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The Bright Side of Bio-pesticides Generating Business Opportunities

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Indian Bio-pesticide Market is Forecasted to Register Sales Volume of 47 thousand Tones by 2024 - Ken Research

Govt. of India has projected to double the real income of farmers till 2022-2023 through major sources of growth operating within the agriculture sector.

AIMS AND OBJECTIVES OF THE STUDY

- *To study the benefits of Bio-pesticides over conventional chemical pesticides.*
- *To study the market opportunities in the COVID-19 pandemic.*
- *The objective of this research is to know the business aspects regarding manufacturing and/or marketing of Bio-pesticides and to know consumer perception towards Bio-pesticides.*
- *To find out the awareness among the ryots and the Entrepreneurs about the benefits of Bio-pesticides over the conventional chemical pesticides and to try to persuade the ryots (farmers) about the use of Bio-pesticides instead of Chemical Pesticides.*
- *To study the market attractiveness for the Bio-pesticides products.*
- *Using the results as an input into analyzing market potential or to help market decisions about site selection or targeted market.*

ABSTRACT

Today the entire world is witnessing the outbreak of COVID-19 pandemic. As a consequence of this outbreak, major players of the Chemical Insecticides and Pesticides will either shut their production or minimize it. The same will give the way for the production of Biopesticides to flourish and accrue the market share. Agriculture has a significant role in the socio-economic fabric of INDIA. It plays a core of Indian Economy. Today India ranks second worldwide in farm output. Agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India. The Indian economy is predominantly agriculture-based, with about 70 percent of Indians engaged in activities linked to agriculture. The use of chemical pesticides and fertilizers increased tremendously after the Green Revolution in the 1970s. But now there is an increasing realization of the risks posed by "rampant and continuous use of pesticides and fertilizers" to human health, ecosystems and their "catastrophic" effects on soil microorganisms.

Biopesticides clearly draw attention as safer alternative to manage pest and diseases in the crop while posing less risk to human being and the environment. Government of India has been trying to increase the income of farmers through major sources of growth operating within the agriculture sector such as improvement in productivity, using of resources efficiently or by saving in cost of production, increasing intensity of crops and diversification towards high value crops as well as launching several Govt schemes viz. "Per Drop, More Crop" etc. With the improvement and enhancement of farmer's income in the country, it is anticipated that it will lead to increasing demand for bio-pesticides in the country as rising use of biopesticides will lead to improvement in the production of crops coupled with using the resources efficiently.

"MAKE IN INDIA" is also promoting the establishment of new indigenous manufacturing units to utilize the available resources to enhance the economy of the country. Hence, accordingly many Govt schemes are made available to start up the manufacturing unit. There is continued need for pest management in agriculture, with pressure continuously increasing on agriculture to achieve higher yield from limited or even lesser land. Pests (which include invertebrates, pathogens and weeds) are estimated to cause between 27% and 42% losses in production for major crops around the world, but this would rise to a staggering 48–83% without crop protection.

Several government agencies such as the Ministry of Agriculture and Farmers Welfare, Department of Biotechnology (DBT) and the Ministry of Science and Technology have been promoting research, development and commercialisation of biopesticides and biofertilisers. Globally, biopesticides amount to only 4.5% of the total pesticides produced, and in the U.S.A. it is 6%, whereas in India, it is only approx 3%. Even as the Maharashtra government grapples with farmers' deaths and injuries due to their exposure to chemical

pesticides, data from the Union Ministry of Agriculture show a more positive all-India trend, with the usage of bio-pesticides across the country rising faster than that of chemical pesticides.

Insect pests cause significant damage to the agricultural production. Human population is dramatically increasing in India and as well as in the developing world. With this projection, there exists a strict need for eco-friendly insect pest management in Indian agriculture to sustain the agricultural produce for future needs. Synthetic chemicals are generally used to control insect pests, which cause harmful impacts on environment and non-target living systems including human beings. Bio-pesticides are natural and good alternative sources. However, few numbers of bio-pesticides or formulations are available in the market at present.

