

Precision spraying and biologicals – driving collaboration



Introduction

Biologicals are seen as part of the toolkit of solutions necessary to address the need for more environmentally sustainable agricultural practices. Recent regulatory changes, particularly in the EU, are starting to make the use of traditional synthetic chemical-based crop protection products increasingly challenging. Some see biologicals as a potential solution, but if products in this broad category are to be successful and adopted more widely, some disruptive changes will probably be needed at different points across the value chain.

To explore some of these changes in more detail, Cambridge Consultants and Agri-TechE took soundings from across the industry. With increasing use of biological material – soil amendments, crop protection and biostimulant products, not to mention release of beneficial insects and microbes – we challenged representatives from global businesses across the industry to think about the future production, formulation, transportation and application of these materials on-farm, and at scale. We convened a series of roundtable conversations with key stakeholders – covering developers of active ingredients, product formulators, original equipment manufacturers (OEMs) and agronomists – to identify the common needs, challenges and potential routes to solutions that benefit all.

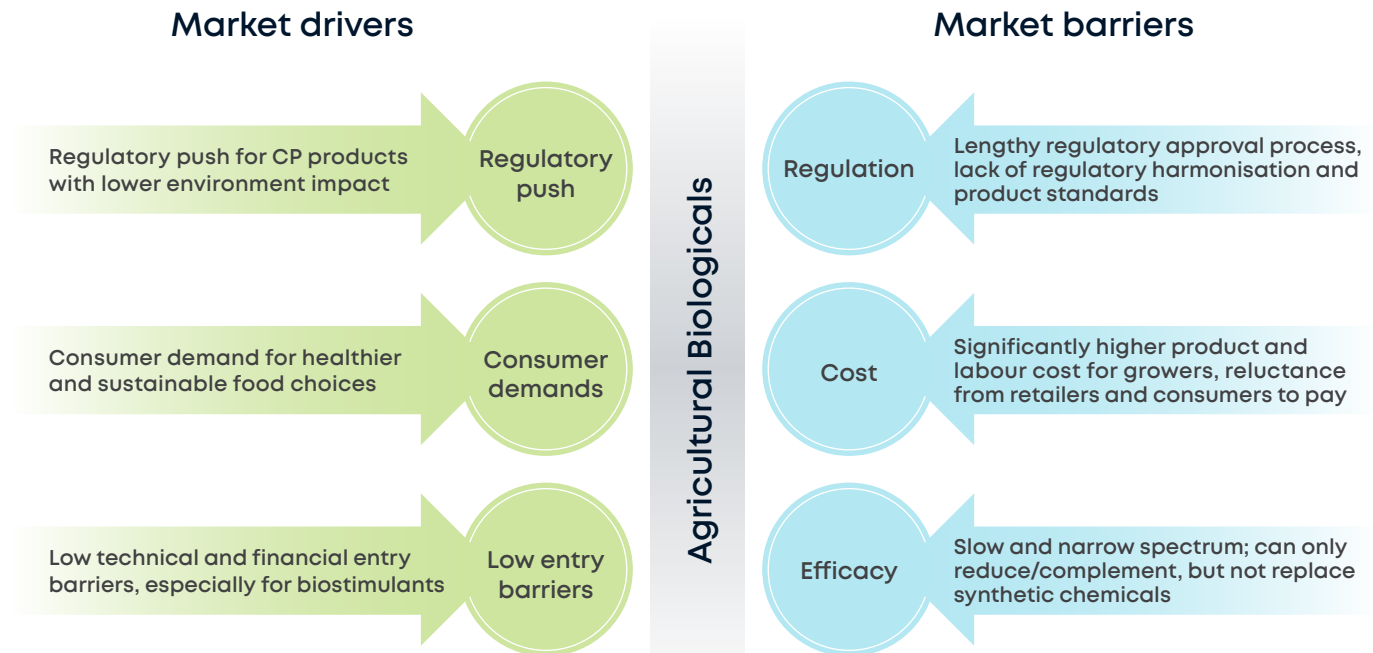
Representing the agrichemical providers, formulators and agronomists were thought leaders from BASF, Bayer Crop Science, Syngenta, Corteva Agriscience, Croda and Hutchinsons. Their peers in equipment and machinery were represented by Garford UK, John Deere and Saga Robotics. We invited our contributors to consider use of a wide range of different biological products but with a core focus on biological crop protection products, considering the position of regulators, retailers, growers and the public.

