BIO-PESTICIDES: A STUDY ON CURRENT MARKET STATUS, FARMERS' PERCEPTION, AND FUTURE PROSPECTIVES IN PURI DISTRICT

A Thesis submitted to the Odisha University of Agriculture and Technology in Partial fulfillment of the Requirement for the degree of Master of Business Administration in Agribusiness Management

By

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This is to certify that the thesis entitled "BIO-PESTICIDES: A STUDY ON CURRENT MARKET STATUS, FARMERS' PERCEPTION, AND FUTURE PROSPECTIVES IN PURI DISTRICT" submitted in partial fulfillment of the requirements for the award of the degree of Master of Business Administration in Agribusiness Management to the Odisha University of Agriculture and Technology is a faithful record of bonafide and original research work carried out by Sipra Subhadarshini under my guidance and supervision. No part of this thesis has been submitted for any other degree or diploma.

It is further certified that the assistance and help received by him/her from various sources during the course of investigation has been duly acknowledged.

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This is to certify that the thesis entitled "BIO-PESTICIDES: A STUDY ON CURRENT MARKET STATUS, FARMERS' PERCEPTION, AND FUTURE PROSPECTIVES IN PURI DISTRICT" submitted by Sipra Subhadarshini to the Odisha University of Agriculture and Technology, Bhubaneswar in partial fulfillment of the requirements for the degree of Master of Business Administration (Agribusiness management) has been approved/disapproved by the student's advisory committee and the external examiner.

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DECLARATION

I hereby declare that this thesis entitled, "BIO-PESTICIDES: A STUDY ON CURRENT MARKET STATUS, FARMERS' PERCEPTION, AND FUTURE PROSPECTIVES IN PURI DISTRICT" being submitted to the Department of Agribusiness Management, Centre for Post Graduate Studies, Odisha University of Agriculture & Technology, Bhubaneswar, is my own work to the best of my knowledge and belief and it contains no materials previously published or written anywhere for the award of any other degree or diploma of the university or other institute of higher learning, any time before.

Sipra Subhadarshini

ACKNOWLEDGEMENT

First of all, I am thankful to the Almighty for showering His blessings for the successful completion of my project work.

I would like to express my gratitude towards Bionic Properties Private Limited for providing me this golden opportunity for the successful completion of my thesis. I would like to thank Mr. Srikant Kumar Jena, Director of Bionic Properties Private Limited, Bhubaneswar. Without his assistance and kind support, this paper would have never been accomplished. I express my deepest thanks to Mr. Bipin Kumar Satapathy, senior Sales Officer of the Company, for taking part in useful decision & giving necessary advice and guidance. The internship opportunity I had with Bionic Properties Private Limited was a great chance for learning and professional development.

It's my proud privilege to express my deep sense of gratitude and special thanks to my research advisor Prof. Mr. Pandaba Charan Munda, PGDM(ABM), MANAGE, Hyderabad, for his supervision, constant support, and suggestion in each and every step for the successful completion of this study.

I also thank our Head of the Department of Agribusiness Management, Dr. Samarendra Mohapatra, PGDM, XIM, Bhubaneswar, for his guidance and support as and when required for preparing the project report.

I would like to thank Dr. Debdutt Behura, Assistant Professor, M.Sc(Agriculture), Ph.D, for his kind support during the preparation of this thesis report.

Finally, I must express my profound gratitude to my parents, seniors, and friends for providing me with unfailing support and continuous encouragement throughout my course of study and through the process of researching and writing this thesis. This accomplishment would not have been possible without them.

Sipra Subhadarshini

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ABSTRACT

Our agricultural crops are vulnerable to attack of various pests like bacteria, fungi, weeds, and insects, leading to reduced yield and poor quality of the produce. Generally, Synthetic Pesticides are highly effective against various pest control because they act on a broad and wide range of hosts but their negative impacts badly affect the environment and the overall sustainability of the farming systems.

Bio-pesticides are regarded as the safe, economic, and eco-friendly alternatives to chemical or synthetic pesticides because these are mainly derived from animals, plants, and other natural living beings such as fungi, bacteria, algae, viruses, nematodes, and protozoa. And all these factors help increase its application in pest management to some extent throughout the world. The research and development in bio-pesticides application are very much in reducing the environmental pollution caused by the chemical synthetic pesticide residues and promotes sustainable development of agriculture. Till the year 2020, a large number of products of bio-pesticides have been registered and released, some of which have played a leading role in the agriculture market in India. Some indigenous plants like Neem, Garlic, Triphala, Pinus, Kesia, *Cymbopogon*, etc., can easily be processed and used for insect-pest management. Some other microbial bio-pesticides like *BT, NPV, Trichoderma, Pseudomonas,* etc. have already registered and are being practiced by farmers as well as Govt. and private organizations. According to the 'state/UTs zonal conference on inputs (plant protection) for rabi and kharif seasons', in 2017-18, demand of bio-pesticides in Odisha was 315 MT, whereas it increased to some extent during 2019-20 to 333MT but reduced 19.81% to 267MT due to the hit of COVID-19 pandemic. Though the consumption pattern of bio-pesticides is still varying (sometimes increasing, sometimes decreasing), it accounts for about 1.90% of total bio-pesticides consumption in India while that of chemical pesticides covers 1.86%. And it shows the growing demand of bio-pesticides among people of Odisha.

This research was conducted to know the current market status and future trends of bio-pesticides, and its efficacy from farmers' point of view in Nimapada block of Puri district of Odisha. To fulfill the stated specific objectives, various type of primary information were collected from sample farmers and dealers. A questionnaire was prepared for both dealers and farmers. The selected farmers and dealers were interviewed with the help of pretested questionnaire schedule for preferred bio-pesticide.

Exploration of new source of bio-pesticides and formulations along with large investment in this sector and awareness among farmers are very much required for the sustainable crop production in different parts of Odisha**.** The problem of toxicity of chemical pesticides, popularity for organic farming, environmental, soil, and health concerns, are the prime drivers of the markets. Less awareness among the farmers, lack of Government initiatives, and the high prices of the bio-pesticides in the market are the key market restraints.

CHAPTER 1

INTRODUCTION

1. INTRODUCTION

1.1 BACKGROUND STUDY

Agriculture plays a vital role in a developing state like Odisha. Apart from fulfilling the food requirement of the growing population, it also plays a role in improving economy of the state. Currently, a small segment, the bio-pesticides market is developing in our state, though with a slow rate as compared to other states, owing to government support and increasing awareness about the use of non-toxic, environment-friendly pesticides.

Agriculture and plant territories contributed higher amount to maintain ecological, social, economic system, but by the application of conventional pesticides insects become resistance to them and encompasses many chemical substances which would bio magnify time respectively. Insects are small in size, but in large quantity they became detrimental and contributed major insecticidal effect. In Odisha, around 70% of population directly dependent on agricultural activities and remain indirectly involved in easily pest affected food industries, forestry, poultry, dairy and many other agribusinesses. Farmers and many food product manufacturing companies use synthetic chemicals to produce, process and preserve the food & crops to enhancing the crop production. Also, local farmers always use high doses of conventional pesticides in crop fields to get higher field products and these chemical pesticides are responsible to acute and chronic toxicity. This became the key factor for lot of diseases like lung, prostate, skin, throat, breast cancers, leukemia, lung diseases, respiratory problems, reproductive problems, hypertension and skin disorders.

Over consumption of the synthetic pesticides and their adverse effect on human, animal and environmental health, has made it a global concern. To inhibit their lethal properties there is a need of organic or bio-pesticides which are not only sustainable, healthy and immuno-protected but also of low cost, pest specific, non-toxic, ecologically safe, and reducible. As of late, the utilization of bio-pesticides is acquiring momentum since they can be proficiently utilized in sustainable agrarian practices. Bio-pesticides are profoundly viable in modest quantities and decay rapidly without leaving risky buildups and subsequently can lessen the utilization of customary pesticides as a fundamental part of IPM programs. In any case, regardless of the benefits of utilizing bio-pesticides, their utilization has not been just about as boundless true to form, for the following reasons:

- Significant expense of pesticide creation because of the costs engaged with screening, creating, and getting administrative freedom for new organic specialists;
- Short time frame of realistic usability because of the affect-ability of bio-pesticides to changes in temperature and dampness;
- Restricted field adequacy due to climatic/local varieties in temperature, moistness, soil conditions, and so on; because of the great explicitness of the bio-pesticides, i.e., they are just viable against target microorganisms and bugs, ranchers are uninvolved in them. They need to utilize various organic specialists to control various microbes and irritations in the field. These specialists are befuddling, exorbitant, and unwieldy, and are likewise not accessible for each vermin or microorganism.

Therefore, Govt. Of Odisha is taking necessary steps to increase the market share bio-pesticides in all districts and has to make farmers as well as retailers and industries more aware about the eco-friendly and economic aspects of bio-pesticides.

1.2. Problem statement

The improvement of conventional or synthetic pesticide items is costly. A common engineered item producing process requires broad R&D exercises and needs to go through administrative endorsements instead of bio-pesticides that are somewhat more affordable and have fast improvement processes. Because of its cost-effectiveness, more modest organizations/new companies are wandering into this market with limited research financial plans. This has prompted exceptional rivalry for the central parts in the agrarian biological market. As per secondary sources, beginning around 1960, there was a consistent expansion in chemical pesticides as a result of increasing R&D ventures, because of which there was a surge in the introduction of the same between the 1980s and 1990s. In any case, the same has diminished throughout the most recent twenty years. This shows that the key companies are moving towards sustainable pest control solutions. In the view of the above facts, this present study is taken for the specific following objectives**:-**

- To study the current market status of bio-pesticides
- To study the market competition/ market players of bio-pesticides
- To study farmers' perception regarding the use of bio-pesticides
- SWOT analysis
- To study the future prospects of bio-pesticides market

1.3 Hypotheses

For any research problem it is important to set relevant hypotheses that can be tested and which would facilitate for significant economic analysis and interpretation of the results. The following hypotheses were formulated for the present study.

1) The Performance of the bio pesticides is positively related to its efficiency and marketing.

2) There is significant impact of price, brand, and efficiency of product, and place of product availability on marketing of bio-pesticides.

3) There is significant impact of use of bio-pesticides on farmers' income.

CHAPTER 2

COMPANY PROFILE

2. COMPANY PROFILE

2.1 ABOUT BIONIC PROPERTIES PVT. LTD.

Bionic Properties Pvt. Ltd. Established in the year 2012, is one of the leading manufacturers and traders of wide range of bio-organic products. It is one of the leading manufacturers of NEEM CAKE. The main feature of these products are non-toxic, pure, hygienic, non-hazardous, no side effects, and environmentally safe.

The company is registered under MSME and it offers entire range of products as per the prevailing trends and standard of the industry. The products are widely used in agriculture and horticulture sector for different purposes. The main competitive advantage of the company is total security control policy and good financial position.

2.2 MANAGEMNET

The company is certified under ISO 9001: 2015 by Central Insecticide Board (CIB), Faridabad. It is currently operating or functioning at Kantabada, Chandaka, Bhubaneswar. The managerial hierarchy of the company is given below.