Since the evolution of industrialization, chemical control of pests is a common practice in agriculture. The research study say that the average reduction in global crop loss due to use of pesticides is around 39%. The postharvest losses and quality decline caused by storage pests are major problems in a subtropical country like India. So, the farmers have relied heavily on the use of chemical pesticides to improve their crop production, which is now paying a huge toll on the human health and environment. Though the chemical pesticides are very effective, what concerns over their use is their effect on soil and environment and presence of residue in food products. Another major issue is the development of resistance in the pests. Therefore, the use of biopesticides to control pests is now preferred over synthetic pesticides because of their pest control ability and diverse mode of actions which helps in avoiding resistance development in the pests. In a country like India with a huge diversity of plants, there is an urgent need for identifying new biopesticides which can serve the purpose of pest control. India needs to develop its own biocontrol agents (BCA) because it will be cost-effective and also environment-friendly.

Today, most of the technologies used in producing Biopesticide is indigenously innovated, which are standardized by ICAR, Research Institutes and State Agricultural Universities. Some bio-pesticides currently being developed may be excellent alternatives to chemical pesticides. Also in India, there are many locally available plants like Beshram, Neem, Garlic, Triphala, Pinus, Kesia etc which can be easily processed and increase the biopesticide consumption in India. However, in India, some of the biopesticides like Bt, NPV, neem based pesticides, Trichoderma etc. have already been registered and are being practiced.

1. SCOPE OF THE RESEARCH STUDY ANALYZING THE MARKET POTENTIAL

In the present calamity of COVID-19 pandemic the graph of global economy is showing steep downfall. In such scenario, the experts and economists are saying that only two sectors viz. Agriculture and Hospitality will be remain unaffected. India has huge potential for the growth of industry as it losses thousands of tones of crops every year due to low consumption of pesticides in the country. Due to presence of higher pesticides residues in food crops, specifically on grains and increasing pest resistance, developed countries are posing strict regulations on use of some synthetic pesticides, which will affect the use of synthetic pesticides and will promote the use of bio-pesticides in the region. Other factors driving the growth of the market are the eco-friendly nature of bio-pesticides, constructive public support policies, increasing public awareness and lesser development of pest resistance.

Presently, bio-pesticides cover only 2% of the plant Protestants used globally; however its growth rate shows an increasing trend in past two decades. Agricultural biological have recorded double-digit sales growth and have accrued around US $2.3 billion in annual sales over the past few years. The global market of bio-agents is expected to reach $4 billion by 2024 from $2 billion in 2016, growing at a CAGR of 8.8% from 2016 to 2024. Similarly, global investment in bio-pesticides was US$1.3 billion in 2011and is estimated to reach US $ 3.2 billion by 2017, with at 15.8 % compound annual growth rate from 2012 to 2017 (www. markets and markets.com).

In India, bio-pesticide industry is projected to grow at a CAGR of 20.2 % since 2010 -2020. Scope of Current market for pesticides was US$ 23.92 million in 2015 which represent only 4.2 % of the overall pesticide market. Highest demand for bio pesticides was observed from West India - Maharashtra followed by South India. As many fruits & vegetables are eaten without proper processing, consumers demand for better crop safety processing. Pesticide residue is generally a concern among consumers. This practice leads to a high increase in pressure on grocery stores and good marketers to offer pesticide-free fruits & vegetables. Also increasing health consciousness of Indian citizens has created a demand of organic food. This indicates huge scope for growth of Bio-pesticides sector.

1.1 Opportunities in India:-

The above cited harmful impacts of chemicals have brought into focus the use of safer and effective alternative such as Bio-agents/Biopesticides. Moreover, the area under organic crop cultivation is on the rise because of the growing demand of organic food, a result of increasing health consciousness among the people. This indicates that there is huge scope for growth of the bio-pesticide sector. The National Farmer Policy 2007

has strongly recommended the promotion of bio-pesticides for increasing agricultural production, sustaining the health of farmers and environment. The bio-pesticide market will continue to grow in future due to increased pest resistance problem and high demand of safe and quality food products.

