



## **The future of agrochemicals**

Capturing value through innovation,  
resourcefulness, and digital alchemy

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# Executive summary

In response to the declining revenues and margins in the past, agrochemicals industry players focused on consolidating their market share through increased mergers & acquisitions (M&A), extending their geographical reach, increasing spending on research and development (R&D) of new active ingredients, and boosting product offerings with digital as a major component. However, challenges continue to persist, primary among them include longer product development cycles and escalating costs, increasing stringency of regulatory requirements, farm subsidy reduction, and accelerated pace of change within and in adjacent markets. Yet, the agrochemicals market seems to be poised to grow out of these challenges, thanks largely to the growing need for more crop protection agents to protect against crop losses and increase yields.

How agrochemicals companies can wriggle their way out of new developments, both short- and long-term, remains a key question. Among these new developments, Integrated Pest Management (IPM), precision farming, and products going off-patent seem to be impacting them the most in the short term. All these have the potential to reduce the revenue-earning potential for agrochemicals companies, especially for the big five. And yet, a few of them have strategically placed themselves at vantage points from where they can take advantage of these short-term developments. These vantage points include but are not restricted to further investing in biologicals, collaborating or acquiring companies in the digital space—farm management software and services, and reformulating their products that will go off-patent into new marketable solutions. And while some have sought M&A, others have started using novel technologies to reduce the time-to-market of new products and reduce their R&D intensity.

In contrast, the jury seems to be still out for agrochemicals companies when it comes to responding to long-term disruptive trends. These trends include genome editing, management of food waste, improvements in animal feed digestibility, decreasing biofuels demand, and the growing popularity of indoor farming. Potential strategic responses to these trends would primarily include optimizing product portfolio, including seeds, digital & material conversion technologies, and making further inroads through collaboration or acquisitions into the start-up space, which spans multiple industries.

The jury seems to be still out for agrochemicals companies when it comes to responding to long-term disruptive trends.

# The past raises more questions

The global landscape in agrochemicals appears to be undergoing a definite change characterized by a disappointing performance during the past few years. With revenues declining starting in 2014 and continuing till 2016, most agrochemicals companies have scrambled to restructure their product portfolio through acquisitions, megamergers, and divestitures. However, the market recovered in 2017 and 2018, as there was cost rationalization, realization of higher prices, and good recovery in the value of agricultural produce in Latin America.<sup>1</sup>

The decline in revenues and margins during 2014–2016 continues to raise various questions, including: (i) How to keep creating and capturing additional value for agrochemicals products and services; and (ii) What alterations agrochemicals companies need to do to their operational and business models to hedge against currency risks, climate change, evolving regulatory requirements, and end-market disruptions? This paper attempts to answer the above questions and analyze a few trends that could shape the future trajectory of agrochemicals.





# Diverse changes indicate a continuously evolving industry

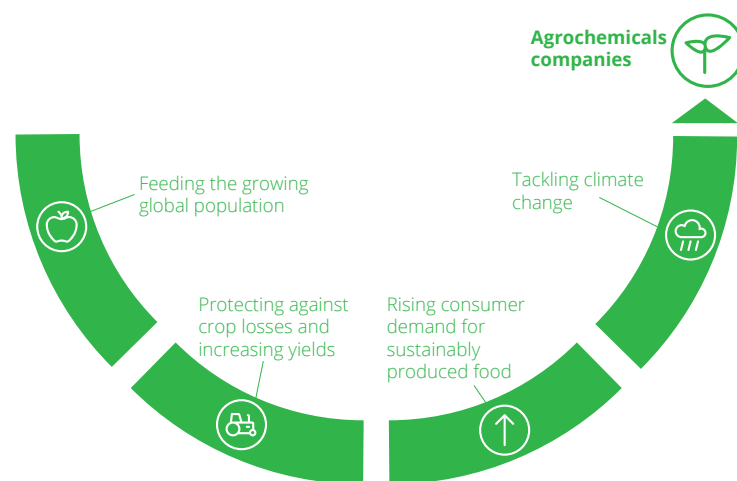
The agrochemicals industry has been evolving over the past many decades where the diversity and intensity of change in terms of the number of active ingredients, level of product innovation, regulatory regime, and product efficacy has been staggering. For example, compared to 100 active ingredients in 1960, the agrochemicals industry today provides roughly 600 active ingredients.<sup>2</sup> Similarly, the average use rate per hectare (product efficacy) of herbicides has decreased from a high of 2,400 g/ha in the 1950s to 75 g/ha in 2010s.<sup>3</sup> This also demonstrates the R&D efforts both in terms of funding and scientific rigor that have been expended—R&D expenditure of major agrochemicals companies today hovers in the 7–10 percent range, higher than major commodity, diversified, and specialty chemicals companies.<sup>4</sup>

