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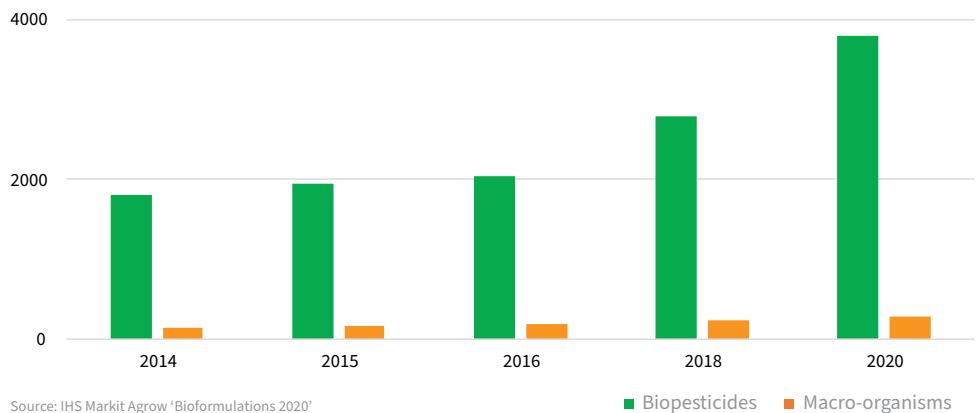
Climate and Sustainable Finance

Biologicals bounce seen as ideal solution for sustainable crop protection growth

Key findings

- Global biological crop protection sales are now valued at around US\$4 billion, out of a total crop protection market of \$57 billion, up from just \$0.3 billion in 2004.
- Average growth in the biologicals segment is seen at around 10% per annum over the next 5 years.
- Some of the biggest growth rates are expected in Latin America, mainly due to their adoption for row crops such as maize and soybeans, as well as cereals in Brazil.
- It takes on average half the time to get a biological product to market as for a conventional one.

Figure 1: Size of the Global Biologicals Market – Estimated at over US\$4 billion in 2020



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Overview

The market for biological products for crops has increased dramatically over the last few years and should continue to do so over the next decade. The application of biological solutions in the crop protection sector of agribusiness is driven mainly by increased concerns over sustainability and the perceived environmental impacts of some conventional agrochemical products, including herbicides, fungicides and insecticides.

The current COVID-19 pandemic might have a short-term impact on market growth but is likely to boost investment in biologicals as part of a wider shift to interest in food security and ensuring more robust supply chains. This should in turn drive interest in new product developments for both biological control agents (BCAs) and biostimulants. Biological Control Agents (BCAs) include naturally-derived products such as plant extracts (for control of pests and diseases), insect pheromones (used primarily for mating disruption), predatory insects, and microbial products.

Biostimulants include amino acids, seaweed-based products, and humic and fulvic acids. These products trigger the processes that enhance nutrient use, increase tolerance to plant stresses such drought and temperature extremes, enhance availability of confined nutrients in soil, and address quality traits beyond the effects of mineral nutrients.

The distinction between BCAs and biostimulants is not always clear. Specific products can exhibit the properties of both categories, as with some plant oils. For regulatory purposes, classification depends on which properties companies claim, and can vary in the European Union, North America, and Brazil, particularly for biostimulants.

BCAs and biostimulants are not new. In the BCA category, commercial bacillus thuringiensis (Bt)-based products have been around since the 1960s and pheromones were introduced in the 1970s. Only recently, however, has their popularity increased.

Over the past decade there has been an acceleration in the loss of many existing agrochemicals, especially in European Union, where product review has been subject to stricter regulation. Biological products have also been favoured by generally taking less time to gain approval to reach the market. This is discussed in more detail below.

Demand drivers

Both BCA and biostimulants markets are still relatively niche, with estimated combined sales approaching US\$4 billion in 2020, while the total crop protection market is valued at around \$57 billion (Figure 1). Average growth in the biologicals segment is seen at around 10% per annum over the next 5 years. Some of the biggest growth rates are expected in Latin America, mainly due to the adoption of BCAs for row crops such as maize and soybeans, as well as cereals in Brazil.