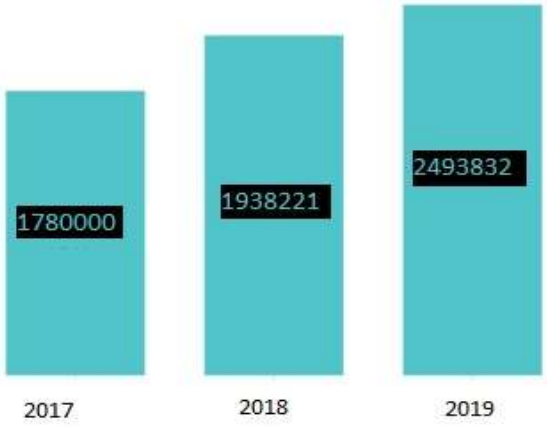

Fig. 1: Indian Bio-Pesticides Market

1.2 Market Overview of India

The India Biopesticides market is anticipated to register a CAGR of 8.8% during the forecast period. Currently, a small segment, the bio-pesticides market is expected to grow in the future, owing to government support and increasing awareness about the use of non-toxic, environment-friendly pesticides. Bio-pesticides are yet to take off in India despite their enormous market potential and government sanctions. The bio-pesticide industry in India is undergoing rapid change, reflecting increased global trade in agricultural commodities, a changing regulatory environment and evolving consumer preferences. Currently bio-pesticides comprise ≈ 5% of the Indian pesticide market, with at least 15 microbial species and 970 microbial formulations registered through the Central Insecticides Board and Registration Committee (CIBRC).

Fig. 2: Market Summary (Study Period: 2016 – 2025, Base Year: 2019, CAGR: 8.8%)

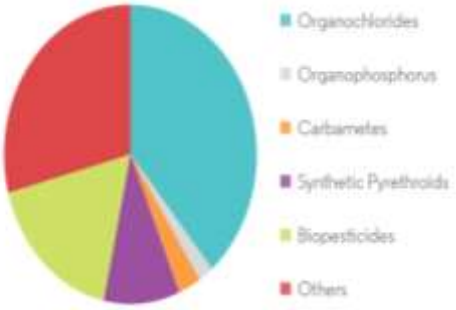

Fig. 3: Pesticide Consumption in % ByType, 2019

As of 2019, over 200 products based on entomopathogenic fungi (*Beauveria bassiana*, *B. brongniartii*, *Metarhizium anisopliae* s.l., *Lecanicillium lecanii* and *Hirsutella thompsonii*) and nematicidal fungi (*Purpureocillium lilacinum* and *Pochonia chlamydosporia*) are registered for use against various arthropods and plant parasitic nematodes. Regarding bacteria, over 30 products based on *Bacillus thuringiensis* (*Bt*) subsp. *kurstaki* are registered against bollworms, loopers and other lepidopterans, while 12

based on *Bt* subsp. *israelensis* and three with *Bt* subsp. *sphaericus* have been used against mosquitoes. Two viruses are registered, namely *Helicoverpa armigera* nucleopolyhedrovirus (22 products) and *Spodoptera litura* nucleopolyhedrovirus (5 products) for use against bollworms and armyworms. Four entomopathogenic nematode species are sold in Indian market. These include long-lasting wettable powder formulations of *Heterorhabditis indica* developed by the ICAR-National Bureau of Agricultural Insect Resources, Bengaluru which have been distributed on a large scale to control white grubs and other sugarcane pests. Biopesticide research on the subcontinent is at a relatively early stage, but evolving rapidly, and focusing on indigenous entomopathogens. Quality-control issues and limited large-scale production facilities, investment in domestic fermentation technologies, improved delivery systems, and promotion of biological control through private and public initiative will increase the share of microbial biopesticides in the country.

Neem oil is most commonly used as Biopesticide by number of farmers in Maharashtra, UP, Karnataka, Tamilnadu. With growing awareness about benefits of Neem as a natural pesticide, the estimated 100 crore neem-based pesticide market in the country is growing by 7-9 % annually, says a report by Export Import Bank of India. The report also verifies that the US was the largest importer of neem extracts from India with 2.62 Mn Dollar imports in FY 2011-12. Institutes like Centre for Indian Knowledge Systems, National Innovation Foundation and Neem Foundation are involved in R & D for Biopesticide in India

2. BIO-PESTICIDES

Biopesticides are certain types of pesticides derived from such natural materials as animals, plants (Botanical origin), bacteria, fungi and virus (Microbial Origin) and certain minerals. For exp, Canola oil and Baking Soda have pesticide applications and are considered Biopesticides. Unlike chemical pesticides, which are made from industrial chemicals, bio-pesticides are derived from plant extracts, fungi, bacteria, protozoans and minerals. They are used for crop protection and are found to be benign for both humans and the environment.

"Biological Pesticides" or "Biopesticides" as the name suggests are naturally occurring substances that biologically control harmful pests, especially among field crops. These are naturally produced bio-chemical materials basically non-toxic to the environment (eco-friendly) that can be employed in pest control. Biopesticides could mean living organisms (bacteria, virus and algae), their products (bio-chemicals produced by them) and also plant by-products. Biopesticides are harmless, target specific and biodegradable.

