GLOBAL PRECISION INITIATIVE

2019 OUTLOOK FOR GLOBAL PRECISION AGRICULTURE

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Global Precision Initiative: Market Forces

Collectively the global market for precision agriculture / digital farming is thought to be on the march. Disparate technologies like farm management software, sensors and remote sensing, microprocessors, variable rate technology, image recognition, connectivity / telemetry, artificial intelligence and machine learning, robotics and automation, predictive analytics, and blockchain are converging and finding application in agriculture. Low margins, labor shortages, and sustainability / traceability initiatives among food companies and retailers are pressing crop producers to do things in different ways. And majorities of respondents to surveys conducted by **Meister Media Worldwide** cross occupations, geographies, and crop areas indicate that precision either is "already here and is starting to mainstream" or is "starting to gain real ground in adoption."

Unfortunately there are many challenges to precision agriculture too, foremost being practical adoption. Many row crop growers have economies of scale needed for technology investments but (currently) not the margins due to prevailing commodity crop prices, while specialty crop growers have the high-value markets suitable for ROI but not the economies of scale that the high-end / large-scale technology providers (e.g., John Deere) tend to seek when developing solutions to very tricky production challenges. "Ag tech" startups are frustrated by grower hesitation and slow-moving annual growing cycles needed for proof of concept. Technology development is uneven across geographical regions, crops, and technologies. Producers don't always report a return on their investment in precision agriculture technology, time, training, and staffing.

The precision / digital market is, in short, fragmented, and it resists ready description and prescriptive solutions. As the concept goes, however, the opportunity to advance an army's progress is when there's smoke on the battlefield – though that progress is almost certain to be slower than many might hope and to take unexpected directions.

Precision Agriculture is a Global Phenomenon – Though Unevenly Distributed.

Precision agriculture largely began in row crops in the U.S. and Canada, and that's where leadership still resides. In 2017, ***CropLife***® magazine's regular survey of precision ag services offered by Midwestern ag retailers, primarily in row crops, found high adoption levels in variable rate applications of fertilizer (78%), lime (63%), and seeding (62%). Australia and New Zealand have joined North America in sophisticated use of in-field machine control and data management, especially in row crops. Western and Eastern Europe comprise the second tier. South America – specifically Brazil and Argentina – is third. In specialty crops, precision agriculture and digital farming are gaining ground where technological expertise, national wealth, and specialty crop production converge: the U.S. West Coast, Western Europe, and South Africa especially, followed by some of the more prosperous and often export-oriented Latin American production areas

including Argentina, Mexico, Chile, Colombia, and Central America. In China, research into drones, sensors, and other technologies often is world-class though are often focused primarily on development for its own in-country use, especially due to increasing governmental pressure to address environmental issues. The Netherlands, Israel, and Ireland are key areas of technology development. Much of the rest of Middle East, Asia, and Africa are hampered by a lack of wealth and/or large and productive enough growing areas to bring economies of scale.

Don't Call It "Ag Tech."

The entry of tech startups and venture capital brought much money and interest but also a haze in what is defined as "ag tech" and "precision agriculture." At Meister Media Worldwide we use ag tech as an overarching term incorporating biologicals controls and genetics, digital farming, and protected agriculture as well as precision agriculture. Digital farming is the digital "operating system" uniting crop inputs, food production, and distribution – from data used in crop input R&D all the way through to blockchain and other traceability efforts. Precision agriculture is best captured, in our minds, by one definition set forth by the membership of the International Society of Precision Agriculture in summer 2018 (emphases ours): "Precision agriculture is a management strategy that uses a wide range of technologies to gather, process and analyze data for the purpose of guiding targeted actions that improve the efficiency, productivity and sustainability of agricultural operations."

