that amount of time and the swath with to come up with an area for that particular data point. As part of the calculations, yes, if you're changing speed throughout the field, then it uses speed when the measurement was recorded in the calculation.

Okay great, one question, the last one now, is it possible to have yield data tied to other parameters such as a cover crop?

Sure, but we will need to do that outside of yield editor. When I was mentioning earlier that your farm software for your farm mapping software may have other information such as treatments, and could be planting depth or fertility or variety information, or the example you provided, it would exist in a different layer and we would bring in the clean yield monitor data to put on top of that. In my mind, I

think cleaning yield monitor data is something that you especially do when you are interested in conducting field trials at the field scale. Does that answer the question?

I think so. One other last question that I have gotten before, is so, someone is using a do it all package that they have received when they purchased their tractor that includes the yield monitor system and yield mapping. Is there already cleaned data before they utilize it and how could they tell if it is cleaned? Is there an easy way to look at a data set and be able to tell if it has been cleaned already?

I think so. And this is what I tell farmers, is look at or look for jagged edges we had talked about on the clean and unclean areas. And if you seem the jagged edges we have talked about, here we go. That's not the right one here's my arrow but if you see these jagged edges where looks out of focus Camino it is not cleaned properly. That is the quickest litmus test. Some software has this built-in to automatically clean it up. But that being said, we don't usually have a human who looks at it to verify. But when you see it, if you see this jagged edge, looks out of focus and that does he what you need to know.

Great, okay, thank you so much Dr. Griffin. I appreciate your time today going a little over. Thank you to the attendees today I hope you gained information and I appreciate everyone taking time out of their day today to participate. Thank you.

Thanks Dana, thanks, Jennifer.