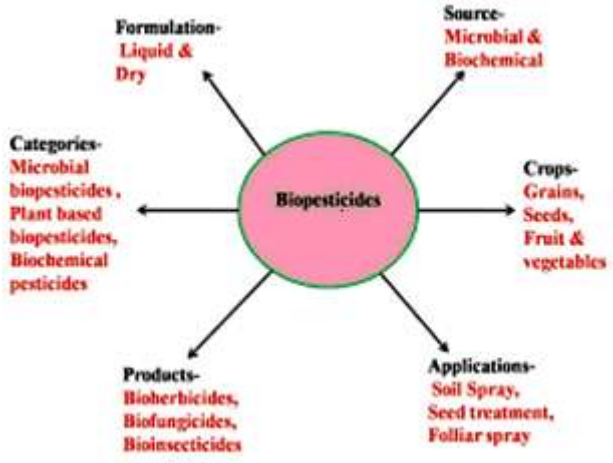

Fig. 4: Bio-Pesticide

When used as a component of Integrated Pest Management (IPM) programs these Biopesticides can greatly minimize the use of conventional pesticides, while crop yields remain high. Biopesticides have the great capability in maintaining the natural diversity without the use of any artificial or synthetic residues. The origin of bio-pesticides can be microbial (bacteria, fungi and virus), herbal (plant extracts) or genetically modified plants (GM), Beauveria spp, Trichoderma spp, and Bacillus spp are some of the microbial Biopesticides. Products made out of Garlic and Neem are used extensively as herbal Biopesticides. Traditionally, GM varieties resistant to particular pests are used in crops e.g. Bt Brinjal and Cotton (Bt Cotton)

There are mainly three categories in Biopesticides –

- Microbial Pesticides - These pesticides originate from micro-organisms such as bacteria, fungi or other protozoan groups. These are mostly target specific organisms that are aimed at killing one or a groupn of pests.

- Biochemical Pesticides - These herbal based substances are naturally produced by a plant or an organism. They are non-toxic and bio-degradable. They help the plant in counter- attacking its pests or producing chemicals that would prevent pest attack on the plant. e.g. Fatty acids, Pheromones.
- Plant Incorporated Protestants - These are genetically modified materials produced by scientists by modifying a protein and introduced into the plant so that it produces its own pesticide.

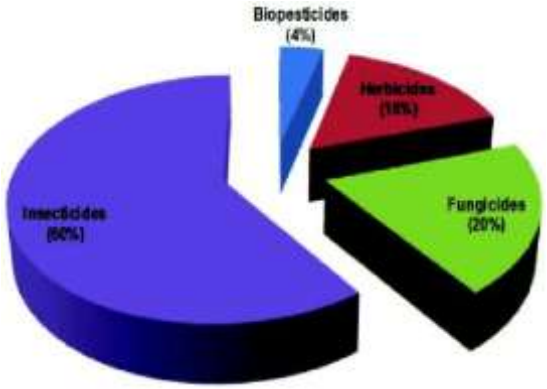

Fig. 5: Bio-pesticide Segmented Product

The India Bio-pesticide Market is Segmented by Product (Bio-herbicides, Bio-insecticides, Bio-fungicides, Other Products), Formulation (Liquid, Dry), Ingredient (Microbial Pesticide, Plant Biopesticide, Biochemical Pesticide), Application (Grains and Cereals, Pulses and Oilseeds, Fruits and Vegetables, Commercial Crops, Turf and Ornamentals).

3. BIOPESTICIDE RESEARCH IN INDIA -

Research work in Biopesticide is mainly funded by Government Department of Biotechnology. The Indian Council of Agricultural Research, Banglore, Indian Institute of Horticulture Research, Hesargatta, Banglore, Central Integrated Pest Management Centre (CIPMC), Banglore, Central Institute for Cotton Research (CICR), Nagpur.

Biopesticide registered in India -

1) Bacillus thuringiensis var. Israelensis
2) Bacillus thuriengiensis var. kurstaki
3) Bacillus thuriengiensis var. galleriae
4) Bacillus sphaericus
5) Trichoderma viridae
6) Trichoderma harzianum
7) Pseudomanas fluoresens

3.1 Why not conventional pesticides (Chemical Pesticides)

The conventional Pesticides which are synthetic or chemical in its nature are produced with the use of synthesized chemical and pose to be harmful to the factors whichever comes into the contact with it. The chemical pesticides are proving to be fatal for human kind, cattles, soil as well as an environment. The chemical pesticides are not target specific. Apart from killing the harmful pest, they also end up destroying plant-friendly organisms such as earthworm, nitrogen fixing bacteria and algae that help plants to suck nutrients from soil, water and air. The chemical pesticides are well known for their role in polluting the environment.