Trends and drivers

Biologicals are gaining interest from a wide audience. Retailers and the general public are keen to see a reduction in chemical inputs used in food production and in turn the residues left in food products – a strong market ‘pull’. The latter noted a disconnect between regulator-approved restrictions on chemical products and the levels – or even the products themselves – permitted by retailers. The latter may impose more stringent constraints than the regulators’ requirements, forcing growers to react accordingly). This has cost implications and margin constraints throughout the value chain, as we’ll explore later.

In addition to this end-user pull, there is a market ‘push’ from regulators to reduce the use of traditional crop protection products. The EU Green Deal and its initial ambition to reduce use of chemical pesticides by 50% was a key driver in the need to reduce use of chemical products. This was compromised in February 2024 in response to growers’ concerns and protests across continental Europe. Availability, or lack thereof, of some traditional materials, due in part to geo-political instability, is also a driver for wider interest in biological-based products.

Biologicals are perceived as more environmentally benign and the aim to move to more sustainable practices in agriculture is a key factor in the increased interest in biological crop protection products. Precision agriculture is a key enabler of this; moving from widespread applications of products to a more ‘per row’ and ‘per-plant’ intervention to deliver these selective products to the crops. Indeed, given the cost associated with biologicals, precision application technologies need to work hand-in-hand with the formulation in order to drive clear benefit to the grower and satisfying the needs of retailers and consumers at the same time.



Tackling the challenges

The overview of trends, with market pull from retailers on one side and regulatory push on the other, would seem to favour biologicals. But our interviews highlight a raft of challenges which need to be addressed before trends turn into widespread adoption.

Cost constraints in biological adoption

There is no escaping that cost is a big barrier to the adoption of biologicals. Growers are looking for the most cost-effective way to produce their crops and this can sometimes conflict with the adoption of biologicals. Several factors may explain this:

- Biologicals are often priced higher than traditional crop protection products.
- The selective and targeted nature of biologicals drives the need to have multiple applications, meaning more passes across the field may be necessary.
- Shelf life of some biological products is shorter than with synthetic chemical alternatives – growers aren't yet able to bulk buy biologicals and thus miss out on economies of scale and the opportunity to take advantage of dynamic pricing.

Formulation and delivery hurdles

Formulation is a huge challenge when it comes to biologicals, particularly when compared to the use cases and application steps associated with traditional crop protection products. The core formulation and delivery challenges are:

- Reduced UV stability compared to synthetic chemicals.
- Potential limited compatibility with other biological and chemical products.
- The inability to tank mix many of these biological products with either other biologicals or with chemical products.
- Reduced shelf life of the products as compared with chemical alternatives
- Specific storage requirements.
- Narrow application windows – potentially even more stringent than spraying conditions for synthetic chemical application.
- Some lack of awareness about the range of biological crop protection options.

All the above can impact product efficacy and wider adoption.

Evaluating efficacy

On the subject of efficacy, when comparing biological and chemical crop protection products, biologicals in general are not as efficacious. They generally require more applications to the crop, requiring more time and costing more fuel and incurring more labour costs associated with spraying. The application window is also more specific, and conditions have to be correct to get the best out of these products. In addition, biologicals may be preventative rather than curative and therefore more crop monitoring is required by growers.

