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Biopesticide Active Ingredients Market Assessment, By Ingredient Type [Trichoderma Viride, Beauveria Bassiana, Pseudomonas Fluorescence, Verticillium Lecanii, Bacillus Thuringiensis, Others], By Source [Plants, Insects, Microorganisms], By Pest Type [Insecticide, Fungicide, Nematicide, Others], By Application [Soil Treatment, Foliar Treatment, Seed Treatment, Others], By Crop Type [Cash Crop (Cereals & Grains, Oilseeds & Pulses), Fruits & Vegetables, Turf and Ornamentals], By Region, Opportunities and Forecast, 2016-2030F

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Abstracts

The Biopesticide Active Ingredients Market size was valued at USD 2.6 billion in 2022, which is expected to reach USD 5.1 billion in 2030 with a CAGR of 8.8% for the forecast period between 2023 and 2030. Conventional synthetic pesticides are considered harmful chemicals, threaten crop yield and aquatic life, and even lead to the deterioration of human health. These agrochemical products are unsuitable for sustainable crop production as they negatively impact soil biodiversity, reduce soil respiration, and lessen the activities of microorganisms. Biopesticides are a better alternative due to their unique characteristics such as environmentally friendly, sustainable, and specific mode of action.

Among the known biological pesticides, Bacillus Thuringiensis (BT) are a prominent active ingredients which are effective and widely used in biopesticides. The different formulation technologies are executed on the composition of Bacillus Thuringiensis over

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the years to analyze the variation of its specific action. The Bacillus Thuringiensis (BT) bacterium generates crystalline proteins (Cry toxins) that are specifically noxious to insects, focusing on larvae of Lepidoptera pests (caterpillars). Its mode of action comprises of ingestion by a pest caterpillar, BT crystals solubilize in the alkaline environment of the larval midgut and are sequentially broken down by Lepidopteran-specific gut enzymes into active toxin proteins. These applications and organic feeds in the crop are expected to fuel the market demand for active biopesticide ingredients.

Commercial Exploitation of Biopesticides

Majorly around 90% of microbial biopesticides on the market are derived from the well-known single bacterium Bacillus Thuringiensis (BT) which covers a vast portion of biological pesticides. The market share for crop protection in the United States is around USD 3 billion globally, just 5% of the global market. The increase in market share for biological pesticides corresponds to around 10% globally. Over 200 products are circulated across the United States market, while the European Union (EU) market comprises only 60 analogs. EU authorizes biopesticides by the same regulations as synthetic substances, where it has an excellent opportunity to add several provisions to the existing one for enhancing the market of biological pesticides. However, all agriculture departments should enforce stringent regulations to provide licensing for biopesticides to recognize the value of their activity and make it an easy-to-implement tool. In a few countries across the European Union, new safety food regulations are implemented, which withdraw the usage of synthetic chemicals in plant protection considering its adverse effects on human and animal health. The above-discussed provisions can generate enormous opportunities for the biopesticides active ingredient market in terms of regulations.

Integrated Pest Management

Massive consumption of synthetic pesticides and their harmful impacts stimulated the search for alternatives, leading to biological pesticides. Bioactive molecules and hydrolytic enzymes are considered very important for integrated pest management, where chitinases are suitable for crop protection due to their specific characteristics imparting fungicidal, insecticidal, and nematicidal activities individually or in combination. Integrated Pest Management (IPM) is explicitly defined by the Food and Agriculture Organization of the United Nations that operates with the objective of careful execution of available pest control techniques. Integrating appropriate methods consequently led to discouraging the application of pest populations and monitoring the

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interventions of harmful pesticides that threaten human health and the environment. Chitinases are harmless for plants and vertebrates that don't comprise Chitin and serve as a promising component for integrated pest management.

The IPM can be practiced with proper application to agricultural and non-agricultural applications such as gardens, homes, and workplaces. IPM practices are not a one-step process; instead consist of a series of pest management evaluations, proper decisions, and controls. Generally, it comprises four significant steps: setting action thresholds, monitoring, identifying pests, preventing, and controlling sequentially. The goal of implementing IPM practices has huge potential in the market to expand and create opportunities for the biopesticides active ingredients market.

Impact of COVID-19

The COVID-19 pandemic has led to unprecedented economic instability, supply chain disruptions, and workforce reductions. The supply of plant protection products (PPPs) comprised of active biopesticide ingredients was affected by imposed lockdown and quarantine protocols. In the early stage of the pandemic, China was severely hit regarding the production of PPPs, which declined sharply. The disturbance created by COVID-19 for the movement of PPPs from global suppliers to the base ground level has significantly reduced the conventional outcomes. To compensate for the losses, countries implement efforts to increase the production of biopesticides. The demand for crops was rising significantly, and to reach the farmer's demand into various applications of various biological pesticides in different crop productions. The global requirement for meeting food demand is exploding, which requires more crop production and, ultimately, biopesticides, giving the biopesticides active ingredients market to grow in different allied sectors.

Impact of Russia-Ukraine War

The annexation of Russia on Ukraine has imposed various sanctions on natural gas supplies by European countries, severely impacting the European agrochemical industry. Natural gas is extensively used to drive active ingredient production. Ukraine and Russia are both key exporters of cereal and oilseed crops, where war led to the impact of cereal grains and sunflower oil seed stocks. The prevailing situation is gradually improving as countries focus on innovation and technological advancement to develop biological pesticides and grow favorable crops according to their conditions. This will reduce dependency on importer countries and provide a way for indigenous structure. Consequently, the market will explode for biopesticide active ingredients,

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which could fascinate investors to explore the market's potential.

Key Players Landscape and Outlook

Companies are continuously putting their efforts into reducing the dependence on synthetic chemicals and increasing the application of biological pesticides. The companies are generating various products which are organic and eco-friendly in usage across the arable lands. For instance, Syngenta AG has a wide range of crop protection products that comprise biopesticides. Their products are registered under trademark in the respective country, which includes individual unique characteristics and delivers significant results to crop protection. BANVEL/CADENCE, herbicide selective, has been extensively used in Argentina, Canada, France, Hungary, and Russia. A well-defined product for perennial broad-leaf weed control primarily focuses on corn and cereals extending its application to turf, pasture, and non-crop land.

Another product, ISABION, which lies in the category of biologicals/bio-stimulants, is complementary to crop nutrition and its protection. It is an amino acid and nutrient-based bio-stimulant that can enhance crop performance (growth, vigor, yield, quality). Likewise, there are opportunities for new biopesticide active ingredients specific to crop protection and improving various characteristics that will dominate the market.

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