



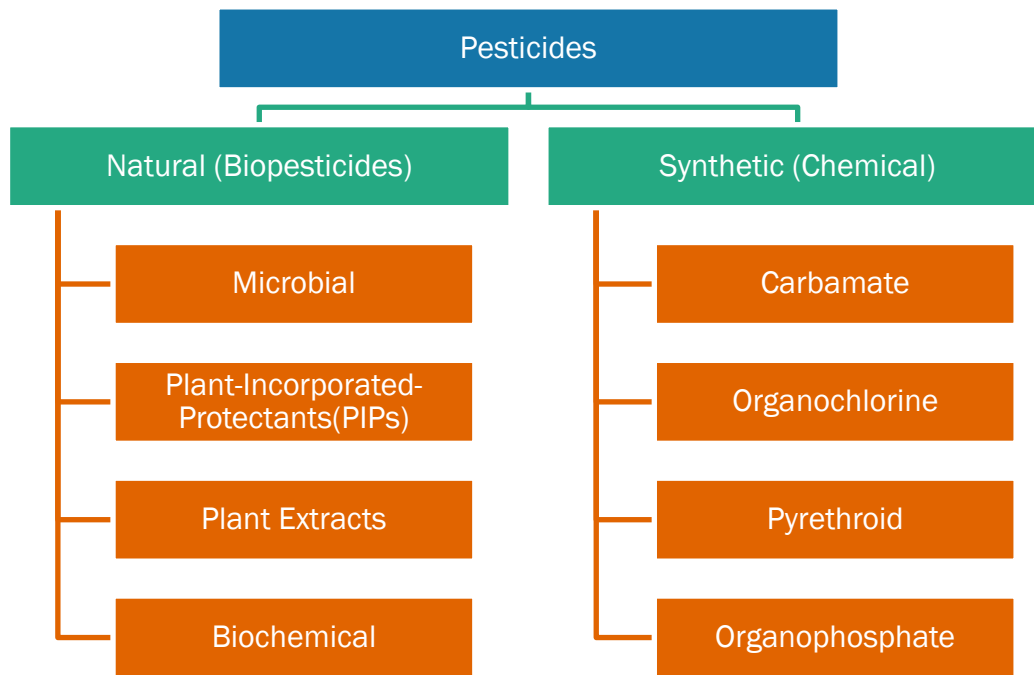
Biopesticides vs Pesticides

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Biopesticides: An excellent means for reshaping and aiding in Sustainable farming practices across the globe

The need to feed the growing global population along with increasing demand for sustainable agriculture practices is expected to further drive the demand for biopesticides. The use of biopesticides enables value addition across food value chain and offers additional alternatives for farmers, buyers, dealers, and others. Even though biopesticides have been in market since long but they have gained importance and are witnessing significant growth in recent years owing to need for sustainable farming practices. Factors such as demand for low residue crop protection chemicals, regulatory changes supporting the use of bio-based solutions, and need for relatively more productive farming practices are supporting the growth of biopesticides. Environmental Protection Agency (EPA) defines biopesticides are types of pesticides derived from natural materials as animals, plants, bacteria, and certain minerals. EPA also regulates Plant Growth Regulators (PGRs), which display no pesticidal activity but can promote, inhibit, or modify the physiology of plants, as biopesticides.

Classification of Pesticides, by Source of Origin



Source: EPA, Secondary Research, and Government Associations

Custom and Consult study available on the above topics

EPA has broadly classified biopesticides into three major categories including microbial, biochemical, and plant-incorporated-protectants.

Biopesticides are defined as crop protection products derived from natural sources and used to control pests, pathogens, and weeds by different means. They are majorly categorized as microbial and biochemical. Microbial pesticides use living organisms such as bacteria, fungi, viruses, protozoans, and yeasts. Biochemical's are made using naturally occurring bioactive compounds that control pests by non-toxic mechanisms which includes plant extracts, semiochemicals/pheromones, and organic acids.