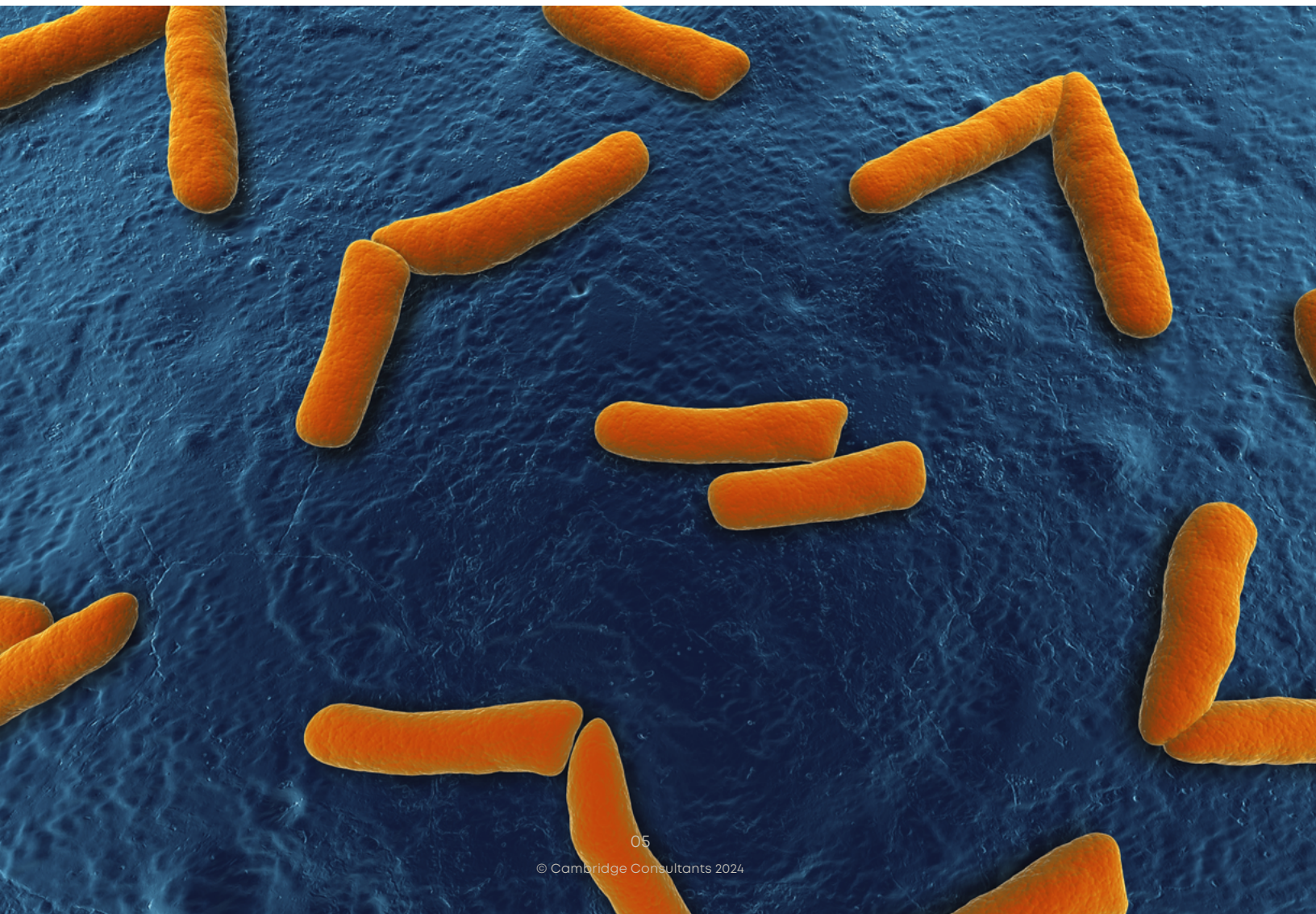
Market options and grower confidence

Finally, the choice of biological products available on the market is currently limited and this plays a part in the adoption of these products. Confidence in biological products has a lot of headroom for improvement, driven primarily by very mixed experiences with the use of some biostimulants which risks tarnishing the reputation of biologicals as a whole. Some of this lack of confidence is based on experience with early products and the perception that it is challenging to integrate these products with existing practices; challenges which have considerable merit, given the list above.

Regulation

Not unsurprisingly it was felt that innovation in both the formulation, active ingredients and precision application equipment has outpaced regulation, which is increasingly outdated. For example, in the UK, legacy regulation exists centred around the number of input applications rather than viewing the total amount applied as a whole across a field. Precision spraying equipment enables spot spraying to be effective and targeted, but its wider use with biologicals is somewhat restricted due to the overly simplistic and general regulation in use today. Greater collaborative dialogue from equipment providers and product developers is required to change legislation for the collective good.

Counter to this was the perception that biological products may not be subject to the same regulatory rigor as chemical products. Biostimulants for example, are not regulated in the same way as biocontrols and this has led to a wide number of biostimulants available with varying levels of efficacy. This has impacted the reputation of biologicals in general and may explain a lack of trust in these products.