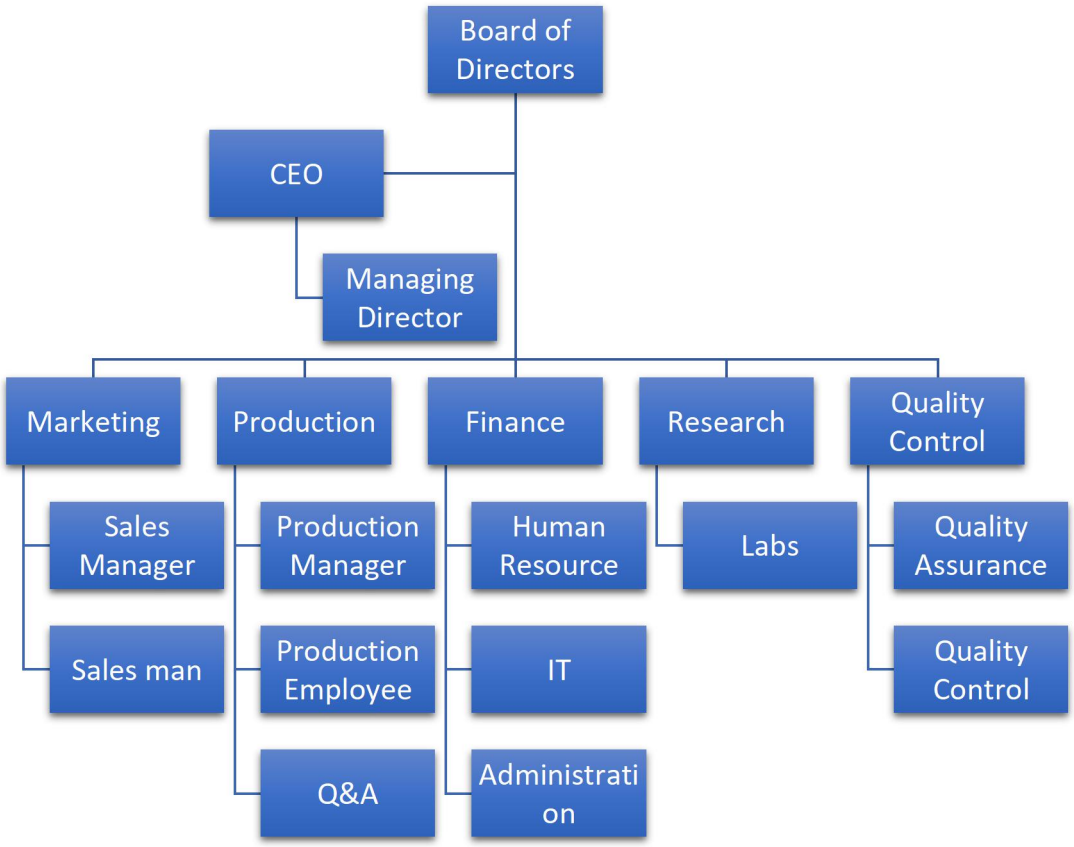

Fig: 2.1 Organizational Structure of Bionic Properties Pvt Ltd

The company has following units:-

- **Production house** where wide range of organic products such as fertilizers, pesticides, plant growth regulators, vermicompost/ organic manures, organic granules, vitamins, organic NPK, stickers and activators, etc. are being prepared.
- **Laboratory unit-** for testing and verification of the composition of each manufactured products for effective results.
- **Purchasing unit –** it maintains the record of all the purchased raw materials, its safe and secure procurement till it reach to the manufacturing or production unit. It also maintains good relationship with the partner agencies for smooth operation of procurement process.
- **Stocking point / go down–** It is the area of supply chain including the number of stock holding locations, their location, and the level of inventory held at each.
- **Distribution point-** it is the unit where all the products are kept post-production, maintains the books of record of all inventory and smooth disbursal of products to the destination.

2.3 VISION OF THE COMPANY

The vision o the company guides every aspects of its business by describing what it needs to accomplish in order to continue achieving sustainable quality growth. To be a world-class manufacturer of Bio-agric extracts which are effective, non-toxic, eco-friendly, and cost-effective through state-of-the-art technology backed by ongoing research and development activities.

2.4 GO ORGANIC

NEEM was called as 'Sarva Roga Nirvarini' in Vedas, but the traditional use of it was regarded as backward which led to abandonment of these ecological sound practices in favor of modern chemical products.

"Happily modern society today, finding themselves confounded in the web of their creation, are willing to revert the nature for remedies" (Govt. Of India, 1996).

2.5 PRODUCTS' DETAIL:

Bionic India deals with a wide range of organic crop protection chemicals details of which is given below:-

Table 2.1: Details of organic crop protection chemicals of BPPL

SL. NO.	PRODUCT NAME	PRODUCT TYPE	DESCRIPTION
1.	Bionic star	Growth regulator	A new generation Organic growth. Quick result and better fruit setting in all fruits and vegetables like chili, cotton, tomato, and paddy.
2.	Spyder	Bio-pesticide	A research organic product of Bionic. Controls varied pests like red mites, aphids, thrips, etc. in all crops
3.	Killer	Bio-pesticide	Most popular bio-larvicide, effective against all vegetables and field crops.
4.	Biomyth	Bio-pesticide	Most popular biological miticide
5.	Eraser	Bio-pesticide	A bio-fungicide, effective against all vegetables and field crops.
6.	Bionic super	Bio-fertilizer	Bio-organic granules
7.	Bio-gibb	Plant growth regulators	Gibberlic acid, Used with organic manure
8.	Samrudhi	Organic fertilizer	Bio-organic balls, helps in better root development.

9.	Heliostar	Bio-pesticide	An Organic larvicide, effective against all vegetables and field crops.
10.	B 1	Bio-fertilizer	Humic-amino-pulvic shiny granules, a biotech research innovation in organic nutrition, based on naturally occurring nutrients.
11.	URBERA	Bio-fertilizer	Organic NPK, micro-nutrient
12.	Bhumi	Vermicompost	Organic compost is converted into compost using earthworms.
13.	Biogrow	Nutritive agent	A single product with multiple effect on crops.
14.	Bio-neem	Bio-pesticide	Neem herbal oil such as emulsified neem oil, neem kernel oil, and neem oil.
15.	Neemba / neem cake	Bio-fertilizer	Contains 100% natural NPK, protects roots from nematodes, soil grabs, white ants, and other plant diseases
16.	ACTIV	Activator and spreader	Used with pesticides, growth promoters, and fertilizers
17.	Bionic magic	Plant growth regulator	For the development of plants
18.	Booster PGR	Plant Growth Regulator	Help development of plants
19.	Bionic Gold	Bio-fertilizer	Organic Granules, helps in better root development, uswful in all types of vegetables, fruits, flowers, nursery plants, field crop and horticultural crops .

CHAPTER 3

BIO-PESTICIDE & THE MARKET

3.1 WHAT IS BIO-PESTICIDE?

Bio-pesticides are mainly derived from plants, animals, bacteria, fungi, minerals, and other natural materials to destroy or kill the host specific target insect-pests. These are biological agents controlling the weeds, insects, crop pests, fungi, bacteria, virus, rodents, etc. with their biological mode of action. The phyto-chemicals and microbial products or byproducts (semi chemicals) derived from the plants such as *Azadirachta*, *Datura*, Eucalyptus, etc. are used to inhibit the effect of target organisms by their non-toxic methods.

Table 3.1:- Bio-pesticides Registered under Insecticides Act, 1968-

Under the Insecticide Act, 1968, only 12 types of bio-pesticides have been registered in India, the list of the same is given in the **table 3.1**. Neem based pesticides, *Bacillus thuringensis* (B.T.), NPV and *Trichoderma* are the major bio-pesticides produced and used in India. Besides this, more than 190 synthetic pesticides are registered till now for use. Transgenic plants and other beneficial organisms, which are called as bio-agents, are also used for pest management in India.

Sl. No.	Name of bio-pesticides
1.	*Bacillus thuringiensis var. israelensis*
2.	*Bacillus thuringiensis var. kurstaki*
3.	*Bacillus thuringiensis var. galleriae*
4.	*Bacillus sphaericus*
5.	*Trichoderma viride*
6.	*Trichoderma harzianum*
7.	*Pseudomonas fluoresens*
8.	*Beauveria bassiana*
9.	NPV of *Helicoverpa armigera*
10.	NPV of *Spodoptera litura*

11.	Neem based pesticides
12.	Cymbopogon

3.2. Adoption of Bio-pesticides Available from Plants

3.2.1 Plant products

Use of botanical pesticides is currently arising as one of the significant means to be used in protection of crop produce and the environment from pesticide pollution, which is a worldwide problem.

Table 3.2 : Plant products registered as bio-pesticides

Plant products used as bio-pesticide	Target pests
Limonene and Linalool	Fleas, aphids and mites.
Neem	Wide variety of sucking and chewing insects.
Pyrethrum / Pyrethrins	Ants, aphids, roaches, fleas, and flies.
Rotenone	Leaf-feeding insects, as well as fleas and lice on animals.
Ryania	Caterpillars and thrips.
Sabadilla	Thrips, caterpillars, leaf hoppers, and bugs.

Neem is regarded as the most effective and eco-friendly plant product which is effective against many insect pests. It can be a very effective source in Odisha also, where its production is an easy job.

3.2.2 Vrikshayurveda

Vrikshayurveda is ancient Indian knowledge of plant life, used to protect a large number of crop plants with seed treatment, plant propagation techniques along with pest management and prevention measures to generate pest resistance for healthy and sustainable crop production. For an instance:- Extracts of plants like neem, garlic, onion, turmeric, ginger, tobacco, papaya, tulsi, aloe, C*alotropis* etc. have been effectively used for curing plant diseases (tested by "Centre for Indian Knowledge Systems, India).

Table 3.3: Potential Bio-pesticides (from plant extract)

Plant extract	**Effective against**
Adathoda vasica and Pudina/mentha oil,	Leaf folder, storage grain pests of cereals and pulses
Extracts of *Andrographis* and Sida	Mosquito, Aphids and borers in brinjal, ladies finger
Neem seed extract for all crops	Leaf folder, aphids, fruit borer and stem borer
Garlic spray	Housefly, sucking pests, caterpillars, BPH, hoppers.

3.3 Bio-pesticide market segmentation

Bio-pesticides are an important ingredient of Integrated Pest Management (IPM) packages due to their 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 or virus), herbal (plant extracts) or genetically modified plants (GM).

The Environmental Protection Agency (EPA) separates bio-pesticides into three major classes based on the type of active ingredients used, I.e., biochemical, plant-incorporated chemicals, and microbial pesticides. Microbial Pesticides are originated from micro-organisms such as bacteria, fungi, virus, and other microbes. These are mostly target-specific organisms that are aimed at killing one or a group of pests (e.g., a bacterium, fungus, virus or protozoan). *Beauveria spp., Trichoderma spp., Bacillus spp*.,etc. are some of the microbial bio-pesticides. Products made out of garlic and neem are mainly called as herbal bio-pesticides. Biochemical Pesticides are herbal-based substances and are naturally produced by a plant or an organism. They are non-toxic and biodegradable. Examples are

fatty acids, pheromones. Plant Incorporated Chemicals are genetically modified chemical materials produced by scientists by modifying a protein which are introduced or incorporated into the desired plant so that it can produce its own pesticide. For example, in case of *Bacillus thuringenesis protein gene is* introduced into the plant's own genetic material. Then the plant, instead of the Bt bacterium, produces the insecticidal substance which destroys the target pest. The bio-pesticides market is segmented as follows:

Table 3.4: Market segmentation of Bio-pesticides

By Type	By Source	By Formulation	By Mode of Action
1. Bio-fungicide *Trichoderma viride,* *Trichoderma harzianum,* Others(Other microbials and plant extracts) **2. Bio-insecticide** *Beauveria bassiana,* *Bacillus thuringiensis,* *Metarhizium anisopliae,* *Verticillium lecanii*, Others (*Paecilomyces fumosoroseus, Azadirachtin,* and *Aspergillus Flavus)* **3. Bio-nematicides** *Bacillus firmus,*	Plant extracts, Microbials, Beneficial insects	**1. Dry** Wettable powders, Dry granules, and Water dispersible granules **2. Liquid** Suspension concentrates, Soluble liquid concentrates, and Emulsifiable concentrates	Bio-pesticides for Soil treatment, Foliar Spray, Post-harvest & Seed treatment

Paecilomyces lilacinus, Others (Other microbials and plant extracts) **4. <u>Others</u>** (bio-herbicides, bio-molluscicides, bio-acaricides, and bio-rodenticides)			

3.4 Market status of bio-pesticides in Odisha

This research paper includes market scenario of bio-pesticides regarding its demand and consumption amount which confines brief specifications about the number of consumers or buyers desire the product and amount of products that are actually being purchased or consumed respectively in a particular period of time. As the bio-pesticide market of Odisha is growing at a rapid pace, still there are many impediments for which its demand and consumption are much more lower than that of chemical pesticides.

According to the report of Directorate of Plant Protection Quarantine and Storage, Govt. Of India, demand of bio-pesticides in all states/UTs of India in 2019-20 was 10,852MT and in 2020-21, it was 11,054MT, out of which demand of Odisha was 3.06% I.e. 333MT and 2.41% I.e. 267MT respectively. On the other hand, consumption of bio-pesticide in all states/UTs of India in 2019-20 was 8847MT and in 2020-21 was 8645MT, and that of Odisha was 333MT I.e. 3.76% and 165MT I.e. 1.90%.

The below data given in **fig 3.1** from 'state/UTs zonal conferences on inputs (plant protections) for rabi and kharif seasons' shows the demand and consumption of bio-pesticides in Odisha in last five years.

