

Agriculture Gets Smart: The Rise of Data and Robotics

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Big Data Meets Agriculture

Big data and agriculture came crashing into the wider consciousness in late 2013 when **Monsanto** placed a billion dollar bet and acquired The **Climate Corporation**, a San Francisco-based provider of agriculture insurance underpinned by data analytics on climate. The company, founded by Google alums and operating in the heart of the Bay Area and the wider Silicon Valley ecosystem, was backed by **Google Ventures**, **Khosla Ventures**, **Founders Fund**, and other top venture firms. It was a major statement by **Monsanto**, a firing of the first shot in a war for dominating the big data and agriculture space. The deal also showed the willingness of a large, established agriculture corporate to spend major dollars to incorporate Silicon Valley innovation DNA into its business. In its press release on the deal, **Monsanto** claimed that data science in agriculture represents a \$20 billion opportunity beyond **Monsanto's** core focus. With that kind of opportunity, **Monsanto** will likely not be the only agriculture giant rushing to capture part of that market share. i3 has tracked partnerships and investments into agriculture companies from corporates ranging from Google to **BP** to **GE** to **Mitsui**, as well as the expected players such as **Syngenta**, **Monsanto**, **DuPont**, and **Cargill**.




Big data is a major area well beyond agriculture, with applications ranging from security to healthcare to retail. [McKinsey cited](#) a \$300 billion opportunity each year for big data to create value in the US healthcare sector alone. The increases in efficiency through more transparent data trends will have impacts in almost every sector and are driving innovation across a number of markets. Tech companies such as **IBM**, **Google**, **Oracle**, and **EMC** have already jumped wholeheartedly into this space.

Within this opportunity for data and precision, agriculture is in particular need of these increasing efficiencies. Each acre will need to produce more food while being tended to by a smaller and smaller group of growers. This will mean tailored solutions that ensure that every plant is optimized. Jorge Heraud, the CEO of **Blue River Technology** and a former Director of Engineering and Business Development at **Trimble Navigation**, sees the trend going from field-level management down to plant-level management. He commented that “there has been, over many years, the realization by farmers that there is lots of variability inside a field. The basic unit of management has moved from farm level to field level to small plot areas. I see that as a trend going from bigger to smaller, and see that trend continuing. There is lots of variability within a small area still. I believe this will lead to plant by plant management.”

Monsanto is clearly jumping in enthusiastically, with a number of acquisitions tracked in i3 over the past few years. In 2012 **Monsanto** acquired **Precision Planting**, an Illinois-based developer of planting products and solutions that contribute to better seed spacing, better depth control, and better root systems. It then moved onto its big move, acquiring **Climate Corp** in 2013 for around a billion dollars. The spree continued in 2014 with **Climate Corp** acquiring the soil analysis business line of **Solum**. Although the deal was potentially not a great exit for investors, the **Solum** deal showed the continued interest in the space from **Monsanto**.

MONSANTO'S DATA ACQUISITION SPREE

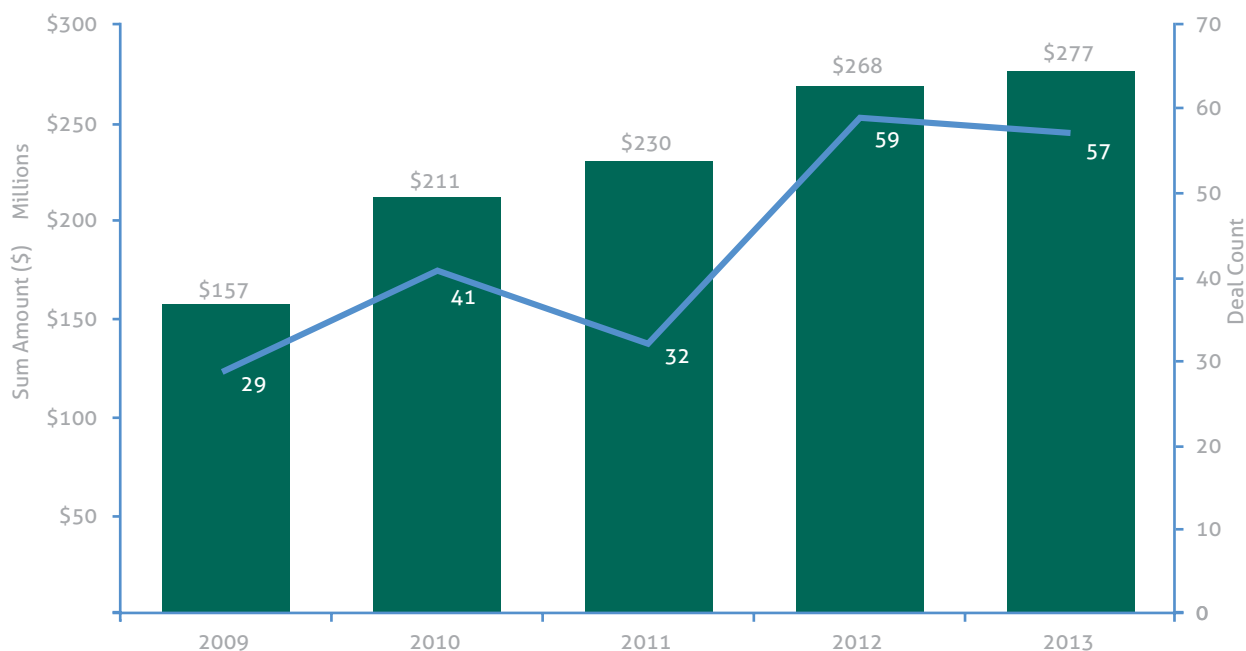
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Acquisition target	Technology	Commentary
	Developer of planting products and solutions that contribute to better seed spacing, better depth control and better root systems	Monsanto acquired Precision Planting for \$210 million in 2012, beefing up its Integrated Farming Systems unit.
	Provider of weather analytics and insurance coverage to protect farmers from the financial impact of climate change	Monsanto acquired Climate Corp for around \$1 billion in 2013, with Monsanto noting that data science in ag is a \$20 billion opportunity.
	Developer of software and management technology for applications in agriculture	Climate Corp , by then a Monsanto subsidiary, acquired the soil analysis business of Solum for an undisclosed amount.

