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## STATE OF

# PRECISION DRONE APPLICATION



SPECIAL REPORT  
PRESENTED BY:





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# DRONE-BASED APPLICATION: Crop Protection Manufacturers Must Prepare for Disruption

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**D**isruptive innovation is seldom taken seriously in its infancy. Computer pioneers in the 1970s famously downplayed how much consumers would want microcomputers in their homes until Apple invented the personal computer.

Newspaper publishers scoffed at internet advertising as “trading dollars for dimes” in the 1990s. In the U.S., print newspaper revenue peaked at about \$65 billion in 2000 and fell to about \$11 billion in 2017. Meanwhile, Facebook and Google capture about 75% of all digital advertising, and Amazon is a distant but significant third. All other publishers are competing for the remaining digital market share.

Kodak invented the digital camera in 1975, but it suppressed the technology so the new product wouldn't erode its film sales. Kodak reached al-



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most \$16 billion in sales in 1996 with two-thirds of the global market share but by 2012 had filed for bankruptcy and was delisted from the New York Stock Exchange.

Agriculture markets and value chains have always been susceptible to disruption from innovative technologies and agronomy. New chemistries, improved seeds, and better practices supplant products and old ways of doing things if they solve problems and bring better value to farm operations.

Today ag industries are set to react again as technology increasingly replaces chemicals with selective weeding and spraying technologies fueled by cloud computing and artificial intelligence (AI). It's happening now in real-world applications, and to the surprise of many, it's happening on smallholder farms.

Drone-applied fertility, seed for pastures, and crop protection are a reality in Asia, where small farms, limited manpower, and strong technology manufacturing have provided access for many small-scale farmers. The

current applicability is limited but promising. We're learning quickly from leading markets, primarily Japan and China. Chinese technology company [DJI](#) says it has millions of hectares under management this year, and while that might be surprising, there is little doubt this technology will chip away at backpack spraying.

Multinational corporations are already making their moves. [Bayer Japan](#) and drone manufacturer [XAG](#) are collaborating on application innovations, including ultra-low volume formulations and specialized adjuvants for drone spraying. [Adama](#) partnered with [Tactical Robotics](#) to develop proprietary equipment, and [Sumitomo](#) has partnered with drone manufacturer [Nileworks](#), backed by a public-private investment fund approaching \$17 million. This is more than a shiny new toy.

Disruption doesn't happen instantly — drones will not replace traditional application methods for much of the world until manufacturers give them the capacity, battery life, and reliability that they are accustomed to for large-area applications.

But some are inching toward this reality. KIWI in Massachusetts has developed an agriculture test concept that has a 50-gallon capacity. Others will follow, and it probably won't take 20 years to disrupt this space.

The only real questions are:

**"When will the adoption curve impact your business?" and "Are you doing enough to prepare for the disruption ahead?"**



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# Variable-Rate Application for Crop Protection to Surge in 2020

*The use of technology is expected to increase rapidly over the next few years and could have big implications for crop inputs.*

**T**HE USE OF PRECISION APPLICATION has seen huge growth in recent years as regulatory agencies and consumer demand put pressure on the use of pesticides and as the technology continues to evolve and improve. As adoption grows, *AgriBusiness Global*<sup>TM</sup> wants to better understand how the industry views this growing trend and learn how it might affect change going forward.

Precision agriculture is still in its infancy in many parts of the world. Not surprisingly, the vast majority of companies responding to the “Precision Application and Crop Protection: What’s Your View?” (methodology P.9) survey have yet to involve their operations with precision application. Only 26.7% of respondents to the survey work with precision agriculture technology, but

more than 82% of the respondents believe precision/variable-rate application of crop protection is positioned for significant growth in the next 12 months. Less than 5% of respondents either disagreed or strongly disagreed with that statement.

**82%** of the survey respondents believe precision/variable-rate application of crop protection is positioned for significant growth in the next 12 months.

As one respondent to the survey said: “Precision applications will be key in the near future to maintain the growing yields,

sustainability, and to be prepared for future regulations and social pressure.”

The changes to input application will come by air and ground. More than 86% of respondents think drones/UAVs will have a big impact or some impact on crop application. Even more (92%) say see-and-spray/variable-rate will have a big impact or at least some impact on crop protection application.

“Developing new formulations should be the first step. There are opportunities for formulators here, but we’re just not there as an industry,” says C.S. Liew, Managing Director, Pacific Agriscience Pte Ltd, and *AgriBusiness Global* Advisory Board member. “It’s kind of a chicken and egg situation because, for drone applications to grow, companies need to create new formulations.”



C.S. Liew

Drones will have the biggest impact in North America, according to the survey, with just over 50% of respondents ranking that region as where drones/UAVs will eventually change the crop input application

According to the survey,

**49%** said the challenges of glyphosate are very much driving changes.

space. Currently the U.S. is hampered by regulations that require drone operators to have line of sight to their drones as they’re being operated, and products must be labeled for aerial application. Large-acre crops also put limitations on technology that has limited battery life and payload.

The rules are less strict in China/East Asia, which ranked fourth on the list of regions where drones/UAVs will have the biggest impact. China/East Asia fell behind Western Europe and South America.