There are many disadvantages associated with the use of chemical pesticides like genetic variations in plant populations, reduction of beneficial species, damage to the environment or water bodies, poisoning of food and health problems such as cancer which makes Biopesticides to come into picture. Their usage reduces risk of exposure to chemicals, reduces water pollution through fertilizer runoff, reduces number of applications, causes less harm to beneficial pests, biodegradable, provides better nutritional quality.

Use of chemical Biopesticides and fertilisers have caused negative impact on environment by affecting soil fertility, water hardness, development of insect resistance, genetic variation in plants, increase in toxic residue through food chain and animal feed thus increasing health problems and many more. This has made it essential to introduce measures which can harness foresaid challenges. Use of Biopesticides and Biofertilizers can play a major role in dealing with these challenges in a sustainable way.

Everyone has experienced the disadvantages of conventional pesticides that had claimed more than 50 ryots in Yavatmal District in Maharashtra (India) whilst spraying it showing the darkside of the chemical or conventional pesticides. In 2005, the DDT traces were isolated from the milk of feeding mother. The traces are

not decomposed and they get involved in the food chain affecting the genome of the living animals including human being.

4. ADVANTAGES OVER SYNTHETIC OR CHEMICAL PESTICIDES

1) Lack of heavy metals - No harmful residues detected in the food chain.
2) Affordability - Can be cheaper than chemical pesticides when locally produced.
3) More effective – Can be more effective than chemical pesticides in the long-term.
4) Environmental hazards – Biodegradable, hence no environmental hazards.
5) Non-toxic - Biopesticides are usually inherently non-toxic nature.
6) Target Specificity - Biopesticides generally affect only the target pest and closely ralated organisms, in contrast to broad sprectum conventional pesticides that may affect organisms as well as birds, insects and mammals.
7) Disposing - Biopesticides often are effective in very small quantities and often decompose quickly, resulting in lower exposures and largely avoiding the pollution problems caused by conventional pesticides.
8) IPM Program - When used as a component of Integrated Pest Management Programs, Biopesticides can greatly reduce the use of conventional pesticides, while crop yield remains high.
9) Safety – We all are well aware about the Yavatmal Dist incidence where more than 50 farmers lost their lives and several others were hospitalized due to the contamination while spraying the Chemical pesticides in the crop field.
10) Soil Fertility - Biopesticides maintains the soil properties keeping up fertile.

5. POPULARITY FOR ORGANIC FARMING IS DRIVING THE MARKET

Organic farming in India has become very popular, acting as the main driver for the Biopesticides market. According to FAO, the country had 1.9 million hectares of land under organic cultivation in 2018, which was 0.2 million hectares more than the previous year. The country had 0.65 million organic producers, producing 1.75 million metric ton of organic food in 2019. Such a vast organic farming industry is fueling the Biopesticides market in India, and it is anticipated to continue in the future.

6. EXPECTED CONTRIBUTIONS OF THE RESEARCH -

1) This research may create and develop awareness among the Entrepreneurs, ryots and common people about benefits to the environment and all the living organisms by using Biopesticides instead of conventional chemical pesticides.
2) This research may help the company or entrepreneur to take any wanted decision about their products. That is which product is running high in the market and which product do not have any demand.
3) This research may help the company to take decision about that particular product which do not have any demand or less demand whether to be manufactured and be circulated in the market or not.
4) The research will help to maintain the health of crop through the use of Plant Growth Regulators.
5) Based on the Research, the Entrepreneurs could be helped and motivated in establishment of production unit of Biopesticides as well as developing effective marketing channel.
6) The research, as Biopesticides being eco-friendly could make ryots aware about the environment by using Biopesticides instead of conventional chemical pesticides.
7) Based on the research, new production techniques, promotion strategies could be suggested to the new as well as existing companies.

7. CONCLUSION -

The use of Biopesticides to achieve the Government's mission to double the farmer's income from agriculture by minimizing the investment in the process to yield the high quantum of crop, and hence the young Entrepreneurs can grab this opportunity by setting up their business to manufacture and market the Biopesticides.

8. REFERENCE AND COURTESY:-

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