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Technology in Row and Specialty Crops: Finding Common Ground in Digital Agronomy

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It's no secret that growers of specialty crops and row crops see farming from different perspectives. Could digitization and integration of data prove equally valuable to both?

Growers of both specialty crops and row crops have embraced technology as a means to an end—producing healthy, profitable crops—and yet their respective operations have evolved using different types of technology for different applications.

In the Midwest, for example, growers of row crops have been using precision agriculture techniques for more than 20 years, enabled by variable-rate application technology and yield monitors. Long gone are the days of treating a field holistically; site-specific agriculture is now commonplace on many farms.

Precision agriculture has allowed growers to:

- Gain a better understanding of the spatial variability within a field.
- Identify the specific requirements of each of those particular areas of a field.
- Create a plan or recommendation of how to address those requirements in order to maximize productivity across the total field.

Specialty crop growers, on the other hand, do not generally capture yield data at a granular level (smaller than field size), so they are not assessing or addressing potential spatial variability. Without those reference points, there has been little value in variable rate applications—each field is treated as a whole.

KEY TAKEAWAYS

- Growers of specialty and row crops can benefit from understanding and incorporating each other's best practices and learnings.
- Data digitization allows myriad data to flow into a system where it can be looked at for similarities, correlations and other details that enables faster and more thoroughly informed decision-making.
- Efficient and accurate data flow from equipment, labs, scouting, and other methods into a central repository where it can be viewed and used improves data integration, access, aggregation, and ultimately, decision making.
- The human element remains critical to bring context to the decision-making, but digitization and integration of data empowers agronomists and crop advisors to be even better at their jobs.

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As the cycle graphic to the right illustrates, you have to be able to close that loop and glean insight on actual productivity in order to see the value in treating orchards, vineyards, and so forth, as if there is variability from one end of the field to the other. In many cases, we are collecting spatial data, but we haven't been able to put it to work. This is because we either lack the means to make the variable-rate application, or because cultural practices are not currently set up for it.

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UNIQUE PERSPECTIVES, STRENGTHS

A lot of times when you're thinking of the West Coast, you're automatically thinking of all the specialty crops. But there are also some of the commodity crops in the West for which we could be using precision ag practices just like in the Midwest.

At the same time that the row crop industry has been fine-tuning precision agriculture and its spatial aspects, on the West Coast – particularly in California – recordkeeping has advanced to state-of-the-art. Driven by stringent regulations, which are (at least in part) demanded by consumers and food processors, specialty crop growers must document every aspect of their production, including pesticide use. And as the crop input chemistries and seed genetic systems have become increasingly complex, managing production data is critical to food and worker safety, not to mention avoiding the cost of fines levied for non-compliance.

While time-consuming, rigorous recordkeeping has become routine for growers in the West, many Midwestern growers tend to focus primarily on data related to how inputs affect yields rather than detailed pesticide use reports (PURs) and documenting traceability. However, with the recent issues surrounding dicamba application, this is changing and could further change reporting regulations in the Midwest.

IS IT TIME TO CROSS-POLLINATE?

While each geographic region has adopted the technologies most important for meeting immediate needs, there are definitely ways growers of specialty and row crops can benefit from understanding and incorporating each other's best practices and learnings. A few of those ways include:

1 **GEO-SPATIAL MAPPING.** Using GPS to geo-reference field locations has made it easier for row crop growers to identify trouble areas, manage resources and track corresponding yields within fields. Many specialty crops have not allowed the efficient use of GPS and sprayer/application tracking due to challenging production systems (for example, dense tree canopies dampening connectivity). There are new technologies emerging, however, that are modified versions of traditional GPS from the Midwest that will work in specialty crops. Assuming these technologies pan out, there is no reason why specialty growers couldn't learn a lot from row crops about ways to maximize production and minimize costs using variable rate applications and associated technologies.

2 **SATELLITE IMAGERY**. Again, it's a practice that started in the Midwest but which is continuing to be refined and is now more suitable for specialty crops. There are two reasons for this: more satellites and better sensors. The sensors' increased precision and resolution results in more frequent images being captured, giving a clearer picture of field conditions, even in crops with dense canopies. Satellite imagery could be a valuable tool for crop advisors and growers managing large areas of diversified crops.

3 **RECORD-KEEPING**. Whether it's pesticide drift, import bans by foreign countries, food product labeling requirements, or documenting organic cropping systems versus traditional systems, the Midwest is not immune to the rising tide of mandatory documentation in agriculture. Specialty crop growers know the ins and outs of pesticide label databases, tank cleaning procedures, PURs, food safety compliance, and much, much more. Tools and systems, as well as best practices that Western growers have learned through experience, can help row crop operations learn the ropes—and avoid pitfalls along the way.