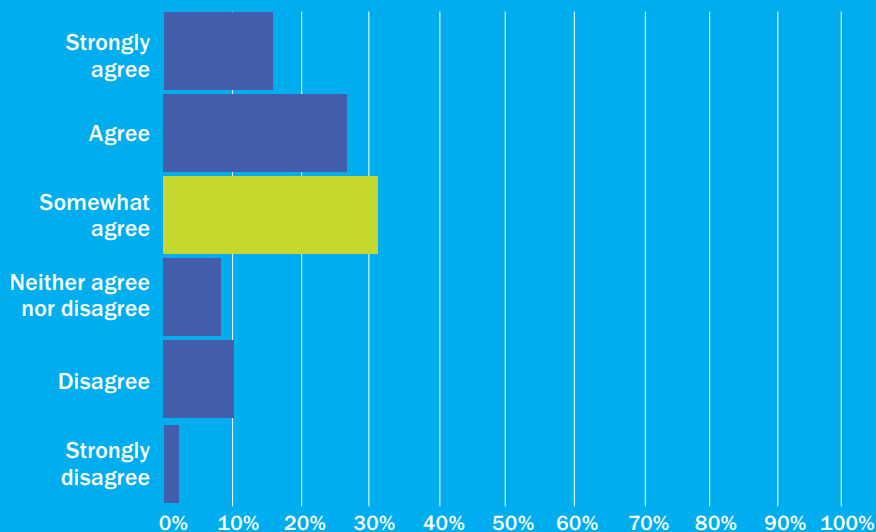
There are other factors that will vary the rate of drone application around the world.

“Countries that have highly regulated markets, their regulatory authorities will need additional data generated for all product registrations to allow for the high vari-

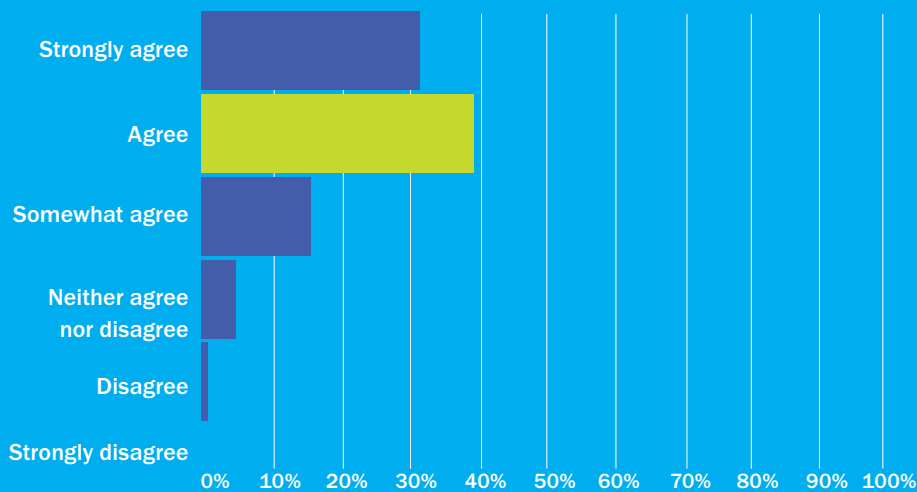


More than **86%** of respondents think drones/UAVs will have a big impact or some impact on crop application.

**CLAIM: Precision application technology will reduce volume of agrichemicals sold in the next 12 to 24 months ...**



**CLAIM: Agrichemical companies and precision application technology companies will need to explore formal business partnerships in the next 12 to 24 months ...**



**“Countries that have highly regulated markets, their regulatory authorities will need additional data generated for all product registrations to allow for the high variance of applications rates and methods with emerging precision application technology equipment and techniques”**

ance of applications rates and methods with emerging precision application technology equipment and techniques,” said one survey respondent. “This would hamper any early adoption due to both costs and time to generate data.”

Ground-based solutions followed a similar pattern to the aerial solution, with North America, Western Europe, and South America taking the top three spots where these solutions will have the biggest impact. China/East Asia slipped to the fifth spot behind Eastern Europe.

It’s not just regulatory pressure driving the growth of precision application, not the least of which are the challenges surrounding glyphosate. Regulations restricting its use and growing weed resistance are help-

ing to push interest in precision/variable-rate application of crop protection. According to the survey, 49% said the challenges of glyphosate are very much driving changes.

For the changes to take hold across the industry, this new technology needs to be embraced throughout the supply chain.

“Retailers need to do a better job of embracing precision application and taking it beyond variable rate of fertilizers and apply the concept to crop protection while developing and writing prescriptions for their farmer customers,” one survey respondent wrote. “This represents a significant opportunity for them to replace profitability



**Drones will have the biggest impact in NORTH AMERICA, according to more than half of respondents. About half also said adoption is being fueled by the challenges to glyphosate and focus on sustainability.**

via services to retain customers and replace profit lost to decreasing margins due to the industry being 90% off patent. Stewardship will also demand it. Technologies and companies that can deliver prescription application of agrichemicals will win.”

The technology involved in creating the active ingredients has become more sophisticated over the decades, allowing growers to decrease the amount of pesticides they’ve needed to spray on crops. Precision applications have the potential to further decrease the amount of product sprayed. Moreover, nearly three quarters of respondents agree with the statement that precision application technology will reduce the volume of agrichemicals sold in the next 12 to 24 months.

“The decrease in the number of liters of products can be inconvenient for the manufacturing companies,” one respondent said. “But a new formulation that allows a better behavior in drones/UAVS can be more profitable than selling many liters.”

Even those who think it might take longer know precision application is coming.

