UK COOPERATIVE EXTENSION SERVICE
University of Kentucky – College of Agriculture

Site Specific Issues

A Precision Agriculture Newsletter

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Dennis Hancock, *Extension Associate for Precision Agriculture*

Preparing Your Yield Monitor for Fall Harvest

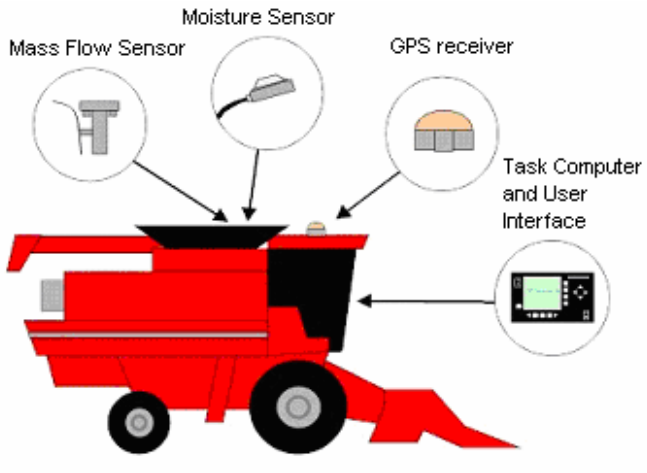
Scott A. Shearer

Now that summer is coming to an end, it is time to begin thinking about fall harvest. While most farmers are concerned with servicing the combine and making necessary repairs – don't overlook the yield monitor. There are several steps that can be taken now to save time and reduce frustration in the field.

First, grab a hand full of wire ties and check the yield monitor cables. Look for signs of wear on cables that are close to rotating shafts and pulleys, or v-belts. If you do find worn spots in the cabling, check to be certain the wires are not shorted. For cables that are loose or hanging, add a wire tie or two to help reduce or eliminate future problems. Pay close attention to cabling in the grain tank. Flowing grain can generate significant forces on cables causing unnecessary strain at the sensors.

Next, inspect the mass flow and moisture sensors. Look for any build-up on the surface of these sensors, and clean if necessary. Also, look behind the mass flow sensor to be certain material (cobs, stalks, wheat straw) is not lodged between the impact plate and the clean grain elevator housing. If build-up on the moisture sensor in the fountain auger is a recurring problem, consider relocating this sensor to the clean grain elevator. Moisture sensors mounted in the clean grain elevator sample the grain stream in contrast to the fountain auger sensors that are exposed to the total grain stream. Elevator mounted moisture sensors can be easily serviced from the ground, and service intervals are extended with the reduced grain flow.

After a visual inspection of the cables and sensors, it's time to dig out the GPS receiver and PC data cards. Mount the GPS receiver and pull the combine out of the shed. With the yield monitor powered-up, check to be certain you have a GPS signal with differential correction. If there is no GPS signal, check the receiver configuration to be certain serial or CAN port configurations are appropriate – some receivers are user configurable. If you have a signal, but no differential correction, be certain your correction signal subscription



is current. Consult the owner's manual for instructions on receiver diagnostics. Also, some yield monitors may require a PC data card to access the set-up and diagnostic screens.

Now that you have confirmed that you have a good GPS signal, start up the combine and engage the separator. Check to be certain the elevator speed sensor is working. In general, elevator speeds of approximately 400 rpm should be displayed at full engine throttle settings. With the combine running, create a new field in the yield monitor set-up. Next, raise and lower the feeder housing to initiate data logging. Drive a distance of 200 ft. or more while logging data in the new field. This should generate a data file of sufficient size to test file transfer procedures to the office PC.

The last area to be addressed is data housekeeping. These procedures are more specific for a particular make and model of yield monitor, although some procedures are similar. Delete the field summaries from the previous harvest season and reformat or clean up the PC data card. Carefully consider how you will approach calibration for the upcoming season. If you have made repairs to the combine such as the installation of a new clean grain elevator chain, you will need to recalibrate. Without major system modifications, the existing calibrations may be valid – however farmers are urged to continually check the accuracy of these calibrations

during the harvest season by comparing scaled weights with yield monitor summaries. Perhaps the last and most time saving activity is to set-up the yield monitor or PC data card with the names of the fields to be harvested. Again, this procedure is specific to a particular make and model of yield monitor.