FROM PRECISION AG TO DECISION AG

Finding value in all of the agricultural technologies available may have been more academic than practical until the data stream began to be digitized, which allows for the faster and seamless (often automated) transfer of information. And while precision agriculture was game-changing, particularly in the Midwest, "digital agriculture" may offer even greater potential because it encompasses the whole data collection, management, and analysis process. It offers more insights than the actual action that defines traditional precision agriculture.

Precision agriculture has been around for decades, and people are still trying to understand what it means and how it varies. Whereas, when you start talking about the digitization of agriculture, that's more clear: it means looking at agricultural data from a different—and broader—perspective.

We're migrating from an analog perspective to digitization, pixel by pixel, as we're trying to get more granular about really understanding the complete dynamic picture in a field. Digitization allows myriad data to flow into a system where you're able to look for similarities, correlations, and other details that will help tease out opportunities to make agronomic adjustments that maximize a grower's field capabilities and potentially their entire operation.

Once you start getting all farm data in a standardized format that is easily transmitted, you can make much better use of it. We're finally starting to have the ability to cross-communicate amongst various data streams. For example, we are beginning to have equipment telemetry that doesn't require manual uploading and downloading—the data is flowing seamlessly from sensors. In short, digitization enables much faster and more thoroughly informed decision making.

THE PRACTICAL APPLICATIONS OF DIGITIZATION

The seamless flow of data could not have happened prior to now. We just didn't have the connectivity we have today. Soil sampling is a good example. Previously, a user would go out to collect a soil sample and then submit it to a lab, which would run an analysis, generate a report, and email it back to the crop advisor. Then the user had to open the email and the attached PDF or Excel spreadsheet, which they stored in a computer folder or printed out and put in a binder. The report includes important data, but that data stands by itself in that document. It can't really "touch" other data sets, so using it in conjunction with other data to draw conclusions was cumbersome.

Now a user is able to collect multiple zone or grid samples, which are all geo-referenced (using only their phone) to exactly where they were taken in the field. After the samples are collected and sent to the lab, the lab is able to communicate back in a digital format that goes right into the farm management information system (FMIS), and that information is automatically in the system.

It's not only tabular, but also graphical, so it's enabling users to have that data much more quickly in a standardized format, and also to have that visual interpretation of what is going on. It also allows a user to look at soil data, satellite imagery, and other details from previous years to see what's happening over time. With information delivered instantly in a useable format, in that same environment, we can start writing recommendations that contribute to a variable-rate application. In one centralized location we've connected

the data with the workflow and with tools that can do things with that data.

This also ties to tissue sampling, which happens during the growth cycle. After the crop is up and growing, collecting tissue samples helps a grower understand how the crop is progressing from a nutritional perspective. It provides in-season insight to allow a grower to augment their nutritional program by making some type of supplemental application while there is still an opportunity to have an impact.

The whole flow of data from equipment, labs, scouting, and other methods, into a central repository where it can be viewed and used, is important because it expedites the data analysis process. It brings all the information together at a central point where someone can examine how the data corresponds to rainfall, temperature, and other factors. It enables the collection and comparison of more different data points, so you can truly understand the interactions that are occurring, and what can be done. That's where efficiencies and power come into it. Data integration, access to data, and having all the data in one spot give us the ability to think, act, and manage more quickly and with greater reliability.

We still have work to do, but that is our goal, and we are getting there as an industry. We no longer just collect data; the data is driving an action, and that helps us move from precision agriculture to decision agriculture.

Ultimately, digitization allows us to go into predictive activities. With a large enough data pool to create predictive analytics, growers can better foresee what is going to happen— and make decisions based on that foresight rather than solely on a historical perspective.

THE HUMAN FACTOR

Will digitization and automation replace crop advisors? Not likely.

Analyzing data requires knowledgeable people who know and understand how to use the systems and correlate information in order to tease out those potential attributes that are having some type of spatial limitations on a field, for example.

Also, weather is unpredictable. We can't control Mother Nature; even with the best technology, the best modeling, she can be elusive.

And lastly, agronomy is still local. We are capturing data, analyzing it and writing recommendations, but it still needs to be validated and vetted based on the local conditions to ensure that it truly does make sense. Case in point: if a grower is looking at a tool that enables them to select an appropriate hybrid for their soil type, topography, or goals, but market conditions change and that hybrid is not available, what are they going to do? Local knowledge and insights are needed to re-assess situations and make new recommendations.

Data empowers agronomists and crop advisors to be even better at their jobs, but the human element remains critical to bring context to the decision-making.