There are common reasons for the growth of these two sectors in the last decade, but there also some significant differences. Among the common reasons:

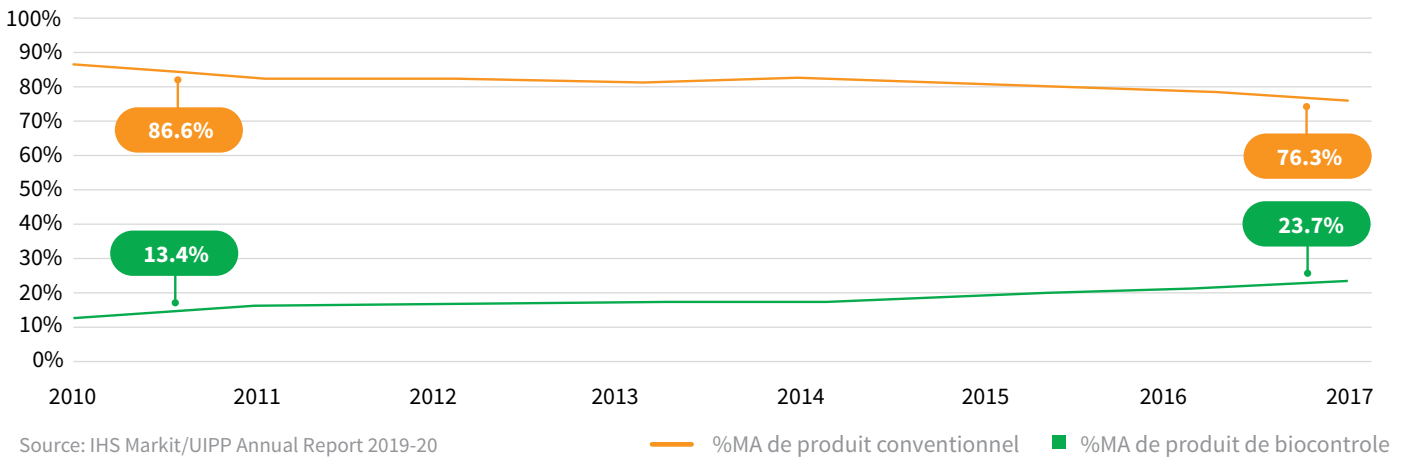
- The continuing push for more sustainable agriculture. Natural products are perceived to be safer, although this is not always true. In Europe particularly, there is a negative perception from the public of “chemicals” and pesticides, and any products which make a claim to be natural are often regarded as being “better” and “safer”.
- The growth of organic agriculture. This market favours the use of naturally-derived products and strongly restricts (or even prohibits) most synthetic crop protection products and chemical fertilizers. Again, this is particularly strong in some European countries, such as Austria, Denmark and Germany.
- The relative ease of registration in some regimes. For example, the United States has simplified and fast-tracked the process to register BCAs accompanied with conventional crop protection products, although this is not yet the case in Europe. With biostimulants, Europe offers the most favourable regulatory environment. In the EU, biostimulants are regulated under the fertilizer legislation, which is much less onerous than that for crop protection.
- The attractiveness of these fast-growing sectors to crop protection and fertilizer companies. All major and many minor crop protection companies have significant BCA programmes. In the fertilizer sector, the Norwegian company Yara has invested significantly in biostimulants. Both sectors have also attracted hundreds of millions of USD in venture capital investment.
- This is part of a wider boom in agricultural technology. In the Agrow report ‘Sustainability in Agrochemicals’ published in 2018, it was shown how a large proportion of agrochemical companies are now publishing data relating to their carbon footprint both in terms of operations and logistics, for example using less water and reducing wastage and pollution, using the United Nations Sustainable Development Goals (SDGs) as benchmarks.

Regulatory regimes

BCAs are influenced by several additional drivers, such as increasing regulatory pressure on conventional crop protection products. This is especially true for conventional crop protection products in Europe, where over half of the products that existed in the 1990s have now been withdrawn. This creates gaps in the market, which biological control agents can only partially fill.