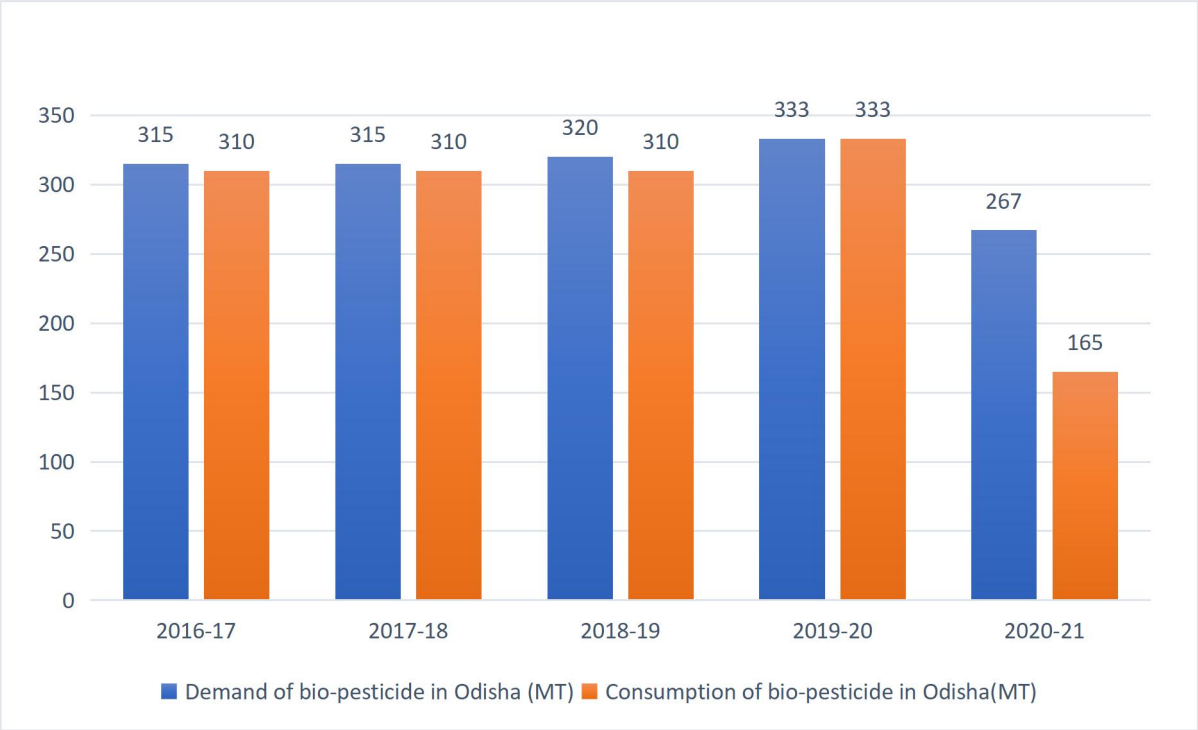

Fig 3.1: Demand and consumption of Bio-pesticides(MT) in Odisha in the last five years

CHAPTER 4

REVIEW OF LITERATURE

REVIEW OF LITERATURE

This chapter presents a brief review of the literature on the current research problem. Review of Literature helps the researcher to find the best ideas regarding the design of appropriate samples and the preparation of a structured discussion schedule to find the best solution to the research problem. Therefore, an attempt was made to review various methods used in previous studies to clarify the concepts used and accepted in the current study. The texts available in the current study are provided below.

Menn and Hall (1999) ; Copping and Menn (2000) ; Chandrasekaran *et al*. (2012) ; Senthil- Nathan (2013) reported that farmers' are likely to adopt bio-pesticides with the recent trend of "organically produced food" and effective introduction of "biologically based products" with a wide range of biological activities against important target pests.

Acoording to the other research and studies of Copping and Menn (2000) ; Senthil-Nathan (2006) ; Senthil- Nathan *et al*. (2006) (2009), Insecticides from microorganisms are produced or manufactured successfully after many research and developments in developing countries, and they have possessed to develop the resources of bio-pesticide in protecting crops from those specific pests. This process of utilization of bio-pesticide would be required to check the resistance development tendency in target insect pests to synthetic chemical pesticides and moreover toxins from bio-pesticides.

Copping and Menn (2000) reported that bio-pesticides have been gaining attention and interest among the public or farmers due to the environment friendly and safe integrated crop management (ICM)- a compatible approach and tactic for pest control.

According to Mazid *et al*. (2011), Bio-pesticides are derived from naturally occurring living organisms such as animals, plants, and microorganisms (e.g., bacteria, fungi, and viruses) that can control target insect pests by their eco-friendly mode of actions, that's why its importance is increasing all over the world. Bio-pesticides and their by-products are mainly utilized for the management and effective control of harmful pests.

Glare *et al. (*2012) reported that The transition from a research project to the realization of the product requires expertise in various fields. There is a need for coordination of bio-pesticide research leading to 'bio-pesticide innovation chains' and/or centralization to research, develop, and deliver bio-pesticides. Bio-pesticide development, as with all other research and development efforts, requires skilled human resources, adequate physical

infrastructure and the association with one or more small and medium enterprises to provide input at the early stages of research, and through-out the development process, to ensure that developed products have potential for commercialization.

Kumar (2012) ; Senthil-Nathan (2013) reported that bio-pesticides do not leave any toxic residue, which is a important factor for consumers, mainly of fruits and vegetables, to adopt bio-pesticide as a safe alternative. When these are used to control insect pests, the efficiency of bio-pesticides can be equal to that of synthetic pesticides, particularly for crops like fruits, vegetables, flowers, and field crops.

Olson (2015) noted that The bio-pesticides market is rapidly expanding due to factors related to: greater environmental and health awareness, sustainability, regulatory pressure and retailer demands. In the past, bio-pesticides were produced exclusively by small local or regional companies who struggled to navigate the laborious regulatory process and hence were unable to grow their market share.

Boyette & Hoagland (2015) reported that Commercial development of bio-herbicides majorly depends on the feasibility of mass production of a living, pathogenic and genetically stable propagules such as microbial spores, fragments, or pellets.

Radhakrishnan *et al. (*2018) noted that, at present, only a few bio-herbicides are successful in the market and this is mainly because of various challenges including limited host-specificity, incorrect formulation, and lack of field persistence. Strategies such as extending or increasing the number of host, developing and improving the formulation, field persistence, enhancing the suppressive nature of weeds, and incorporating advanced research and techniques are very much needed to make bio-herbicides a significant as well as sustainable weed control agent.

Damalas & Koutrobas (2018) suggested that Risk assessment is a key requirement for registration of bio-pesticides. However, even though this assessment should be done through scientific evidence-based processes, submission procedures in some countries are unnecessarily lengthy. Tailoring of registration requirements to facilitate effective assessment of bio-pesticide active substances is therefore required. The high cost related to the registration of new agents is another factor hindering the registration of bio-pesticides.

CHAPTER 5

MATERIALS AND METHODS

5. MATERIALS AND METHODS

Methodos adopted for selection of study area, sample design, sample selection, etc. are discussed below. The study was based on the primary and secondary data. Primary data was collected from Retailers and farmers through interview schedule and Secondary data were collected from different journals, research papers, annual report of

The methods employed are presented below.

1. The study area

2. Sample design

3. Nature and collection of data

4. Method of analysis

5.1 The study area

The present study was confined to Puri district, Odisha. Puri district comprises of 11 blocks. Out of these, Nimapada block was selected for the study area.

5.2 Sample design

Company: Bionic Properties Private Limited

Number of selected farmers:

I. Small farmer (up to 2 ha): 27

II. Medium farmer (2 to 5 ha): 21

III. Large farmer (above 5 ha): 12

Total: 60

Table 5.1 - Name of selected villages:

Sl no.	Name of selected villages	No. Of farmers selected from each village
1.	Ratilo	10

2.	Balanga	10
3.	Haripur	10
4.	Bhanapur	10
5.	Khelar	10
6.	Sagada	10
	Total	**60**

Table 5.1 shows the number of farmers selected from six villages of Nimapada block. Total six villages were selected namely Ratilo, Balanga, Haripur, Bhanapur, Khelar, and Sagada. 10 number of farmers from each villages were selected randomly for the data collection. Total 60 farmers are categorized into three-size of group like small (up to 2 ha), medium (2-5ha) and large (above 5 ha). Out of them, 27 are small farmers, 21 are medium, and 12 are large farmers.

5.3 Nature and collection of data:

To fulfill the stated specific objective, various type of primary information was collected from sample farmers regarding their basic information, crops grown, land covered, and crop protection chemicals used etc. and from distributors regarding their sale, % share, and sale promotional activities at block and village level. The company wise quantity of bio-pesticides sold in Nimapada block was also collected from distributors. On the basis of information top five companies in case of bio-pesticide was determined by calculating the percent share to total sales.

5.4 Method of analysis:

Both primary and secondary source of data have been used in preparing the report. A questionnaire was prepared for both distributors and farmers. The company wise sales' figure was taken from distributors in study area. The selected farmers were interviewed with the help of pre-tested questionnaire schedule for preferred bio-pesticide.

All the collected data were put in the excel sheet and the univarietal analysis was done for each section of questionnaire. Simple arithmetic tools such as percentage, average have been used for evaluating market share and impact assessment.

CHAPTER 6

RESULT ANALYSIS AND DISCUSSION

6. RESULT ANALYSIS AND DISCUSSION

6.1 RESULT ANALYSIS

This chapter deals with the uni-varietal analysis of the data collected from both dealers and farmers in the field survey. On the basis of collected data, result and conclusion has been drawn in light of the objectives of the study under following heads.

Table 6.1 Major Dealers of Bio-pesticide and their turnover in Nimapada block

Sl no.	Dealer firms	Total turnover per year (lakhs)	Turnover from bio-pesticides (Rs.)	Share of bio-pesticide sale (%)	No. Of retailers (if any)
1.	Balanga (1)	7	1	14.28	6
2.	Balanga (2)	8	1.5	14.75	6
3.	Bhanapur	7	1.8	40	5
4.	Ratilo	9	1.5	16.67	7
5.	Khelar	6.2	1	16.12	6
6.	Haripur	9.5	2	21.05	8
	Total	**46.7**	**8.8**	**18.84%**	

Table 6.1 inferred that out of the total turnovers generated by these dealer firms annually, bio-pesticides covers around 18.84% with approximate value of 8.8lakhs which includes many bio-pesticide companies.

Fig 6.1: Total Turnover (lakhs) per annum

Fig 6.1 indicates that total annual turnover of the dealer of Haripur was higher among than the other five dealers of Nimapada Block which was around 9.5lakhs. Besides this, the dealers of Ratilo and Balanga (2) had the second highest and third highest turnover annually I.e. 9lakhs and 8lakhs respectively. This data shows that in Haripur village, there were more key customers of agriculture inputs such as seeds, fertilizers, and pesticides than other five villages.

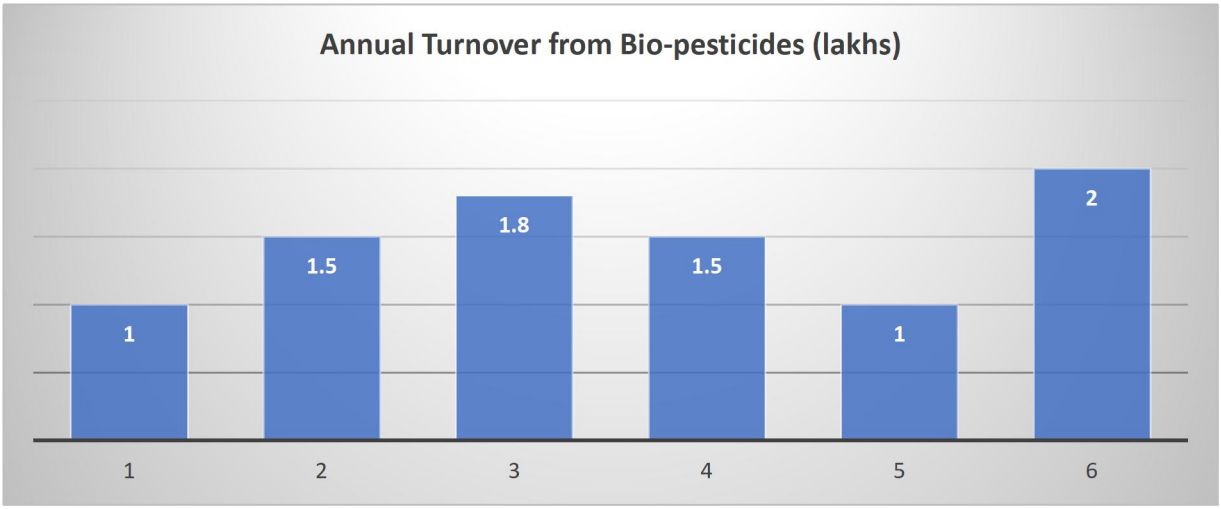

Fig 6.2: Annual Turnover from Bio-pesticides (lakhs)

Fig 6.2 shows the total annual turnover earned by the individual dealers only from bio-pesticides in lakhs which indicates that dealer of Haripur village was earning higher income from bio-pesticides I.e. 2lakhs per annum followed by the dealer of Bhanapur followed by the dealers of Balanga(2) and Ratilo, i.e. 1.8lakhs and 1.5lakhs respectively.