The future of agrochemicals looks bright considering the global population growth rate, the growing need for more crop protection agents to protect against crop losses and increase yields, rising consumer demand for sustainably produced food, and agrochemicals' role in tackling climate change through reducing the need to convert forests to farmlands, and thereby reducing potential greenhouse gas (GHG) emissions. However, there are several challenges that could stifle the growth potential of agrochemicals companies.

## 1. Longer product development cycles and escalating costs:

The average lead time to develop a new crop protection product has increased from 8.3 years in 1995 to 11.3 years in the 2010–14 period.<sup>5</sup> This is due to the difficulty in finding new product leads as well as tightening of regulations surrounding the market commercialization of new agrochemicals products. All these factors have resulted in higher product development costs. For instance, the overall R&D costs for a new agrochemicals product have increased from \$152 million in 1995 to \$286 million during the 2010–2014 period, reflecting an annual average increase of around four percent.<sup>6</sup> Most of this R&D cost is spent on crop protection, product safety testing, and registration, and since safety requirements have consistently increased for such products, the overall developmental costs have also risen.

**Figure 1: Opportunities in the current agrochemicals industry**



Source: Deloitte Analysis

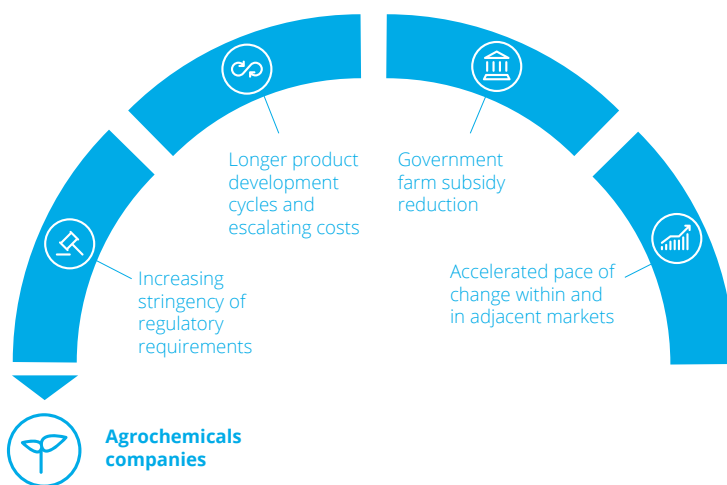
**2. Increasing stringency of regulatory requirements:** Stringent regulatory laws, especially in Europe, are challenging the further development of new, innovative technologies like gene-editing in plants, and use of some types of crop protection agents like glyphosate. In fact, the number of glyphosate-related cases for a major agrochemicals company crossed 11,000, impacting its stock price performance.<sup>7</sup> A ban on a prevalent crop protection chemical like glyphosate could potentially remove up to 40 percent of the revenues for a few companies—most agrochemicals companies being highly dependent upon glyphosate to drive their revenues and margins.