Microbial pesticides are derived from various microorganisms (including bacterium, fungus, virus, or protozoan) and these are used as an active ingredient to control pests. These comprise of the organism themselves or the metabolites they produce. Microbial pesticides are further segmented into six categories namely, bacteria, viruses, fungi, protozoa, yeast, and nematodes.

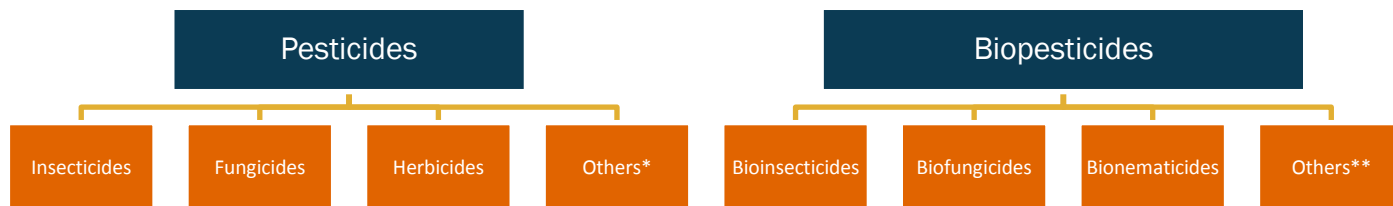
Biochemical biopesticides are defined as naturally occurring compounds or synthetically derived compounds that are structurally related (and functionally identical) to their naturally occurring alternatives. These act by a non-toxic mode of action that may affect the growth and development of pest or its ability to reproduce. Biochemicals are further segmented into six subcategories including Plant growth Regulators (PGRs), Insect growth regulators, Organic acids, Plant extracts, Pheromones, Minerals.

Plant-incorporated-protectants also termed as genetically modified crops are defined as pesticidal substances that plants produce from genetic material that has been added to the plant.

Synthetic pesticides comprises of chemical that are used for the control and management of plant pests such as weeds, insects, and fungal pathogens. The use of synthetic pesticides can have a negative impact on both crop and environment and this has led to the demand for biopesticides. Biopesticides are gaining importance owing to need for sustainable farming practice. Factors such as high effectiveness, target-specific, improved options for delivery and application, and relatively fewer environmental risks make biopesticides an excellent alternative to synthetic pesticides.

Crop protection chemicals are classified into pesticides and biopesticides depending upon their source or origin as discussed in previous section.

Classification of Crop Protection Chemical, by Type



Source: EPA, Secondary Research, and Government Associations

Others* include rodenticides, disinfectants, fumigants, plant growth regulators, and mineral oils

Others** includes biomolluscicides, bioacaricides, and biorodenticides

Custom and Consult study available on the above topics

Biopesticides vs Pesticides

Biopesticides	Pesticides
<ul style="list-style-type: none">• Relatively less toxic• Specific to target pest• Effective in small quantities which eventually results in lower operator exposure• It decomposes quickly• It is less likely to have resistance issues	<ul style="list-style-type: none">• Kills pest quickly• Highly effective in controlling target pest populations• Longer residual activity• It offers greater persistent control under field conditions

Source: Secondary Research and Government Associations

Regulations and Legislation governing Biopesticides registration and usage in developed and developing economies and their impact

The United States

Biopesticides are regulated by the same laws and regulations as traditional chemical pesticides in the United States. All biopesticides product registrants are required to submit data to the Biopesticides and Pollution Prevention Division (BPPD) of the Office of Pesticide Programs (OPP) concerning the composition, toxicity, degradation, and other characteristics of the product. The information shared is further reviewed to certify that a product will not negatively affect human health or the environment. EPA requires relatively less data to register a biopesticides as compared to that of a chemical pesticide as biopesticides cause less risks. This enables registration of biopesticides in less than a year as compared to chemical pesticides that need an average of three years to register. Field-testing of biopesticides on high-value specialty crops can be relatively expensive for small biopesticides producers who may benefit only a small return on investment for a product with a very limited usage. The regulatory landscape prevailing in the country is favorable for the use of biopesticides and will definitely play a key role in further promoting its usage and adding to sustainable farming practices.

