2025 PRECISION AGRICULTURE DEALERSHIP SURVEY

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Departments of Agronomy and Agricultural Economics

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ABOUT THE SURVEY, RESPONDENTS, AND RESPONDENT'S COMPANY/ORGANIZATION

In February-March 2025 CropLife magazine and the Departments of Agricultural Economics and Agronomy at Purdue University conducted the 25th survey of crop input dealers about precision agriculture technologies. Recipients were asked questions about what precision products and services they offer to their customers, the profitability of these products and services, custom applications of fertilizers and pesticides, their usage of drones for custom applications, and questions about automation and artificial intelligence. To keep the survey length reasonable for respondents, we ask some questions in alternate years—so some survey questions that were asked in 2024 and not 2025 are included in this report, as well as some time-series information that goes back many years, in some cases into the 1990's. This survey is the longest-running, continuous survey of precision farming practices in the world.

The questionnaire was all electronic using QuestionPro (https://www.questionpro.com/us/?) due to its formatting capabilities, with a link emailed to a subset of CropLife's email list. Survey questions are at the end of this report. With any survey a recipient may not respond, respondents may not answer all questions, or may also answer some questions incompletely. We did not include a respondent's survey responses in this report if they:

- Only answered demographic questions (1, 2, 3, 4, 5, or 6) and nothing else.
- Did not answer 1, regardless of any other responses, which asks about their type of business. We report on business types separately, so 1 was essential for sorting.
- Responded to Question 1 as a farm equipment dealer or agricultural consultant. If those options were chosen, the online survey instrument thanked the respondent then terminated.
- Did not answer 5, regardless of any other responses, which asks about crops grown in their area. We report field crops and specialty crops separately, so 5 was essential for sorting.

Otherwise we accepted all other responses, however complete or incomplete. In this report we present a summary of the 93 surveys from agricultural retail input suppliers working with field crops only. The remainder of the surveys represent retail input suppliers of specialty crops. Respondents identified as working with field crops indicated corn, soybeans, wheat, rice, cotton, milo, sugar beets, dry beans, or hay/forages were the primary crops for the products and services they provide. Those tagged specialty crops were providing products and services primarily to nursery, greenhouse, tree fruits and nuts, vegetables, berries, or grapes.

2017 was the first year we asked respondents specifically about their type of business, if they were input suppliers, equipment dealers, consultants, or other. Prior to that respondents could have fit a broader definition of ag retail by just being on CropLife's mailing list. 2019 was the first year we asked about the crops in their areas so we could distinguish dealers working mostly with specialty crops from dealers working mostly with field crops. Looking at past reports most responses were from the Midwest, so it is assumed most past surveys reflect mainly dealers working with field crops more than specialty. This year most field crop retailer survey responses were from Midwest states, similar to previous reports. Response by state is shown in Table 1 (categories may not add exactly due to rounding).

Table 1, Q6: Respondent location by region and state. 32% did not indicate.

Midwest 42%				South 14%		West 8%		East 4%	
Iowa	8%	Indiana	2%	Alabama	5%	Washington	2%	Maryland	2%
Illinois	6%	Michigan	2%	N Carolina	2%	California	1%	New York	1%
Ohio	6%	Missouri	2%	Tennessee	2%	Colorado	1%	Pennsylvania	1%
S Dakota	4%	Nebraska	2%	Texas	2%	Idaho	1%		
Minnesota	3%	Wisconsin	2%	Arkansas	1%	Montana	1%		
N Dakota	3%			Georgia	1%	Utah	1%		
				S Carolina	1%				

Of the ag input retailers 47% indicated they represented a cooperative, 36% an independent dealership and 18% were part of a national or regional dealership (not a cooperative), Figure 1.

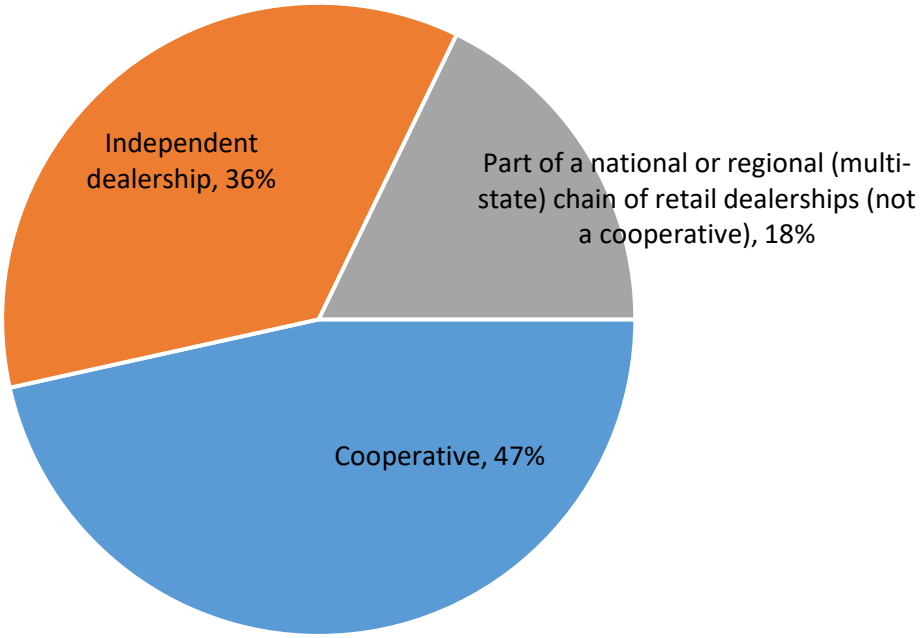

Figure 1, Q1: Organizational type represented by respondents.

The organizations the respondents represent are primarily multiple retail locations, Figure 2. Three percent of the respondents worked for a company that did not own or manage a retail outlet, even though they responded that they were an agricultural retail input supplier. Nineteen percent of respondents reported having only one retail outlet. Less than half of respondents owned or managed five stores or less, and 79% respondents worked for a company that owned or managed six or more stores. Ag retail consolidation is apparent looking back to previous surveys--for example in 2015, a decade prior, about half of respondents worked at a company that had six or more stores; two decades back in 2005 it was 36% who worked at a company with six or more stores.

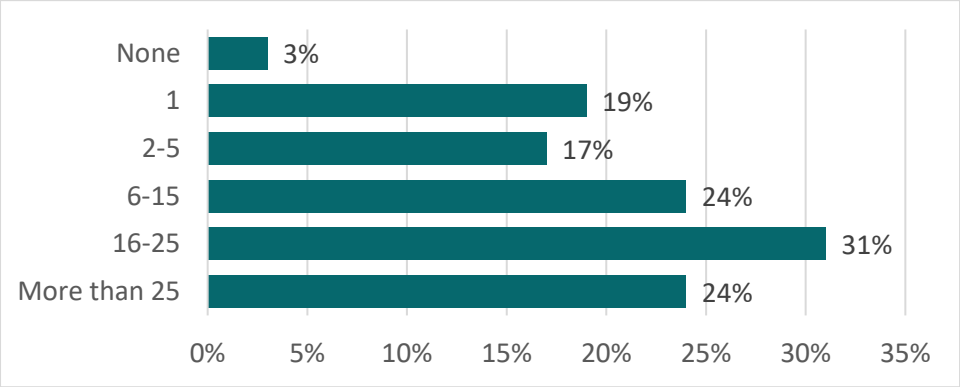

Figure 2, Q4: Number of retail outlets owned or managed by company of respondent.

The survey asked about the position the respondent held within their organization. Thirty-nine percent reported being the owner or location manager, and a quarter were in sales or sales management. Other common job responsibilities for respondents were technical consultant/agronomist (16%) and precision manager (14%). Write-ins for other included IT director, Chief Operating Officer, and Agronomy Manager. Overall, the respondents of the survey are those that lead and manage the organization, or work directly with customers (Figure 3).

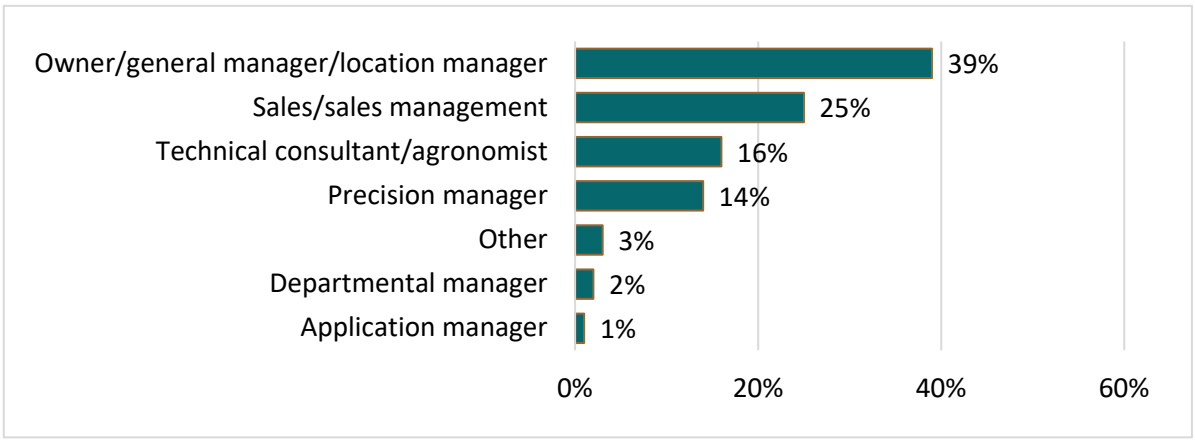

Figure 3, Q3: Responsibility of survey respondent.

DEALER USE OF PRECISION TECHNOLOGIES

Dealers get utility from the precision technologies they use for their own business purposes, such as guidance and section/nozzle controllers on their applicators. We detail that here, followed by the precision products and services they offer to customers in the next section.

The use of guidance technologies by dealers for their custom pesticide and fertilizer applications indicate a maturing market, with 74% of dealers using GPS autoguidance (Figure 4), and 82% of those who offer precision services using guidance of any type (including manual guidance/light bars) in 2025. These numbers represent the percent of dealerships utilizing the technology in some form, which they may use on some or all of their

equipment and on some or all of the acres they service. Manual guidance, which was used by 24% of dealers in 2000, peaked at 79% in 2009, and has fallen back to 24% of dealers in 2025 (data not shown). GPS-guided boom section/nozzle controllers on sprayers, which reduce doubling-up and skips, are used at 67% of dealerships. Another guidance-related technology, sprayer turn compensation, is now at 32% of dealerships. Turn compensation adjusts rates along the sprayer boom so amounts applied are not too low on the outside of a turn, where the boom is moving faster, nor too high on the inside of a turn, where the boom is moving slower. About half of dealers are using telemetry to exchange information among applicators or to/from office locations, up dramatically in recent years, and around half are using GPS fleet management to track the locations of vehicles and guide vehicles to work sites. Both of these can improve operational efficiency, so their growth may be partially related to the changing costs for fuel, and the availability of labor. Forty-three percent are using some type of a smart scouting app on a mobile device (not shown for visual clarity), with this hovering around half of dealers the last few surveys. Some year-to-year variation of survey results is normal, as survey respondents differ each year. A difference of a few points in one year may or may not signal a trend.

Note that the survey went from every year to every other year from 2009 to 2019, then back to yearly, although to keep the survey as short as possible this question was not asked in 2024. All technologies used by retailers were down in 2017 compared to 2015, but all rebounded for 2019 and have remained—a weak farm economy then might explain the dip.

