

Bugs and Bytes: Monsanto-Bayer to dominate in Microbials and Big Data-Driven Precision Farming

If the Bayer-Monsanto merger is allowed to go through, the resulting company will have a monopoly stake in microbials and big-data enabled precision agriculture technologies, both important new markets for industrial agriculture.

Microbials:

Since the 2010s the world's largest industrial agriculture enterprises have been investing in the development and commercialization of "microbials" – products derived from living organisms – that can be added to seeds and soils and/or sprayed on crops with the aim of increasing crop yields and pest-resistance. Microbials aren't new: for example, *Bacillus thuringiensis*, or Bt, is a bacterium that has been used for pest control for more than a half-century. But spurred by the mounting critique on environmental impacts and lack of sustainability, along with the resource scarcity in mineral fertilizers, companies are taking advantage of big data advances to identify other apparently beneficial microbes as well as communities of microbes working together as "functional consortia."¹ Synthetic biology-enabled fermentation technologies are allowing companies to quickly add microbials to their product offerings as an environmentally-friendly and sustainable "complement"² to conventional agrochemicals and fertilizers.

Global market figures are notoriously fuzzy, but the latest estimates put the value of agricultural biologicals at USD 2.8 billion in 2017, expected to reach USD 5.4 billion by the year 2022.³

Monsanto, in early 2013, announced it had struck a 5-year R&D deal with Synthetic Genomics, Inc. and bought "technology assets" from Venter's Agradis, Inc., including its collection of plant-associated microbes and screening processes.⁴ In late 2013, Monsanto announced a collaboration, dubbed the BioAg Alliance, with the world's largest enzyme producer, Denmark-based Novozymes, to commercialize microbials for agriculture. When Monsanto Growth Ventures (MGV), the company's venture capital arm, announced its first investment portfolio in

¹ See <http://www.taxon.com/technology-platform.php#syntheticconsortia>.

² See <http://www.monsanto.com/products/pages/agricultural-biologicals.aspx>.

³ See <https://www.researchandmarkets.com/research/w9mfj/global/>.

⁴ See <http://www.syntheticgenomics.com/300113.html>.

2016, US start-ups focusing on microbials appeared prominently,⁵ including Pivot Bio, a company working on microbes that aim to enhance nitrogen-fixation in corn, and biologicals start-up AgBiome. Monsanto Growth Ventures also led a \$30m series C funding round for NewLeaf Symbiotics, a Missouri start-up trying to use bacteria to help crops grow better.

Bayer, too, was an early microbe enthusiast, paying \$425 million in 2012 to acquire California-based AgraQuest, a microbial pesticide company. Two years later, Bayer bought Biagro Group, an Argentinian company focusing on biological seed treatments. In 2015, Bayer announced a research collaboration with Elemental Enzymes, a US-based company. The collaboration focuses on “optimizing” soil microbes aimed to increase crop yields.⁶ In 2017, Bayer announced a partnership with Gingko Bioworks to create a new company that will develop microbials to enhance nitrogen-fixation in plants.

The recently-merged **Dow/DuPont**, following the same technological trend line, is a significant market player in microbials as well. DuPont acquired Taxon Biosciences, a California-based industrial microbial producer, in April 2015;⁷ and in October 2015, Dow AgroSciences announced a collaboration with UK-based Synthace, Ltd to “support development of superior microbial production strains” aimed to boost yield and act against pests.⁸ In 2017, the Agriculture Division of the new, merged company DowDuPont announced a long-term strategic collaboration with Arysta LifeScience to provide microbials for corn and soybeans. Also in 2017, DuPont Pioneer (part of DowDuPont Agriculture) announced a multi-year research collaboration with Israel-based Evogene to develop microbial seed treatments for corn.

Precision Agriculture:

All major agricultural input enterprises are investing in data-dependent “precision agriculture” technologies. As MGV’s (Monsanto Growth Ventures) Investment Director speculates, **“We can now see a legitimate path to a utopian time-not-too-far-away, where ‘see and spray’ fungicides, microbes, and, of course, weeding combinations of selective and non-selective herbicides, can be used to tend each plant individually.”**⁹

MGV has investments in other digital agriculture companies, including:¹⁰

- Blue River Technology, USA (recently acquired by Deere), a company outfitting tractors with cameras and computers using artificial intelligence to scan fields and identify weeds

⁵ See <https://monsanto.com/news-releases/monsanto-growth-ventures-announces-first-investment-portfolio/>.

⁶ <http://www.elementalenzymes.com/assets/bcs-and-elemental-enzymes-collaboration-release.pdf>.

⁷ See <http://www.dupont.com/corporate-functions/media-center/press-releases/dupont-acquires-taxon-biosciences.html>.

⁸ See <http://newsroom.dowagro.com/press-release/dow-agrosciences-synthace-research-collaboration-accelerate-product-development-using->.

⁹ <https://www.linkedin.com/pulse/blue-river-technologies-journey-acquisition-kiersten-stead/>.

¹⁰ <https://monsanto.com/news-releases/monsanto-growth-ventures-announces-first-investment-portfolio/>

- AgSolver, USA, which develops software and analytic systems related to land management, valuation and business planning;
- Vital Fields, Estonia, which provides farm analytics to European growers;
- HydroBio, USA, which provides prescriptive irrigation recommendations.

In 2015, Bayer bought Canadian company Zoner, which analyzes satellite images, aerial imagery, data on yield and soil electrical conductivity and provides real-time, field-level information about the weather.¹¹ In 2016, Bayer added proPlant, a spin-off from a German university, to its Digital Farming division; proPlant provides a system for plant health diagnosis. Also in 2016, Bayer became a partner of Planetary Resources, whose hyperspectral sensing technologies can produce data on soil moisture and temperature from satellite imagery; eventually, Bayer hopes the technology will also provide data on pest stress.¹² According to reports, Monsanto's digital agriculture subsidiary Climate Corporation, which the company acquired for \$930 million in 2013, sealed Bayer's interest in a Monsanto acquisition.¹³ Three months after Monsanto and Bayer signed their merger agreement, Climate Corporation acquired Vital Fields, the Estonian start-up in which MGV had invested.

Dow-DuPont announced in 2017 that it had agreed to acquire San Francisco-based Granular, Inc., a software and farm analytics company, for USD 300 million.

¹¹ <https://zoner.bayer.com/>.

¹² <https://agfundernews.com/bayer-adds-to-digital-farming-business-with-planetary-resources-partnership-as-startup-raises-21m-series-a5941.html>.

¹³ Emma Cowan, "The Race to Consolidation: Why Bayer is Backing the GMO Horse," *Agfunder News*, 2 June 2016: <https://agfundernews.com/the-race-to-consolidation-why-bayer-is-backing-the-gmo-horse5929.html>.