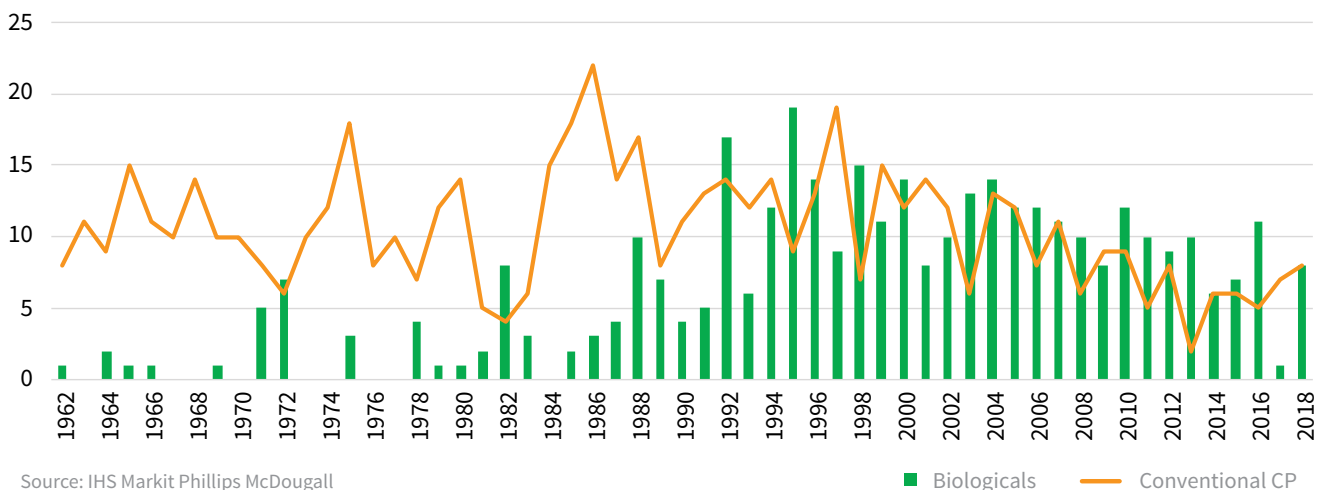
In a strong scenario, the EU could lose many more crop protection products over coming years, adding to farmers’ pressure to protect their yields. While the industry does have a healthy pipeline, the rate of innovation has been declining and is not yet sufficient to fill all the gaps. In addition to EU-wide regulation, some countries are imposing their own pressures on conventional crop protection products. In France, for example, the government has a target of reducing crop protection usage by 50% by 2025 and encouraging the use of BCAs. This reinforces an ongoing trend (see Figure 2).

Figure 2: Share of BCA and CP volumes in France 2010-2017



Other key drivers are lower crop residues and resistance management. BCAs often leave less residue in crops and thus can be used right up until harvest, unlike many synthetic products. This makes them particularly attractive for food retailers. Resistance to conventional crop protection products has always been a problem and is increasing. By offering new modes of action, biological products can be used as part of resistance management programmes. As a result of these drivers, more BCAs have been introduced into the market than conventional products over the last five decades (see Figure 3).

Figure 3: Number of new Crop Protection products and new BCAs introduced between 1962 and 2018



Future directions for biologicals

In January 2018, the World Economic Forum (WEF) produced a report on the “Transformative Twelve” technologies which it considered to have the most potential for transforming the challenges associated with global provision of food. Many are relevant to the growth of biocontrol products, but three in particular will drive market growth.

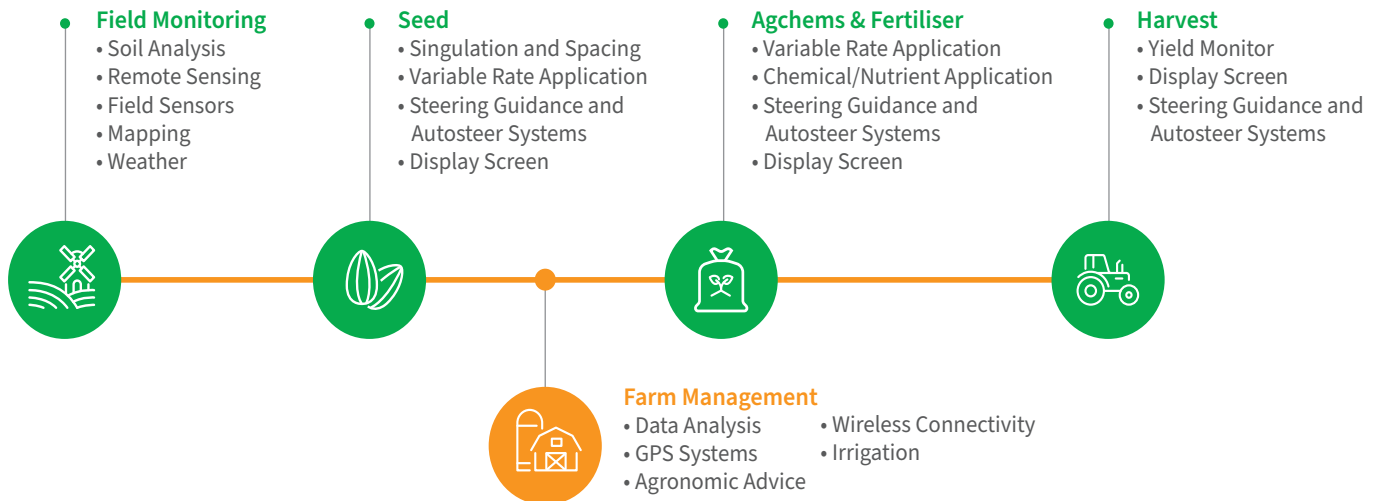
These are:

- Precision Agriculture for Input and Water Use Optimisation;
- Microbiome Technologies to Enhance Crop Resilience;
- Biological Based Crop Protection and Micronutrients for Soil Management.