“The visionaries have this one right, but the technical complexities are greater than anticipated. The timelines will be longer than predicted before UAV spraying or ground see-and-spray are a significant portion of acres sprayed,”

**More than 90% of survey respondents agree with the statement “agrchemical companies and precision application technology companies will need to explore formal business partnerships within the next 12 to 24 months.”**



one respondent said. “Farmers shouldn’t double-guess the scheduled purchase of their next high-wheel field sprayer.”

Another respondent put it this way: “Much like most practices, precision application of crop protection products will have its place; but it will not be the end all be all.”

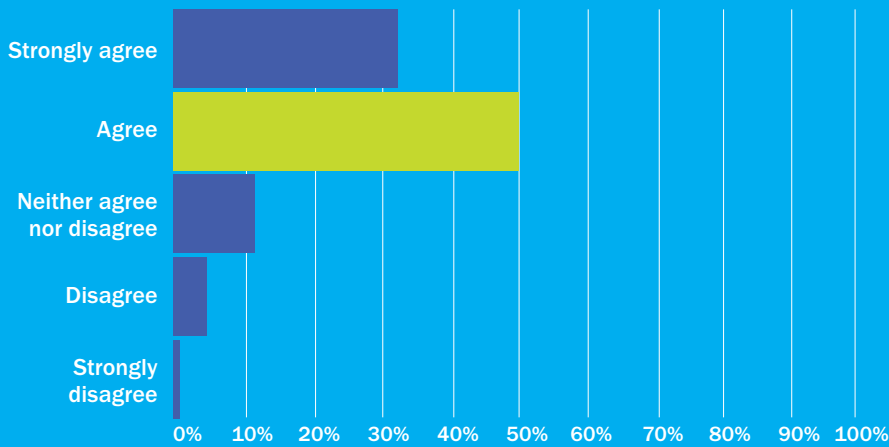
The challenge for many companies

interested in precision agriculture is where to invest their money and energy. The key is finding the right organization already in the field. As one respondent said, “Seed and fertilizer companies, too, even biological product producers, need this technology.”

More than 90% of survey respondents agree with the statement “agrchemical companies and precision application technology companies will need to explore formal business partnerships within the next 12 to 24 months.”

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**“Precision applications will be key in the near future to maintain the growing yields, sustainability, and to be prepared for future regulations and social pressure.”**



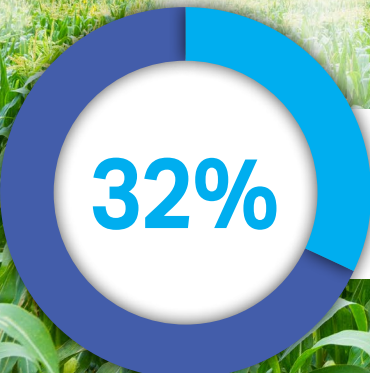
And, of course, precision application is only one part of the precision agriculture offering. As one respondent stated: “New innovative application methods are required. Only using drones or precision sprayers won’t be enough.”

The next several years should prove interesting for precision application specifically and precision agriculture in general. The results of this survey suggest this is no passing fad, and that companies should prepare to deal with this growing trend. One respondent to the survey suggests the coming changes will have huge and lasting impact on the industry: “Precision agriculture will be next revolution after the Green Revolution.”

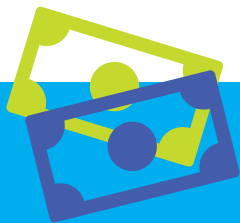
*About the Survey*

*There were 210 respondents from 57 countries. The respondents were primarily manufacturers (36%) and distributors/retailers/co-op members (25%). The remainder was divided among university/government, association/NGO, contract research organization, consulting, and others. Of the respondent companies, 71% are involved in agrichemicals, 50.5% deal with biologicals/biocontrols, and 48% work with biostimulants. Some 38% work with seed treatments, and 36% deal with micronutrients, and 34% work with NPK fertilizers/macronutrients. More than a quarter (28.5%) work with adjuvants/inerts. Currently only 26.7% work with precision agriculture technology, slightly more than the 23.8% who deal with equipment.*

# Stats



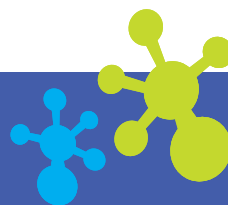
Share of precision agriculture investment spent on drone technology in 2016



**11.2%**  
CAGR agriculture  
drone invest-  
ment between  
2013 and 2016



**Up to 90% of  
water use**  
for irrigation can  
be saved with  
drone technology



**Up to 50% of chemical  
volume** can be reduced  
with drone spraying, and when  
combined with AI-based spot-  
spray technology, chemical  
reductions of 95% are possible



Source: Ipsos Business Consulting; Some data based on industry estimates, manufacturer data and analysis.