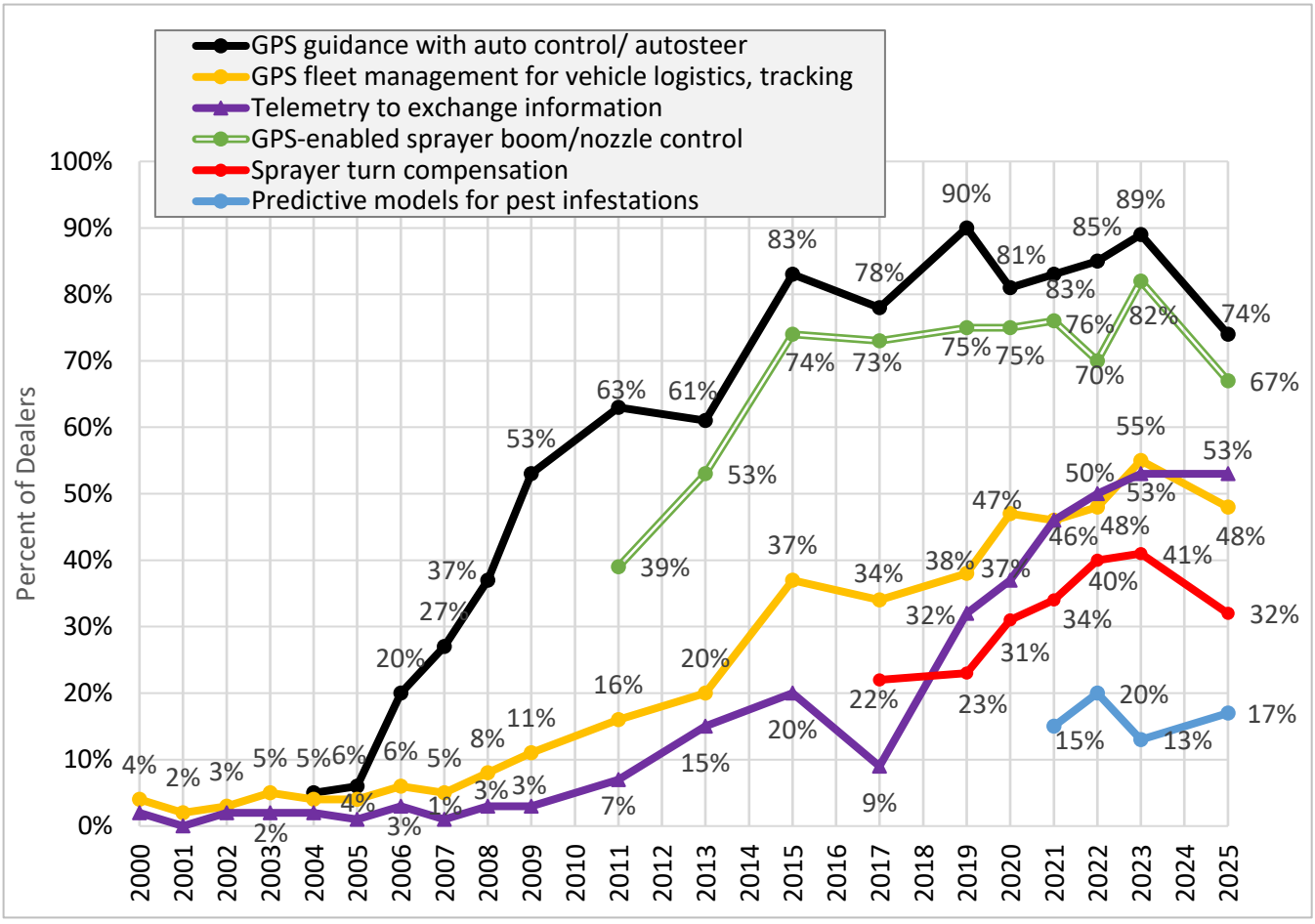

Figure 4, Q7: Retailer use of precision technology for their business.

CUSTOM APPLICATIONS

Survey respondents made custom applications of herbicides, fungicides, insecticides, and other inputs to their farmer customers on an average 330,000 acres in 2025. Multiple applications to the same acres were counted multiple times. Dealers reported 78% of their fertilizer sales and 51% of their crop protection sales were custom applied. As previously noted, 4% of dealers indicated they offered applications using machine vision weed detection. Seven percent of herbicide applications used machine vision weed detection. Table 2 below details technology use on all crop protection (herbicide, fungicide, insecticide) applications:

Table 2, Q17: Technology Use on Crop Protection Applications.

Technology	Percent of acres for dealers who were doing custom application
Manual GPS guidance (light bar)	24%
Automated GPS guidance (autosteer)	85%
Auto sprayer boom section or nozzle control	76%
Variable rate prescription map	37%
Turn compensation	28%

DEALER OFFERINGS OF PRECISION SERVICES

Another element of precision technology for dealers is in the services they offer to their farmer customers. Respondents were asked to report their current offerings of precision/site-specific services and what they plan to offer three years from now, in 2028 (Figure 5). Current dealer offerings are ranked top to bottom in green. Due to rounding, rows may not total 100%.

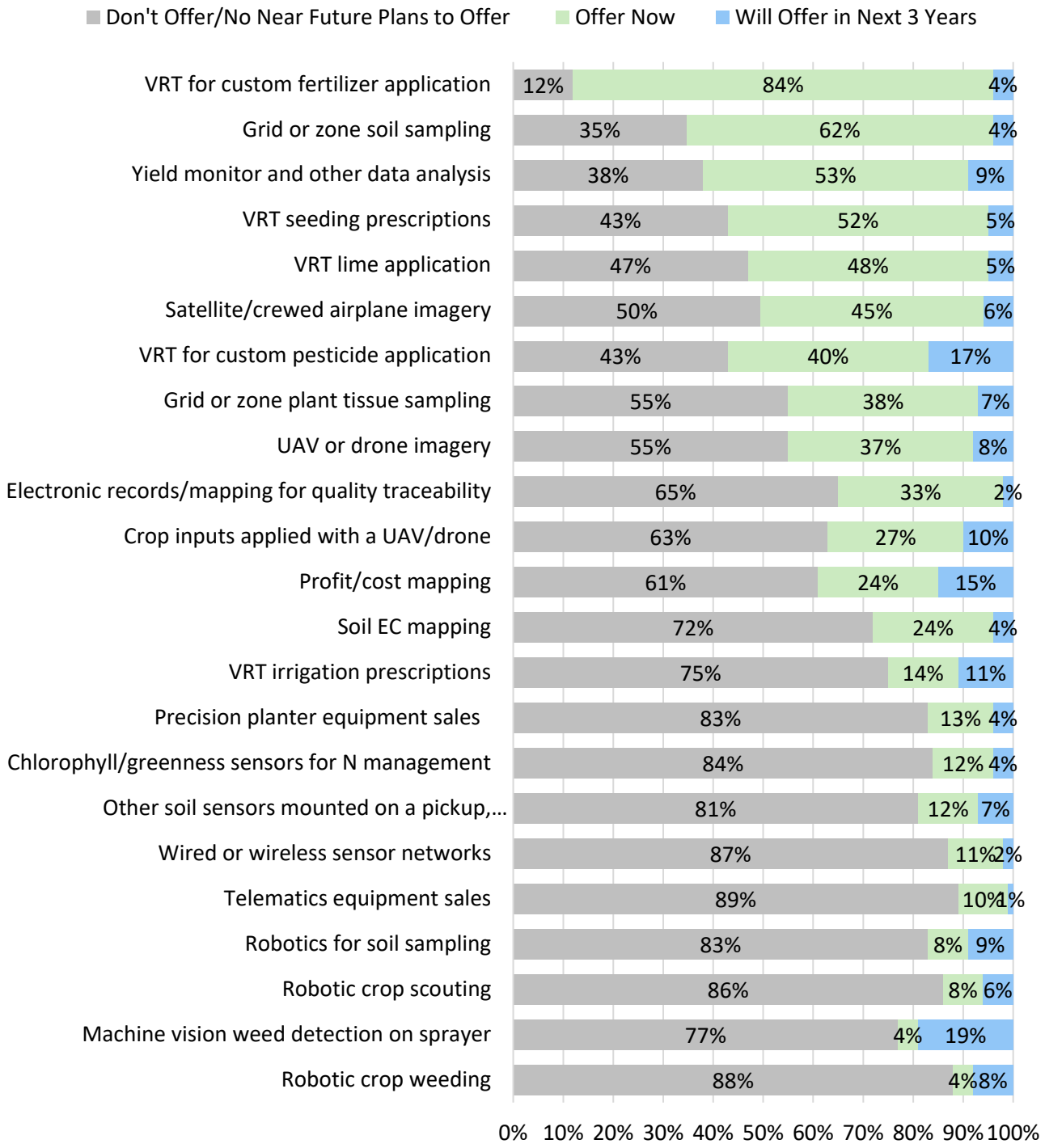

Figure 5, Q10: Dealer offerings of precision services, ranked by current offering.

Variable rate technology (VRT) for fertilizers leads the offerings at 84% of dealers providing this service. VRT fertilizer offerings have always been calculated as the percent of all dealers who offer this service. But in 2024 only 58% of dealers indicated they were doing custom fertilizer applications, as indicated by their answers to questions 12 and 14. We can only speculate why there was such a drop in custom applications. Custom application acres were not asked in 2020, 2021, or 2022, so the numbers series cannot be adjusted going back. But custom acres were asked on every survey from 2000 to 2019, and the percent of dealers that were doing any custom application ranged from 78% in 2001 to 94% in 2017. So for 2024 (and onward) the number is the percent of dealers who are doing VRT fertilizer that do any custom fertilizer application, not the percent of all dealers (whether they do custom fertilizer application or not).

Sixty-two percent of dealers offer grid or zone soil sampling, a complement to VRT fertilization, the second most common dealer technology offering. Unlike the VRT fertilizer offerings, we report the percentage of all dealers, as dealers could offer soil sampling without also doing custom applications. The next common offerings of dealers are yield monitor and other data analysis at 53%, VRT seeding recommendations at 52%, VRT lime applications at 48% of dealers, and satellite/aerial imagery at 45% of dealerships. With the exception of two years where UAV/drone imagery was slightly higher than satellite/aerial, these six were the top going back more than a decade (Figures 6 and 7).

To be consistent with fertilizer custom applications, starting in 2024 VRT pesticide offerings of percent of dealers are only for dealers who indicate they custom apply pesticides. Forty percent of dealers custom applying pesticides are currently doing at least some VRT. Over the next 3 years, the technologies respondents

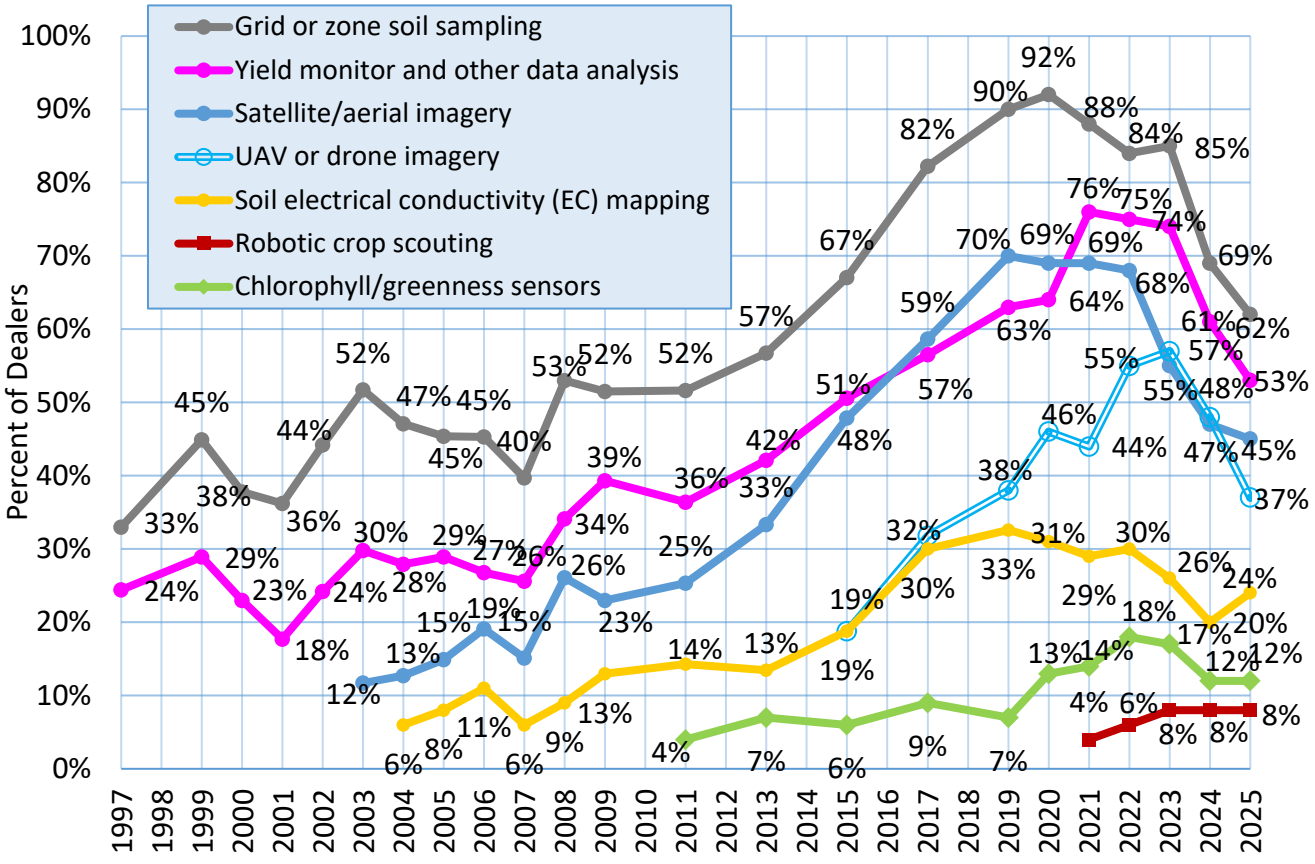

Figure 6, Q10: Dealer offerings of precision services over time, sensing and related services.

are planning the most growth (longest blue bar in Figure 5) are in machine vision weed detection (19% of respondents not doing it now will add), VRT for custom pesticide application (17% will add) and profit/cost mapping (15% will add). In many past surveys, dealers have optimistically overestimated their precision offerings plans compared to the actual numbers the survey showed in years following.

Figure 6 shows the adoption of sensor and related precision ag services over time. As with the technologies the dealers are using for their own purposes, these data represent the percent of dealers offering these services, not the percent of acres where these services were applied. Over the years there has been a changing mix in the precision products and services dealers offer to their customers, with mostly increases from 2007 to 2017, some leveling off after 2020 and many dropping in 2024 and 2025. Less than half of dealers now offer satellite, aerial, and drone imagery. We define aerial as imagery acquired by a crewed airplane. Imagery service offerings remain higher than a decade ago, but have been on a decline the last few years. Part of this could be that imagery is often bundled with a data service offering.