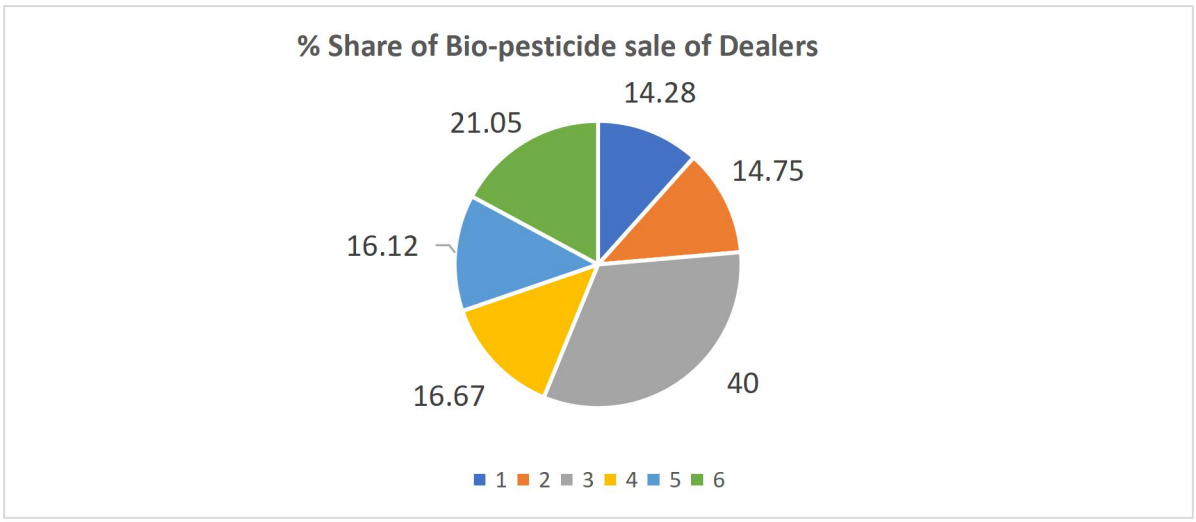

Fig 6.3: % Share of Bio-pesticide sale of Dealers

Fig 6.3 indicates that the average annual turnover from bio-pesticides generated by the dealers is how much percentage of their total average annual turnover from all the products. Out of the six surveyed firms, dealer of Bhanapur had the maximum contribution towards the marketing of bio-pesticides of different companies in Nimapada Block followed by the dealer of Haripur, and the dealer of Ratilo, I.e**.** 40%, 21.05%, and 16.67% respectively. After the questionnaire survey with dealers, five major players of bio-pesticides according to the dealers are listed below.

Top five companies selected from Nimapada block:

1. Crimson organics pvt ltd
2. Bionic India pvt ltd
3. Atul biotech
4. Multiplex agrochemical
5. Focus biotech

Table 6.2: Major Players of Bio-pesticide and their turnover in Nimapada block

Sl. No.	Name of Company	Total average turnover from each company (Rs.)	Turnover from bio-pesticide (Rs.)	Share of bio-pesticides (%)	Rank
1.	**Bionic India**	37,500	19,166.67	51.00	II
2.	**Focus Biotech**	25333.3	11,000	43.42	V
3.	**Multiplex**	38,333.3	23,333.3	60.08	I
4.	**Atul Biotech**	19,833.3	6583.3	33.19	IV
5.	**Crimson**	28.833.3	14,083.3	48.84	III
	Total	**150333.3**	**74,166.67**		

Table 6.2 shows the top five companies that were selected for study for the collection of primary data regarding their sale of bio-pesticides from each retail firms. It gives the detail information regarding the total average turnover from the above companies earned by the selected dealers, turnover generated only from bio-pesticides, and the percentage share of bio-pesticides sold or marketed by those dealers. This data also shows that the total turnover earned by the dealers of Nimapada block from bio-pesticide in a year was around **Rs.**

74,166.67, which is calculated to be 49.33% or approximately 50% of their total average turnover earned in a year from all the products. It indicates the increase in marketing of organic pesticides in the block though all the farmers don't have awareness and proper information at proper time, and they have lack of economic and support services. Other sections of the table is explained in detail in the following graphs.

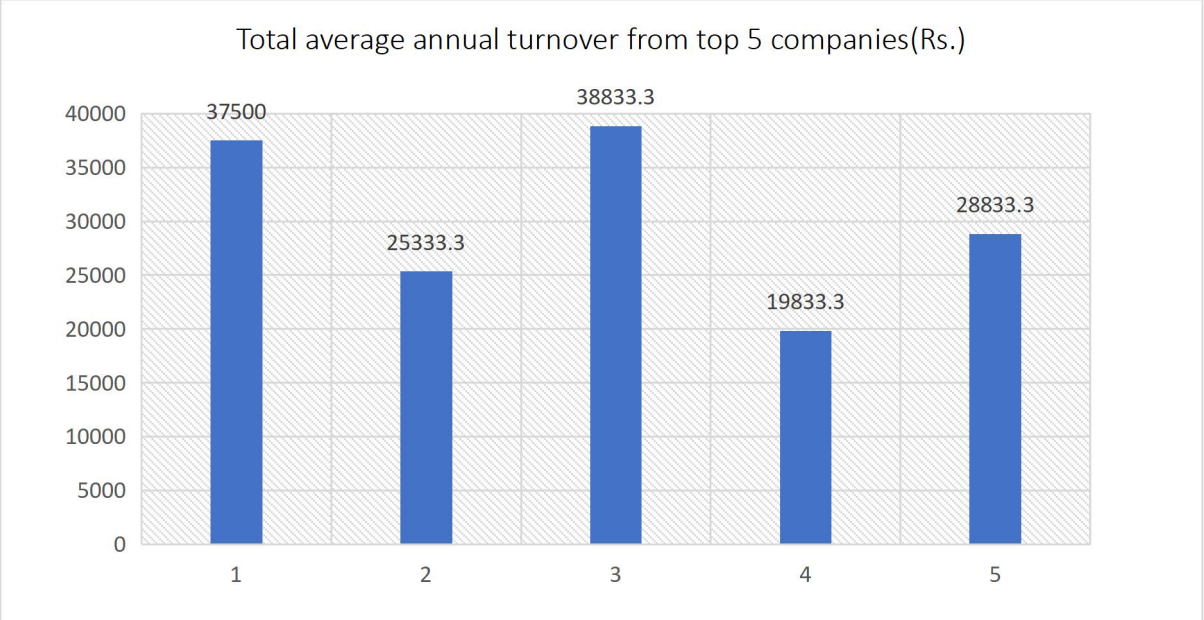

Fig 6.4: Total Average annual turnover from top 5 companies

Fig 6.4 shows the total average turnover generated annually by each dealer from all the inputs supplied by these top five bio-pesticide companies and this indicates that the total average annual turnover generated from Multiplex company was the highest I.e. Rs. 38,333.3, among other selected companies. The second highest average annual turnover was being generated from Bionic India company I.e. Rs. 37,500 followed by Crimson Organics Company I.e. Rs. 28,833.3

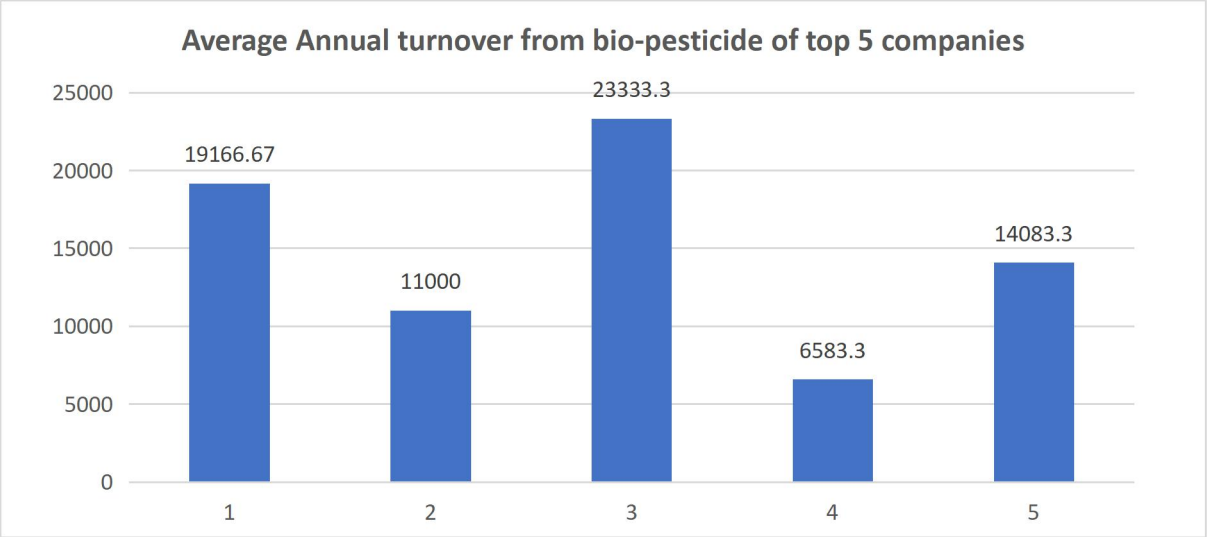

Fig 6.5 Average annual turnover from bio-pesticide of top 5 companies

Fig 6.5 shows the average annual turnover from bio-pesticides of Multiplex agrochemical was the highest among other four companies. According to the data collected, the top three companies from where the dealers were earning higher turnovers from bio-pesticides, are Multiplex Agrochemical, Bionic India, and Crimson Organics with Rs. 23,333.3, Rs. 19,166.67, and Rs. 14,083.3 of annual turnover respectively.

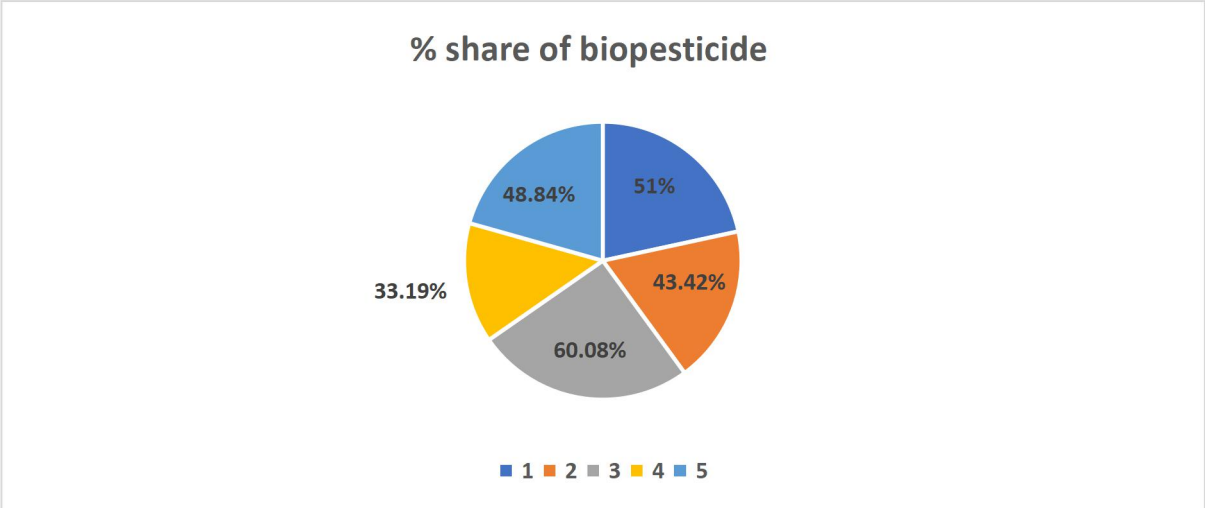

Fig 6.6 Percentage share of bio-pesticide by the top five companies

Percentage share of bio-pesticide is the average annual turnover from bio-pesticides of each companies is how much percent of total average turnover generated through these companies' all products. **Fig 6.6** indicates that Multiplex agrochemical gives the largest share of turnover from bio-pesticide i.e., 60.08% to dealers, Bionic India occupies 2nd place with 51% share, and Atul Biotech gives the lowest turnover i.e. 33.19% . According to the

calculated percentage share of bio-pesticides of these companies in Nimapada block, the companies such as Multiplex agrochemical, Bionic India, and Crimson Organics are given I, II, and III ranks respectively in **table 6.2.**

6.2.1 DEALERS' DETAIL:-

As per the survey, the dealers belong to different villages of Nimapada block were having the graduation degree with the current occupation of dealership for many years and marketing various chemical as well as biological crop protection products of many reputed Indian as well as Companies of Odisha. The list of some suppliers/ distributors of bio and chemical pesticide are given below:-

Table: 6.3 Name of Suppliers/ Distributor companies

Name of Bio-pesticide Companies	Name of Chemical pesticide companies
Focus Biotech, Crimson Organics, Sambhav Biotech, Multiplex agro-chemicals, Bionic India ltd, Atul Biotech, JU agri-science, Grace grow pvt ltd, hpm chemicals and fertilizers ltd., Tropical Agro-chemicals, India Pesticides Ltd, Karnataka agro-chemicals, and Unique Biotech, etc.	Bayer, Syngenta India, Dhanuka Agro tech, Ichiban, hpm, Bharat biotech, UPL, karnataka agro chemicals, global agrochem, etc.