# Stats



**\$6.5 Billion**

Estimated global commercial drone market in 2020, more than half of which are agriculture drones

**\$80 Billion**

Estimated global economic impact of commercial drone adoption by 2025

**\$30 Billion**

Estimated global economic impact in agriculture by 2025

## Investment in Agriculture Drones



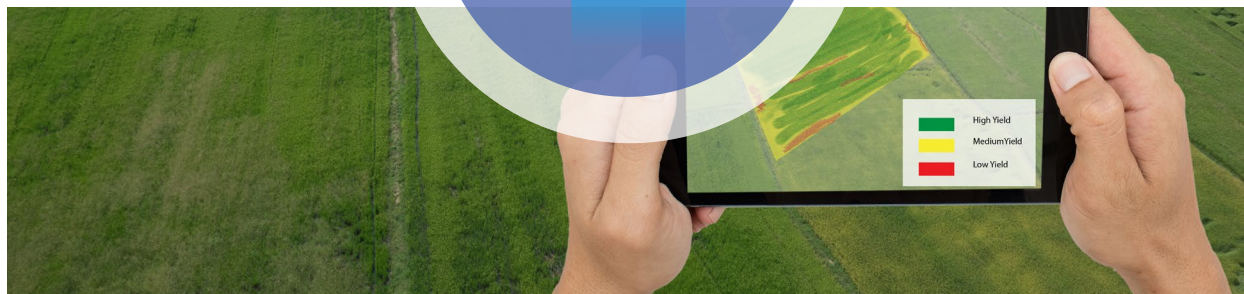
**\$94.1 Million**

2013

**344%  
increase**

**\$323.9 Million**

2015



Source: Ipsos Business Consulting; Some data based on industry estimates, manufacturer data and analysis.



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# Spray Application Drone Industry Prepares for Takeoff

**D**rones at first were a solution in search of a problem, and the recalibration and emerging rebirth of various commercial uses in the last six months to a year is exactly what the drone industry has needed., although there remains much work to be done.

A compelling aspect of this rebirth is the use of drones for spray application abroad. In the U.S., currently around 20% of agricultural spraying is aerial-applied by plane. What seemed far-fetched just a few years ago is now being embraced by some promi-

nent players among drone companies and crop protection manufacturers, resulting in partnerships that are moving the needle on drone-applied inputs.

Growth in the agricultural drone market, projected to be \$6 billion by 2020 according to a 2016 Goldman Sachs report, is second only to construction in the commercial sector. Until FAA lifts the ban on drone spraying, or begins issuing more Part 137 Operations

Growth in the agricultural drone market, projected to be **\$6 billion by 2020** according to a 2016 Goldman Sachs report



In the U.S., currently around **20%** of agricultural spraying is aerial-applied by plane.

exemptions for more aerial crop protection spray jobs, the biggest case for drone adoption is the ability to capture multispectral and Normalized Difference Vegetation Index (NDVI) imagery and using the maps to create stand count and emergence maps, enabling real-time data analytics.

Additionally, some drone service providers are finding growers eager to have them image fields early in the season and map out weed pressures, so that spot herbicide treatments can be applied, and growers can save money compared with making a complete field, blanket herbicide application. Put simply, growers are demanding automation and precision agriculture tools now more than in any previous year, and drone service profes-

sionals serving farmers are no different in that regard.

Drones will also play a role in alleviating farm worker shortages plaguing all facets of U.S. agriculture, as well as provide an answer to the ongoing push from consumers to keep farm nutrients and active ingredients where they are intended to stay. Conceivably, drone application will alter adjuvant and active ingredient concentration levels, but that is still being worked out by crop protection product manufacturers and drone application companies alike.

### Major Players

Top ChemChina-owned crop protection player [ADAMA](#) has made a big push in the drone space in 2018-19. It announced a partnership with fellow Israeli company [Tactical Robotics Ltd.](#), for a joint feasibility study for a unique vertical-take-off-and-landing (VTOL) unmanned aircraft the companies call the Ag-Cormorant, for aerial spraying. What sets the Cormorant apart is its high payload capacity – it can carry more than 130 gallons (up to 199 gallons including fuel), it does not require an

Growers are demanding automation and precision agriculture tools now more than in any previous year, and drone service professionals serving farmers are no different in that regard.



airstrip, and can be transported by truck.

ADAMA will shift to looking at different agronomic considerations, such as what heights are best for applying products to crops, and whether the military-grade drone Tactical is using provides any sort of drift-reduction benefits compared to ground-rig application.

Drone-based application would also serve to shore up the depleted ranks of aerial application pilots and provide an overnight application window when pilots are not able to fly. Whether the company's prototype will be cost and/or regulatory prohibitive remains to be seen.

In early 2019, ADAMA also teamed up with smart farming startup [Taranis](#) and crop input distributor Landmark in Australia. Taranis is a fast-growing Israeli smart farming startup which has made a name for itself with its AI2 ultra-high resolution

(UHR) aerial imagery solution and created something of a one-stop shop for precision ag with its acquisition of fellow UHR leader Mavrx in May 2018. Taranis uses patented aerial imagery technology that when affixed to high-speed UAVs and manned aircraft, can provide more than 500 times the detail compared to existing monitoring platforms. The company emphasizes its delivery of actionable insights and prescriptions that help manage how crops are grown, rather than forcing the farmer to do a technical deep dive.



**The key advantage to drone spraying in any country is largely one of preventing worker exposure to agrichemicals, and over the last year of working on application via drone, the company has discovered other benefits, such as time savings.**

Partnerships similar to these – crop input players and distributors linking up with drone spraying and imagery providers – are likely to increase going forward.

German multinational [Bayer Crop Science](#) is dedicating substantial R&D resources to crop protection product application via drone in China and Japan. The company is targeting smallholder farms, where product is commonly applied via backpack sprayers due to the small, irregularly shaped fields that comprise production farming in those countries.