Though commercially available for many years, most dealers are still not offering soil electrical conductivity (EC) mapping or chlorophyll/greenness sensors such as Greenseeker, CropSpec, or OptRx (Figures 5 and 6). EC has been shown to relate well to differences in soil salinity and soil texture differences. But for most farming operations it has been difficult to connect site-specific management to soil EC differences. Chlorophyll/greenness sensors offer what seems a perfect opportunity to manage crop nutrient needs in real time. But in practice, there can be substantial productivity losses if waiting to correct nutrient deficiencies after symptoms show in plants. And many farmers are hesitant to depend on in-season fertilization if there is a chance field conditions could cause delays. Not shown in Figure 6 to allow readability are grid or zone plant tissue sampling, traceability, profit/loss mapping, precision planting equipment sales, telematics sales, sensor networks, and other soil sensors. Most of these were first asked in the last ten years, and their past adoption information can be found in previous survey reports.

Variable rate fertilizer applications have been offered by most dealers for almost two decades (Figure 7). The mid 2010's were a pivot point, increasing to 69% in 2015, rising to near 90% in 2020, but slipping in the last few years. As previously explained, prior to 2024 VRT fertilizer numbers were for all dealers, but now are only for dealers who indicated they custom apply fertilizers. Dealers offering VRT seeding prescriptions has come down in the last three years, compared to a substantial upward burst from 2013 to 2020.

As noted previously an area of growth anticipated by retailers is high-tech pest management. VRT pesticide application has been up and down for the last few years, and is higher than a decade ago. Forty percent of dealers now offer VRT pesticide applications, but 17% more say they will be doing this in three years (Figure 5). These would include machine vision such as See and Spray from Deere and Precision Planting's Symphony Vision as well as applications varied by soil properties. In recent years this anticipation was larger than anything else we asked about--a 25% three year out increase estimated in 2017 for 2020, 30% estimated increase in 2019, a 20% in 2020, 26% in 2021, 22% in 2022, 13% in 2023, 21% in 2024, and now a 17% increase estimated for 2028. It is easy to see in Figure 7 that this exuberance was not matched by the adoption dealers reported three years later, but the trend has been up. To be consistent with fertilizer custom applications, starting in 2024 VRT pesticide offerings are only for dealers who indicate they custom apply pesticides.

The interest in precision pest management might be driven by pesticide costs and availability, as well as continued pest resistance issues. But trying to determine and measure the factors that relate to a variable rate have proven a bigger challenge than anticipated, whether that be organic matter or soil texture for soil applied pesticides; weed, disease, or insect levels for in-season applications, or detected on the go using machine vision. Twenty seven percent of dealers say they are currently offering crop inputs applied via a UAV/drone, a flying robot, just the fifth time for this question.

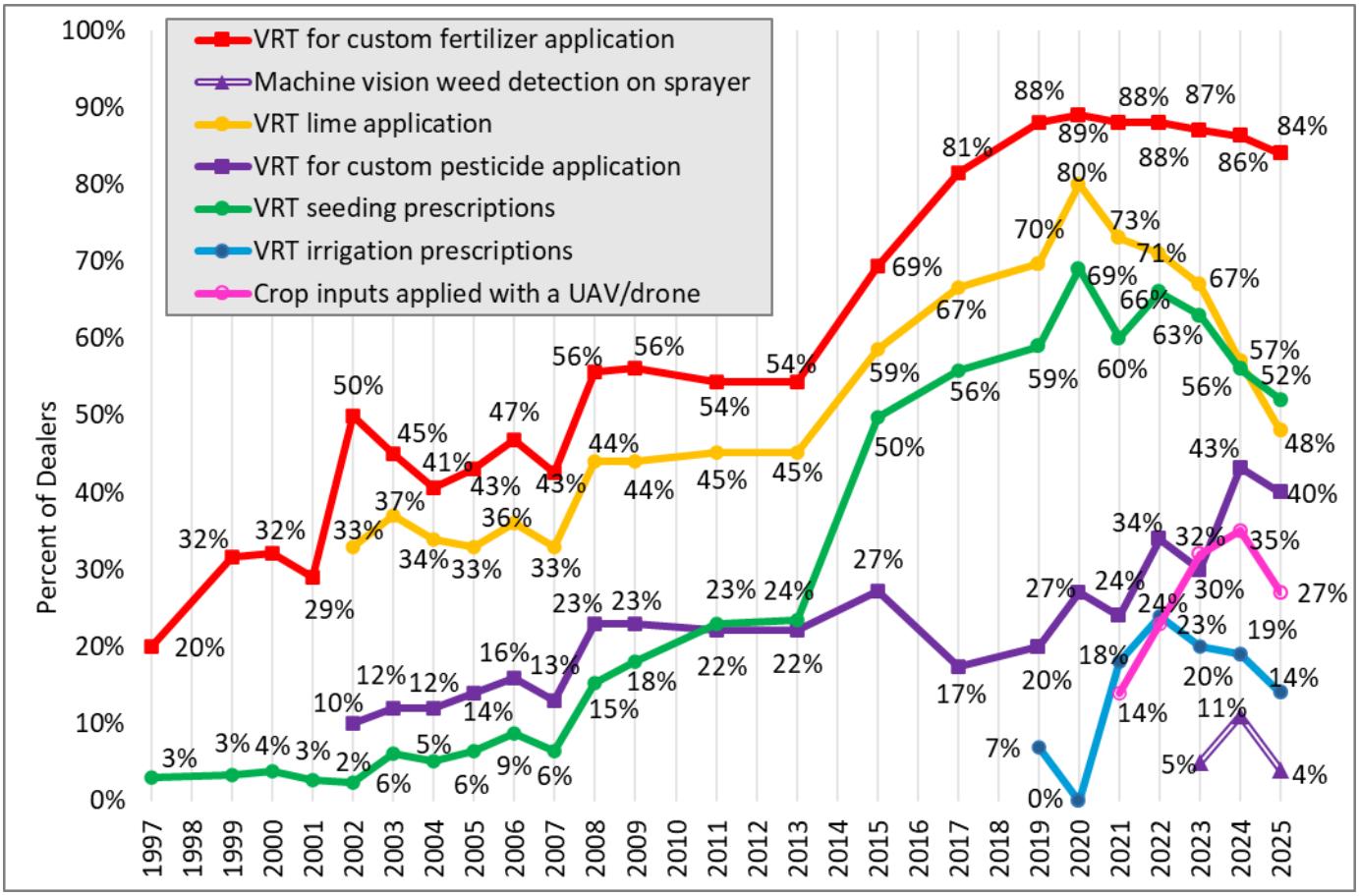

Figure 7, Q10: Dealer offerings of precision services over time, variable rate technologies. Starting in 2024 VRT fertiizer is only for dealers who indicate they custom apply fertilizers, and starting in 2024 VRT pesticides are only for dealers who indicate they custom apply pesticides. Prior to that they were for all dealers responding.

ANALYSIS OF DATA

Precision agriculture can generate an overwhelming amount of data from yield monitors, soil sampling, machine operations across fields, as-applied amounts, and remote sensors, to name a few. Often producers need assistance in analyzing these data in the hopes they can be turned into meaningful insights. Figure 8 reports how dealers help customers manage farm-level data in decision-making. Respondents could mark any or all that apply. Only 4% of the respondents do not help farmers with their farm-level data. The most common way dealers were helping customers in the past was printing maps, such as yield, soil electrical conductivity, and soil maps, but with paper giving way to digital that was on a decline and we dropped that question in 2023. Beyond printing maps, in 2025 more than half of dealers are archiving and managing yield, soil test, and other farmer data for future use. Forty-six percent of dealers report working with farmers and their on-farm data one-on-one, a third are aggregating data among farmers but within the dealership, and 17% offer services where data is shared outside the dealership. Sixty-three percent of dealers say their organization has a customer data privacy statement and/or data terms & conditions agreement.

Figure 9 shows the types of decisions where pooled customer data is used for decision-making, reported by dealers as a major influence, some, or no influence. We define pooled data as that which is aggregated from multiple farms, either managed within the dealership or as part of an outside offering. Dealers report pooled data has the most influence on nitrogen decisions. P & K (phosphorus and potassium fertilizer) decisions were the most influenced by pooled data prior to 2025 (Figures 9 & 10).

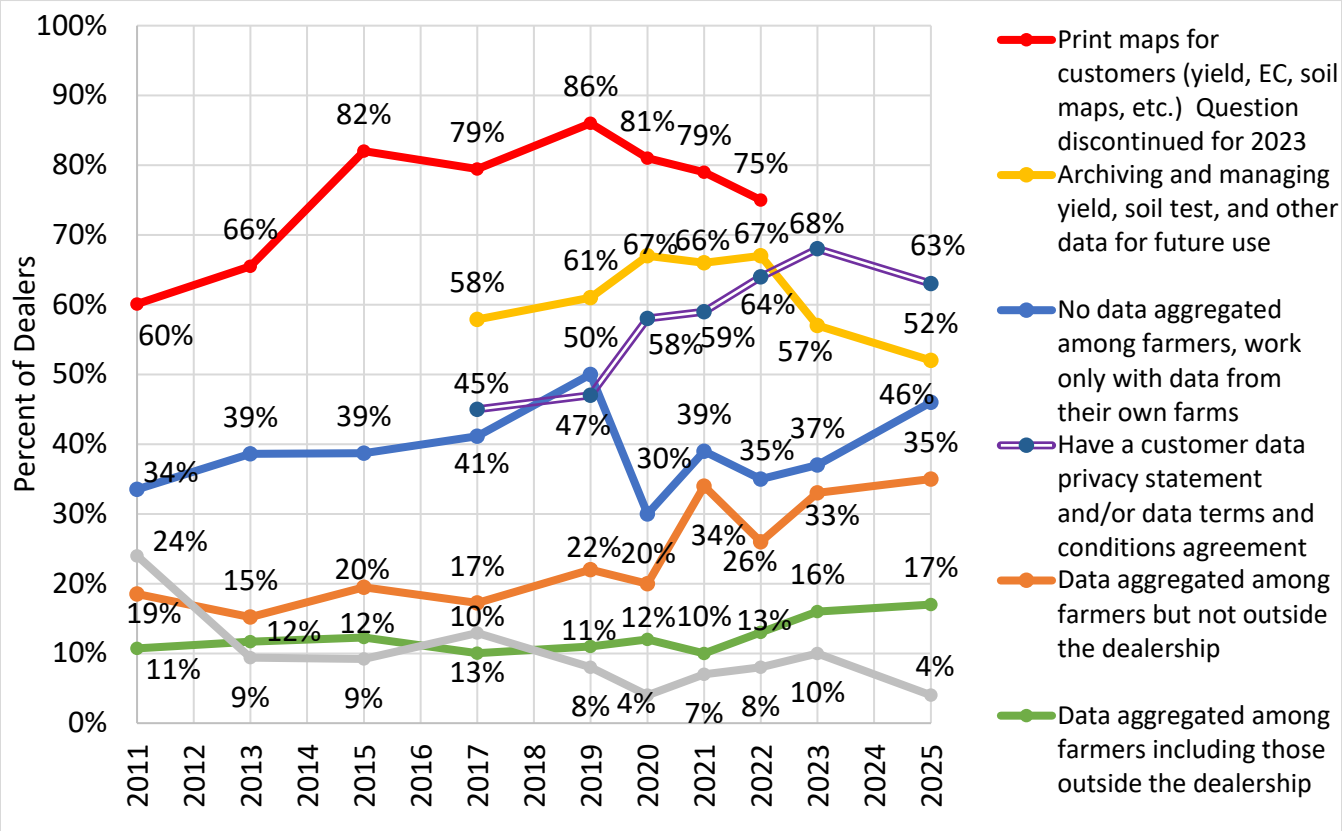

Figure 8, Q8: Managing farm-level data to assist customers in decision making over time. There was no survey in 2012, 2014, 2016, and 2018, and this question was not asked in 2024.

There was a remarkable uptick in crop management decisions from pooled data in the 2017 to 2019 period (Figure 10). Only around 10% of dealers in 2017 reported pooled data was having a major influence on any of the listed decisions, but with the exception of cropping systems/rotation decisions and irrigation, data's impact on the decisions has increased multi-fold since them.