These three elements are in many ways interlinked and there are a number of terms used together with Precision Agriculture such as “Smart Farming”, or “Digital Agriculture”. Irrespective of which heading is used, precision agriculture can be defined as the combination of advanced technologies such as sensors, data acquisition, data processing, networked devices, unmanned vehicles and robotics in order to provide agricultural production which is both more productive and more environmentally sustainable (Figure 4).

Figure 4: Digital Farming: A complex mix of technologies

Precision Farming



Variable Rate Nutrient Application (VRNA) is a developing technology within precision agriculture where the application rate of nutrients is adjusted according to the local need of a crop in a specific field. Whilst at present this is limited to fertilizers, as new sensors are developed and improved, we can expect that this is extended to biostimulants and other biocontrol methods. This latter application is sometimes referred to as Variable Rate Pesticide Application (VRPA).

In some cases, sensing is used to build a map of the state of crop and weeds and then the application rate is determined for each point on a map, supported by GPS technology whereas in another variant, the sensors are used in a dynamic manner as the vehicle moves through the field. A review in 2017 cited several studies which indicated that savings of up to 90% in herbicide use could be achieved.

The interaction between microbes, plants, soil and climate is a significant barrier to the successful application of many biocontrol technologies on a large scale but recent initiatives such as the microfluidic based “Microbiome on a Chip” could significantly aid in improving the efficacy of microbial based products in relevant field conditions.

Future challenges and opportunities

Despite their favourable characteristics, BCAs cannot completely replace conventional crop protection products. By their nature they are often pest- or disease-specific and cannot be used to control the broad spectrum of pests that attack most crops. Additionally, once a pest is controlled, new pests inevitably occupy the ecological gap. BCAs must be used in combination with conventional products as part of integrated pest management (IPM) programmes, sometimes as ‘hybrid’ products, another growth area, particularly in seed treatments.

In some cases, the efficacy of BCAs might be inferior to the synthetic products they are substituting, but farmers have no alternative. Also, not everyone is convinced of the value of both BCAs and biostimulants. In some quarters, they are still considered to be not much more than deceptive marketing; while in others, this description is considered outmoded and unfair, and confidence in their efficacy is growing.

There are also cost challenges. Some BCA products present considerable manufacturing challenges. Fermentation products and pheromones, for example, can be extremely expensive to manufacture, reducing the economic incentive for buyers to replace conventional products. Several companies are working on ways to reduce their production costs.

Because of the lower barriers to entry and market attractiveness, hundreds of companies are involved in both the BCA and biostimulants sectors – including all of the major crop protection companies as well as many mid-tier companies. With all of the venture capital money flowing into the sector, there are also numerous start-ups – small enterprises challenged to have enough resources to register and develop products and gain market access. Some of these have in turn been snapped up by the major, so provide good investment opportunities.

As the biological market grows and regulatory standards (which may include quality and performance measures) become more established we would expect further mainstream interest. As the presence of the larger agrochemicals companies grows in the biological market, their standards will predominate and most likely the rest of the industry will follow suit.

We would then expect a greater attention to be paid to the issues of stability and delivery which would imply continuing investment in developing new molecular formulation approaches. The resources of major crop protection companies will be significant in this process, as shown by patenting activity below (Table 1).

Assignee	% of Publications
Syngenta	10.8
Bayer	10
BASF	6.8
DOW	3.2
Nippon Agricultural	1.3

Source: IHS Markit Agrow ‘Bioformulations 2020’



Conclusions

It is highly likely that the current high level of interest and investment in the BCA and biostimulant sectors will continue over the next few years, given the advantages outlined above. Because of their limitations and complexities, however, both product groups are likely to remain niche sectors – albeit large niches – that will not seriously challenge the mainstream products but rather continue to be used alongside them.

As in conventional crop protection control products mergers and acquisitions are expected to increase as the market matures. This consolidation has come from various sources, but by far the greatest has come from “biocompanies” merging to gain some critical mass, rather than perhaps the perception that major pesticide companies are taking over small biocontrol companies. As the market grows, we can expect much more consolidation, although to get to the level seen in conventional crop protection, it is likely to take at least 15 years.

The market for BCAs and biostimulants is a fast growing one with increasing expectations. Product formulation and chemistry will be key to meeting these expectations and will follow mainly the same path as that for conventional plant protection products with the exception that the changes are likely to be much quicker and more dynamic.

Market expectations for the quality and performance of biological products will probably increase, and this is also likely to drive investment in formulation technology across the industry. The COVID-19 pandemic might have a short-term impact on market growth but is likely to boost investment in biologicals as part of a wider shift to interest in food security and sustainable crop production and ensuring more robust supply chains.

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