**3. Government farm subsidy reduction:** With expectations of government subsidy cuts in the United States, farmers are likely to have less of a safety net in case of any weather-related disaster, pay more crop insurance premiums from their own pockets, and have less financial incentive to buy new and more effective crop protection products and seeds.<sup>8</sup>

**4. The accelerated pace of change within and in adjacent markets:** The threat of precision agriculture, use of advanced robotics, drones, machine learning algorithms, and biologicals would lead to lower use of crop protection products as these new methods/products can enable higher efficiency at lower R&D and capital intensity—at least in the short term. Similarly, gene editing, reduced biofuel demand (due to electric vehicles and fuel efficiency mandates), alternative meats and improved animal digestion (leading to lower grain demand), and indoor farming (which minimizes the use of agrochemicals in growing fruits and vegetables) could effectively diminish long-term demand for crop protection chemicals.<sup>9</sup>

Yet, through critical strategic maneuvers, agrochemicals companies have managed to keep a few of the above challenges at bay in the current cycle, a theme that we will explore in the following section.

**Figure 2: Challenges in the current agrochemicals industry**



Source: Deloitte Analysis

# Current performance and strategy of nurturing the growth momentum

The agrochemicals market performed relatively better in 2017 and 2018 (compared to the 2014–16 period), thanks largely to the recovery of demand in Latin America, higher agrochemicals prices realized due to supply shortages emanating from China (due to industry rationalization and efficiency drives), and imposition of US tariffs on Chinese imports.<sup>10</sup> But apart from these external factors, the improved performance of most agrochemicals companies has been a result of performing some of these strategic maneuvers:

- 1. Leveraging M&A to optimize portfolio and extend geographical presence**—Over the past few years, large agrochemicals firms have undergone major portfolio optimization and consolidation via the M&A route. Apart from enhancing the current product portfolio, many of these M&A deals have also sought to increase the acquirer companies' geographical presence—especially in geographies where these companies didn't have a good distributor network. For instance, Bayer's acquisition of Monsanto not only expanded its herbicides and seeds businesses, but also its presence in North America and Latin America.<sup>11</sup> Similarly, the recently concluded UPL merger with Arysta LifeSciences has deepened its distribution network in EMEA (Europe, the Middle East, and Africa) and Latin America regions.<sup>12</sup>
- 2. Focusing on innovation and R&D to develop and commercialize new products**—Today, the registration of a new crop protection product requires comprehensive research of 160,000 new molecules—up from 52,000 in 1950s.<sup>13</sup> While this is due to an increasing difficulty in finding new product leads, it also reflects increased screening of product candidates. And while M&A might serve as an effective tool in acquiring a new product line (which happened in the case of BASF, which acquired the seeds business of Bayer CropScience), creating and scaling external partnerships or collaborations can be key. For example, Adama entered into many partnerships in the AgTech space, which are thought to have helped it in launching more than 30 new products in key markets.<sup>14</sup> Similarly, Corteva Agriscience is targeting multibillion-dollar sales from new, differentiated solutions (for example, healthy oils and natural crop protection products) in the next two to three years.<sup>15</sup>

- 3. Bolstering product offerings with digital technologies to enhance the firm-farmer engagement**—Major agrochemicals producers have already moved from being simple providers of farm inputs to complex providers of integrated product offerings, which have digital as a major component. For instance, Syngenta recently acquired Brazil's Strider, a leader in farm management technology, and expanded its in-house Seedcare Institute network to increase access to the latest seed treatments.<sup>16</sup> Similarly, Monsanto, which is now part of Bayer CropScience and had earlier acquired Climate Corp., launched a digital platform called FieldView that enables farmers to remotely monitor their fields through data collection, visualization, modeling, and weather monitoring, enabling them to weed out inefficiencies during field trials and eventually maximize crop yields.<sup>17</sup> All these efforts are being directed to create and maintain new value pools for farmers.

Creating differentiation through innovation, expanding geographical presence through M&A, and capturing additional value by deepening farmer engagement will likely also remain the key strategic themes going forward. But the question remains around how exactly companies in the agrochemicals space can tackle future disruptions that can potentially impact the current revenue streams and what potential strategic positioning this might entail.

# Strategic positioning required in a future that is uncertain but full of opportunities

As the arable land deficit grows and agricultural practices become more efficient, the narrative could be shifting to “doing more with less.” Also, given the renewed interest in sustainability across industries, and not just agriculture, farmers, governments, and consumers look forward to a more diverse mix of agricultural practices that don’t just focus on the use of agrochemicals, but also other aspects which can increase the longevity of arable land without harming the environment in irreversible ways. Given these larger-than-life forces surrounding the fate of agrochemicals, it is important to look at some key aspects toward which agrochemicals companies can point their strategic compass.