The bio-pesticide dealers had various numbers of sub-dealers or retailers working under them for the business expansion in the nearby area. According to them, there were different percentage of farmer who were using bio-pesticide. And all these data along with the Number of sub-dealers and the dealership experience of each selected dealers are presented below:-

Fig 6.7: Number of Sub-dealers/retailers

According to the **Fig 6.7**, the selected dealers in Nimapada block were supplying their products or agricultural inputs to different retail stores to generate higher income and for their business expansion.

Fig 6.8: Numbers of years in Dealership

Fig 6.8 indicates that the dealers had started their dealership business before 2 to 6 years with different reputed companies. Along with the bio-pesticide, they were also selling chemical pesticides, all types of fertilizers, and seeds of hybrid and local varieties.

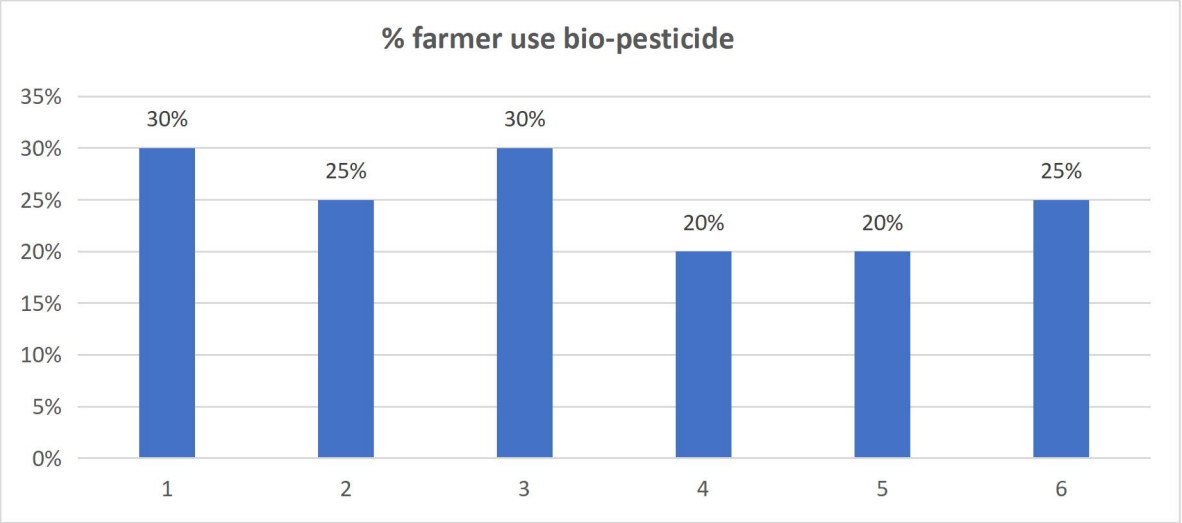

Fig 6.9: Percentage of farmer use Bio-pesticide

Fig 6.9 gives the approximate data, collected as per the dealers' point of view, I.e. the number of farmers in the selected villages use bio-pesticides out of the total farmers use any type of crop protection chemicals, and it is presented in percentage. This data indicates that only around 20-30% farmers had adopted the use of bio-pesticides in the block.

6.2.2 FARMERS' DETAIL:-

6.2.2.1 Demographic details of farmers

According to the data collected from 6 different villages of Nimapada block such as Balanga, Dhanua, Haripur, Sagada, Ratilo, and Rench Sasan, uni-varietal analysis of each sample farmer is presented below:

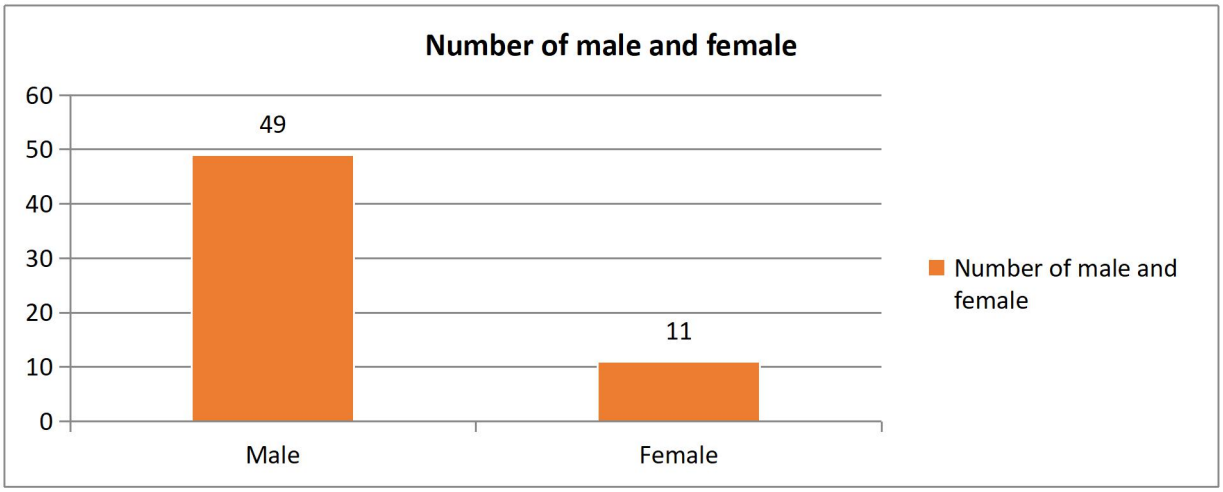

Fig 6.10: Number of male and female

Fig 6.10 shows that out of the 60 surveyed farmers of three different categories, there are 49 numbers of male and 11 numbers of female with varied educational backgrounds starting from no education to 12th pass out.

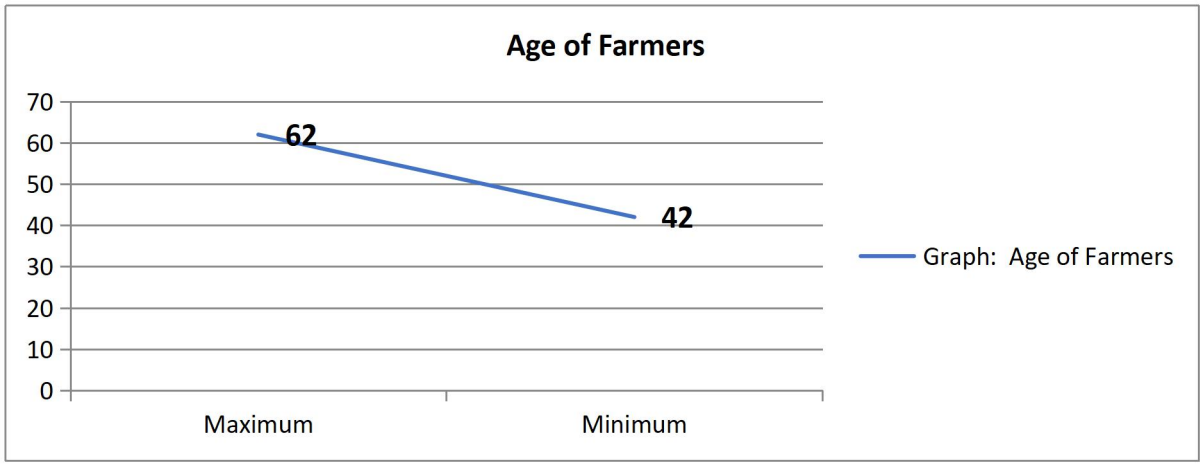

Fig 6.11: Age of Farmers

Fig: 6.11 indicates that for this research, minimum 42 to maximum 62 age group of farmers' data were collected randomly whose average age was 53.45, almost equal to 53.

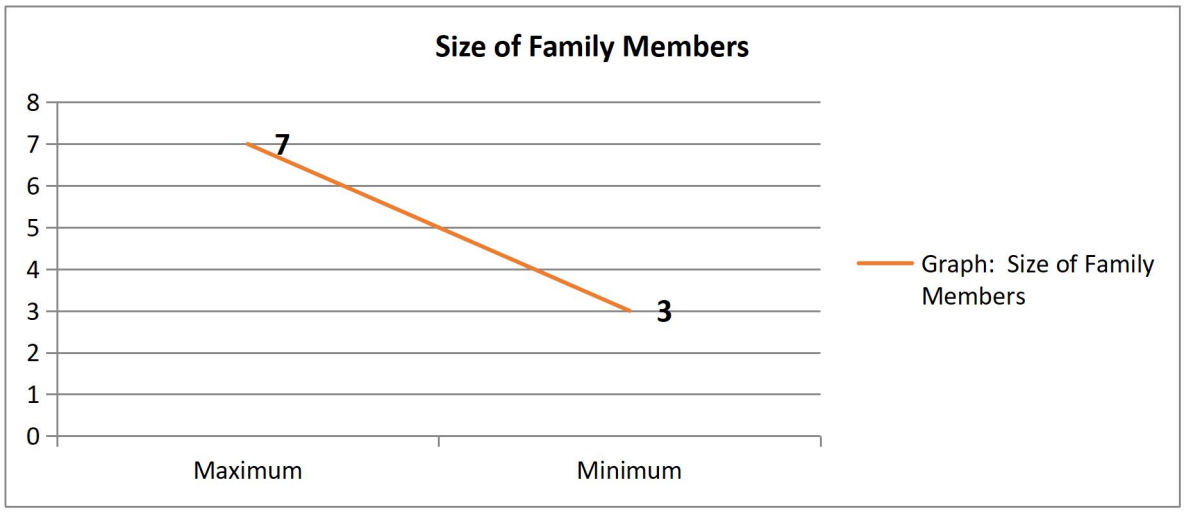

Fig 6.12: Size of the family members

Fig 6.12: gives a brief information regarding the number of family members in each selected farmers I.e. there were 3 to 7 numbers of members, average size of family member was 4.95 I.e. 5**.** The higher number of member was an important factor for the economic growth of those farm families.

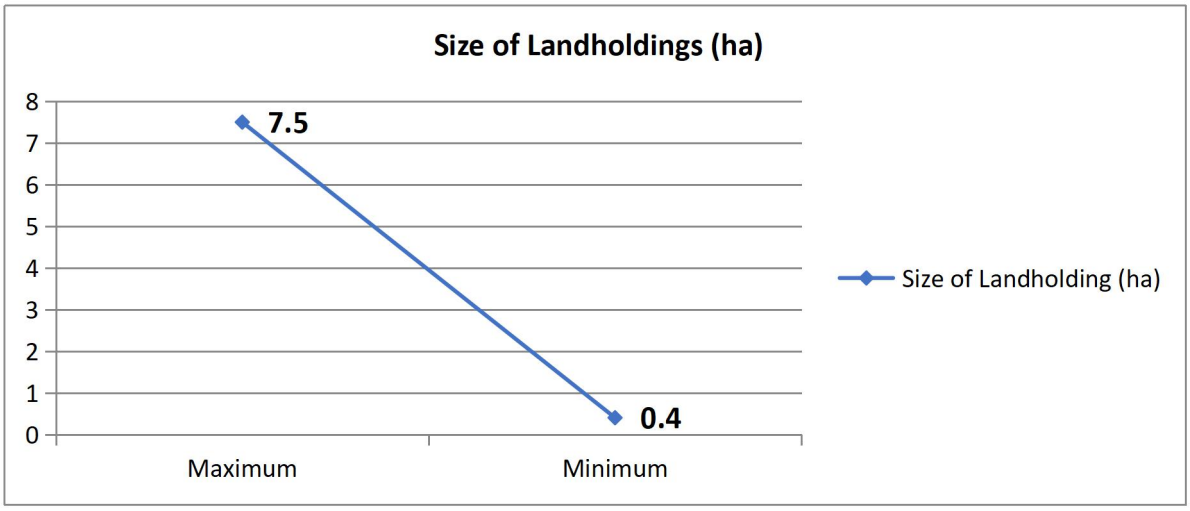

Fig 6.13: Size of landholdings (ha)

Fig 6.13 shows that there were different categories of farmers living in the selected villages, I.e. out of them, the minimum landholding size was 0.4ha and maximum landholding size was 7.5ha. As the farmers belong to small, medium, and large size landholding group, their average landholding size was found to be 2.89 ha.