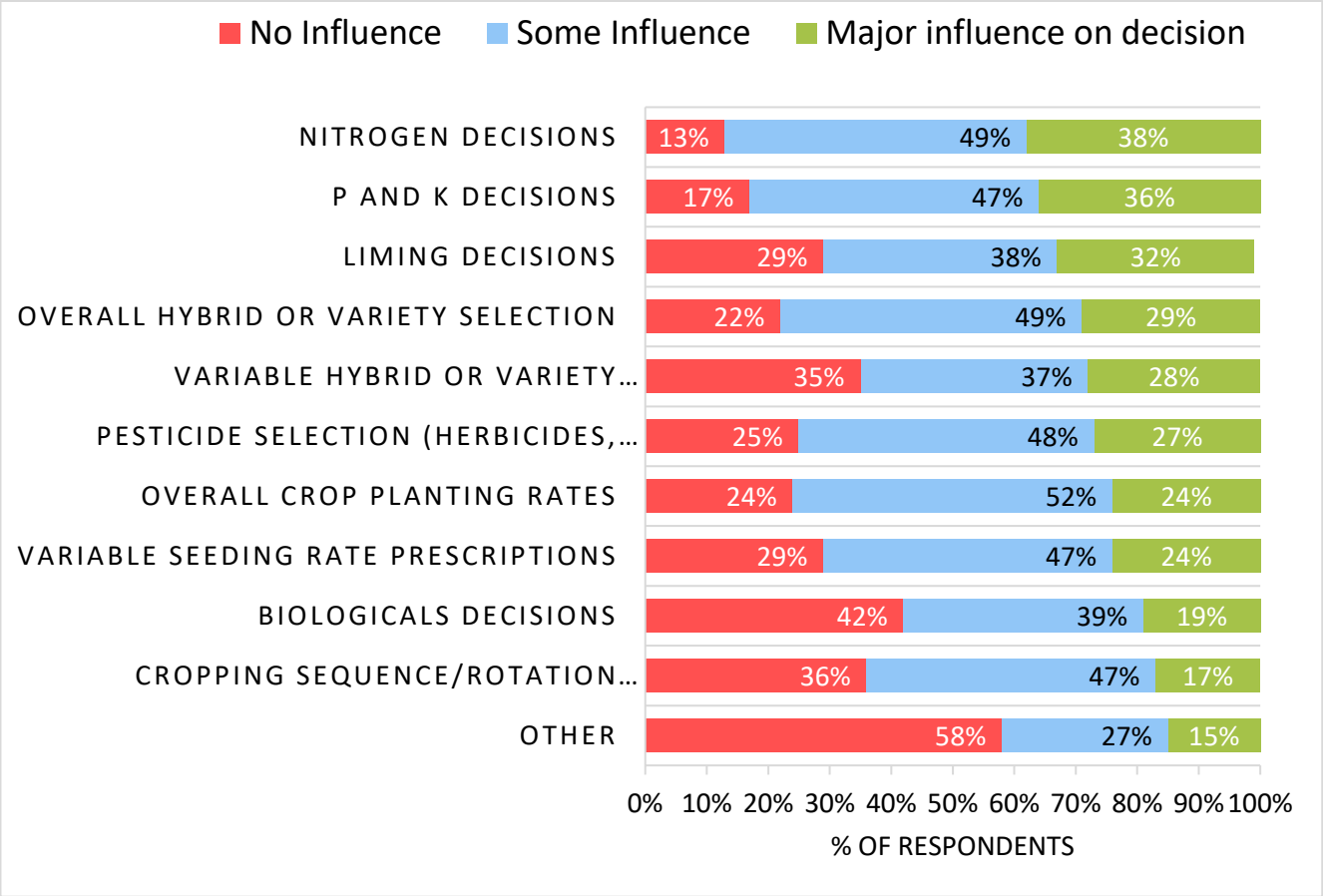

Figure 9, Q9: Crop management decisions influenced by pooled data from customer's farms, ranked by major influence. Due to rounding, percentage numbers for a technology may not total 100.

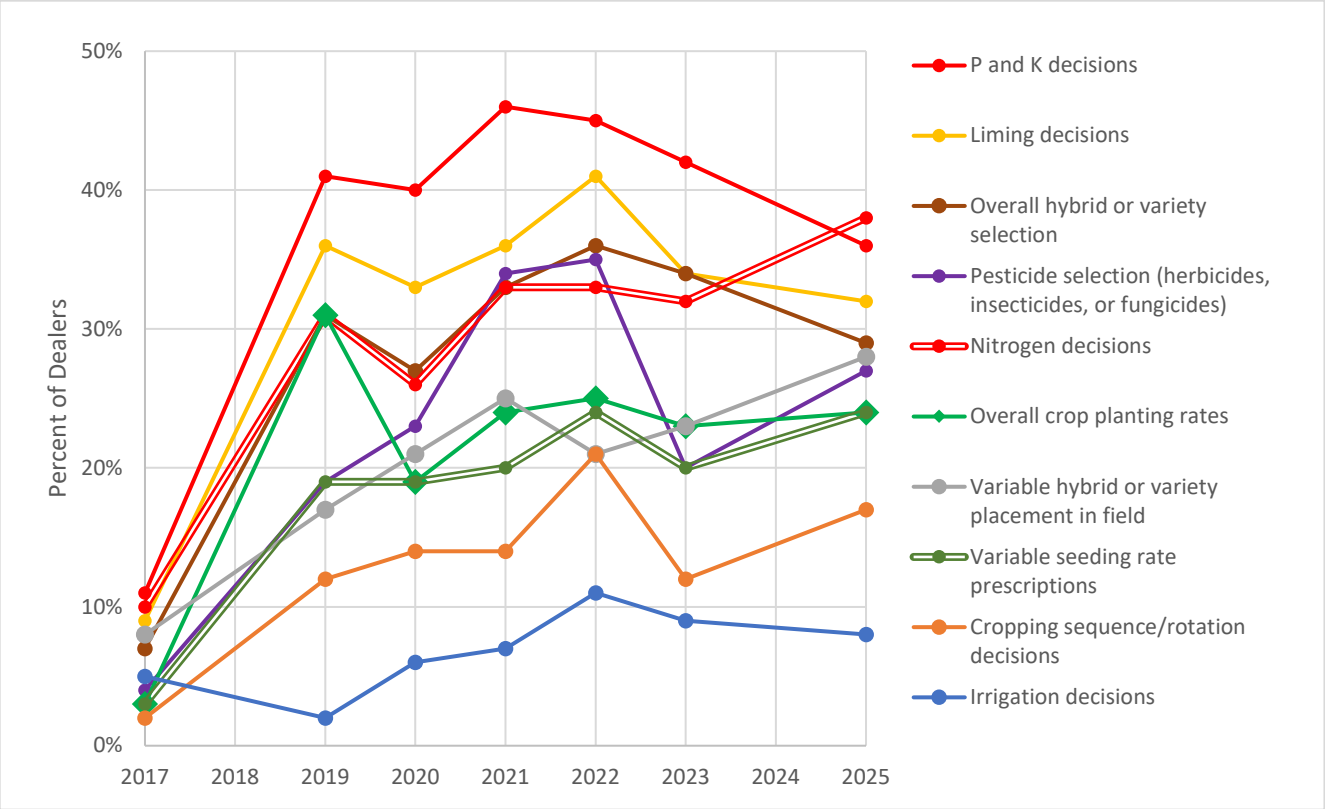

Figure 9, Q9 : Percent of dealers over time indicating data had a major influence on management decisions. There was no survey in 2018, and this question was not asked in 2024.

SOIL SAMPLING PROCEDURES

Most agricultural dealers help producers manage soil nutrients, which for precision agriculture commonly has a foundation in grid or zone soil sampling. The location of the soil sample (or subsamples) is determined using GPS. The location information combined with a fertilizer recommendation from a lab informs the rates used for variable rate application technology. In 2025, 62% of dealers were offering precision soil sampling (Figure 6).

In 2025, 57% of dealers offered grid soil sampling, lower than previous years, 49% offered sampling using management zones, and 41% offered traditional or whole field sampling (Figure 11). The percent of dealers offering traditional whole field sampling was much lower than previous years. Multiple responses were allowed for multiple procedures. For dealers who offer sampling in management zones, more are using soil mapping units or yield maps to delineate the zones, and fewer are using soil electrical conductivity (Figure 12, respondents could only choose one), but the use of yield maps has dropped. For dealers who grid sample, 2.5 acres (1 hectare) is the most common grid size, although 17% say they sample in larger grids up to 5 acres and 17% sample in smaller grids (Figure 13). The appropriate grid size is a compromise of the labor/time and equipment needed for sampling and soil testing costs vs. the specificity desired to inform variable rates.

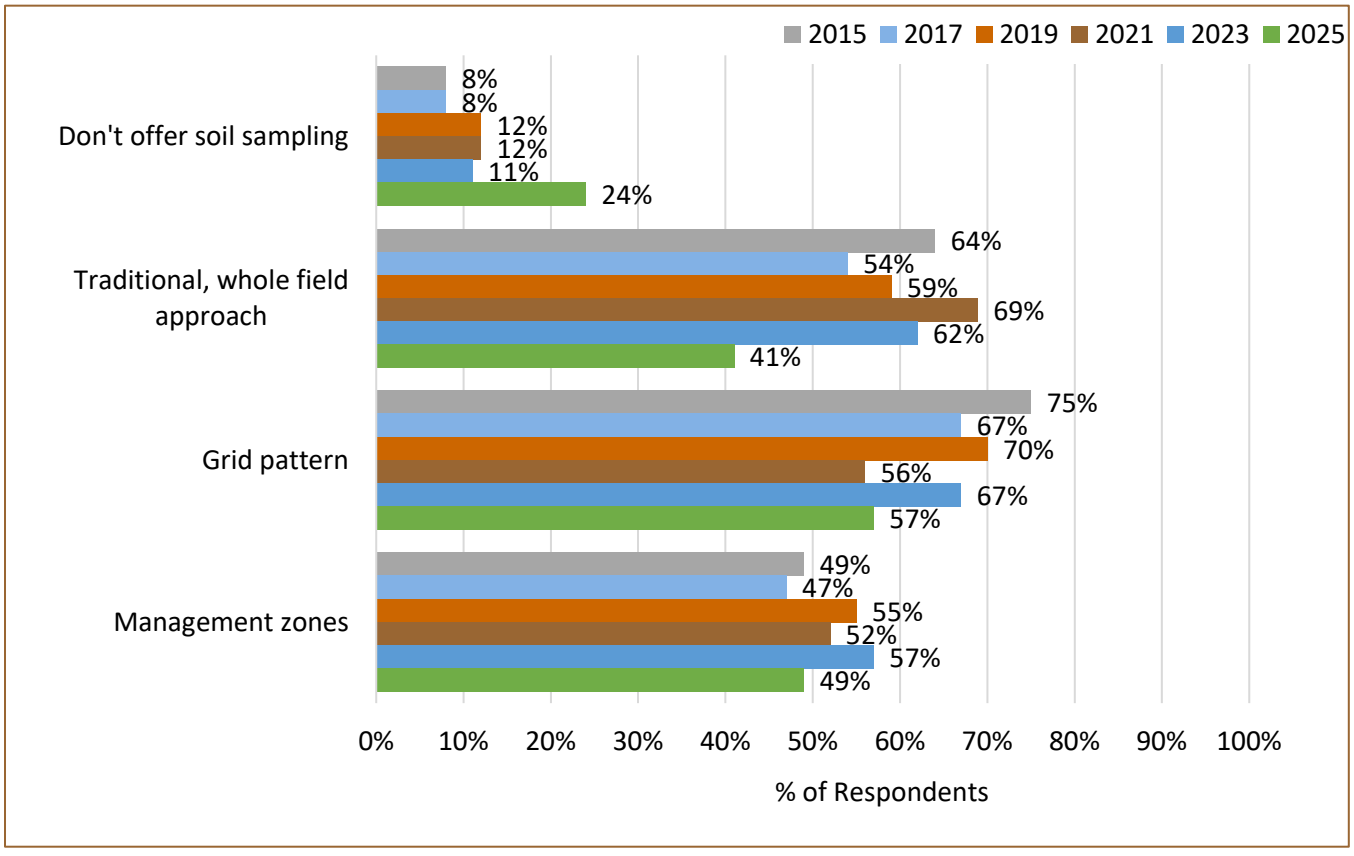

Figure 10, Q6 : Types of soil sampling services offered by retailers. Multiple responses were allowed. This question is asked every other year.

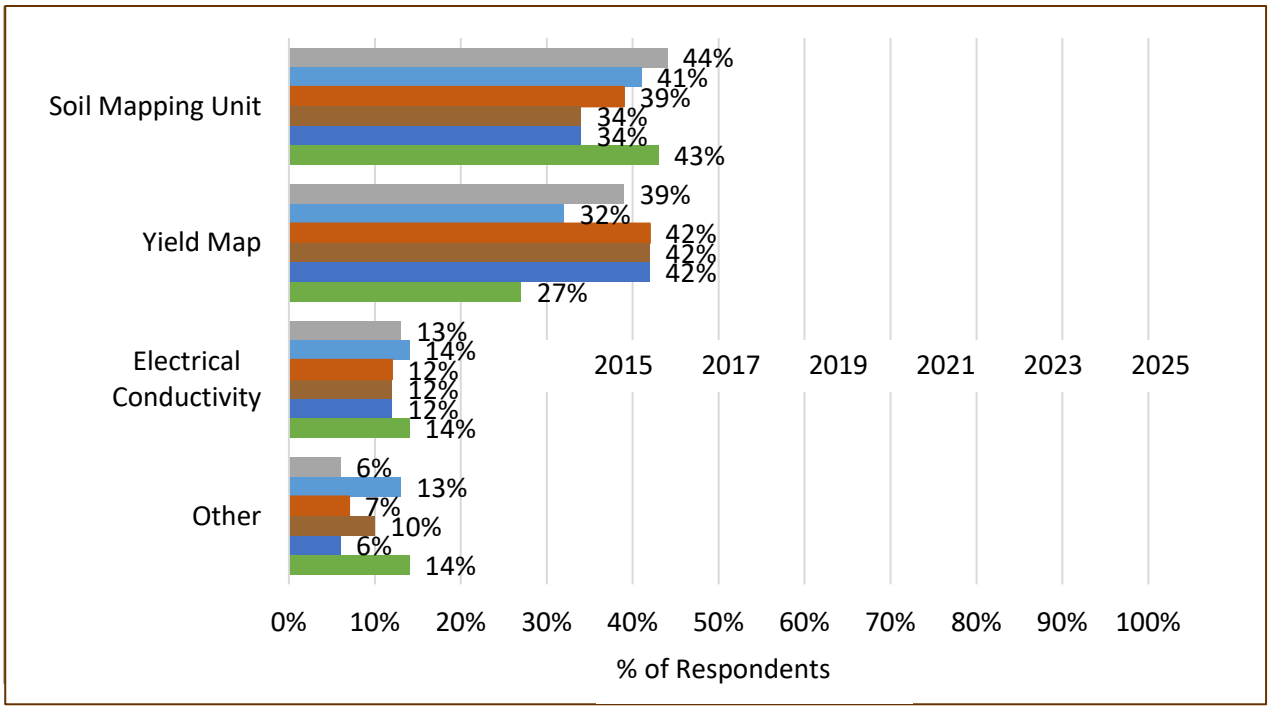

Figure 11, Q6 : Factors used by retailers to determine management zones for precision soil sampling. Due to rounding, percentage numbers each year may not total 100.