Time and attention spent going over the yield monitor and associated components will help to reduce frustration at harvest, and should improve the accuracy of the resulting yield data.

Fall Soil Sampling Thoughts

Dennis Hancock, Lloyd Murdock

Whenever given the chance, we tend to talk about the value of soil sampling and how important it is. However, we rarely emphasize good methods, particularly with respect to when the best time to sample would be and how one should manage those results to get the most out of them. Soil samples can be collected through much of the year, although fall (September to December) or spring (February to April) are the most common times. Fall sampling, however, offers many advantages.

Nearly half of all the fertilizer used in Kentucky each year is bought by farmers during the rush of the spring planting season. As a result, it is often difficult for the fertilizer industry to meet customer demands during this 6 to 8 week period. This is all-too-common when using custom application services, especially if you're thinking of custom variable rate applications (VRA).

Much of the fertilizer used during the spring rush could be applied during other seasons of the year. For example, phosphorus (P) and potassium (K) aren't very mobile through the soil and tend not to leach into the groundwater. As a result, they can easily be applied in the fall, stored in the soil over winter, and taken up by the plants in the spring. Since many acres of Kentucky cropland are in no-till systems, worries over erosive transport of P and K into water systems are minimized in a fall applied situation. It is important to note that this is not true of all fertilizers. The most notable exception is nitrogen (N), which can leach into the groundwater or suffer denitrification losses. Such nutrients are best applied when the plant is able to readily utilize them.

The clearest example of a fall soil sampling advantage would be that of pH adjustment. When lime and fertilizers are applied to soils, many chemical reactions take place — some immediately, and some over long periods of time. These reactions have a great influence on when lime and fertilizer can be applied and how efficiently fertilizer is taken up by growing crops, and this influences the economic returns from lime and fertilizer use. Unlike most conventional fertilizers, the chemical reactions that make lime effective at reducing soil pH usually take 6 or more months. As a result, it is critical to apply lime in the fall to see the results of its application in the following growing season.

In addition to those agronomic advantages, there may be significant economic advantages. In many instances, off-season discounts can be obtained. In addition, more even applications throughout the year would mean that much of the fertilizer necessary for spring planting would already be on the field. This would save valuable time during spring planting and eliminate the risk of not being able to apply fertilizer because of wet land in the spring. Fertilizing in the fall would also ease problems of soil compaction caused by spreading equipment since the soil would have time to mellow over winter.

Taking soil samples is often easier in the fall in terms of the logistics of sampling and analysis. It is usually easier to probe the soil and typically the soil isn't extremely wet. When you take a typical representative soil sample, keep in mind that those few ounces of soil are being tested to determine lime and fertilizer needs for what may be several million pounds of soil in the field. It is absolutely necessary to take care to assure that the soil sample you send to the laboratory accurately represents the area sampled. The most representative sample for a large field can be obtained by sampling in smaller units on the basis of soil type, cropping history, erosion, or past management practices. More accurate results are obtained when problem areas are sampled separately.

Geo-referencing, or being specific about where that sample came from, is extremely important. It may be as simple as designating what area of the field it originated in or as detailed as coordinates generated by GPS. The new Extension soil sample system enables you to use a naming system that can be much more descriptive.

Sampling differing problem areas or "zones" during the fall may result in good clues as to what is occurring in those areas and will give you time to plan for the next growing season. Applying the appropriate fertility regime to those areas will then help reduce over-fertilization in some areas and under-fertilization in others. More soil sampling can make your fertilization plan more efficient. However, one shouldn't sample areas that are so small that you can't feasibly treat them any differently. For more information on fall soil sampling, check out the following publications: AGR-1 Lime and Fertilizer Recommendations, AGR - 5 When To Apply Lime and Fertilizer, and AGR -16 Taking Soil Test Samples.