With the interest from corporates like **Monsanto**, venture firms are realizing the potential for the sector. Agriculture & Food more broadly attracted \$277 million across 57 deals in 2013 according to i3. While the largest rounds went to seed genomics and contaminant detection, a number of companies in the big data + agriculture space, including **HydroPoint Data Systems**, **FarmLogs**, and **Harvest**

Automation, received VC funding. Corporates are also putting their money where their mouth is, with **Mitsui**, **Syngenta**, and **Westlake Chemical** all making equity investments. With the **Climate Corp** deal in late 2013, we will likely see an uptick in deals across 2014. Already we have seen deals for **Hampton Creek Foods**, **Chromatin**, **Granular**, and others in 2014.

VENTURE AND CORPORATE INVESTMENT IN AGRICULTURE & FOOD



Innovation in Big Data + Agriculture

While corporates are very involved with big data and agriculture, startups are still at the heart of the action, providing solutions across the value chain, from infrastructure and sensors all the way down to software that manages the many streams of data from across the farm. Corporates are already targeting this area heavily, especially in the areas of sensors and positioning systems for farm equipment. Sensors can be used to detect plant- and plot-level soil moisture, fertilizer input, weeds, and disease. For instance, **Libelium** produces sensors for markets ranging from smart grid to healthcare, and specifically for agriculture, sensors to track conditions in vineyards and greenhouses. These sensors are also incorporated into drones and robotics to make those systems more effective. Positioning and guidance systems, or global navigation satellite systems (GNSS), for farm equipment is also becoming standard for farmers, with global position systems (GPS) and differential GPS customary on new farm equipment. These systems allow farmers to program precision planting and chemical inputs for higher precision. The new wave of innovation uses sensors and GNSS to further the efficiency of agriculture with increasingly easy-to-use systems for farmers. More generally, Precision Agriculture and Agriculture Software are the fastest growing areas of agriculture innovation within i3, with new companies coming into the product weekly. In particular, the areas of drones, sensors, and software are growing, while robotics is emerging from its nascency.

DRONES

One of the hottest innovation spaces is drones, or unmanned aerial vehicles (UAVs), that are providing effective and cheap imaging capabilities. By showing variability in irrigation, yields, and pests, the drones give insight into conditions from the plot to plant level. This new breed of drones can fly themselves and provides composite images that are immediately of use to the farmer. Many of these companies are focusing on both the hardware and software, with a

particular focus on the software. With drones heading down the path to becoming commodities, the software will ultimately make it useful for farmers to be able to operate without special training, and to gather useful data. Some of the companies at the forefront of this field are **PrecisionHawk**, **Aerial Precision**, **Ceres Imaging**, and **HoneyComb**.



PrecisionHawk is an Indiana-based provider of end-to-end aerial data collection, data management, and data analysis systems. The company's specialty is in its artificial intelligence software for its UAVs, which can fly themselves using flight planning software. The data is then made usable using data review and management, online aerial video management, automated orthomosaic processing, and a cloud platform for accessing the composited and ready-to-use images. Although agriculture is PrecisionHawk's first target market, it is planning to expand to other markets.



Aerial Precision is a maker of multi-copter drones based in Arizona. The company, a division of Roboflight, offers integrated aerial platform that gives agricultural producers easy to fly vehicles providing video and photo images to scout crops, making farming operations more precise and better managed.