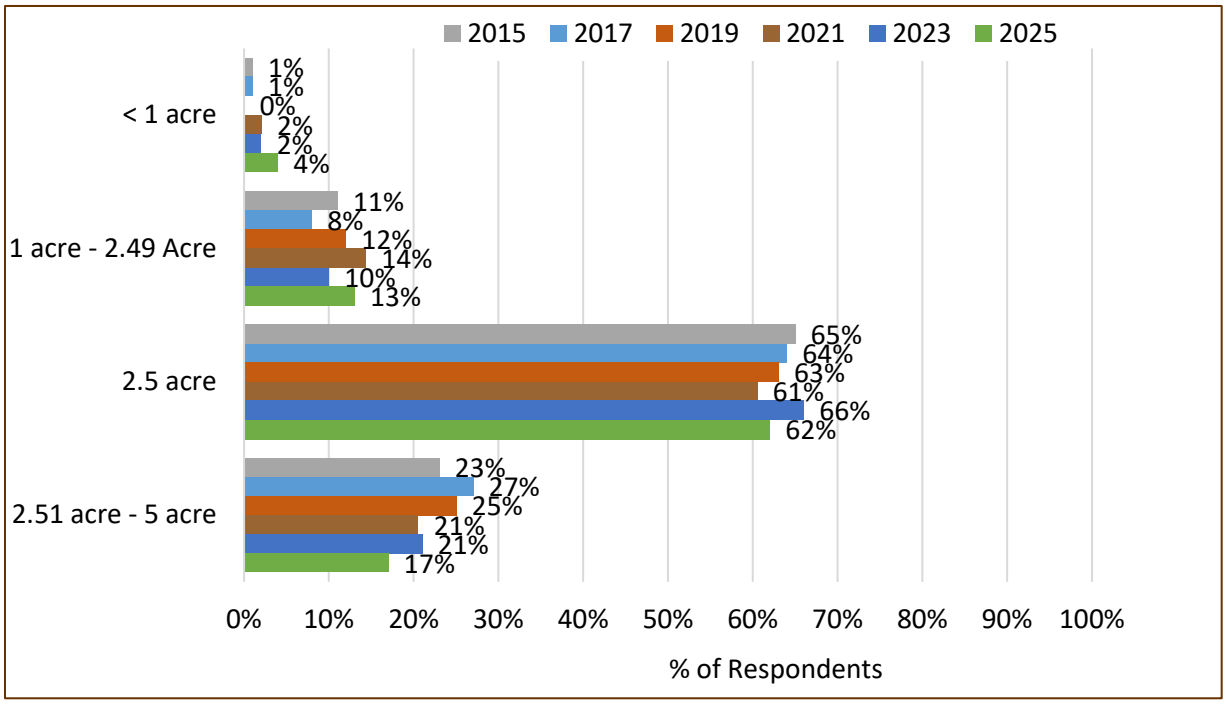

Figure 12, Q6: Grid sizes used by retailers for precision soil sampling. Due to rounding, percentage numbers by year may not total 100.

DEALER PERCEPTIONS ABOUT AUTOMATION/ROBOTICS

Dealers were asked in the 2024 survey how they thought automation/robotics might affect their businesses. Automation is already widely used in crop production—for example boom/nozzle controllers and autosteer, but appears poised for greater expansion. Most dealers think that automation/robotics will increase the accuracy of crop input applications (Figure 14, green bars)—indeed it already has with section controllers, and the planter row controllers and variable rate downforce used by their farmer customers. And most dealers say automation will reduce application mistakes. But less than a third of dealers indicate automation will reduce their labor needs associated with crop inputs. To some this may be a surprise, as labor savings is often viewed as the most obvious result of automation—to take a task out of a human's hands that we pay to employ.

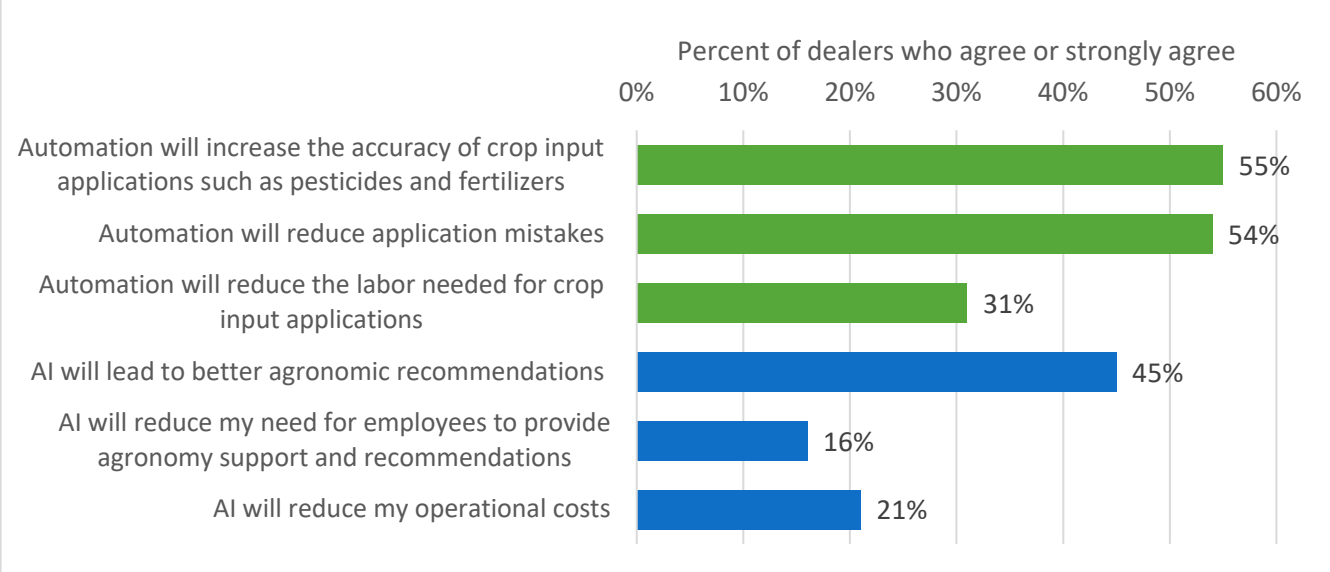

Figure 13, from 2024: Dealer attitudes about automation (green bars) and artificial intelligence (blue bars).

DEALER PERCEPTIONS ABOUT ARTIFICIAL INTELLIGENCE

Dealers were asked how they thought AI might affect their businesses. Almost half of dealers say AI will lead to better agronomic recommendations (Figure 14, blue bars). That makes good sense, and comes at a good time. It seems we have been at an impasse on agronomic recommendations for many years. With fertilizers, we are following recommendations that in some cases have been around for decades. Many new methods have not had the impact we thought they might—such as greenness/chlorophyll sensors, or electrical conductivity measurements (EC). And we are not even close at making full use of yield maps or field imagery, in measuring field variability then acting upon it. We need that "next thing" that will move us forward. At the same time, few dealers say AI will reduce their need for agronomic expertise, or reduce their operational costs, perhaps by needing fewer workers or being more efficient. Perhaps dealers' thinking aligns with how previous technologies have affected the workplace. Long ago mechanization, computers, pesticides, and other labor-saving devices were each expected to bring in a new era of less work with more time for leisure. Ask any ag retailer if their workload is less than in the past. In many cases workers were just expected to do more or were assigned to other tasks.

THE BUSINESS OF UAV/DRONE CROP INPUT APPLICATIONS

About one fourth of the dealers reported that they provide UAV/drone application services in-house, and another fourth say they contract this to another company (Table 3). For those providing the services, the average number of crews used was about two, with each having two workers and one or two drones. Dealers said setting up a crew costs an average of around $62,000, to equip, license, and train. And it costs around $13,000 per month to keep each crew running—the variable costs which could include wages, fuel, repairs and maintenance, insurance, etc. This of course needs to be compared to the revenues from these services, and the alternative costs in most cases of owning and operating a ground sprayer or hiring an aerial applicator, each of which involve considerable expense. Dealers offering drone services indicate that around two-thirds of applications are for fungicides on corn, around 13% are herbicide applications in pastures and fencerows, approximately 10% are insecticide applications on corn, and about 6% insecticide applications on soybeans. Other applications noted but each not exceeding 2% are fungicide applications on soybeans, wheat, and alfalfa, and insecticide applications on wheat.

Table 3, from 2024: The Business of UAV/Drone Applications for Agricultural Dealers.

How UAV/drone services are procured by customers	Percent of dealers
Service provided to customers in-house	27%
UAV/drone service to customers contracted to another company	25%
Customers use UAV/drone companies not affiliated with us	27%
Not aware of inputs applied via UAV/drone in my area	20%

Operations of those offering UAV/drone applications in-house (25 respondents)	Mean
Number of UAV/drone crews per dealer	1.7
Workers per crew	2.2
Drones per crew	1.4
Investment to equip, license and train one crew	$62,000
Monthly variable cost per crew	$13,000

PROFITABILITY OF PRECISION SERVICE OFFERINGS

Dealerships were asked to report on the profitability of the precision technology services they offer: either making a profit, breaking even, not breaking even, or don't know, Figure 15. This question was asked in 2024 but not in 2025. Most dealers are at least breaking even in 19 of the 23 product or service offerings asked, but dealers are making a profit in just five of the 23.

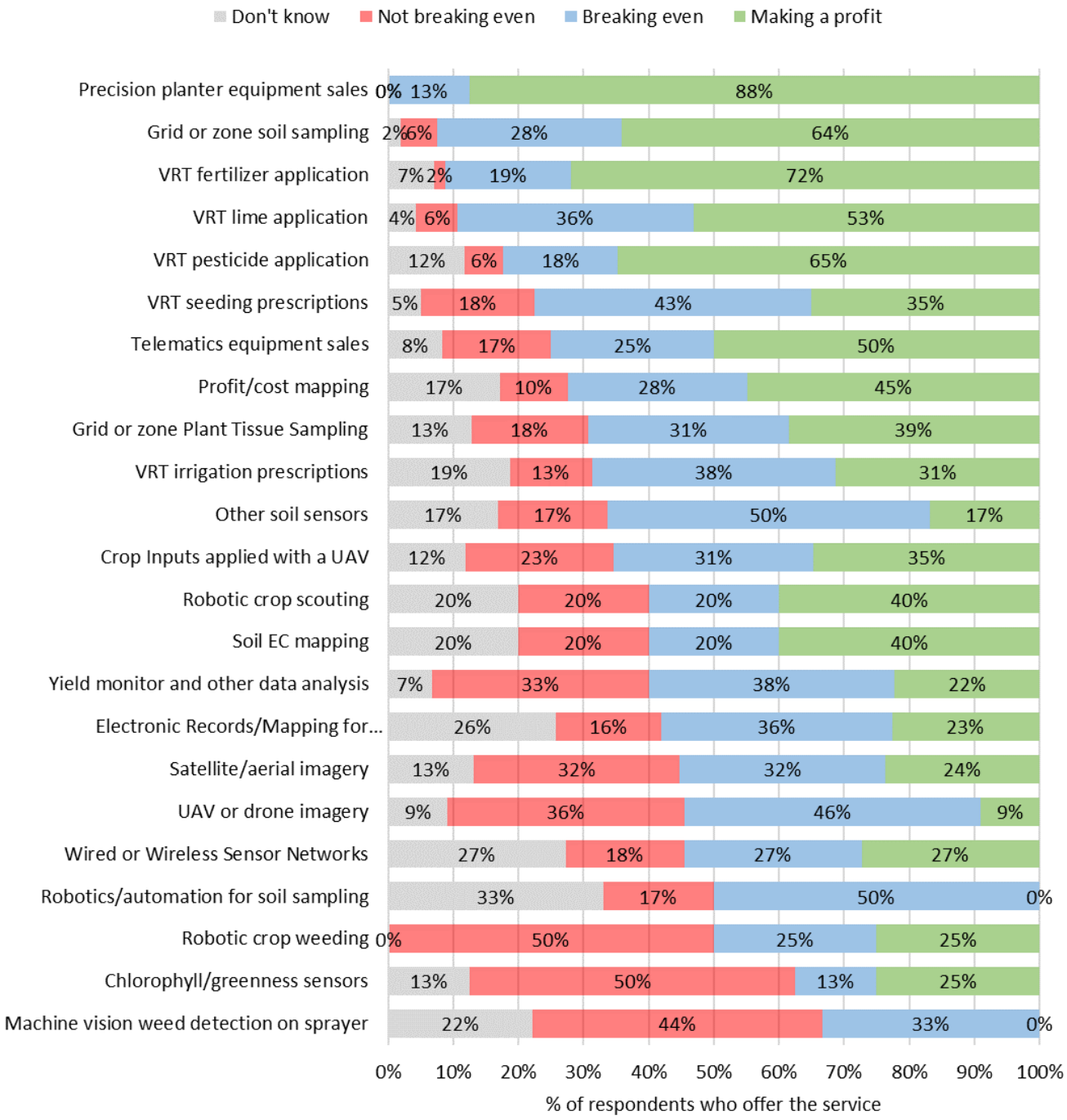

Figure 14, from 2024: Profitability, ranked by percent at least breaking even (breaking even plus making profit).