The key advantage to drone spraying in any country is largely one of preventing

worker exposure to agrichemicals, and over the last year of working on application via drone, the company has discovered other benefits, such as time savings. Regulatory agency support for drone spraying has been described by Bayer as robust in both China and Japan.

The sustainability angle to more precise crop protection spot-spraying via drone is an appealing potential story for Bayer and its many stakeholders – arguably more so with the latest wave of court cases and negative publicity surrounding glyphosate. Bayer expects the technology to make its way to broadacre crops in the U.S. within the next few years.

[Rantizo](#), a seven-employee startup out of Iowa City, IA, rounds out the short list of players in drone spraying. The company recently filed for a U.S. patent on its refillable crop protection product cartridge system (products are mixed and then loaded onto a cartridge carried by the drone) and is eyeing expansion into the high-value specialty (think wine grape growers in California) and cannabis crop markets in the near future. Rantizo became the first company in Iowa to be legally authorized to use drones for aerial application of agrichemicals in July and is expanding into other markets.

The company's drones utilize an innovative technology, that of electrostatic energy that allows the spray solution to lightly wrap around and coat the plant's leaves evenly, reducing drift while providing better coverage. The group is looking to undertake some paid customer trials with its electrostatic spray capabilities in 2020.

Rantizo management's strategy is to

go right up to the U.S. Federal Aviation Administration Part 107-allowable 55 lb. payload limit, and then utilize swarms – for which it will need exemptions under FAA Part 107 in order to do. The company is also exploring foliar micronutrients and granular spreaders to apply via drone. Rantizo is banking on ag retailers and service providers as the main adopters of its yet-to-be-commercialized drone application system.

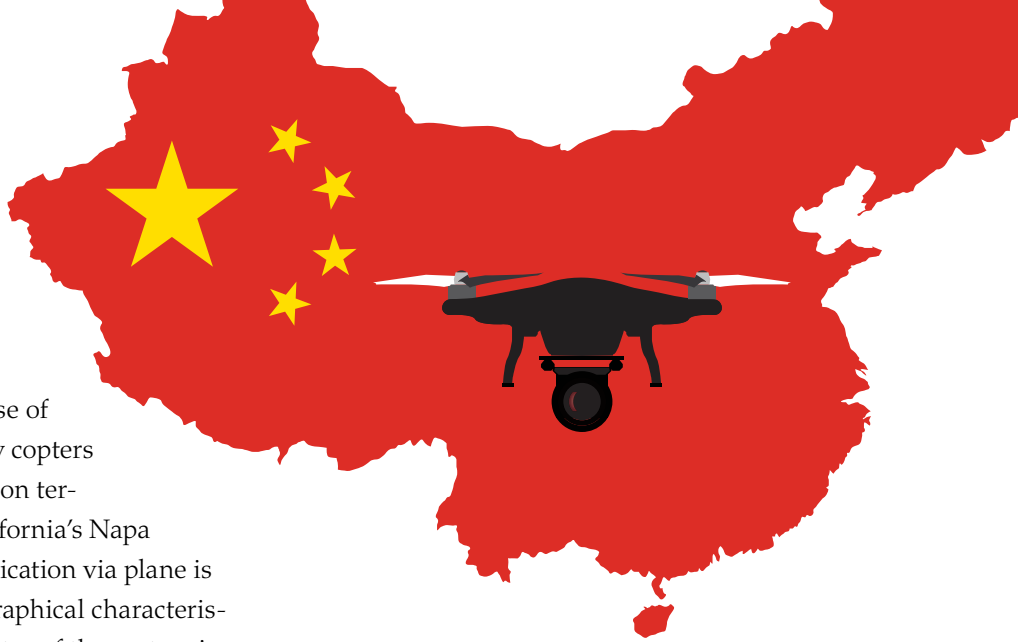
## Regulatory Questions

Were it not for regulatory restrictions on agricultural spraying via drone in the U.S., the market would doubtless look entirely different. The ban has held back R&D to such an extent that innovators originating in North America are forced to take R&D campaigns on the road to either Asia or South America. Regulatory changes have come slowly, notably the aforementioned Part 107 released in September 2016. One would expect the tide to turn, potentially in the near future. FAA has indicated in the past a willingness to look at easing the Beyond Visual Line of Sight (BVLOS) and night flight bans under the rulemaking, but so far that easing of restrictions has not occurred.

Another Part 107 regulation that the commercial drone industry needs softened is the prohibition against flying over people and property, although this is less a concern in agriculture due to the remoteness and low population density in most of the rural areas of the U.S.

One company has been granted an exemption under FAA's Part 137 Operations rulemaking (which normally certifies aerial application via plane operations) in





[Yamaha's FAZER unmanned aircraft](#), where FAA signed off on the use of the remote-control spray copters to apply crop protection on terraced wine fields in California's Napa Valley, where aerial application via plane is not feasible due to geographical characteristics. A major limiting factor of the system is the fact that FAZER's tank is still only able to carry up to 6 gallons of crop protection product, rendering it unusable for treating large U.S. farms, which average 442 acres. FAA rules also effectively prevent swarms, or groups of networked drones flying and applying in concert with one operator at the helm, in that each drone must be piloted individually. By contrast, in Japan, where drones have been used in agriculture for decades, the average farm is under 4 acres.