Strategic Decision Making with Precision Agriculture Data

Laura Powers, Carl Dillon, Steve Isaacs, Scott Shearer

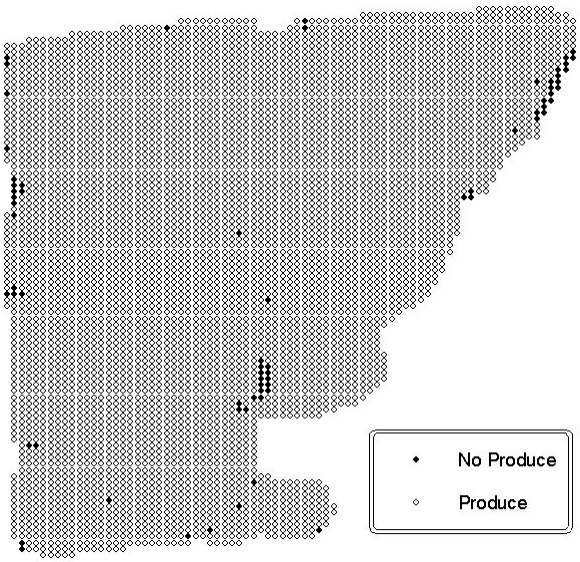
One of the most important and fundamental roles of the farm manager is making decisions. Making decisions depends on the ability to collect accurate information. While agricultural producers have long been aware that productivity varies within fields, traditional agriculture has not provided the means to accurately measure this spatial variability. Precision agriculture now gives producers the ability to collect and analyze information on much smaller units, such as 100 m^2 grids, within fields and apply decisions at the sub-field level, rather than the field level.

From the beginning of precision agriculture, farmers have been looking for uses of the information collected. This study has shown that with yield maps and production expense information, producers can make long-term decisions to improve profitability. One such decision is where should, within a field, production take place. Rather than assuming that an entire field should be in production, perhaps net returns can be increased by analyzing fields at the sub-field level. Production in a given area is justified when the returns generated in that area are greater than its costs. When combining yield monitor data with the relevant costs, specific areas not covering production costs can be identified for corrective action.

Using yield maps from a cooperating producer in western Kentucky, a case study has been developed to identify these "problem areas". A 124 acre field was divided into 100 m^2 grids where site-specific returns and costs were compared. Results showed that, in this particular field, 1.4% of the land should be removed from production to increase profits.

Relatively little information is needed to begin this decision-making process. In addition to yield maps, farm averages yields (used to adjust the yield map data), relevant production expenses, and net sales price (including LDP payments) are needed. Not all production expenses need to be included in the analysis. In the base scenario of production or non-production, only those expenses affected by removing land from production should be included. For example, the cost of seed would be reduced if land is removed from production, so seed should be included as a production expense. However, expenses such as taxes would be paid even if parts of the field were removed from production, so they should not be included.

Identifying land for non-production is only the first step in the decision-making process. The producer must then choose what to do with that land. The producer could profitably improve the land, such as addressing drainage or fertility problems to improve profitability. If the land is eligible, it could be enrolled in the Conservation Reserve Program (CRP). Enrolling land in the CRP would increase farm revenue by the net difference between the CRP payment and the establishment and annual maintenance costs for the enrolled area.



Using maps such as this, a producer could determine which areas aren't efficient. If the areas are contiguous enough, it may warrant taking it out of production.

Placement of the non-production areas is an important consideration for this decision. For example, it may be easier to leave fallow areas along field borders than scattered areas in field interiors. Additionally, what size would an area have be to justify non-production? Should the area equal an acre, half an acre, or even a quarter of an acre? Until these questions are studied further by researchers, it will be up to producers to make these decisions.