6.2.2.2 Crop protection measures

As agriculture is the first and foremost occupation of around 70% people in Odisha, It was found that farmers of the selected villages usually cultivate paddy, pulses, vegetables, and fruits while adopting the disease, pest, and weed control measures by using fertilizers, pesticides, and herbicides for effective crop production. According to the survey conducted, though the users of chemical pesticides have heard about bio-pesticides, but they are unwilling to adopt them due to its slow action and comparatively higher price than that of chemicals.

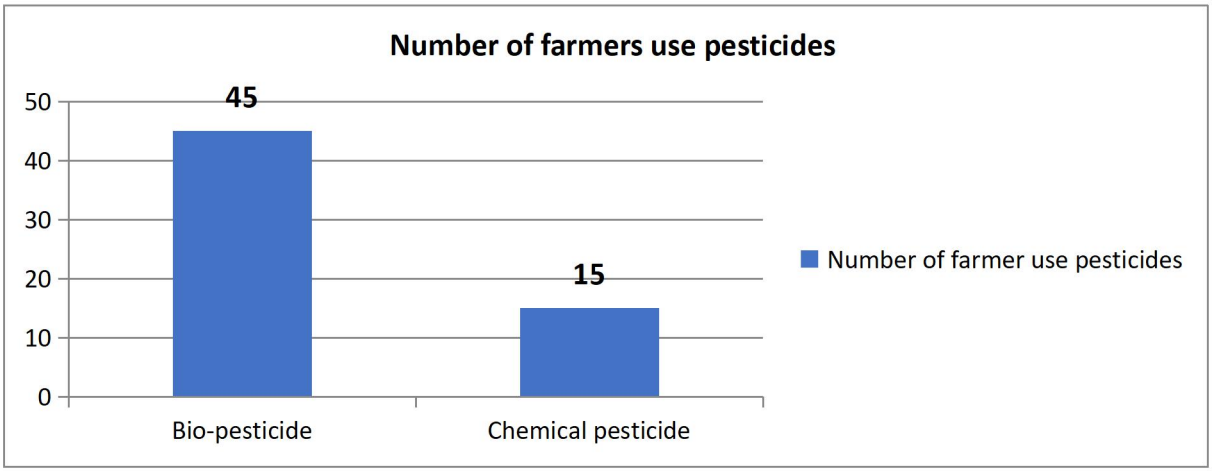

Fig 6.14: Number of farmers use pesticides

Fig 6.14 indicates that out of the selected 60 farmers of the block, 15 number of farmers were using chemical pesticides while rest 45 number of farmers were using bio-pesticides which is calculated to be 40% and 60% respectively.

6.2.2.3 Competitors in bio-pesticide market

Biological pesticides are mainly eco-friendly, retains soil fertility, and help generate higher profit. Though there are so many R&D and marketing organization related to this sector in India, in Nimapada block of Puri district of Odisha, the market is largely occupied by many companies such as Focus Biotech, Crimson Organics, Sambhav Biotech, Multiplex agro-chemicals, Bionic India ltd, Atul Biotech, JU agri-science, Grace grow pvt ltd, hpm chemicals and fertilizers ltd., Tropical Agro-chemicals, India Pesticides Ltd, Karnataka agro-chemicals, and Unique Biotech.

6.2.2.4 Market share

Market share is the percentage of market accounted for by a specific entity. It is calculated by taking the companies' turnover of a particular product sale over the period and dividing it by total sales of top five studied companies over the same period. Result is used to give a general idea of size of company to its market and its competitors. In this section the effort has been made to estimate the market share of different companies of bio-pesticides in study area. The estimated market share of bio-pesticide of major players in Nimapada block are given below.

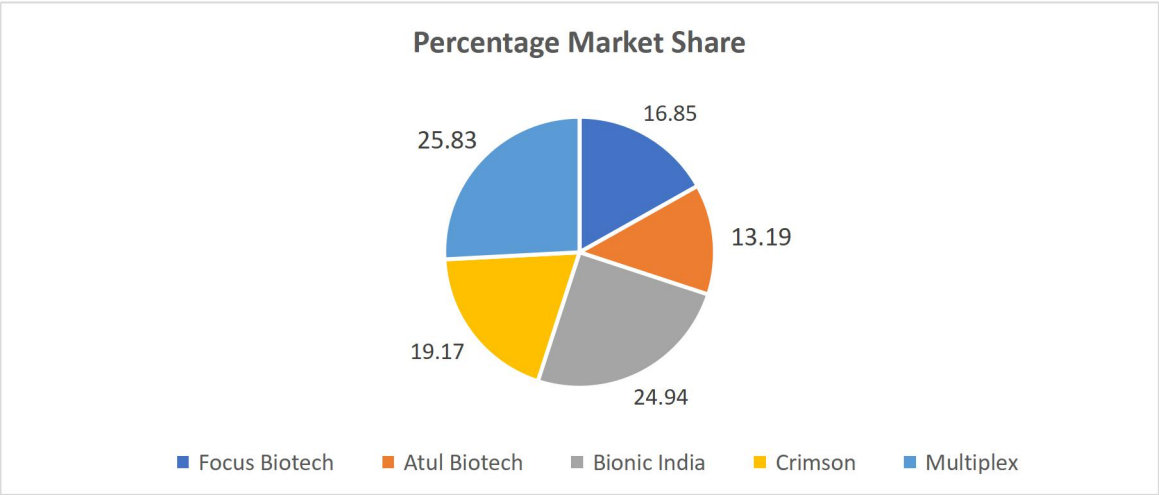

Fig 6.15: Percentage Market share

Fig 6.15 shows that Multiplex Agrochemical has the highest percentage of market share in Nimapada block i.e. 25.83% followed by Bionic India with 24.94%, and Crimson organics with 19.17%.

6.2.2.5 Training and Support Services to Farmers

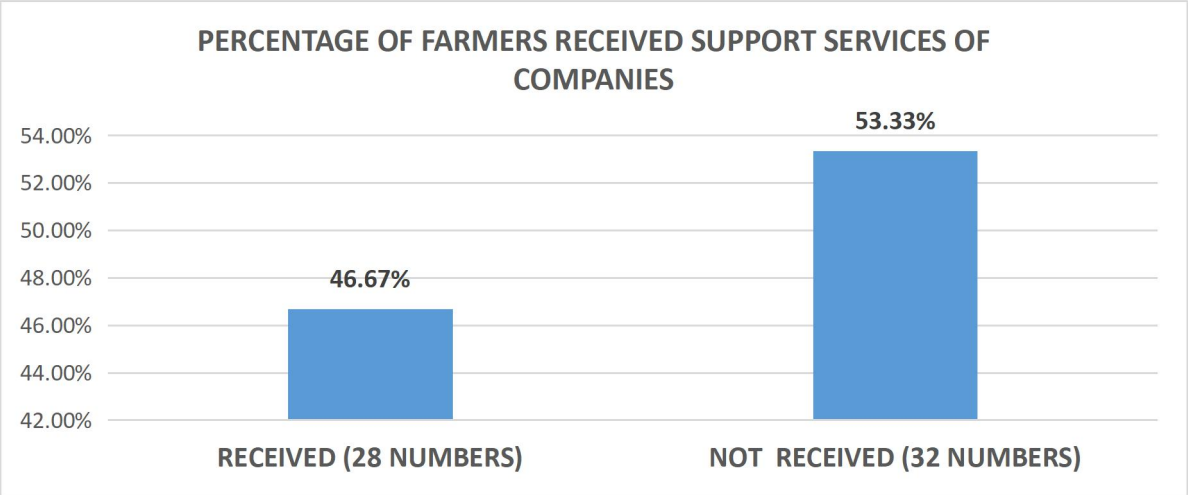

Fig 6.16: Percentage of farmers received support services from companies

Fig 6.16 depicts the percentage and number of farmers received support services from the various distributor companies. Different bio pesticide companies provide free demonstration on farmers' field. Some provide free products where as some companies provide free training to encourage the farmer community to adapt non-toxic as well as eco-friendly pest control methods for the sustainable development of agriculture. But out of the surveyed farmers, only 28 numbers (46.67%) of farmers had experienced these. And there were still 32 numbers or 53.33% of farmers who didn't have received any of these support services, or might not have aware of it.

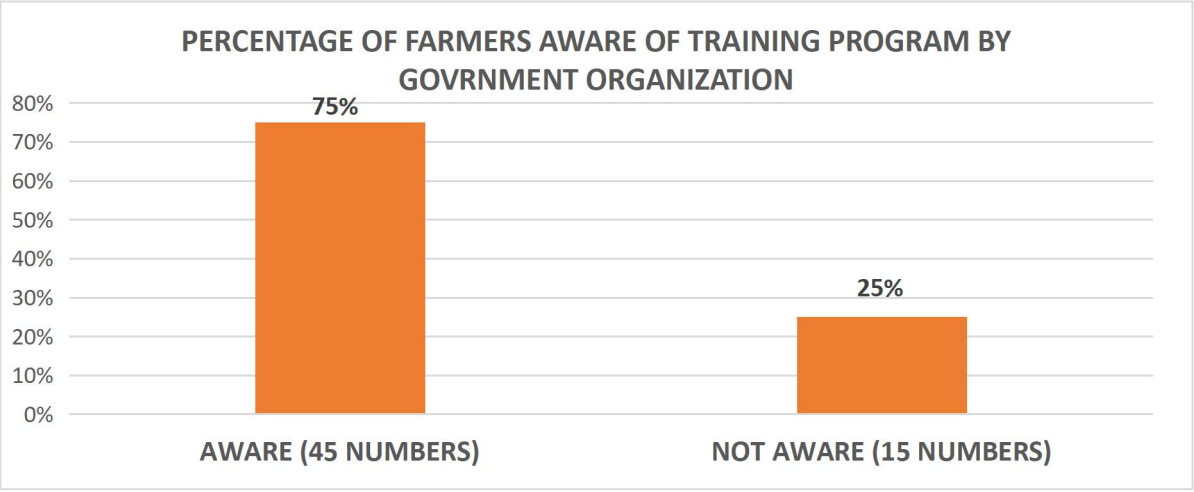

Fig 6.17: Percentage of farmers aware of training programs by Govt. Organizations

Besides all these, government organizations such as KVK of Puri and OUAT, ATMA of Puri, Cuttack, etc. also conduct free farmers' training periodically to provide adequate

knowledge and information regarding the use of organic pesticides. This study revealed that out of 60 survey farmers, only 45 numbers or 75% of people were aware of the training programs that the Govt. Of Odisha conducts to provide adequate information and knowledge, and to create awareness to adopt the latest eco-friendly method of pest control, also they had attended many of it at different Govt. Organizations. At the other hand, 15 numbers or 25% of farmers were still not aware of these training programs, thus had not attended any of it.