Similarly, [DJI](#) – the leader of the drone world in nearly every vertical market – offers a spray drone called the Agras MG-1, but its tank capacity is just 2.6 gallons. A lack of automation on both this drone and the FAZER poses another problem. In order to fully leverage drone technology as a spraying platform, the spraying needs to be paired and synchronized with precision technology to address the affected area of a plant, and the automation needs to be at a level where a typical agronomist or Part 107 service provider Pilot in Charge could precisely target and apply chemicals in a replicable manner.

It should be noted that DJI has a baked-in competitive advantage in its China headquarters, where it benefits from greater R&D access and more palatable commercial

drone regulations overall, potentially meaning a quicker rollout of a viable drone for broadacre crops for when FAA regulations (presumably) shift.

In China, government subsidies encourage the use of drones for spraying pesticides. DJI claims that more than 10,000 trained operators are using the Agras MG-1 series 8-rotor spraying drones and that it expects to sell 45,000 of its drones for farms by 2020.

[XAG](#) is DJI's top agricultural drone competitor in China. It says it has nearly 30,000 drones operated in over 19 countries, and has provided precision spraying services on over 5 million hectares of lands in China. In 2019 the company launched a JetSeed Granule Spreading System, used with its P30 Plant Protection drone, designed to dispense granules such as seeds, fertilizers and pesticides precisely through high-speed airflows while combatting grassland degradation.

**XAG says it has nearly 30,000 drones operated in over 19 countries, and has provided precision spraying services on over 5 million hectares of lands in China.**



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# Three Spray Drone Models That Promise to Break Through

*As growers deal with large fields and shrinking labor forces, these companies are banking on their machines coming to the rescue.*

**D**RONE TECHNOLOGY IN AGRICULTURE has moved rapidly through the technology hype sequence, from curiosity to irrational exuberance to overblown misfit. In reality, drones at first were a solution in search of a problem, and the recalibration and emerging rebirth is exactly what the drone industry has needed.

A compelling aspect of this rebirth is the use of drones for spray application. What seemed far-fetched a few years ago is now being embraced by some prominent players among drone companies and crop protection manufacturers, resulting in partnerships that are moving the

needle on drone-applied inputs.

Here we take a look at three entities driving spray drone research and development in row crop farming:

- Adama via its recently announced partnership with Israel-based Tactical Robotics
- Bayer's Crop Science division and its efforts in China and Japan on smallholder farms
- Rantizo (a seven-employee startup out of Iowa City, IA, United States)

Representatives from each company shared some details about their business approaches, use of technologies, and views on the future of drone application in ag.



Earlier this year Tel Aviv, Israel-based [Adama](#) announced the undertaking of a joint feasibility study with neighbor and drone innovator Tactical Robotics on high-payload unmanned aerial vehicles (UAVs) for aerial crop spraying.

Dani Harari, Senior Vice President of Strategy and Resources, Adama, says the first feasibility flight, in which Tactical outfitted its high-payload UAV with spray booms and included a test spray with water, has finished. The company will shift to looking at different agronomic considerations, such as what heights are best for applying products to crops, and whether the military-grade drone that Tactical is using provides any sort of drift-reduction benefits compared to ground-rig application.

Harari says that Adama's approach — partnering with Tactical Robotics and using its Ag-Cormorant high-payload (500 KG), vertical-takeoff bi-rotor drone — sets it apart from other developers in the space.

"First of all, we did computer simulations to check the Ag-Cormorant's potential and saw it can fly in every air speed that is required by the operator," Harari says. "As far as drift is concerned, we can adjust spraying height and use the unique downwash effect

to reduce drift and improve coverage.

"To my knowledge, there is no similar UAV spraying platform with this kind of payload capability available at the moment," Harari says. "Published initiatives, with DJI for example, are focused on significantly lower payload capabilities

(i.e., under 55 pounds) and adjuvants for drift reduction, using small drones. We're talking about totally different things."

Harari points to Tactical's log of more than 300 successful flights and its ability to spot spray a field with the Ag-Cormorant as additional differentiating points among its rivals.



Ag-Cormorant, the high-payload, vertical-takeoff bi-rotor drone made by Tactical Robotics and Adama, represents the "future of aerial spraying," Adama's Senior VP of Strategy and Resources Dani Harari says.

"It's the future of aerial spraying," Harari says. "In the U.S. alone about 20% of the spraying is aerial. I believe that there are a lot of advantages for this kind of platform, especially when combined with Adama's R&D and formulation capabilities. Both companies together will create a whole solution, which will be customizable and adjusted for various crop protection applications."

Harari says the company is currently targeting what they consider the big markets for aerial drone spraying — the U.S., Brazil, Argentina, Australia, and Canada.

Drone-based application would serve to shore up the depleted ranks of aerial application pilots and provide an overnight application window when pilots are not able to fly. "Application timing is an important factor, and

**"To my knowledge, there is no similar UAV spraying platform with this kind of payload capability available at the moment."**

— DANI HARAI, ADAMA

the best time to spray is mostly when it is still too dark for the pilots to take off," Harari says. "An unmanned aircraft can enable spraying in better conditions for reducing drift."

Another important factor is the Ag-Cormorant's vertical-take-off-and-landing capability, which reduces turnover time and increases productivity, he notes. "Today pilots fly back and forth to the airfield — the Ag-Cormorant does not need an airfield, and it does not need to fly from the airfield to the field with a tank full of chemicals, which makes it much safer to use. I believe our UAV sprayer can compete successfully with the manned aerial sprayers or even the big ground tractors."

