

## About RI Technologies

RI Technologies is a premier source of market research on the Biotechnology & Healthcare sector. We emphasize on factual insights and forecasts with maximum global coverage. RI Technologies is constantly monitoring the biotechnology & Healthcare industry, tracking market trends, and forecasting industry based on specialized analysis. The life sciences sector is an ever growing marketplace with emerging technologies in areas of discovery, design and development.

## Research – As Good as the Methodology is!

- Gauging Competitive Intelligence
- Identifying Key Growth Areas and Opportunities
- Understanding Geographic Relevance to Product
- Knowing Regional Market Sizes and Growth Opportunities and Restraints
- Keeping Tab on Emerging Technologies
- Equity Analysis
- Tapping New Markets

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## II. REPORT SYNOPSIS

### INTRODUCTION

#### **Pesticides**

A mixture of substances used to destroy pests is known as pesticides. Pesticides include insecticides, fungicides, herbicides, nematocides (used to kill nematodes, elongated cylindrical worms), and biopesticides used against any type of pests.

Chemical pesticides were developed worldwide for the control of insect pests. The market was flooded with a wide variety of chemical formulations. But soon it was realized that unwise use of chemical pesticides causes a major hazard to human health and environment.

The indiscriminate use of these pesticides has led to increased resistance of insect pests to them. A typical example is the insect pest *Helicoverpa*. The larvae of this moth species are polyphagous causing destruction to several economically useful crops. They have developed resistance to many of the insecticides commonly applied. Apart from this, several associate problems have cropped up. Many non-target species of organisms, some of which are actually beneficial, are wiped out by the pesticides.

It is a shocking revelation that many of the chemical pesticides used excessively and inadvertently remain without degradation in plant body for a prolonged period, and consequently they are found in parts that yield food, fiber, and fodder. These pesticide residues gain entry through food chain into meat and dairy products, and ultimately into human system. According to an estimate of WHO, about 25 million cases of human pesticide poisoning in developing countries and 20 thousand fatal cases worldwide are recorded annually. The situation is alarming in developing countries rather than in developed countries.

As improved chemical pesticides are being developed, the obsolete ones accumulate creating disposal problems. Moreover, the novel chemical pesticides are too expensive for the average farmers to procure.

#### **Discovery of Biopesticide**

Realizing such drawbacks of chemical pesticides, many research institutions around the world initiated major research projects to seek suitable alternatives to the chemical pesticide, which can pose reduced threat to human health and environment. As the reckless use of chemical pesticides in agriculture to alarming levels has undesirable impact on ecosystem, it is imperative that ecofriendly methods of pest control are developed, and thereby soil fertility is sustained.

Among these strategies, biological control of pesticides has drawn the attention of producers and users. This control method will be the most sought after pest management strategy of modern times owing to their sustainability, affordable cost, and environment safety.

Biopesticides are pesticides that are made up of a huge number of a biological control agents which is usually a pathogen. An example of this is the bacillus thuringiensis Bt is a bacterium that destroys insects. It does not linger in the environment for a long duration and can be mass produced on an industrial scale. Pesticides obtained from plants, animals, and naturally occurring materials are known as biopesticides. Minerals and plants are the source for biopesticides. The biopesticides are biologically based agents produced in large quantities and are used for controlling plant pests. In this

class are semiochemicals, plant incorporated products, naturally occurring substances plant abstracts, nematodes and micro-organisms, invertebrates and living organism which are the natural enemies. Biopesticides are known to be very specific. The bacillus thuringiensis also known as Bt, the baculoviruses, and neem are the most widely used biopesticides.

## Segmentation of Biopesticides

### Exhibit 1: Segmentation of Global Biopesticides Market by Type (Microbial, Biochemical, Macrobial, Plant-Incorporated-Protectants (PIPs)/Bt (Insect Resistance) & Other), and by Application (Cereals, Fruits & Vegetables, Soybean, Cotton and Other)

By Type	By Application
➤ Microbial Pesticides	➤ Cereals
➤ Biochemical Pesticides	➤ Fruits and Vegetables
➤ Plant Incorporated Protectant (Bt Insect Resistance)	➤ Soybean
➤ Macrobial Pesticides	➤ Cotton
➤ Other (1)	➤ Other (2)

(1) Includes Weedicide and Termiticide

(2) Includes Oil Seeds, Pulses, Plantation (Coffee, Tea & Sugarcane), Woody plants, Ornamentals, Turfs (home and garden) & Forestry etc).

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Global biopesticides market is projected to reach about US\$**XX** billion by 2012 from an estimated US\$**XX** million in 2005, growing at a compounded annual growth rate (CAGR) of 10.53% during the analysis period 2005-2012.