Ceres Imaging is a California-based provider of solutions to farmers that help optimize water and nitrogen use. The company is piloting its system with California growers and partnering with UC Davis.



HoneyComb is an Oregon-based developer of UAVs for use in farming and forestry. The company's hardware product, AgDrone UAS, can be equipped with a variety of cameras including thermal, spectral, and visible. The company's software product provides mapping and analytics and provides data that allows farmers to detect crop deficiencies and better allocate resources.

ROBOTICS

Artificial intelligence is also being used to incorporate robotics into agriculture. Robotics can provide a labor replacement as agriculture struggles with an aging farm workforce and decreasing amounts of immigrant labor. Jorge Heraud, the CEO of **Blue River Technology** and a former Director of Engineering and Business Development at **Trimble Navigation**, sees the next yield increase breakthrough coming from making every plant productive, with "the challenge being where the robotic applications appear first and which area are most in need of robotics. Plant by plant care can provide a tremendous increase in yield, decrease input requirements, and improve agricultural sustainability." **Blue River Technology** is a California-based provider of robotics for agriculture. The company uses cameras, computer vision, and machine learning algorithms to provide an efficient lettuce thinning process.



BRINGING IT ALL TOGETHER

With all of these technologies, from sensors to UAVs, gathering data, the next step is to bring it together in one easy-to-use system for farmers. One challenge to bringing all the data together in a useful way is the wireless infrastructure present in many rural areas. For areas not covered by the big carriers like AT&T and Verizon, getting

data from sensors to a central software system is extremely difficult. **Intelligent Wireless Networks** is a company tackling this problem by developing specialized WiFi networks in rural and farming communities. Not only can the farmers get the data without sending someone to collect it from each sensor, it provides in-field connectivity for the many farmers who now work primarily from phones and tablets.

Once all this data has made it to a central location, it needs to be useable. Lance Donny, the CEO of **OnFarm**, comments that "many farmers are frustrated with their data in different places, making it hard to run their operation from anywhere but the office." That is where companies like **OnFarm** come in. The company offers a cloud-based platform that enables the integration of data from multiple sources and an open network of solution providers. Farmers can select the information they need from soil, plant, weather, and equipment solutions and have a single system to plan, manage, and control their field operations. Like **OnFarm**, **Granular**, the recent spin-off from **Solum's** acquisition by **Climate Corp** and **Monsanto**, develops a cloud-based software platform for planning, production, marketing, and accounting in production agriculture.



Taking the data one step further, companies like the **Climate Corp** are using publically available data and making it useful for farmers. **Climate Corp** uses public data to inform its big data analytics, which provide the basis for its insurance plans for farmers. The **Climate Corp** also offers field-level data from **Precision Planting**.

WHAT'S NEXT?

Despite all these drivers, from climate change to increasing populations, and myriad technologies addressing these markets, there are many challenges to fully implementing big data in agriculture. One of the early issues in scaling these technologies is farmer concern over data ownership. Just as users of Facebook and Google worry about who owns their personal and search data, farmers are wary of technology without establishing who owns the data from sensors, drones, and software. Lance Donny, CEO of **OnFarm**, comments that “farmers are becoming increasingly concerned about who owns the data generated on their farms, who can access it, and for what reason. Significant opportunities exist for data analysis that drives increased efficiencies in agriculture, but data ownership and privacy in agriculture, like other industries, is complex and companies will have to consider the right balance between what’s confidential to the farm and what data can be used to enhance their solution.” Although this issue of data ownership will likely not prevent growers from adopting these technologies, companies working in this space will have to have clear guidelines and make growers feel confident in the security of their data.

One unknown in this space will be which corporates ultimately dominate it. **Monsanto** has clearly put a flag in the ground and aims to be a leader. Companies like **Syngenta**, **Dow**, **Bayer**, and John Deere will likely participate in these trends. However, they may be competing with more traditional data and tech firms, such as Google and **IBM**, who see agriculture as a new market to apply their technology. Will the next billion dollar acquisition of a big data + agriculture company come from **Monsanto** or Google?

With all the corporates jumping into the space, most are looking to partner or invest in companies that can help them leapfrog competitors and incorporate Silicon Valley DNA into these agriculture giants. New companies are forming all the time and are equally hungry to meet the investors and corporates. These partnerships, investments, and acquisitions will be the defining force shaping the big data + agriculture space in the years to come.

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- It's often difficult to differentiate between the top innovators

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- Leverage i3 to broadcast your current needs to targeted groups of entrepreneurs
- Tap our network of 60,000+ entrepreneurs and innovation stakeholders worldwide
- Use our team to do your initial vetting

■ ■ Simple process, great results

- We reach out to select groups of entrepreneurs
- Entrepreneurs answer a personalized questionnaire to speed up the initial validation process
- We tier the results and deliver direct introductions with the 5-10 best fits in just 5 weeks

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Gil Demeter
Senior Associate
Qualcomm Ventures