Currently, U.S. FAA's Part 107 and its current regulatory structure makes testing such a high-payload spray drone here in the States virtually impossible. But Harari is optimistic

that both the passage of time and the public growing more comfortable with drone technology will hasten the adoption of spray drone technology on U.S. crop land.

"The technology is already there," he allows. "Part 107 came after drones were almost everywhere already, and I believe that new regulations will adapt to the technological development. It might take three years or five years, perhaps less."

"If there is going to be technology that proves this is much better for the environment, for growers, for applicators, for the whole industry, then there might be an incentive for the regulators to allow higher payload in unmanned flights. We see the potential use of autonomous UAVs in other industries, like what Uber and Tesla are working on, so the need for regulation adaptation might come from this angle as well."

## 2 • Bayer Crop Science

Wendy Poulsen, Head of Field Solutions Technologies with [Bayer's Crop Science](#) division, says the German multinational is dedicating significant R&D efforts toward applying crop protection products via drone in China and Japan. The company is targeting smallholder farms, where currently a lot of product is applied via workers with backpack sprayers due to the small, irregularly shaped fields that comprise production farming in those countries.

"First and foremost, at Bayer we're always

working to make sure that our products are keeping up with the latest technologies, and we agree that the evolution of drones across the world is really advancing rapidly," Poulsen says. "We're especially seeing that in China and Japan, where we've already been conducting field trials with equipment manufacturers and with smallholder growers to really look at the advantages that we can find in those areas."

Poulsen says the issue in Asia is largely one of pre-

**"Spraying when it's wet and muddy makes it hard to get in and get out, whereas a drone can get into any field in any condition."**

— WENDY POULSEN, HEAD OF FIELD SOLUTIONS TECHNOLOGIES, BAYER CROP SCIENCE





Drones will necessitate a new approach to applications and large row crops. "What drones will offer is going to flip the whole industry on its head," Bayer Crop Science's Wendy Poulsen says.

venting worker exposures to agrichemicals, although over the last 12 months of working on application via drone, the company has discovered that there are other important advantages.

"You compare it to a worker walking through a rice paddy with a backpack sprayer. Even just from an ergonomic perspective with the operator, they don't have to carry a huge amount of liquid on their back," Poulsen says. "And from a time perspective, they can really get in and get out of the field (using the drones) vs. something that could take a whole day to get through with a backpack. It's really

taken off quickly, and part of that has been the result of robust support from the regulatory agencies in China and Japan. We're jumping in very quickly to make sure our products have been tested for safety and efficacy in the drone application scenario."

How will this play out in large row crop fields in the U.S.? Poulsen says that a new approach to application will be required.

"If you look at a comparison to a big tractor that can cover a very large field in a short amount of time, it does begin to look very expensive if you try to do that from a drone," she says. "I think that what drones will offer is going to flip the whole industry on its head in terms of what we do today.

"You have to think about why we have these big expensive tractors. It's because oftentimes the times that we can get into the field are very limited." Spraying when it's wet and muddy makes it hard to get in and get out, whereas a drone can get into any field in any condition.

Then, she adds, with the evolution of precision ag and Bayer's ability to detect problem areas, it may not be necessary to spray the entire field. "There's certainly advantages in the U.S. and Brazil, in areas where we have very large fields, but it's going to cause us to think differently than how we have before."

Asked whether Bayer was in favor of the large, high-payload drone approach that the Adama/Tactical Robotics partnership is leveraging, or whether it prefers the tactic of deploying smaller drones swarmed in fleets or teams to cover acres, Poulsen says the jury is still out.

"Honestly, there is probably room for both. We don't believe that it will be a question of either-or," she says. "We're looking at all opportunities, so we've got to think about this differently."

The sustainability angle to crop protection product application via drone is with-

out a doubt an appealing potential story for Bayer and its many stakeholders — arguably more so now with the latest news about glyphosate.

“We’re also thinking about sustainability, so the answer is ‘yes’ on that. As we think about our products at Bayer, and as consumers get more aware of these kinds of products, they’re going to demand we use less broadcast application and be more precise in how these things are applied.

“I think technologies like spray drones will offer us the ability to deliver more on sustainable applications for our customers and consumers around the use of less product,” Poulsen says, “which is something that we as a company have pledged to undertake, and that is one of the things we look at. We believe we

can get to something that will be more precise.”

Going forward, Bayer will continue its R&D efforts in China and Japan, “testing existing and new Bayer product formulations in those countries where we are permitted to do so,” as well as working with U.S. EPA going forward on “what they need from us in order for us to conduct similar trials here in the U.S.”

Like her Adama counterpart, Poulsen sees a shrinking timeline for spray drone integration in the States.

“Overall, we’re well-positioned to collaborate and learn from our various partners in our R&D efforts, and we’re in that space now where we envision it’s going to be a few years probably before this technology is on acres in the U.S.”

# 3

## • Rantizo: Swarms Bring Strength in Numbers

Iowa City, IA (U.S.)-based [Rantizo](#) is carrying the spray drone R&D mantle domestically in the United States, and CEO Michael Ott shed some light on what the outfit is working on as the race to apply via drone in the U.S. heats up.

Rantizo recently filed for a U.S. patent on its refillable crop protection product cartridge system (products are mixed and then loaded onto a cartridge carried by the drone) and is eyeing expansion into the high-value specialty (think wine grape growers in California) and cannabis crop markets in the near future.