The services where more than half of agri-dealers are making a profit are precision planter equipment sales (88%), VRT fertilizer applications (72% indicate profit), VRT pesticide applications (65%), grid or zone soil sampling (64%), and VRT lime applications (53%). These five offerings stand apart from the others for profitability. The three biggest money losers for dealers are chlorophyll greenness sensors (50% not breaking even), robotic crop weeding services (50% not breaking even), and machine vision weed detection on sprayer (44% not breaking even). Not far behind for not breaking even are UAV/drone imagery (36% not breaking even), helping farmers with their yield monitor and other data analyses (33%), and satellite/aerial imagery (32%).

With many technologies a high percentage of dealers report that they don't know the returns—robotic soil sampling, IoT sensor networks, and electronic records/mapping for traceability the three where profitability is least known.

Figure 16 shows the percentage of respondents making a profit in certain precision ag services over time. In recent surveys profitability is asked about all offerings, but before 2017 profitability was only asked on select services, so just a subset of offerings are shown over time. Grid/zone sampling and VRT fertilizer applications continue to be the most profitable for dealers in 2024. The percent of dealers indicating these fertilizer-related services return net positive revenue has roughly doubled in the last twenty years, and during that time these have been consistently more profitable than other offerings. Dealers report profits in satellite and aerial imagery and yield monitor and other data analysis have not had similar increases in that same time. UAV or drone imagery is a service area where dealers have struggled to make ends meet—possibly because much of imagery is not directly tied to an input that generates revenue.

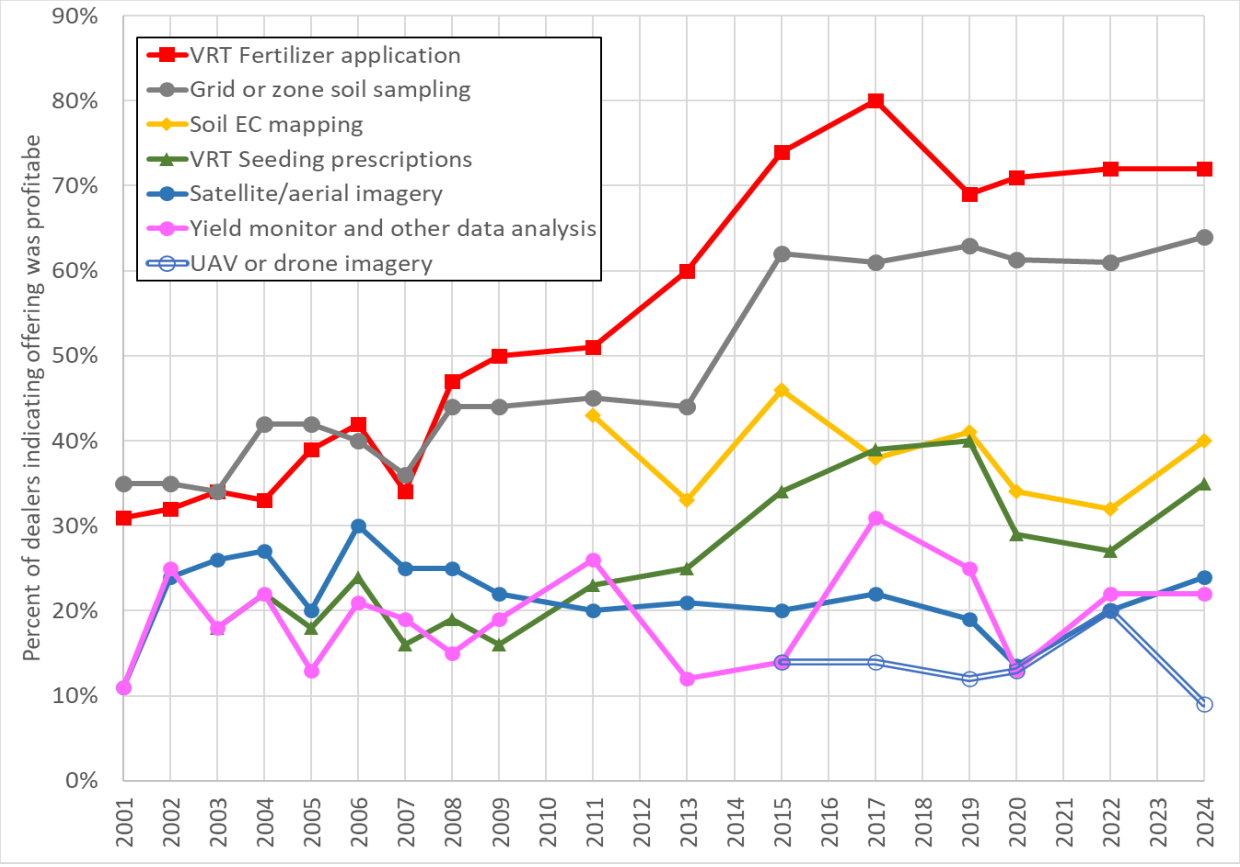

Figure 15: Profitability over time.

PRODUCER'S USE OF PRECISION TECHNOLOGIES

The survey asks dealers what the farmers in their area are doing with precision farming technologies. Dealers reported on the share of acres (not the percentages of farmers) in their local market area utilizing various practices. Table 4 shows these estimates for the last seven surveys, ranked most to least for 2025.

Table 4. Q11: Farmer use of precision technologies, local market area estimated by retailers, ranked for 2025. Color shading shows green most, yellow middle, and orange lower.

	2017	2019	2020	2021	2022	2023	2025
Guidance/Autosteer	60%	66%	66%	76%	69%	77%	74%
Yield Monitor	-	69%	65%	75%	68%	72%	66%
Sprayer Section Controllers	-	56%	62%	65%	63%	64%	60%
Planter Row or Section Shutoffs	-	45%	46%	52%	51%	54%	52%
Grid or Zone Soil Sampling	45%	52%	52%	60%	57%	51%	52%
VRT Fertilizer Application	38%	39%	44%	51%	49%	43%	43%
Cloud Storage of Farm Data	14%	21%	29%	36%	42%	40%	43%
VRT Lime Application	40%	41%	44%	56%	52%	43%	40%
Variable Down Pressure on Planter	14%	29%	31%	40%	41%	38%	39%
Electronic Records/Mapping for Quality Traceability	-	20%	21%	21%	34%	31%	39%
Any Data Analysis Service	13%	26%	25%	33%	38%	30%	31%
Satellite or Aerial Imagery	19%	26%	31%	27%	31%	21%	22%
VRT Seeding	13%	19%	19%	23%	22%	22%	20%
VRT Pesticide Application	3%	8%	7%	8%	9%	6%	15%
Grid or Zone Plant Tissue Sampling	-	-	-	-	-	-	13%
Soil EC Mapping	9%	10%	14%	17%	19%	15%	9%
Variable Hybrid Placement Within Fields	7%	11%	17%	15%	14%	12%	9%
UAV or Drone Imagery	6%	9%	12%	10%	17%	10%	8%
Crop Inputs Applied with a UAV/Drone	-	-	-	-	-	5%	8%
Wired or Wireless Sensor Networks	-	-	-	-	18%	9%	7%
Autonomous Support Vehicle (grain cart) for Harvest	-	-	-	0%	5%	6%	5%
Selective Harvest for Quality Improvement	-	4%	7%	7%	15%	5%	5%
Chlorophyll/Greenness Sensors for N Management	3%	5%	5%	6%	8%	4%	5%
Machine Vision Weed Detection on Sprayer	-	-	-	-	-	2%	5%
VRT Irrigation	-	4%	5%	4%	6%	15%	4%
Robotics/Automation on Harvester	-	0%	1%	1%	3%	3%	4%
Robotics/Automation for Scouting	-	-	-	1%	3%	1%	3%
Robotics/Automation for Weeding	-	0%	0%	0%	3%	1%	2%

There was no survey in 2018, and the question was not asked in 2024. GPS guidance with automatic control has the highest farmer adoption, with dealers reporting around three-fourths of the acres in their market areas using these systems. There are many benefits to autosteer that go beyond the cost savings that can come

from more precise pass to pass accuracy including less operator fatigue, and more time focused on operating equipment. By mistake, yield monitors and spray section controllers were not on the survey in 2017. Yield monitors are standard equipment on nearly all new combines now, with dealers saying they are used on two-thirds of the cropland in their areas. But having a yield monitor doesn't necessarily mean the farmer is creating a yield map.

More than half of farm acres employ sprayer section controllers, planter row controllers, and are precision soil sampled, as has been the case for several years. Despite being available for two decades or more, dealers report most farmers are not using imagery (whether that is satellite, aerial, or drone), not applying fertilizers using variable rate technology, or VRT liming. Variable hybrid placement peaked a few years ago and is going down. This was the fourth year the survey asked about VRT irrigation, where dealers indicated just 4% of their market area was using this. The VRT irrigation numbers should be treated with caution, as most responders were from the Midwest where in most areas irrigation is the exception. Some notable increases in the last five years were in cloud storage going from 14% in 2017 to 43% of acres in 2025, planter variable down pressure, from 14% to 39%, and the use of any type of data analysis service, from 13% to 31% (Table 4). The much-discussed coming technologies of robotics automation have not yet materialized to any extent on U.S. row crop farms.

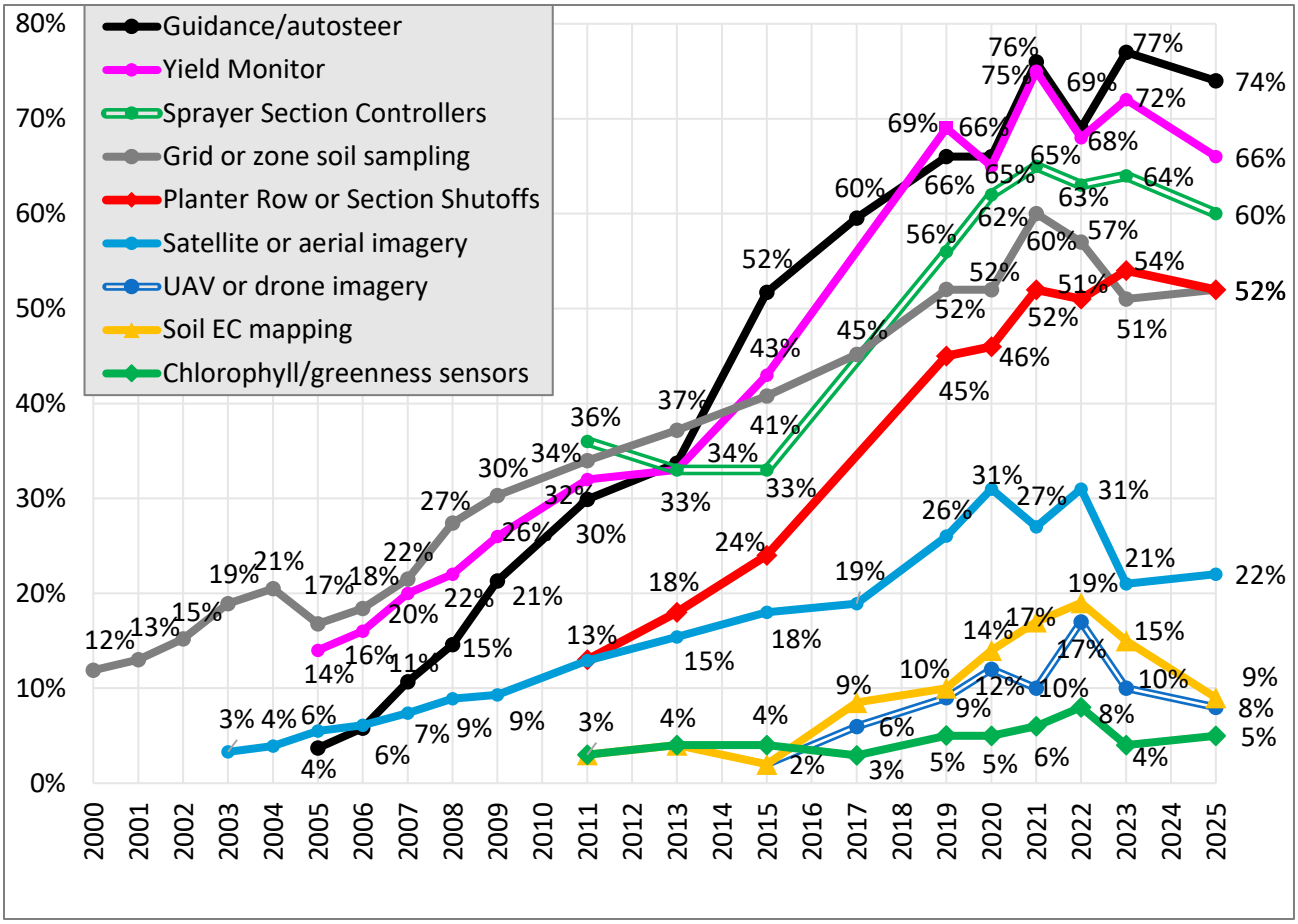

Figure 16, Q11: Producer use of precision technologies, retailers estimate of their market area.