**1. Capturing value from increasing interest in sustainable agricultural practices and precision farming:** Sustainable agricultural practices include components like Integrated Pest Management (IPM), which involves proactive monitoring of pest populations, and preventing them from growing to unprecedented, damaging levels without causing irreversible soil toxicity or environmental harm. It comprises an integrated approach wherein the use of nonchemical tools and digital technologies is encouraged.<sup>18</sup> Because of its uncompromising focus on minimizing the use of agrochemicals, a greater adoption of IPM practices can lead to long-term demand decline in major classes of crop protection chemicals including herbicides. However, because of IPM’s focus on natural pest control mechanisms, the demand for biologicals can increase to a great extent and command higher premiums than conventional crop protection chemicals. In fact, over the last two decades or so, the growth in biologicals (or biopesticides) has outpaced that of overall crop protection chemicals.<sup>19</sup> This may

**Figure 3: Specific opportunities that can have an impact in the short term**

	Global opportunity 2018 → 2025	Most relevant aspect(s) of the opportunity for agrochemicals	Other players competing with agrochemicals companies	Next stage of evolution	Challenges
<b>Integrated Pest Management (IPM)</b>	\$32B → \$49B (CAGR = 6.3%)	<b>Biologicals</b> • \$2.8B → \$7.1B • CAGR = 14.4%	Biotech companies Small R&D-focused companies or start-ups occupying niche positions Providers/aggregators of IPM services	Improvements in formulation, ease of use, shelf life and spectrum	Increasing the efficacy and scale over the life cycle of the product
<b>Precision farming</b>	\$3.9B → \$9.0B (CAGR = 12.6%)	<b>Farm management software</b> • \$0.9B → \$2.7B • CAGR = 16.4%  <b>Services</b> • \$0.6B → \$2.1B • CAGR = 19.4%	Farming equipment manufacturers like John Deere Advanced analytics companies/start-ups Satellite imaging companies	Incorporating computer vision, deep learning, AI, and satellite imagery into next-gen farming systems  Microelectromechanical systems (MEMS), nanoelectromechanical systems, and nanotechnology	Lower annual agricultural research budget from the government  Steeper technology adoption/learning curve by farmers
<b>Patent expiry of a few agrochemicals products</b>	More than 100 kinds of agrochemicals to go off-patent between 2017 and 2023—valued at \$11.0B	In the short term (2017–2020), around \$4.1B worth of agrochemicals are going off-patent	NA	NA	Established players will likely reformulate the off-patent products into profitable agrochemicals cocktails, diminishing the potential opportunity for generics

Sources: Grand View Research, *Integrated Pest Management (IPM) Market Analysis and Segment Forecasts to 2025*, accessed in April 2019; Mordor Intelligence, *Global Precision Farming Market (2018-2023)*, accessed in April 2019; Research and Markets, *Global Guide of Coming Off-patent Agrochemical Active Ingredients - Fourth Edition*, August 2017; Natalie Gagliardi, “How self-driving tractors, AI, and precision agriculture will save us from the impending food crisis,” *Tech Republic*, December 12, 2018.



also be because biologicals tend to be subjected to a less strict regulatory regime than many conventional pesticides, allowing companies to introduce new biologicals products at a brisk pace. In recent years, there have been more patents filed for biologicals than conventional crop protection products.<sup>20</sup> Despite this increased interest and demand for biologicals, they still constitute less than 10 percent of overall crop protection sales.<sup>21</sup> Agrochemicals and biotech companies should make biologicals more effective over their life cycle, which can increase their sales potential.