“We want to supply the industry with picks and shovels, in a sense,” Ott says. “Or you could put it this way: People are growing their acreages, and they need to spray. Our strategy is we go right up to the FAA Part 107-allowable 55-pound payload limit, and then we utilize swarms — for which we’ll

need (U.S.) Federal Aviation Administration exemptions under Part 107 in order to do. We’re looking at things like foliar micronutrients, and there are granular spreaders we can use to apply (via drone) as well. There are multiple things we can put out as long as we keep the volumes down.”

**“Our message as a company has been resonating because we listen to growers and ag retailers and understand their problems.”**

— MICHAEL OTT, CEO OF RANTIZO

Ott foresees Rantizo’s drone swarms as helping to alleviate the labor issue (that is, worker shortage) plaguing all facets of U.S. agriculture, as well as the ongoing push from



Rantizo sees its drone swarms as being an option to worker shortages. “There are not a lot of people who can get this application work done when the growers need it,” CEO Michael Ott says.

consumers to keep farm nutrients and active ingredients where they are intended to stay.

“Our message as a company has been resonating because we listen to growers and ag retailers and understand their problems,” says Ott. “Almost universally, labor is the biggest issue, there’s no doubt. There are not a lot of people who can get this application work done when the growers need it.”

As for reducing drift, Rantizo’s drones also utilize downwash from the props to aid spray mixes in penetrating the canopy. And the company says it boasts a unique piece of technology to that regard. “The prop wash really helps, and then we’re using electrostatic spray in our sprayers,” Ott shares. “We were applying in 21-node cotton, about 36 inches tall and very thick canopy. Our very first spray we measured 18 inches of penetration deep into that canopy.”

Ott says charging the spray solution with electrostatic energy allows the spray solution to lightly wrap around and coat the plant’s leaves very evenly while also provid-

ing better coverage with less carrier while maintaining the same rate of active ingredient. The group is looking to undertake some paid customer trials with its electrostatic spray capabilities in 2020.

Additionally, an ag retailer that contracts with a Rantizo service provider on application work can potentially open up its operating territory and reach new farmer-customers.

“There’s a great stat on that. Say you’ve got a self-propelled sprayer, and it goes about 35 to 40 mph on the road,” Ott says. “You can get about a maximum of 75 miles diameter away in any direction from the hub, or main office, in a day and still have time to get back by the end of the day. Well, with these swarms in the back of a pickup truck, you can go about a 100-mile diameter from the hub and make it back on time, opening up another 73% of operating territory.”

Rantizo is also banking on ag retailers and service providers as the main adopters of its yet-to-be-commercialized drone application system, Ott says.



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# What's Next for Agricultural Drones

In May I made the trek to downtown Chicago to attend the annual conference of the [Association for Unmanned Vehicle Systems International \(AUVSI\)](#), mercifully shorthanded to the event known as [XPONENTIAL](#).

This year was the eighth edition of the meeting, a sprawling, exhausting display of all things unmanned.

As you can imagine, the meeting was created originally to serve the largest industry that employs unmanned technology — the military. Long-time attendees told me that in the early days it was difficult to find a civilian amid a sea of uniformed conference delegates.

In 2019 XPONENTIAL exhibitors and attendees were clearly skewed to civilian

causes for autonomous technology — I saw one person in fatigues there during my two-day immersion.

And, full disclosure, agriculture is definitely not a primary target for most of the participants. Industrial inspection, oil and gas, mining, site surveying, and other industries in which offering remote access is

not only more efficient but life-saving are clearly the focus.

But present were some companies that we all know

— Topcon, Trimble, PrecisionHawk, and AeroVironment, among others — who will be taking the bits of useful unmanned technology and applying them to agriculture.

I went to the conference not really knowing what to expect. I've been a drone skeptic, at least as far as figuring out how retailers





## Today you can't fly a drone to where you can't see it, which significantly diminishes its utility in a number of industries, including agriculture.

could create a legitimate business plan by adding drone imagery and field inspection to an agronomy program. But I left the conference a bit more hopeful about the future.

For starters, a term that we should all become familiar with is “beyond visual line of sight,” or BVLOS. (The “cool” people say BEE-VLOS.) Today you can't fly a drone to where you can't see it, which significantly diminishes its utility in a number of industries, including agriculture.

But when you can fly beyond the horizon, perhaps centrally controlling drone flights without having to watch their every move — that could change the game a bit.

Most of the exhibitors I talked to, whether they were in ag or not, were hotly anticipating the [Federal Aviation Administration \(FAA\)](#) finally relaxing the rules about line of sight. Most other countries around the world are already way ahead of the U.S., and the pressure continues to grow as drone and ground control technology improves (as

does opportunities to build business).

Of course, it remains to be seen what direction FAA will ultimately choose to go — its approach to drones has leaned toward “abundance of caution” as it considers commercial aviation risks, as well as concerns for low-altitude agriculture aviation.

One interesting development at the conference occurred while talking to some of the many universities and state-based organizations that are working to build business around drone technology. In the Oklahoma booth they talked about creating “droneports” out of county and regional airports, which would offer centralized ground control and dispatch of drones. Seems like a pretty practical idea to address concerns about drone management, and a way for agriculture to potentially tap into an efficient method for using drones.

The regulations may be a year or two in the offing, but BVLOS could move the needle on ag drones.

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