The Challenge of Separating the Signal from the Noise

With so many suppliers and technologies out there, the challenge – and the opportunity – is in distinguishing who and what really matters. This process will continue for some time as new technologies continue to emerge, are refined and adapted for production agriculture, and continue to become more affordable for most growers. In doing so it's helpful to sub-categorize the wide-ranging world of precision agriculture into four key areas: data collection (weather; soil sampling; field imagery from cameras, sensors, drones, airplanes, and satellites; yield monitoring; machine data); data storage, synthesis, and analysis (complex farm management systems like Wilbur-Ellis's AgVerdict); data application (especially variable rate of seed, crop nutrients, crop protection, and water); and harvest/postharvest (robotics, packinghouse mechanization, traceability through the food system using sensors, etc.). Underlying this is data and the geolocation and connectivity used to piece it all together, the latter increasingly provided not only by broadband but also by Internet of Things (IoT) technology. A cross-market survey in February 2018 primarily of growers and ag retailers and ag consultants but also including crop input manufacturers, technology providers, and equipment manufacturers found particular excitement about the areas of sensors, field and crop imagery, and precision irrigation / water management, followed by variable-rate application of crop inputs, the abundance and effective management of data, and farm management / decision-support systems.

Precise Field Application is Back, with Potentially Huge Impacts on Crop Inputs

Precision farming pretty much all began with the aim of placing crop inputs where they're needed and *not* putting them where they ain't. After ag tech's many forays and sizeable investments into new ways to gather field data (e.g., aerial imagery, sensors) and synthesize and analyze data (e.g., Climate's FieldView), precision agriculture's attention increasingly returns to more precise field application. Why? Because the value of sophisticated data collection and analysis is for naught if seed, water, crop nutrient, and crop protection inputs are misapplied. AMVAC's SIMPAS – short for "Smart Integrated Multi-product Prescriptive Application System" – is one example of a back-to-basics approach that is also quite sophisticated. Much the same is true of John Deere / Blue River Technology's "See & Spray" technology, which uses cameras, machine learning, microprocessing, and application engineering to train its machinery to distinguish between crops and weeds and spray only crops. If such variable rate technology becomes widespread, it could have a significant impact on the manufacture and formulation of crop inputs – crop protection especially – and the companies that make them. For instance, U.K. analyst firm IDTechEx in autumn 2018 wrote that "see-and-spray technologies will drastically impact the volume and type of the chemicals employed, potentially transforming the business … toward one in which they sell many specialized selective chemicals tailored to various plants." IDTechEx further believes that "agrochemical companies have no choice but to become intricately involved with robotics and AI" and that "the value chain will become more digitized with data and intelligence capturing a more significant part of the overall value." (Indeed, the newly formed Corteva Agrisciences is organized around the three major areas of crop protection, seed, and digital.) Wider use of variable rate application in crop protection likely will impact herbicides first, followed by fungicides, and then insecticides. VRA is ongoing in fertility programs, where newer sensor and predictive-analytics technology provides in-season alerts based on field-condition data that in-season applications are likely to preserve or improve projected yield.

Robotics and Automation on the Rise

The image of robotic arms, or of robotics entirely supplanting workers, both are misnomers to a large degree. More than likely the practical application of robotics and automation will be to augment the work of laborers in the field and the packinghouse, leaving those workers – through training and redeployment – to focus more on higher-end work like practical agronomics, technology maintenance, and troubleshooting. Still, the efforts of robotics developers continue to move forward. The annual gathering of FIRA, the International Forum of Agricultural Robotics, in December 2018 marks the third such meeting. As with self-driving cars, the practical use of autonomous farm vehicles still could be quite a ways off, and practical considerations – sunlight, moisture, weather, rough field conditions – continue to bedevil the advancement of robotics in agriculture. Yet there is an emerging feeling that robotics will arrive in food production soon enough. For example, Barry Micallef of the University of Guelph wrote in autumn

2018 that "robotic weeding systems already exist, and they should make our present approach to chemical weed control in agronomic and horticultural cropping systems obsolete in the next 10-15 years. That also includes transgenic herbicide-resistant crops; they will become obsolete as well."

The Pull-through Influence of Food Companies and Retailers Is Real

Once a large retailer such as Walmart or Tesco analyzes and seeks to reduce its own carbon footprint, it seeks to do the same with its major suppliers. It is here that they come to discover that production and distribution of (say) potato chips has a far larger environmental impact than might have been anticipated. In this particular case, the value of precision technologies becomes twofold: to reduce farmers' use of crop inputs, and to amass data that proves a reduction was achieved. There's also the important issue of traceability in the event of a food scare. Walmart's announcement in late 2018 that it wants all of its suppliers of leafy greens to join the blockchain system of IBM Food Trust within about a year is a major signifier of the importance and pull downstream buyers.