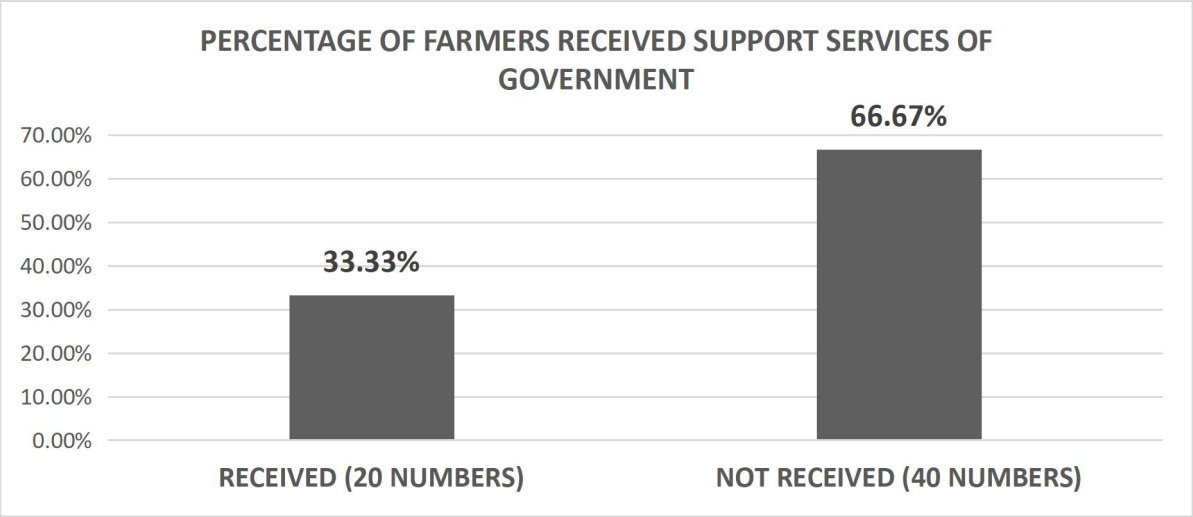

Fig 6.18: Percentage of farmers received support services of Govt.

The Government always sets their mission and vision while creating or introducing any schemes or programs for farmers, and public as a whole. **Fig 6.18** indicates that among the support services provided by the Govt., different crop insurance and agricultural schemes are the most important services for our farmers' community. As per this study, out of 60 surveyed small, marginal, and large farmers, only 33.33% or 20 numbers of farmers were availing the benefits of PKVY (Paramparagat Krishi Vikash Yojana) scheme which is especially to promote organic cultivation, and rest 40 farmers or 66.67% of farmers had not registered their names yet.

6.2.2.6 Factors influencing use of bio-pesticides

After banning of many harmful toxic chemicals in India, use of chemical pesticides has been reducing gradually. Acceptance of organic pesticides by the customers as well as its marketing is influenced by many components such as availability of pesticides at time, its price in the market as compared to chemicals, efficiency or ability of bio-pesticides to show desirable results, crop production, and profit from it as compared to chemicals.

From the study, it is revealed that at the time of purchasing bio-pesticides most of the small farmers preferred price of the product while in case of medium size farmer, they considered both quality and price of the product. Under large size farmer they preferred efficiency, brand, and timely availability of the product.

The number of factors which influence the purchasing of bio-pesticides by the farmers in Nimapada block are given in the table.

Table 6.4: Factor influencing use of bio-pesticide

Sl. No.	**Farmers' category**	**No. Of farmers**	**Factors**
1.	Small	27	• Available nearby • Available timely • Dealers' advice • Higher profit
2.	Medium	21	• Efficiency • Eco-friendly • Timely availability • Higher profit
3.	Large	12	• Efficiency • Brand • Eco-friendly • Timely availability • Higher profit

This data of **table 6.4** indicates that eco-friendly nature, higher profit, efficiency along with timely availability of the bio-pesticides are the important factors considered in the mind of the farmers during purchase of various kinds of bio-pesticides.

According to the 45 farmers who were using bio-pesticide, these organic pesticides were frequently available in their nearby markets which was helping them of easy access to the products before the peak period of insect pest infestation.

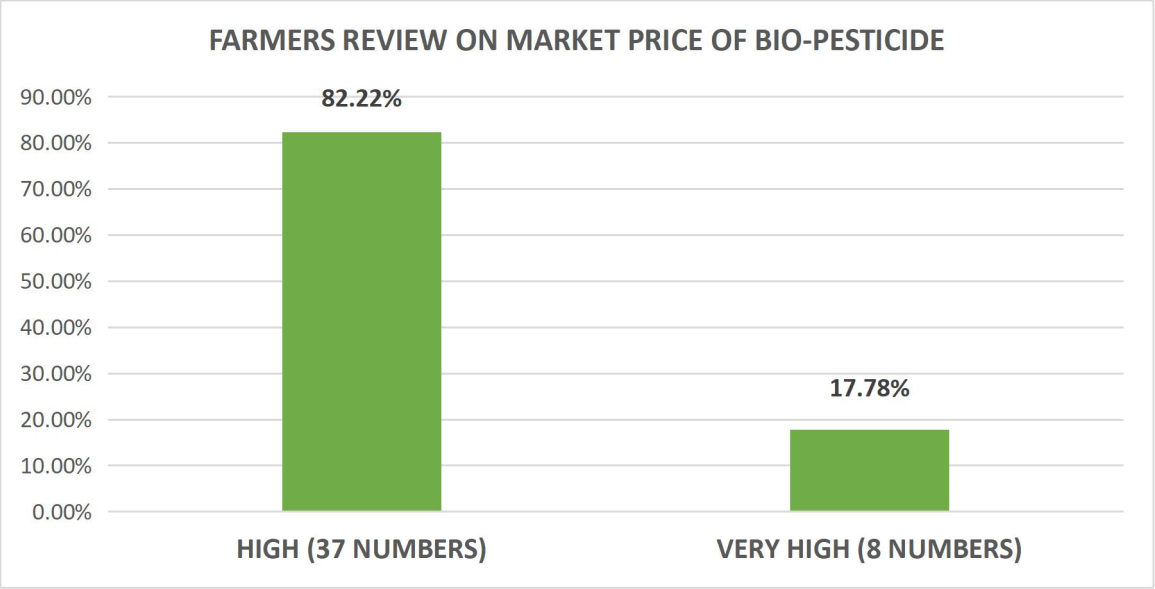

Fig 6.19: Farmers' review on 'market price' of Bio-pesticide

'Price' is one of the important factor that affects the demand and supply of any product. A bio-pesticide is a natural method of pest control, so there are some factors that cannot be fully controlled by human intervention. They may take time to kill the target pest, or the microorganisms may have a complex life cycle. Therefore, storage and handling constraints make them more expensive than synthetic pesticides. Thus, the **Fig 6.19** indicates that available market price for bio-pesticides seemed 'high' for 37 farmers and 'very high' for 8 farmers and percentage of both the categories of farmers was calculated to be 82.22% and 17.78% respectively.

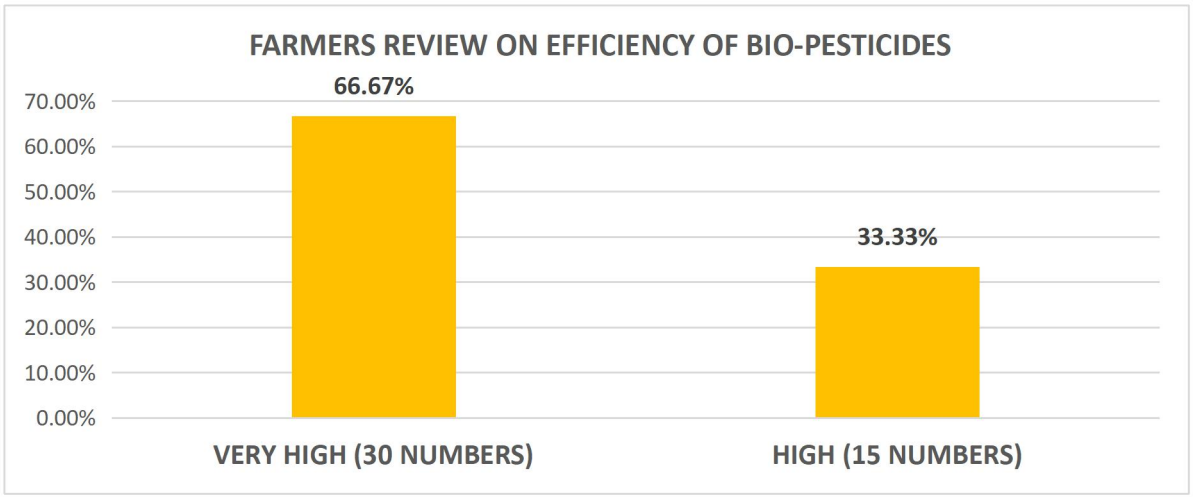

Fig 6.20: Farmers' review on efficiency of bio-pesticides

In **Fig 6.20,** it is mentioned that 'Efficiency' of a product determines its ability to produce or show desirable results. After the questionnaire survey, in comparison to chemicals, out of 45 farmers, 30 farmers had been experiencing 'very high efficiency' of biological products whereas 15 others gave 'high' efficiency for the same and percentage for both categories was calculated to be 66.67% and 33.33% respectively.

'Crop production' is an important factor which was seen to be lower (in case of every survey farmers) when the organic pesticides were being used than that of conventional system of crop production.

Industries or companies will only develop bio-pesticide products if there is 'Profit' in doing so. Similarly, the decision for a farmer whether or not to adopt a technology can be thought of in economic terms as a cost-benefit comparison of the profits to be made from using the organic versus the conventional method of crop raising.

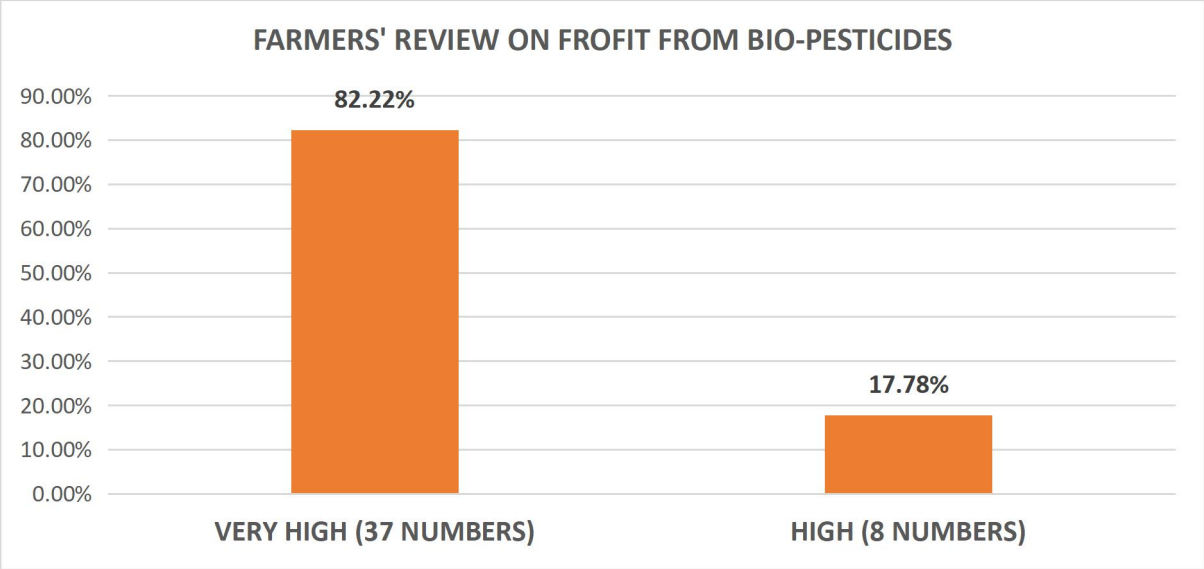

Fig 6.21: Farmers' review on 'Profit' earning from bio-pesticides

According to the **Fig 6.21**, out of the total profit earned from using organic pesticides, 37 farmers agreed to have 'very high' profit while only 8 farmers rated it to be 'high' I.e. 82.22% & 17.78% of farmers in each category respectively.

6.2.2.7 Promotional activities adopted by major bio-pesticide companies

It is another way of promoting or increasing sales of various products. Sale promotional activity consist of display shows, exposition, demonstration, and other special effects such as off-season discount, advanced booking scheme, coupons etc. This creates more sale of the product. It helps the trader and the sale force to represent the product to the consumers.

Table 6.5: Promotional activities adopted by major players

Company name	**Promotional activities**		
	For Dealers	**For Farmers**	**others**
Bionic India	Dealer's meeting, product literature, cash discount, sale offer.	Campaign, field demonstration, farmers' meeting,	Poster, wallpaper, magazine, leaflet, pamphlet
Focus biotech	Tour, dealer meeting, literature, gift items,	campaign field demonstration, farmer meeting, exhibition, sample distribution	Calendar, banner, sticker, leaflet, pole poster, demo kit
Crimson	Tour, dealer meeting, literature, gift items,	Field visit, wall painting, campaigning, personal contact	Poster, wallpaper, magazine, pamphlet, News paper
Multiplex agro chemicals	Dealer's meeting, product literature, cash discount, margin, sale offer	Field visit, wall painting, campaigning, personal contact	Demo tray, magazine, pamphlet, poster banner

6.2.3. SWOT ANALYSIS

SWOT analysis is an organized arranging technique that assesses strength, shortcomings, opportunities, and threats implied in any organization. It tends to be done for an organization, item, spot, industry, or individual. Strength and weaknesses are the internal factors, opportunity and threat are the external factors that influence the operations of an entity.