This research is the beginning of a new era of decision aids for PA users. The large amount of information collected through yield monitoring is one place to start. Specifically, by combining the site specific yields from yield monitor data with expenses from the same location, areas of a field that do not cover expenses can be identified and removed from production or profitably improved to increase farm profitability. This study has also shown the importance of accurate yield monitoring. Decisions are only as good as the information on which they are based. Thus, the more reliable the yield maps, the more reliable the decisions.

The objective for developing decision aids is to make them available to those who can use them, in this case, for users of precision agriculture. The next step in the process is the development of a vehicle to make this a reality. One possibility is a web-based economic advisory service to which producers can send the relevant data, such as yield maps and relevant costs. The service would send net returns maps back to the producer. The information and skills developed through this case study will be used to create a pilot project. This pilot project will help address the issues involved in bringing this service to users of precision agriculture.

Something to Think About

Some Editorial Thoughts on PA topics from Researchers at UK

When the Infatuation with Precision Agriculture Technologies Fades

*Scott Shearer**

Yield monitors and GPS are now a common place on many farms. The farm press coined the phrase "farming by the square foot." The newness has worn off and now many farmers are asking does this technology pay? While we continue to see accounts of what it has done for some producers, it may be time to look at your own operation to establish the value of your efforts.

I recently traveled to Bloomington, MN for the 6th International Conference on Precision Agriculture. The conferences attracted nearly 600 professionals (academics, business leaders and farmers) who came together to discuss the latest developments in precision agriculture. I observed numerous presentations on defining management zones and the application of remote sensing technologies. The possibilities seem endless. Perhaps overlooked by some at the conference were the hands-on "A to Z" sessions dedicated to practitioners. I found one session particularly interesting – it was a panel discussion of four farmers from across the U.S. (Montana, South Dakota, Minnesota, and Georgia). Each of the farmers made a presentation on the elements of precision agriculture they had adopted, and how they were profiting from these technologies. I learned how one producer was using remote sensed data to apply herbicides, and how another producer used electrical conductivity (EC) to develop management zones. In keeping with the foundations of precision agriculture, they were managing inputs on a spatial basis – "farming by the square foot." In short, I was impressed. These gentlemen were pushing the envelope with this new technology!

When it came to the panel discussion portion of the presentation I was curious as to the thoughts of these producers with respect to software packages. Specifically, I asked if they were able to utilize their spatial data (from the GIS/mapping packages) in their accounting packages. The response was somewhat mixed. I probed further by asking if any of these producers were tracking profitability on a field basis -- treating each field as a profit center. The room was very quite. Finally, one of the farmers admitted that he could not even tell me if it was profitable for him to raise soybeans.

On the trip back from Minnesota, several colleagues and I began to reflect on what we learned at the meeting. The major revelation for me was that "farming by the square foot" may be a myth, or at best, a goal. Perhaps the current state of site-specific management has not yet reached field scale. While many farmers do treat fields differently, the shortcoming may be the failure to close the loop by assessing profitability at the field level. As producers adopt "farming by the square foot" technologies, determining if they profited from these practices may be easier if they begin treating individual fields as profit centers.

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* Dr. Scott Shearer is a Professor in the Biosystems and Agricultural Engineering Department. In addition to his numerous research projects in the area, Dr. Shearer also serves as the current Chair for the Precision Agriculture Steering Committee at UK.

Hands-on Training Opportunities:

Fundamentals of GPS and Precision Agriculture

When: Wednesday, October 16, and Wednesday, October 23; 9:00 am – 3:00 pm
Where: Lexington (16th) and Princeton (23rd)
Who: Tim Stombaugh

The Global Positioning System (GPS) is becoming a bigger part of everyday life. We see it in cars, boats, backpacks, cell phones, and even watches. Many high schools are even initiating curricula involving GPS and mapping applications. In agriculture, GPS has revolutionized the way fields can be managed. These techniques, known as Precision Agriculture, allow producers to optimally manage small sub-areas of fields. This training session will cover the basics of GPS and precision agriculture. Those who complete the session will have a solid understanding of how GPS receivers work, be able select and use GPS receivers and advise clientele about techniques for implementing GPS in agriculture and other applications, and have an understanding of the basics of Precision Agriculture. Examples will include non-ag applications, so all agents and specialists should benefit.