Data Is King, But Brings Its Own Set of Problems

Data is increasingly paramount in agriculture. Producers who consistently gather the most important data points are in a position to command a premium because food producers and processors want this data to underpin their sustainability initiatives. Data informs pre-planting decisions, in-season decisions, harvest decisions. It underpins predictive analytics. Yet a lack of a standardization and commonly used platform, coupled with hesitation many growers have to share their data, leaves much valuable data inside "walled gardens" and often largely unusable. One potential breakthrough is crowdsourcing of data – for instance, Xarvio's scouting app which encourages smartphone users to catalog millions of photos of pest problems in real-world production situations and detect in-field stress by taking a photo. Xarvio says the free app "determines weeds, classifies and counts insects in the yellow trap, recognizes diseases, analyzes leaf damage and shows the nitrogen status." Critical to real-time use of such technologies, however, will be wider availability of broadband internet in rural areas, which is still challenged in key parts of the world including the U.S.

Use of Precision in Commodity Crops Continues to Be Price-Dependent

Precision services – much like, say, fertilization – often can be seen by farmers as a luxury line item that can be skipped for a year or two when commodity prices decline and margins are tight. This along with a lack of ease of use and lingering incompatibility across a quilt work of products and platforms has limited adoption of precision farming – at least as defined as full use of data from pre- through post-production – to the low double digits as a percentage of all U.S. farmers. Suppliers hope to see this adoption level increase as the price of technology comes down and farmers see more of a direct financial ROI from precision services.

Horticulture Markets Are Ripe for Precision

While prices for commodity crops bounce up and down and often take farmer interest in precision with them, growers of specialty crops – who are chronically beset by labor issues, water costs and shortages, and food safety/sustainability requirements, but who are also motivated by potential premiums for their products – are jumping into a more specialized subset of precision. Soil and weather sensors, variable rate control of insects, precision irrigation, in-field robotics, and postharvest automation are of particular interest, and commodity boards are emerging as important arbiters of trialed-and-approved precision products and services. Growers say they want these technologies, but affordability, durability, clear ROI, and ability to readily adapt and maintain them – not to mention manage and make practical use of the data that many of them provide – will be critical.

Services Increasingly Matched to Grower Needs

The hazard of new precision technologies is that attention can gravitate to the breakthroughs themselves rather to their practical implementation. But precision suppliers increasingly are fine-tuning their benefits messages to match distinct grower pain points. Among these matchups are soil data for seed and fertilization decisions; weather data to validate insurance claims; imagery to respond to field data and make decisions; variable rate application to optimize inputs; machine data to improve field performance (e.g., detect compaction, ensure correct tractor speed); irrigation alerts to optimize water use; sprayers to optimize spray windows and avoid drift; pest alerts to initiate pest response (in row crops) and mate response (using biocontrols); and storage using moisture and weather sensors.

Water Optimization Has Become Paramount

If anything good came of the long drought in the Western region of the U.S., it's that application of water must be approached as carefully as application of crop protection chemicals and crop nutrients. This is no revelation in arid countries such as Israel, which long ago adopted precision irrigation technologies that can be adapted for use around the world. Irrigation systems – utilizing IoT connectivity to combine sensor readings with weather forecasting and expert analysis, so that water can be applied more judiciously – will become more common as water becomes increasingly scarce and expensive.

Precision Interacts with Biocontrols

Not only are suppliers and growers using precision tools to measure and prove the ROI of biocontrol products, they also are adapting these tools to parallel uses – e.g., taking cameras that were installed to measure the population of pests attracted to pheromone traps, then repurposing them so that these cameras also can (say) view and record the size of blooms on fruit and nut trees and assess a need for thinning, or predict number of days to harvest.

Predictive Analytics Is Where the Real Value Lies

Precision agriculture began in the 1980s and 1990s as a way to record and analyze "what happened" – e.g., that this much grain was harvested from this part of the field using this mix of crop inputs. But the real value now will lie in *predictive* analytics. For instance, a premium winegrape grower seeking the peak day and even hour to harvest his or her grapes doesn't benefit much from an alert to harvest that arrives at (say) 11 p.m. However, when sent an alert days in advance, growers can ensure their harvest crews are lined up for an expected time to harvest (or else one day will be able to deploy a fleet of robots, which while not yet quite ready for primetime, will be able to work in the dark). Similar tools already are found in commodity crops – e.g., nitrogen management tools that can use current soil moisture and longer-range weather forecasting to predict not only what the size of harvest is expected to be, but also to advise how much a grower might gain financially via greater yields from side applications of fertilizer.