At the same time, precision farming remains on the uptrend. Precision farming enables efficient decision-making using digital tools and technologies (like sensors, modeling and visualization tools, GPS monitoring, satellite imagery, etc.). Of late, many agrochemicals companies have shown interest in acquiring or collaborating with companies that offer these services. For instance, Granular, a leading farm management software company (now part of Corteva Agriscience), has signed a multiyear deal with Planet, an integrated aerospace and data analytics company, to integrate Planet's satellite imagery data with Granular's farm management software. This will enable farmers to make real-time decisions at the tap of a button.<sup>22</sup> These types of developments indicate that the leading agrochemicals companies are moving toward becoming "solutions providers," rather than just providers of crop inputs, venturing into unfamiliar terrain and creating differentiation that is difficult to replicate easily.

**2. Taking advantage of asset-light business model and achieving innovation success:** An example of this would be that of Arysta Life Sciences, which thrived on sourcing 800 different active ingredients from R&D-focused Japanese companies and formulated them into innovative solutions. Instead of pouring millions of dollars into active ingredient development, the company relied on its in-house formulation capabilities, providing highly marketable solutions to farmers in a market dominated by highly commoditized, off-patent products. This helped it to be nimble, less capital intensive, a low-cost producer, and focused on marketing and distribution. And with the new merger happening with UPL (itself a low-cost manufacturer), and many molecules going off patent in the 2018–21 period, there could be ample opportunity to be captured by generic companies like UPL–Arysta.<sup>23</sup>

For well-established innovators whose business models remain asset-heavy, leveraging the power of Machine Learning and Artificial Intelligence (AI) might help a great deal. For instance, instead of testing the efficacy of seeds in a field, Bayer CropScience has made use of simulations and big data to test the same in a computer. This has reportedly shaved off one to two years' worth of R&D efforts, improved the time-to-market for new seeds, and reduced its R&D expenditure.<sup>24</sup> Agrochemicals companies can also learn from what chemicals companies in other segments are doing to potentially speed up the time to commercialize a new product. For instance, BASF recently acquired a quantum computing start-up, which could help it to solve complex problems and shorten the product introduction lead time.<sup>25</sup>

### **3. Recognizing long-term opportunities that masquerade**

**as challenges:** Genome editing, management of food waste, improvements in animal feed digestibility, decreasing biofuels demand, and the growing popularity of indoor farming, will likely pose challenges to the long-term growth potential of agrochemicals. However, agrochemicals companies can proactively recognize the extent of disruption caused by these long-term trends, and look for opportunities where they can cash in. For example, genome editing of crops using advanced techniques like CRISPR-Cas9, will likely lead

to lower agrochemicals demand in the future. This is because these new generation seeds are expected to need lower amounts of water and agricultural inputs to produce higher crop yields. However, since most agrochemicals companies are also invested in seeds, they can leverage these novel gene editing techniques to introduce select genetic modifications that would not impact the demand of their leading agrochemicals products. For example, a few agrochemicals companies have introduced seeds with herbicide-tolerance that, in fact, have led to higher usage of specific herbicide classes. A list of such opportunities that often masquerade as challenges is highlighted in figure 4. It is to be noted that such long-term opportunities can bring in additional revenues that vary from \$0.5 billion to \$66 billion for interested agrochemicals companies that are willing to tweak their business models (see figure 4).

Figure 4: Long-term opportunities that can lead to alterations in the business models of agrochemicals companies