European Union

Directive 2009/128/EC aims to achieve sustainable use of pesticides in the EU by reducing the risks and impacts of pesticide use on both human health and the environment and also promoting Integrated Pest Management (IPM) and alternative approach or techniques including bio-based alternatives. Biopesticides were not categorized as per regulation in EU. In 2017 as defined in Regulation 2017/1432 which was amendment of Regulation 1107/2209 which further categorized the pesticides in to “basic substances” and “low-risk substances”.

Basic substance are defined as substances not mainly proposed as crop protection products but instead can offer crop protection capabilities and their approval is dependent on existing evaluations carried out following other EU regulations. Low-risk substances on the other hand need to fulfil the criteria listed in Annexure II of regulation 1107/2209. Approval of these low-risk substances may be approved in part based on literature data opposite to that of how chemical pesticide active ingredients would have been approved. The use of biopesticides will benefit from the European Green Deal as per which the European Commission is aiming for sustainable use of pesticides. As per the deal by 2030 it is being aimed to reduce the use and risk of chemical and hazardous pesticides by 50% in the EU. This could be a major factor supporting the use of biopesticides in the region going forward.

China

According to Ministry of Agriculture and Rural Affairs of China (MoA), China's green pest management area reached close to 0.067 billion hectare in 2020, with green pest management being applied on 41.5% of major crops to control pests which is 18.5% higher as compared to 2015. MoA planned an initiative to decrease pesticide use and improve its efficiency and introduced incentives to encourage the registration of biopesticides. This is expected to promote the market entrance and application of these products and offering more opportunities for the development of biopesticides. The newly revised "Data Requirement on Pesticide Registration" implemented in 2017 enables the reduction in time for biopesticides test and registration process. The residue test requirements have been reduced for microbial, botanical, and part of biochemical pesticides. The Chinese government policies will create opportunities for the use of biopesticides as a preferred means for crop protection and this will further support sustainable farming practices in the country. However, the utilization rate of biopesticides in China is relatively lower as compared to that of North American and European regions owing to limited R&D, disordered production, misusage by farmers owing to lack of training & awareness, low efficiency, and high cost.

India

The Insecticides Act, 1968 and Insecticides Rules, 1971 regulate the import, registration process, manufacture, sale, transport, distribution, and use of insecticides with an aim to prevent risk to human beings, animals, and environment. All pesticides have to mandatorily go through the registration process with the Central insecticides Board & Registration Committee (CIB & RC) before being available for use or sale. Biopesticides too in India are registered under the guidelines of the Insecticides Act, 1968 which was approved by the pesticide Registration Committee in India.

Key players in the market are developing bio-based solutions to aid in sustainable farming practices and biopesticides are witnessing increasing demand as the use of chemical pesticides poses environmental risks



Bayer states that the use of biologicals in crop protection enables them to reduce the use of synthetic pesticides, decrease residue levels, and support resistance management strategies. And their product portfolio comprising of both biopesticides and synthetic pesticides enables them to offer a holistic application system which eventually results into better agriculture practices. Bayer has been innovating and its product pipeline also constitutes of biologicals that has enabled it to promote and contribute in sustainable agriculture practices. There are many bio-based crop protection products which are in development phase and are planned to be launched in 2023.

Corteva among the leading player of crop protection solution offers broad range of improved product & services to its end customers through focus on advancing its science based innovation. The company helps to overcome farmer's productivity challenges through new product innovations while addressing key area of concerns including natural resistance, regulatory changes, safety requirements, and competitive dynamics. The company follows a unique approach to cater to its market by working face-to-face with farmers to understand their need.