### Exhibit 2: Biopesticides (2005-2012) – Global Market Analysis (Current & Future) in US\$ Mllion

Year/Region	Market
2005	<b>XXX</b>
2006	<b>XXX</b>
2007	<b>XXX</b>
2008	<b>XXX</b>
2009	<b>XXX</b>
2010	<b>XXX</b>
2011	<b>XXX</b>
2012	<b>XXX</b>
%CAGR	<b>XXX</b>

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### Exhibit 3: Biochemical Pesticides (2006, 2009 and 2012) – Percentage Breakdown of Global Market Value by Geographic Region for NAFTA, Europe, Asia-Pacific<sup>^</sup>, Latin America, Africa, Japan and Middle East

Year/Region	NAFTA	Europe	Asia-Pacific	Latin America	Africa	Japan	Middle East	Total
2006	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
2009	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
2012	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

^ Excludes Japan

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### III. PRODUCT TECHNOLOGY/RESEARCH

#### INTRODUCTION

Natural plants and microbial pesticides hold wider scope in the market for controlling of pests and diseases. Biopesticides have influenced growers over the years where nearly hundreds of biocontrol products are been commercialized.

Bacillus thuringiensis (Bt) is an important source for product development and is considered to be valuable in IPM (Integrated Pest Management) process. Bt is considered to be adopted by many growers and is commercialized in the world market. Like many other biopesticides, Bt strain produces a different toxin that kills a set of species without effecting the environment and crops. The large scale application of Bt to Insect Resistance Crops proves to be a boon for growers as it saves time and is economic. Insect Resistance in crops through Bt application has been regarded as the latest intervention in the field of agricultural biotechnology. GM crops that are modified with Bt can resist specific pests and insects such as European and southwestern corn borer, tobacco budworm, pink bollworm, cotton bollworm and Colorado potato beetle.

#### Biopesticides against Insects

Insects have a large range of enemies including:

- Arthropods
- Nematodes
- Vertebrates

Nature has more than three hundred families of insects falling under 10 insect orders that are predators and or parasitoids (parasites) of other insects. This list includes insects from order Neuroptera, which eat other insects at larval stage. Some of the insects from this order of insects continue to be predators even after growing up. These predator insects, especially the full-grown ones, have well developed antennae attached to a body that is slim and soft. The wings are large and membranous, full of vein networks resembling nerves. That is why the order has been classified as “neuroptera” or the nerve wing. Other beneficial insects include predatory wasp that preys on bollworms, or other caterpillars destroying cotton plants. Arthropods such as mites and spiders also relish their insect preys.

## Cotton

### Growth Trends – Global Market for Cotton

**Exhibit 4: Global Market for Biopesticides by Application in Cotton– Geographic Region (NAFTA, Europe, Asia-Pacific, Latin America, Africa, Japan and Middle East) for 2005 through 2012**

Region	%CAGR
Middle East	XXX
Africa	XXX
Latin America	XXX
Asia-Pacific	XXX
NAFTA	XXX
Europe	XXX
Japan	XXX
<b>Total</b>	<b>XXX</b>

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## IV. MARKET DYNAMICS

### MARKET OVERVIEW

Biopesticides have registered huge demand in all the parts of the world. The growth for biopesticides is driven by changes in legislation, government policies and consumer approaches. The worldwide demand for GM crops has added another advantage in the biopesticide market.

The registration procedure has been simplified in order to commercialize the biological based products. Cost of registration for biopesticides is less comparatively to pesticides. Several other activities have been popularized on large scale by creating an awareness among the farmers about biopesticide products through management tools called IPM.

Regulatory authorities have to assure about the quality and safety of biopesticides and not to restrain from commercialization. Hence a system of regulatory procedures is necessary in the European regions like the UK, in order to bring about more biopesticide products to the market. Very few products have been commercialized here, but with the introduction of Pilot Scheme, the problem of registration has been solved and direct support is given to assist application for alternative control in the market.

**Exhibit 5: Biopesticides (2005-2012) – Global Market Analysis (Current & Future) by Geographic Region for NAFTA, Europe, Asia-Pacific, Latin America, Africa, Japan and Middle East in US\$ Million**

Year/Region	NAFTA	Europe	Asia-Pacific	Latin America	Africa	Japan	Middle East	Total
2005	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
2006	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
2007	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
2008	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
2009	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
2010	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
2011	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
2012	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
%CAGR	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

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**Exhibit 6: Biopesticides (2005-2012)-Global Market Analysis (Current & Future) by Application for Cereals, Fruits and Vegetables, Soybean, Cotton and Other in US\$ Million**

Year/Appliction	Cereals	Fruits & Vegetables	Soybean	Cotton	Other	Total
2005	XXX	XXX	XXX	XXX	XXX	XXX
2006	XXX	XXX	XXX	XXX	XXX	XXX
2007	XXX	XXX	XXX	XXX	XXX	XXX
2008	XXX	XXX	XXX	XXX	XXX	XXX
2009	XXX	XXX	XXX	XXX	XXX	XXX
2010	XXX	XXX	XXX	XXX	XXX	XXX
2011	XXX	XXX	XXX	XXX	XXX	XXX
2012	XXX	XXX	XXX	XXX	XXX	XXX
%CAGR	XXX	XXX	XXX	XXX	XXX	XXX

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