In Figures 17 and 18, you can see the changes over time in the percent of the market area of various precision ag technologies used by farmers. As a group, precision ag practices grew on farms for the two decades from 2000 to 2020, but the growth has stagnated or decreased in the last few years. The two time-scale graphics do not include all technologies to provide for visual clarity—see Table 4 or previous reports. Just a decade ago guidance was the only precision technology that we tracked used on more than half of farm acreage. Since then many technologies have rapidly expanded in use, but some are plateauing in the last few years. As technologies reach market maturity it is logical that the gains in adoption would level off. But many that are leveling/lowering are far from full market penetration. There are numerous theories and examples of product life cycles, where for most there is an initial period of expectation and growth, sometimes a period of disillusionment and stagnation, then possibly rising again with eventual widespread acceptance or decline. Some precision agriculture technologies are highly interdependent—for instance variable rate fertilizer applications rely on an informed set of information that could come from soil maps, yield maps, soil tests, tissue tests, imagery, soil EC, and more, and that can complicate implementation. Some are not much interdependent—guidance and section controllers do their work without needing much information other than GPS coordinates.

It is interesting that going back 20 years, the percent of acres receiving grid or zone sampling was always higher, normally by a few points, than the percent of acres receiving VRT fertilizers, indicating that not all acres with precision sampling follow up with a precision application.

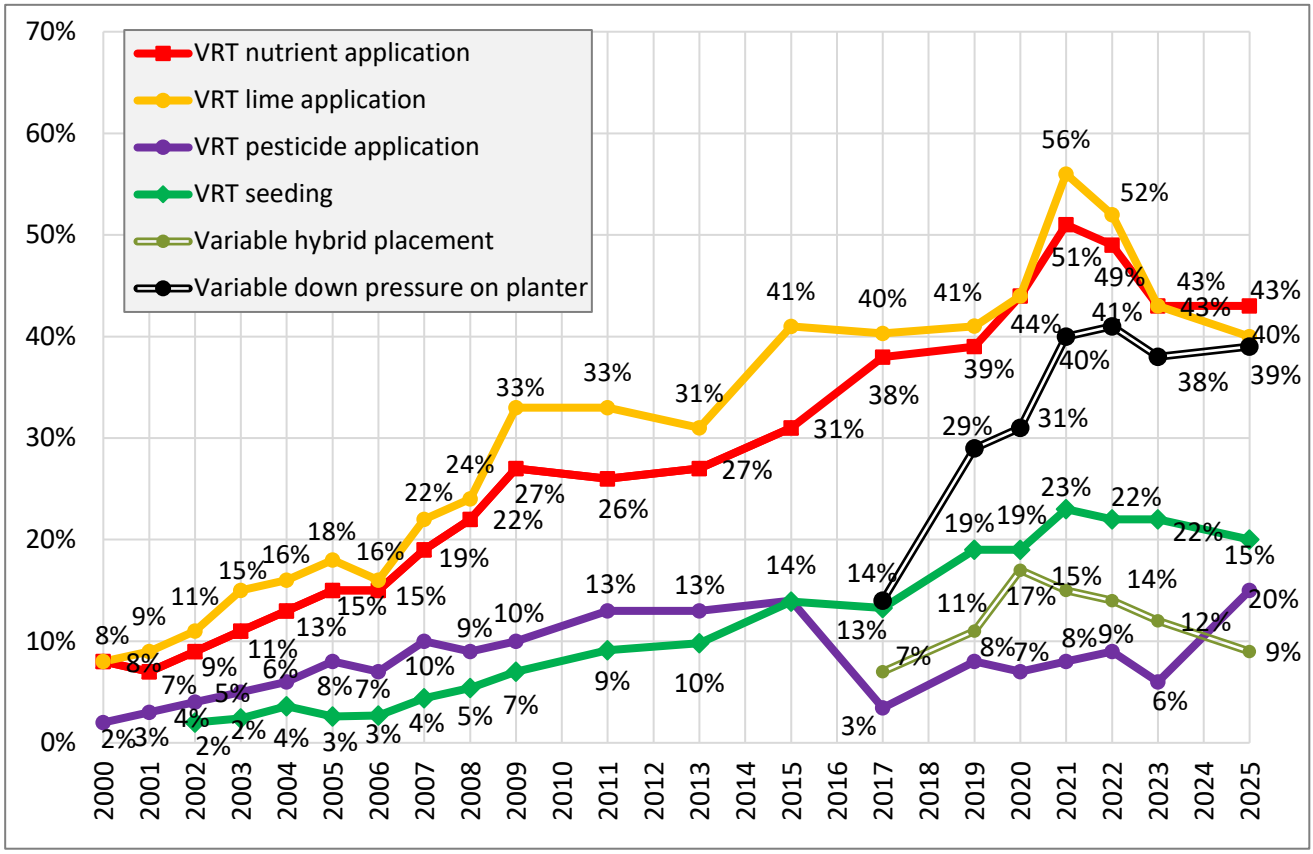

Figure 17, Q11: Producer use of variable rate technologies (VRT), market area estimated by retailers.

BARRIERS TO GROWTH AND EXPANSION

In an attempt to understand differences and possible reasoning in the use of precision technologies, not just report on their use, the survey asked respondents to report on producer and dealer barriers. What is preventing more farmers from adopting or expanding their use of precision farming? What is preventing retailers from offering more precision services? Barriers asked were for precision technologies in general. While information about the barriers for individual technologies would be useful, it was not possible to ask about individual barriers for each technology while keeping the survey concise. Most of the barriers retailers see affecting their customer's adoption of precision technologies were up a bit in 2025, but most of the barriers dealers identify as holding them back from moving more into digital ag were similar to previous years.

Producer Barriers

If digital agriculture is today's technology wave that will increase productivity, allow more efficient inputs, and reduce environmental consequences of farming, what holds back farmers from doing more? Asked about seven factors (Figure 19), overall farm income stands out as the greatest impediment for farmers adopting precision agriculture in 2025, with 55% of dealers agreeing or strongly agreeing with that concept. Going back a decade it has always been the single biggest issue, and also the one that fluctuates the most. In 2013 farm income was at historic highs (thus the low point in farm incomes being a barrier), but incomes quickly reversed to be well below the average of the last two decades for 2015 and 2017. The second biggest issue in 2025, and with one exception always second in the last decade, is the costs of precision services being greater that the benefits many receive. Third in 2025 but not asked before 2017 is customer concerns with data privacy. The third or sometimes fourth highest factor for most of the last decade was customer lack of confidence in site-specific agronomic recommendations. Topography limiting use, soil types limiting profitability, and interpreting and making decisions taking too much time are barriers that dealers rate consistently lower from year to year as factors why farmers may not be using precision agriculture. Note the time scale is irregular as the question is not always asked on consecutive surveys.

Dealer Barriers

For farmers it is the economics, so what is holding back dealers from moving more into digital ag? Similar to the farmer barriers, reported is the percentage who agree or strongly agree the stated barrier is preventing them from adopting or expanding their use of precision agriculture at their dealership, or offering more precision ag services. In 2025 the most agreed (as chosen from a list of eleven, see Figure 20) is the difficulty in finding employees who can deliver precision agriculture services. Prior to a decade ago this factor wasn't on top, but it has been since 2021. Certainly this has also been a concern for many businesses in and out of agriculture. Second in 2025, but usually not among the top in previous years is the cost of the equipment needed to provide precision services. Prior to 2025, with one exception and going back a decade, the three barriers that were always the highest were the difficulty finding employees to do precision, the costliness of quickly changing equipment needs, and the fees charged for precision services not being high enough to make precision services profitable. On the opposite end of the spectrum, "Lack of manufacturer support for precision services" was always the lowest barrier going back to when the question was first asked. Dealers feel strongly they get good company support!

Customer issues that create barriers to expansion and growth in precision agriculture	2004	2008	2009	2011	2013	2015	2017	2019	2021	2023	2025
My farmers are interested in precision services, but pressure on farm income in my area limits their use	72%	34%	50%	35%	25%	49%	65%	78%	37%	39%	55%
The cost of precision services to my customers is greater than the benefits many receive	53%	33%	31%	34%	24%	30%	34%	48%	24%	31%	36%
Customer concerns with data privacy limit their participation							11%	27%	30%	15%	33%
Customers lack confidence in the agronomic recommendations made based on site-specific data	25%	27%	26%	28%	23%	29%	24%	37%	24%	23%	32%
Interpreting and making decisions with precision information takes too much of my customer's time	17%	27%	27%	19%	19%	22%	21%	28%	22%	29%	31%
Soil or crop types in my area limit the profitability of precision agricultural practices for my customers	26%	20%	27%	19%	23%	18%	23%	30%	15%	21%	25%
The topography (i.e., rolling ground, etc.) in my area limits use of precision services by farmers	28%	22%	27%	24%	22%	20%	20%	21%	15%	13%	16%

Figure 18, Q18: Customer issues that create barriers to expansion and growth in precision agriculture. Percent who agree or strongly agree, ranked for 2025. Color formatting of green indicaes higher, yellow medium, and orange lower.

Dealer and technology issues that create barriers to expansion and growth in precision agriculture	2004	2008	2009	2011	2013	2015	2017	2019	2021	2023	2025
It is difficult to find employees who can deliver precision agricultural services	47%	49%	49%	44%	50%	47%	62%	63%	49%	62%	51%
The cost of the equipment required to provide precision services limits our precision offerings	72%	51%	47%	49%	36%	42%	41%	54%	31%	40%	45%
The equipment needed to provide precision services changes quickly, increasing my costs	65%	62%	54%	54%	45%	56%	50%	72%	46%	43%	44%
The fees we can charge for precision services are not high enough to make precision services profitable	61%	57%	51%	55%	43%	48%	51%	65%	42%	48%	41%
Demonstrating the value of precision services to our growers is a challenge	63%	44%	46%	42%	36%	42%	41%	54%	40%	40%	39%
Incompatibilities across types of precision equipment and technology (different data formats, inability to share	35%	45%	49%	41%	35%	41%	41%	50%	37%	45%	39%
The cost of the employees who can provide precision services is too high for precision ag to be profitable	43%	45%	37%	40%	35%	28%	40%	53%	31%	39%	36%
The equipment required to deliver precision services is too complex for many of my employees to use	29%	33%	28%	32%	27%	29%	28%	30%	20%	33%	32%
Creating a precision program that adds significantly more value for the grower than a traditional	46%	37%	28%	38%	29%	31%	31%	44%	30%	29%	31%
Our competitors price precision agricultural services at levels that are not profitable for us	43%	38%	36%	44%	36%	41%	43%	49%	35%	34%	26%
Lack of manufacturer support for precision services limits our ability to provide such services	22%	19%	23%	19%	18%	20%	24%	29%	15%	20%	24%

Figure 19, Q18: Dealer and technology issues that create a barrier to expansion and growth in precision agriculture. Percent who agree or strongly agree.

SUMMARY

The Precision Agriculture Dealership survey has been tracking the changes in digital technology use in crop retail input establishments and on farms since 1996. Since that time there have been watershed changes to the technologies as well as new types introduced. Three decades ago, agri-dealers offering precision services were most likely grid or zone soil sampling along with offering customers variable rate fertilizer applications. And with the advent of the combine yield monitor at about that same time, there was much activity in trying to link soil nutrient tests with crop yield responses, and then working to determine the optimum combination of nutrients and soil amendments for any particular part of a field. With enhancements in planter technology, varying planting rates and varieties soon followed. Soil maps and aerial or satellite imagery were often a part of understanding crop responses, too.

2025's Precision Agriculture Dealership Survey shows continuing shifts. We report on dealers who are serving farmers who primarily grow field crops and are mostly located in the Midwest. Dealers have invested in technology to streamline their logistics, such as fleet management and telemetry, used now by about half of dealers. Most dealers are using autoguidance and spray section/nozzle controllers for their custom pesticide and fertilizer applications, as has been the situation for several years.

Precision soil sampling along with VRT fertilizer and lime applications continue as customer offerings at most dealerships, along with helping customers analyze their yield monitor and other data, and making variable seeding recommendations, but these are mostly down since 2000. Grid/done soil sampling has especially decreased, from over 90% of dealers offering to now just over 60%. Along with the corresponding decreases in market area doing VRT fertilizer and liming, we have been questioning the direction these practices have been taking. In the next few years respondents say the greatest areas of growth will be in the numbers of dealers offering machine vision weed detection on sprayer, VRT pesticide applications in general, and profit/cost mapping.