BASF among the leading player in crop protection market continually innovates to offer biosolutions to its end customers which help it to contribute to sustainable agriculture practices. The company has introduced wide range of biosolutions for crop protection and these contributed to around USD 167 million in annual sales in 2020.

UPL Limited is the global leading manufacturer and distributor of biosolutions with products & technologies derived from different natural sources such as botanicals, marine extracts, viruses, microbials, or fermented extracts, and these have almost negligible impact on the environment. Natural Plant protection (NPP) is UPL's new division completely focused on biosolutions aims to addressing abiotic stress soil health, chemical residues, and resistance management in developed and developing economies through its wide-ranging

portfolio. This is evident from the fact that UPL's differentiated and sustainable products contributed to around 29% to the revenue. The company its exclusive program, ProNutiva combines the use of natural biosolutions with conventional chemical protection products to meet or exceed the real-world needs of farmers. The use of both biosolutions and traditional plant protection helps to overcome key challenges including supporting sustainable farming practices, improving farmers economics, and meeting the growing food chain needs. The company is contributing to the sustainable practices through its wide range of differentiated biosolutions product offerings and estimates the biosolutions to be among the fast-growing segment in the agriculture industry reaching almost ~USD 10 billion by 2025.

Recent developments by key players in the market which will positively impact the demand and growth of biopesticides to further extent.



- **Bayer** introduced Vynyty Citrus which is biological and pheromone-based crop protection product to control pests on citrus farms during the International Symposium on Horticulture in Europe –SHE2021, March 8-11
- **UPL Limited** is the largest manufacturer and distributor of biosolutions worldwide. The company launched NPP-Natural Plant Protection, global business unit offering broad portfolio of natural and biologically derived agricultural inputs and technologies.NPP product offerings will benefit from UPL's extensive global distribution footprint and utilizing innovation, research, & development capabilities. This will help the company to have more focused approach towards its bio-based offerings.
- **Syngenta Crop Protection AG** acquired two next generation bioinsecticides, NemaTrident and Unispore from leading biocontrol technology developer, Bionema Limited. Syngenta will have full global development and commercialization rights for the assets. This will help in building biologicals portfolio of the company and will open up new opportunity for expansion in biocontrol solutions for crop protection.
- **FMC Corporation** entered into a strategic collaboration with Novozymes (among leading player in biological solutions), to research, co-develop, and commercialize biological enzyme-based crop protection solutions for farmers across the globe. The collaboration between two companies will help

them to focus on enzyme-based biocontrol technology for the global fungicide and insecticide markets under multi-year global agreement.

Even though biopesticides offer great benefits over synthetic pesticides their implementation is still limited which could be due to costly production methods, relatively poor storage stability, inclination to environmental conditions, efficacy issues, and others. They also face certain challenges which impact their commercialization including quality control issues, relatively short shelf-life, low awareness, and higher expense. Biopesticides offer safer means for crop protection and still they face challenges in their implementation, development, and manufacturing. These challenges are being addressed by further research in production, formulation, and delivery by the companies in the market and as discussed in previous sections. There is no doubt the challenges in their implementation over weighs the benefits offered by their use and this segment has been witnessing fast-growth considering its key contribution to sustainable agriculture which is the common goal among all the economies.

Case Study

Pukka Partners worked closely with one of the leading crop protection chemical player and helped them to meet their objective. The client was aiming to expand its portfolio in to a specific category of biopesticides and their initial focus on understanding the current & future market scenario (current estimate & forecast, CAGR, YoY growth rates), drivers, challenges, opportunities, regulatory landscape, market segments, competitive benchmarking, key products & formulations, and others. Followed by this they were looking for recommendations on the:

- Formulations they should expand in to and why
- Key geographies they could target
- Market entry strategy for the same

Pukka Partners through their research expertise and robust research methodologies were able to provide the key insights and recommendations to the client and assisted them throughout their process of introducing the product to its launch and commercialization in key geographies.



THANK YOU



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