Using GPS for Sampling and Scouting

When: Thursday October 24; 9:00 am – 3:00 pm
Where: Princeton
Who: Tim Stombaugh

One of the fundamental components of Precision Agriculture is intensive soil sampling. There are many

questions that have arisen regarding proper mapping and sampling techniques especially with the use of GPS in grid sampling. Participants in this session will get hands-on experience with GPS equipment and modern software to learn field mapping, grid or zone establishment, scouting, and map creation. A small amount of GPS literacy will be helpful, but not required. This session will be a nice follow-up to the "Fundamentals of GPS and Precision Agriculture" session on the preceding day.

Economic Computer Decision Aids

When: Noon Wednesday, December 18 – Noon Thursday, December 19
Where: Pennyrile State Park
Who: Gregg Ibendahl, Steve Isaacs, Dick Trimble, and Laura Powers

This training will focus on the various computer decision aids available from the Ag Economics department. The workshop will begin at noon on Wednesday, December 18th and end at noon on Thursday, December 19th. The first afternoon will focus on explanation and demonstration of the various computer tools. The following morning will be devoted to hands-on exercises. Among the computer decision aids to be discussed are: the farm planning tool, a specialty grain calculator, computerized budgets, and computerized financial statements. Most of these tools have been updated since two years ago so even if you've seen these tools before, this workshop should still be beneficial. This in-service is being funded by a grant so we are providing lunch and dinner on the 18th and breakfast and lunch on the 19th. Lodging for the 18th will be provided as well. We can provide some PCs but if you have your own, please bring it.

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Highlighting PA Web Sites

Check out some of the new additions to our website: www.bae.uky.edu/~precag/

- We have recently updated our list of PA websites and added some new PA publications and brochures.
- Keep a lookout for a new look to our webpage later this fall. We hope to make the information we have even more navigable.

Quotables:

"A month of going through records will save me a whole day on the computer."
– **Chuck Merja**, Precision Farmer in Sun River, Montana, jokingly referring to how PA has helped him be more time-efficient.

"Not everything that can be counted counts, and not everything that counts can be counted."
- Albert Einstein

"Men have become the tools of their tools."
- Henry David Thoreau

Research HIGHLIGHTS

Soil Characteristics and Yield- *Lloyd Murdock, Tom Mueller, Paula Howe*

Fertility variation in the surface layer of soil has not successfully explained yield variability, implying that factors other than soil fertility may have influence yields. The study's objective is to map soil morphological characteristics, both on the soil surface and in the horizon, and then determine if it is associated with yield variability of corn and/or soybeans.

- Of the 15 characteristics that were investigated, topsoil depth was the most important, describing 70-90% of the yield variability in data collected so far.
- Having 8 in. of topsoil is important, as each inch increased the corn yields by 10.1 bu/ac up to 8 in. on average.

Variable-Rate Seeding and Nitrogen Application - *Richard Barnhisel, Morris Bitzer, Scott Shearer, Lloyd Murdock, Paula Howe*

Prior work suggests that varying seeding and nitrogen rates based on topsoil depth could have an economic benefit to the grower. The purpose of this study is to evaluate techniques for varying seeding and nitrogen rates.

- Yields from the variable seeding rate plots, based on topsoil thickness exceeded the yields from the constant seeding on the similar soil depths.
- The highest yield was on the deepest soil, where the variable seeding rate increased net return $20.89/a and $32.63/a compared to the 24K and 27K seeding rates, respectively, the first year averaged over the seven locations.
- Averaged over three years and seven locations each year, variable seeding increased net return $ 17.51/a per year (range was $5.73 to $34.95) over the recommended constant 27K seeding rate.
- Varying both the seeding and nitrogen produced the greatest net returns, varying seeding and N increased gross returns by $39.10 per acre compared to the constant 24K, 27K & 30K seeding rate with a constant 160 pounds N.