As indicated most dealers offer precision soil sampling, but slightly more offer grid sampling services as compared to management zones or whole field sampling. If a dealer is zone sampling, more are using soil mapping units to delineate zones, fewer are using yield maps, and about 14% are using electrical conductivity. If a dealer is grid sampling, most use 2.5 acre grids, about one in six sample in larger grids, and about one in six mostly sample in grids smaller than 2.5 acres.

Fertilizer-related dealer offerings such precision soil sampling or VRT fertilizer applications provide greater returns than other precision services. Pooled on-farm data is guiding decisions at rates much greater than several years ago. Pooled data is used more in crop nutrient management, and less for helping to guide hybrid/variety selection, crop planting rates, variable rate seeding prescriptions, crop rotations, or pesticide selection.

Most dealers say automation will increase the accuracy of their input applications and help reduce mistakes, but most do not think automation will reduce their labor needs. Many dealers think artificial intelligence will lead to better agronomic recommendations, but overwhelmingly do not think AI will reduce their labor needs or operational costs.

Dealers are evenly spread on how most UAV/drone input application services are accessed by their customers. About a quarter provide these services in-house, another quarter contract with a company to provide the services, an equal share have customers that use UAV/drone companies not affiliated with their dealership, and about 20% of dealers say they are not aware of inputs applied via UAV/drones in their service areas. For those dealers providing drone input applications either in-house or contracted, the average number of crews

used was about two, with each having two workers and one or two drones. Dealers said the investment for setting up a crew is around $62,000, and costs around $13,000 per month to keep each crew running.

Retailers report that most of the acres in their areas use autoguidance, yield monitors, sprayer and planter row/section controllers, and do grid or zone soil sampling, but most acres still do not manage their fertilizer with a variable rate approach, and fewer yet with variable seeding. About 20% of acres are using aerial or satellite imagery, and less than ten percent are utilizing drone imagery.

Most of the barriers retailers see affecting their customer's adoption of precision technologies were up a bit in 2025, but their relative importance was much the same as in previous years. Most of the barriers dealers identify as holding them back from moving more into digital ag were similar to previous years, but many were down. Economic factors were the highest barriers identified by retailers for their farmer customers. The issue that stands out as most important to retailers for moving precision programs forward in their business were in finding suitable employees to deliver on products and services.

SURVEY INSTRUMENT

The survey is administered electronically, but the following shows the survey questions in a printable form.

CropLife

25th Precision Agriculture Services Dealership Survey

PURDUE UNIVERSITY

IRB APPROVAL 1702018754

Dear agricultural retailer,

The CropLife/Purdue survey is the longest-running, most widely used survey that chronicles the development and adoption of precision agriculture! We depend on your continued input. Please complete by March 1, 2025. **Thank you for your participation!**

Bruce Erickson & Jess Lowenberg-DeBoer *Purdue University* | Eric Sfiligoj *CropLife/Meister Media*

1. Which best describes your business? *[mark only one]*

[ ] Agricultural retail input supplier. *Sell fertilizers, seeds, or pesticides, and related crop production services to farmers.*

[ ] Farm equipment dealer. We appreciate your interest, but are focusing on ag retail input suppliers. [Survey terminates]

[ ] Agricultural consultant. *Provide advice and services to farmers such as soil testing, scouting, or farm management.* [Survey terminates]

[ ] Other: *[please specify]* _____. [Survey terminates]

2. If you answered agricultural retail input supplier above. Are you a: *[please mark only one]*

[ ] Independent dealership
[ ] Cooperative
[ ] Part of a national or regional chain (not a cooperative)
[ ] Other: *[please specify]* _____

3. Your primary responsibility: *[please mark only one]*

[ ] Owner/general manager/location manager
[ ] Departmental manager
[ ] Precision manager
[ ] Application manager
[ ] Technical consultant/agronomist
[ ] Sales/sales management
[ ] Other: *[please specify]* _____

4. How many total retail outlets does your company own or manage? *[please mark only one]*

[ ] None [ ] 1 [ ] 2-5 [ ] 6-15
[ ] 16-25 [ ] More than 25

5. Rank the following crop types according to the value of products and services you provide to each

[1=highest, 2=next highest, etc. Leave blank if less than 2% of your business.]

[ ] field crops (corn, soy, wheat, rice, cotton, milo, sugar beets, dry beans, etc.)
[ ] hay and forages
[ ] nursery or greenhouse
[ ] vegetables (incl. potatoes, melons, lettuce, tomatoes)
[ ] tree fruits & nuts
[ ] berries (strawberries, blueberries, raspberries, etc.)
[ ] grapes
[ ] Other: *[please specify]* _____

6. Do you offer soil sampling — traditional, following a grid pattern and/or by management zone? *[mark all that apply]*

[ ] Don't offer soil sampling
[ ] Traditional, whole field approach
[ ] Grid pattern
[ ] Management zones

If grid, what grid size most common? *[mark only one]*

[ ] < 1 acre
[ ] 1 acre - 2.49 acre
[ ] 2.5 acre
[ ] >2.5 acre

If zone, determined by what factor? *[mark only one]*

[ ] Soil mapping unit
[ ] Electrical conductivity
[ ] Yield map
[ ] Other [please specify]: _____

7. In which of the following ways does your dealership use precision technology? *[mark all that apply]*

[ ] GPS guidance systems with manual control (light bar)
[ ] GPS guidance systems with automatic control (autosteer)
[ ] Auto sprayer boom section or nozzle control
[ ] Sprayer turn compensation
[ ] Telematics to exchange information among applicators or to/from office locations
[ ] GPS fleet management for vehicle logistics, tracking locations of vehicles, and guiding vehicles to the next site
[ ] Smart scouting using an app on a mobile device to record field situations and locations
[ ] Predictive models for pest infestations
[ ] Do not use precision technology

8. How do you help manage the farm-level data (i.e., yield maps, soil tests, EC, imagery) of your farmer- customers to assist in their decision-making? *[mark all that apply]*

[ ] No data aggregated among farmers, work with farmers only with the data from their own farms
[ ] Data aggregated among farmers but not outside dealership
[ ] Data aggregated among farmers including those outside dealership
[ ] Archiving and managing yield, soil test, and other data
[ ] Other *[please specify]* _____
[ ] Do not help customers with their farm-level data

9a. What crop management decisions are being influenced by pooled data from your customer's farms?

[please mark only one column per row]	No influence	Some influence	Major influence
Nitrogen decisions	[ ]	[ ]	[ ]
P and K decisions	[ ]	[ ]	[ ]
Liming decisions	[ ]	[ ]	[ ]
Overall hybrid or variety selection	[ ]	[ ]	[ ]
Variable hybrid or variety placement in field	[ ]	[ ]	[ ]
Overall crop planting rates	[ ]	[ ]	[ ]
Variable seeding rate prescriptions	[ ]	[ ]	[ ]
Pesticide decisions (herbicides, insecticides, or fungicides)	[ ]	[ ]	[ ]
Cropping sequence/rotation decisions	[ ]	[ ]	[ ]
Irrigation decisions	[ ]	[ ]	[ ]
Biologicals decisions	[ ]	[ ]	[ ]
Other *[please specify]:* _____	[ ]	[ ]	[ ]

9b. Does your company have a customer data privacy statement and/or data terms & conditions agreement?

[ ] Yes [ ] No

10. Which services/products do you offer now? If not now, will you in three years? If you don't offer now and have no plans for the near future, leave blank.

	Offer now	Will offer by 2028
VRT fertilizer application	[ ]	[ ]
VRT lime application	[ ]	[ ]
VRT pesticide application	[ ]	[ ]
VRT seeding prescriptions	[ ]	[ ]
VRT irrigation prescriptions	[ ]	[ ]
Yield monitor and other data analysis	[ ]	[ ]
Satellite or crewed airplane imagery	[ ]	[ ]
UAV/drone imagery	[ ]	[ ]
Grid or zone soil sampling	[ ]	[ ]
Grid or zone plant tissue sampling	[ ]	[ ]
Soil electrical conductivity (EC) mapping	[ ]	[ ]
Services using other soil sensors mounted on a pickup, applicator or tractor (example:pH sensor)	[ ]	[ ]
N management using Chlorophyll/greenness sensors (GreenSeeker, Augmenta Mantis, OptRx, etc.)	[ ]	[ ]
Precision planter equipment sales	[ ]	[ ]
Telematics equipment sales (Farmobile, Trimble DCM-300, etc.)	[ ]	[ ]
Profit/cost mapping	[ ]	[ ]
Electronic records/mapping for traceability	[ ]	[ ]
Wired or wireless sensor networks, IoT, hardware and software	[ ]	[ ]
Robotics/automation used for crop scouting	[ ]	[ ]
Robotics/automation for mechanical weeding services	[ ]	[ ]
Machine vision weed detection on sprayer for custom applications	[ ]	[ ]
Robotics/automation for soil sampling services	[ ]	[ ]
Crop inputs (seeding, pesticides, fertilizers) applied with a UAV/drone	[ ]	[ ]
Other digital product or service not mentioned above. *[Please specify]*_____	[ ]	[ ]

11. Approximately what percentage of the total acreage in your market area (all growers, not just your current customers) is currently using the following practices?

VRT fertilizer application _____%
VRT lime application _____%
VRT pesticide application _____%
VRT seeding _____%
Variable hybrid/variety placement within fields _____%
Variable rate irrigation _____%
Satellite or crewed airplane imagery _____%
UAV/drone imagery _____%
Guidance/autosteer _____%
Sprayer section controllers _____%
Planter row or section shutoffs _____%
Variable down pressure on planter _____%
Grid or zone soil sampling _____%
Grid or zone plant tissue sampling
Soil EC mapping _____%
Other soil sensors mounted on a pickup, applicator or tractor (example:pH sensor)
Chlorophyll/greenness sensors for N management _____%
Yield monitor _____%
Cloud storage of farm data _____%
Any data analysis service (Granular, FieldView, FBN, etc.) _____%
Wired or wireless sensor networks, IoT _____%
Robotics/automation for mechanical weeding _____%
Robotics/automation for crop scouting _____%
Robotics/automation on harvester _____%
Autonomous support vehicle (grain cart) for harvest _____%
Electronic records/mapping for traceability _____%
Machine vision weed detection on sprayer _____%
Selective harvest for quality improvement _____%
Crop inputs (seeding, pesticides, fertilizers) applied with a UAV/drone _____%

CUSTOM APPLICATIONS

12. **In a typical year how many total acres do you custom apply at your specific location (fertilizer, chemicals, seeding – total acres including multiple applications)?** _____acres *[If none, go to Question 18]*
13. **How many acres did you or a contracted company apply crop protection with a UAV/drone in 2024?** __*acres*
14. **In 2024, approximately what percentage of your total fertilizer sales were custom applied? _____%**
15. **In 2024, approximately what percentage of your total crop protection sales were custom applied?** _____%
16. **In 2024, approximately what percentage of your total herbicide application acres used machine vision weed detection? _____%**
17. **In 2024, approximately what percentage of your total crop protection applications (total acres, all products) used:**
    Manual GPS guidance (light bar) _____% Auto sprayer boom section or nozzle control _____%
    Automated GPS guidance (autosteer) _____% Variable rate prescription map _____%
    Turn compensation _____%

18. **What are the primary barriers preventing more farmers from adopting or expanding their use of precision agricultural services and/or preventing you from offering more precision services?**
    Please rate the following statements on a scale from 1 (strongly disagree) to 5 (strongly agree).

		Disagree Agree
Customer Issues	The cost of precision services to my customers is greater than the benefits many receive	1 2 3 4 5
	My farmers are interested in precision services, but pressure on farm income in my area limits their use	1 2 3 4 5
	The topography (i.e., rolling ground, etc.) in my area limits use of precision services by farmers	1 2 3 4 5
	Soil or crop types in my area limit the profitability of precision agricultural practices for my customers	1 2 3 4 5
	Interpreting and making decisions with precision information takes too much of my customer's time	1 2 3 4 5
	Customers lack confidence in the agronomic recommendations made based on site-specific data	1 2 3 4 5
	Customer concerns with data privacy limit their participation	1 2 3 4 5
Dealer issues	The cost of the equipment required to provide precision services limits our precision offerings	1 2 3 4 5
	The cost of the employees who can provide precision services is too high for precision ag to be	1 2 3 4 5
	It is difficult to find employees who can deliver precision agricultural services	1 2 3 4 5
	The fees we can charge for precision services are not high enough to make precision services profitable	1 2 3 4 5
	Lack of manufacturer support for precision services limits our ability to provide such services	1 2 3 4 5
	Creating a precision program that adds significantly more value for the grower than a traditional agronomic program is difficult for us	1 2 3 4 5
	Demonstrating the value of precision services to our growers is a challenge	1 2 3 4 5
	Our competitors price precision agricultural services at levels that are not profitable for us	1 2 3 4 5
	The equipment needed to provide precision services changes quickly, increasing my costs	1 2 3 4 5
	The equipment required to deliver precision services is too complex for many of my employees to use	1 2 3 4 5
	Incompatibilities across types of precision equipment and technology (different data formats, inability to share information) limit my ability to offer precision services	1 2 3 4 5

19. **For your retail location, what state are you located in?** _____.

THANKS AGAIN FOR YOUR INPUT!