"Gamification" of Farmer Tools

It's long been asserted that most farmers aren't "into" precision tools, that they prefer to rely on their own in-field perceptions rather than on rote generation of data. But the widening use of platforms such as The Climate Corp.'s FieldView has shown that data and farmer instincts merged with data displayed in a visually compelling way can be powerful with farmers. Such "gamification" of data – meaning it's fun for the farmer to "play" with the data – is likely to accelerate precision adoption. With their iPads, farmers can analyze field maps, circle any areas they wish, analyze a host of data points including inputs applied and historical harvest and weather data, and ask questions of their agronomists informed by empirical data as well as their own hunches gained through years of farming.

Grower Advisers Remain Critical to Precision Adoption

With so many potential precision solutions out there, it's been estimated that 80% to 90% of U.S. growers rely on their ag retailers to help them winnow out technologies. Just as importantly, retailers and other service providers are critical to helping ensure growers capture as much of their data as possible – e.g., that they make sure they USB sticks, that they store their data, etc. – because when the grower fails to gather data, that season's information is compromised or is gone outright forever. The key for retailers and other service providers will be to see their own ROI from investing in and offering precision services, rather than watching them get bundled into the farmer's overall payment for crop inputs and custom application.

More Valid Information, Please

Last, there is an acute need for good, reliable, useful information on precision and digital technologies. In a Meister Media Worldwide survey of growers, ag retailers, and many other decision-influencers, a significant minority among 827 respondents said they were either "a little prepared" for the impact of precision technology and

were “starting to get a little nervous” (23.5%), or were “not at all prepared” and felt “a little panicked” (4.4%). But herein lay opportunity for those who serve field practitioners. In the same survey, more than 60% of respondents said their top step in reacting to the increase of precision technologies is to “actively seek more and better sources of information.” This was equaled by “increasing training of our current personnel,” and followed, at about 55%, by “acquiring new technology.” Interestingly, “recruiting new personnel” drew only a bit more than 20% of the responses, perhaps suggesting that know-how in practical crop production and crop protection remains critical, even with new precision and data technologies. Having ready access to reliable information remains paramount.

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ABOUT THE GLOBAL PRECISION INITIATIVE

Meister Media Worldwide presents the Global Precision Initiative and its mission to foster and advance the use of precision agriculture and digital farming technologies around the world.

Precision farming by its very nature is very locally focused – down to the individual field and even sections of a field. However, many major field technologies and software platforms – and most data management regimens and sustainability and traceability programs – are relatively crop-agnostic and in fact gain strength through use by a wide range of constituents. But because these technologies are still relatively new and are ever-evolving, there's a demonstrable need for greater community and more information sharing across national borders and “silos” of cropping systems as precision agriculture and digital farming continue to mainstream. This is the void which the Global Precision Initiative sets out to fill.

Global Precision Initiative's Mission

In-field precision technologies and techniques used by row crop farmers and specialty crop growers (fruits and vegetables) – especially digital and machine control of farming processes and application of crop inputs, sensors and sensor platforms, and robotics and automation

Digital farming – data analytics, decision aids, management software, as-applied farm recordkeeping

Post-farmgate – traceability and management of downstream market logistics

ABOUT MEISTER MEDIA WORLDWIDE

Meister Media Worldwide, founded in 1932 and headquartered in Willoughby, Ohio, USA, produces integrated business solutions for worldwide specialized agriculture. A leader in the industry, the company provides information and networking opportunities to communities including fruits, nuts, and citrus; vegetables; cotton; ornamental horticulture; horticulture in Latin American; precision agriculture; custom application of crop inputs; and the manufacturing, formulation, and distribution of crop protection and plant health products in the U.S. and globally. Meister Media's stable now includes 14 major brands whose portfolios include print publications, digital products, conferences and tradeshows, and Connect hosted-buyer events. In addition, Meister Direct produces custom print and digital products, and strategic business development services from concept planning through development and delivery, we know who you want or need to reach and how best to get their attention. Contact us at info@meistermedia.com.

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