Opportunities

Incorporating application of biologicals with existing precision agriculture approaches could help reduce the cost needed by the grower to implement these new products, and in turn help with increasing the efficacy which is a key barrier to uptake. Greater collaboration is an over-used term, but it is in the mutual interests of both equipment manufacturers and product developers to work together to improve updated regulation regarding application. In addition, improved optimisation of formulation and equipment design could help to overcome issues with tank mix. Recent innovations in direct injection nozzles may offer one example where equipment innovation can help improve the cost effectiveness of biologicals.

There are some examples of effective collaborations, for example the recent announcement in January 2024 by John Deere and Corteva, which will be key for increasing innovation in this space and allowing more growers to move to more biological products without completely disrupting current practices. Collaborations and acquisitions linked to biologicals are occurring within the industry and this advances the state of the art and widens the portfolio of available material at scale. These activities and the general move to more development within biological crop protection, all have the potential to reduce cost and reduce the barriers faced by growers when making their choices for crop protection products.

Staying on the topic of integration of equipment and active ingredients, it was interesting to note where the potential of autonomous equipment could enable greater use of biologicals. The example of autonomous UV-C application at night for mildew treatment in speciality crops was cited as a facilitator for predatory mite application. Given the machines operate slowly over many hours at night with no human in the loop, it was found that they could apply predatory mites more accurately than humans, improving the efficacy of the treatment. As autonomous equipment becomes more common and electrification increases, the concerns around time, labour and fuel emissions disappear, improving the business case for adoption of some biological treatments.

More broadly, the use of synthetic biology was deemed by some respondents to be a game changer for biological product development but legislation around use of GMOs, particularly in Europe, makes this route currently non-viable. Synthetic biology approaches would widen the choice of biological products available, reduce the development time for producers and open up the possibility for novel gene based approaches too. The potential for gene-edited and genetically modified products to have broader selectivity could have significant benefits in reducing the number of passes through the field for effective application, with anticipated cost reductions in terms of fuel and labour.

Conclusions

Development, delivery and use of biologicals by growers at scale requires new partnerships across the value chain. Some encouraging bilateral conversations are underway and some close corporate relationships are forming, but these are piecemeal and not holistic across the ecosystem. There should be end-to-end collaboration from active ingredient innovators all the way through the retailers if needs are to be fully understood and addressed.

Collaboration – and subsequent commercial adoption – has to be driven by the imperative to make it simple for growers to adopt and use biologicals. Focus on improving their ease of use at the point of application is critical, so they can be incorporated into existing practices. For effective uptake, it will be crucial to understand and accommodate the economic and practical imperatives (for agri-business and growers). This is not limited to specific selective efficacy; consideration has to be given as to how this aligns with current spray windows, the number of passes through the field and where spot spraying technologies allow for different application concentrations.

Equipment innovations beyond spot spraying are a key enabler too. As greater automation becomes more common on farms – starting in speciality produce and moving to row and broadacre crops – the potential for more targeted and cost-effective application of biologicals rises. Regulation needs to reflect rapid technology advances for automation and spot spraying benefits to be realised. This allows growers to apply local treatments in the volumes required for effective results and evolve away from broadcast, uniform application based rules as is the case today.

Linked to all of the above, effective communication and education of the whole supply chain is necessary and it's important that these efforts are pitched correctly – talking 'science' to all won't resonate. This will ensure that everyone, from biologicals discovery and development, formulation and manufacture, equipment manufacturers and regulators to growers, retailers and the general public, understands the constraints on the supply chain currently and what is needed to address the challenges with biological crop protection products. This will enable biologicals to become a core part of the toolkit of solutions available to growers to help make agriculture more environmentally sustainable for the benefit of all.

Continue the conversation

If you'd like to discover more about the challenges and opportunities around biologicals – or would like to discuss your ambitions for the new bioeconomy – please get in touch with Niall Mottram, Head of Industrial and AgriTech, Cambridge Consultants
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Agri-TechE's membership is global and spans the agri-tech value chain. If you have an interest in being part of the Agri-TechE membership ecosystem, perhaps through developing new technologies, undertaking R&D or seeking new market insights, please contact
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Agri-TechE is an independent not for profit membership organisation, supporting the growth of a world-leading network of innovative farmers, producers, scientists, technologists and entrepreneurs who share a vision of increasing the productivity, profitability and sustainability of agriculture. Together we aim to help turn challenges into business opportunities and facilitate mutually beneficial collaboration.



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