	The future opportunity	Opportunity size	Threat to agrochemicals	What agrochemicals companies can do?
<b>Editing plant/seed genomes through novel methods (CRISPR-Cas9)</b>	Selectively editing the genome of seeds/crops to add value to farmers	Additional revenues of <b>\$0.5B</b> by 2025 (for CRISPR-Cas9) growing at 19% per annum	<ul style="list-style-type: none"> <li>Genome editing can make the use of agrochemicals redundant, thereby decreasing their eventual demand</li> </ul>	<ul style="list-style-type: none"> <li>Leverage genome editing to produce seeds which are drought-resistant, or have other superior features without affecting agrochemicals demand</li> </ul>
<b>Producing 'pollinator-friendly' agrochemicals</b>	Charging a higher premium for 'pollinator-friendly' agrochemicals	<b>\$1–\$2B</b> additional value capture by mitigating the risk of agrochemicals damaging pollinators	<ul style="list-style-type: none"> <li>With public narrative shifting toward environment-friendly chemicals, conventional agrochemicals might face the threat of bans</li> </ul>	<ul style="list-style-type: none"> <li>Reformulate existing products in agrochemicals portfolio to come up with new 'pollinator-friendly' chemicals</li> </ul>
<b>Managing wastage along with the food value chain</b>	Upgrading food supply/value chain efficiency	10% improvement will lead to <b>\$42B</b> worth revenue opportunity (including \$10B opportunity for robotics and other digital systems)	<ul style="list-style-type: none"> <li>Over a period of 30 years, this could lead to lower agrochemicals demand because of improvements in crop yields being indirectly influenced by increased supply chain efficiency</li> </ul>	<ul style="list-style-type: none"> <li>Invest in robotics and other digital systems that could gradually manage the food waste issue without cannibalizing crop protection sales</li> </ul>
<b>Improving animal feed digestibility and enhancing protein efficiency</b>	Commanding 3%–5% higher prices from crops that are 1% more digestible	<b>\$1–\$3B</b> opportunity for technology providers (and \$8–\$12B savings for farmers)	<ul style="list-style-type: none"> <li>Improved animal digestion would mean lower demand for feed (crops), that could negatively affect agrochemicals demand</li> </ul>	<ul style="list-style-type: none"> <li>Develop and market crop production approaches that could improve animal feeds digestibility that could include a combination of seeds, technology, etc.</li> </ul>
<b>Reducing biofuels demand due to increasing fuel efficiency</b>	Cashing in on the biofuels opportunity in developing nations like Brazil, India, China	Additional revenues of <b>\$66B</b> by 2025 but growing at ~5% per annum (including <b>~\$20B</b> if we only consider feedstock)	<ul style="list-style-type: none"> <li>Reducing biofuels demand in developed countries would lead to lower crop demand</li> </ul>	<ul style="list-style-type: none"> <li>Market technologies that convert farm waste/residue to new revenue streams (e.g., corn kernel fiber to bioethanol)</li> </ul>
<b>Growing popularity of indoor farming</b>	Capturing additional value from indoor farming technologies	Additional revenues of <b>\$26B</b> by 2025 growing at ~10% per annum	<ul style="list-style-type: none"> <li>Increased reliance on indoor farming would lead to reduction of agrochemicals use in such farms</li> </ul>	<ul style="list-style-type: none"> <li>Invest in indoor farming companies or start-ups</li> <li>Invest in biopharmaceuticals companies</li> </ul>

Sources: PRNewswire, "[CRISPR Cas9 Genome Editing Market Worth \\$5.3 Billion by 2025](#)," November 19, 2018; Jefferies Equity Research of FMC Corp, March 2019; Zion Market Research, "[Biofuels Market To Drive Swiftly And Reach USD 218.7 Billion in 2022](#)," September 18, 2018; Pharoah Le Feuvre, [Transport biofuels - Tracking Clean Energy Progress](#), International Energy Agency, May 27, 2019; Future Farming, "[Indoor farming technology market to grow to \\$40.25 billion](#)," December 17, 2018; Erik Kobayashi-Solomon, "[Investing In Vertical Farming: Five Take-Aways](#)," April 5, 2019.

# A future where capturing value may trump selling value

The future of agrochemicals may seem a little daunting for established players on the surface, but many changes underway are likely to transform it completely. A future that is focused on sustainability, “doing more with less,” and digital technologies could make agrochemicals players rethink their long-term business plans and lead to long, drawn-out boardroom discussions. Will leading agrochemicals companies eventually increase their exposure to long-term disruptive trends and unfamiliar markets? Will generics continue to outsell their product offerings through a

clever mix of innovation, low-cost manufacturing, and marketing & distribution? What portion of the size of the opportunity that each long-term disruptive trend presents can be effectively captured by agrochemicals companies? There are no easy answers, but “capturing” rather than “selling” value might more likely describe the strategic maneuvers that agrochemicals companies make in the future.



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