The detailed information about SWOT analysis of Bionic India Company, retailers, and farmers is provided in the following section.

6.2.3.1 SWOT analysis of retailers

STRENGTH:

- ✓ High customer base on the particular area for chemical products
- ✓ Wide product range i.e. Seeds, fertilizers, pesticides, herbicides, etc. (both chemicals and bio products)
- ✓ Training from companies and govt. Organizations
- ✓ Transportation facility
- ✓ Dealership with reputed companies
- ✓ Good supply chain
- ✓ Customer satisfaction
- ✓ Good profit margin

WEAKNESS:

- ✓ No business expansion yet outside that particular area
- ✓ Lack of digital or online marketing of products
- ✓ Lack of knowledge and awareness among buyers
- ✓ Small building/ infrastructure
- ✓ Lack of skilled manpower

OPPORTUNITIES:

- ✓ Collaborations with more bio-pesticide brands and companies to increase sourcing scale
- ✓ Creation of more market linkage along with more skilled labor employment
- ✓ Expansion of business through online and offline (both location and product base)

- ✓ Govt. Subsidies and awareness for bio-pesticide lead to more profitable marketing and market expansion
- ✓ Increase number of Farmers' meeting or awareness campaign

THREAT:

- ✓ Lack of government's support services like subsidies to market bio-pesticide
- ✓ Lower demand of bio-pesticide
- ✓ Lack of govt schemes and field demonstrations
- ✓ Very low customer base for bio-pesticides
- ✓ More tax on bio products so as higher price

6.2.3.2 SWOT analysis of Farmers

STRENGTH:

- ✓ Timely availability of product
- ✓ Training by some companies and govt institutions
- ✓ Healthy and eco-friendly crop production
- ✓ Higher profit than conventional method
- ✓ Retains soil fertility
- ✓ Low cost of production
- ✓ Availability of agricultural inputs like seed, fertilizers, pesticides, etc.
- ✓ Local market access for inputs and marketing
- ✓ Low land with good production

WEAKNESS:

- ✓ Economic constraints
- ✓ Lack of quality education
- ✓ Unavailability of skilled manpower
- ✓ Bio-pesticides gives late result
- ✓ Production is lower than conventional method
- ✓ Small storage space or lack of storage structure
- ✓ Lack of farm diversification
- ✓ Lack of technical advancement

- ✓ No use of digital platform
- ✓ More number of family member
- ✓ Not aware of latest technologies

OPPORTUNITIES:

- ✓ Online and offline market expansion
- ✓ Partnership with govt. Organizations like FPOs
- ✓ More training and visit system
- ✓ Various initiatives and support services from govt.
- ✓ Special infrastructures or storage go-downs for bio products with license
- ✓ Farm integration and diversification
- ✓ Technical advancement
- ✓ Engaging skilled manpower

THREAT:

- ✓ Lack of effective Awareness campaign by govt. organizations
- ✓ Lack of field demonstrations
- ✓ Lack of financial support services
- ✓ Lack of training and education regarding new technologies and method of crop production
- ✓ No subsidy by govt.
- ✓ Lack of field visit or exposure
- ✓ Lack of information about the varieties of bio-pesticides and uses
- ✓ Presence of middleman
- ✓ Not getting the actual price for bio products or low market price
- ✓ No proper induction of govt. initiatives

6.2.3.3 SWOT analysis of Bionic Properties Pvt Ltd Company

STRENGTH:

- ✓ Wide range of product categories
- ✓ Effective marketing and strong supply chain across Odisha
- ✓ Competent authorities and employees

- ✓ Customer satisfaction

WEAKNESS:

- ✓ Expansion of business digitally

OPPORTUNITIES:

- ✓ New technology generation
- ✓ More Value addition
- ✓ More research and new product development
- ✓ R&D in nanotechnology

THREAT:

- ✓ Competitive market due to emergence of new technologies and products.
- ✓ Acceptance of bio-pesticide is low due to the lack of govt support and initiatives towards the manufacturing and development of products in the state.

CHAPTER 7

FUTURE PROSPECTIVES OF BIO-PESTICIDE MARKET

FUTURE PROSPECTIVES OF BIO-PESTICIDE MARKET

There is huge increase in the worldwide demand of bio-pesticides to reduce the harmful pest population like weeds, plant microorganisms and bugs while presenting less danger to person and the climate. In the US, bio-pesticides are checked by Environmental Protection Agency which upholds their enrollment dependent on the discoveries of no antagonistic impacts to human and the climate to allow their deal and dispersion under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), just as guarantees a sensible conviction of no damage under the Federal Food, Drug, and Cosmetic Act (FFDCA) to give pesticide buildup free food and feed. By the issues of pesticide opposition and withdrawal of plant assurance items, farmers are mostly affected, but then they are strategy takers rather than strategy creators.

Thus, the development, manufacturing and sale of environment friendly alternatives to chemical pesticides through public-private approach for the developing states like Odisha is the need of the day.

Establishment of manufacturing units especially for bio-pesticides, bio-fertilizers, and other bio-products, Research in production, formulation and delivery may greatly assist in commercialization of bio-pesticides. In our state, more research and development are required towards integrating biological agents into production system, improving capability of developing states and districts to manufacture and use bio-pesticides. Simultaneously, it is likewise needed to energize public supported projects, business financial backers and pesticide organizations to take up bio-pesticide undertakings. Similarly significant is the improvement of severe administrative instruments to keep up with the quality and accessibility of the bio-pesticides at reasonable expense in the state. Thus, different parts of bio-pesticides covering the current status, limitations, possibilities and administrative organization towards their successful use to serve humanity should be surveyed routinely.

CHAPTER 8

RECOMMENDATION AND CONCLUSION

RECOMMENDATION AND CONCLUSION

8.1 RECOMMENDATION

As the chemical pesticides utilized for managing pests can not be abandoned completely, there should be a diversity of methods for maximizing adaptability, accuracy, and stability of pest management with sustainable ecosystem. To recognize the most encouraging chances for expanding advantages of and diminishing risks posed by pesticide use—the private as well as public sector firms should identify the followings:

- Investments in research and strategy changes that underline improvement of pesticides and application technologies that pose reduced well-being hazards and are viable with environmentally based pest management.
- Both the government and private organizations should conduct frequent promotional as well as awareness campaigns to increase the market share and enhance the acceptance of organic pesticides among farmers communities.
- The organizations should ensure the reach of information regarding all the support services and awareness activities to all the small, medium, and large farmers along with their active participation.
- Advance logical and social initiatives to utilize options in contrast to pesticides in a wide range of managed and natural environments.
- Increase the ability and motivation of farming laborers to reduce their exposure to possibly unsafe synthetics and refine worker-protection regulations and authorize consistence with them.
- Decrease unfavorable off-target impacts by judicious choice of chemical products, execution of precision application innovation and assurance of financial and ecological effect limits for pesticide use in rural frameworks.
- The most important aspect for increasing profits and reducing risks is to invest time, money, and effort into developing a diverse method of pest-management strategies that include manufacturing and adopting the safe products and practices that coordinate chemical approaches into an overall along with eco-friendly approaches for sustainable production as well as livelihood.

- Principal research on public and farmers' perception, risk assessment and analysis would be helpful to determine the wide acceptance and adoption of the biological pest management methods.

8.2 CONCLUSION

The production and use of bio-pesticides in Odisha are increasing at a quick speed. The interest in organic farming and chemical-free agrarian produce would absolutely warrant increasing adoption of bio-pesticides by the farmers. Preparing on production and quality control to producers, and authoritative preparing to extension workers and farmers to advocate bio-pesticides might be fundamental for better acceptance and adoption of this innovation. As ecological well being is a worldwide concern, we really want to make awareness among the farmers, producers, government offices, strategy creators or policy makers, and the common people to switch-over to bio-pesticides for pest management prerequisites. It is likewise accepted that organic pesticides might be less vulnerable against hereditary varieties in plant populations that cause issues identified with pesticide resistance. Whenever sent properly, bio-pesticides can possibly carry sustainability to worldwide farming for food and feed security.

Bio-pesticide is now one of the successful emerging sectors in Odisha. Though there are so many public as well as private Indian organizations are involved in its research, development, and marketing, in Odisha, marketing and development of this organic pesticide are not so developed and its use is still not accepted by the majority of our farmers.

Synthetic pesticides are gradually being phased out from the local as well as export market due to its toxic residual effects on environment and ecology as a whole. Bio-pesticide market is likely to introduce the solutions mostly for bacterial, viral and fungal diseases, organic substances for effective weed control, and a wide range of pest control alternatives. Though bio-pesticides are considered as the best alternative to synthetic pesticides, their slow mode of action, higher cost, and lack of availability of proper information make these organics less accepted by farmers.

CHAPTER 9

REFERENCE AND ANNEXURE

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ANNEXURE – I

QUESTIONNAIRE FOR DEALERS

Date……..

1. Name of the dealer

i. **Address**
ii. **Educational background**
iii. **Occupation-**
iv. **No. of years in dealership**

2. Products you're dealing with-

i. Machinery
ii. Pesticides
iii. Fertilizers
iv. Seeds
v. All of the above

3. No. of sub dealers:

4. If selling pesticides, which type of pesticide?

i. Chemical
ii. Bio-pesticide
iii. Both

5. If bio-pesticides, give the following info.

6. Dealership detail (2020-21):

SL. NO.	Name of companies	Product name

7. which type of pesticide has more demand among buyers/farmers?

i. Chemical pesticide
ii. Bio-pesticide

8. If chemical pesticide has more demand, why?

9. If bio-pesticides has more demand, why?

10. Percentage of farmer use bio-pesticide

i. 0-10%
ii. 10-20 %
iii. 20-30 %
iv. 30-40 %
v. >40%

11. Turn over from bio-pesticides (2020-21)

Sl. No.	**Name of company**	**Total turnover (per year)**	**Turnover from bio-pesticides (per year)**

12. Among all brands of bio-pesticides, which brand has more demand?

13. Which brand gives maximum product variation? (arrange in descending order)

14. Which brand gives maximum offers/ discounts? (arrange in descending order)

15. Criteria for selection of a brand by a customer

i. Price
ii. Brand
iii. Time of availability
iv. Other

16. Promotional activities adopted by companies-

17. which company provide more training/other promotional activites? (descending order)

18. Does the Govt. conduct training program for retailers/dealers?

i. Yes
ii. No

19. If yes, how many times?

i. Monthly
ii. Quarterly
iii. Half yearly
iv. Annually
v. Other

20. What are the support services provided by both companies?

i. Bonus-
ii. Discounts-
iii. Training & visit system-
iv. Free products-
v. All
vi. None of the above-

21. What are the support services from Govt. organizations?

i. Subsidies-
ii. Financial assistance/loan
iii. Frequent Field demonstration
iv. Specific price structure
v. None

22. Is there Any promotional activities by Govt. organization?

i. Yes
ii. No

22. If yes, what are those?

23. At the current volume of sale, rate the profitability of bio-pesticide marketing in this area?

i. Highly profitable

ii. Profitable
iii. Break even
iv. Not profitable
v. Loss

24. Your opinion about the current sale performance of bio-pesticide?

i. Rapidly increasing
ii. Increasing
iii. Same as before
iv. Decreasing
v. Rapidly decreasing

25. Is there too many competitors for your bio-pesticide market?

i. Yes
ii. No
iii. Average

26. For how many years have you been selling bio-pesticides?

i. >10years
ii. 5-10 years
iii. 1-4 years
iv. <1 year

27. Are you willing to expand your business in near future?

i. Yes
ii. No
iii. Not yet decided

28. Are you going to open your own exclusive bio-pesticide store in future?

i. Yes
ii. No
iii. Not yet decided

29. Answer the followings

i. Strength

ii. Weakness
iii. Opportunity
iv. Threat

30. What are the constraints in marketing bio-pesticide? (if exist)

31. According to you, what are the future prospects of bio-pesticide market in this area?

32. Any suggestions:

ANNEXURE - II

QUESTIONAIRE TO FARMERS

1. Demographic

i. **Name**
ii. **Age**
iii. **Education**
iv. **Gender**
v. **Location/hometown**
vi. **Occupation**
vii. **No. of family member**
viii. **Crop land owned-**
ix. **Crops grown-**

2. What are the crop protection measures you adopt?

i. Fertilizers
ii. Pesticides
iii. Herbicides
iv. All

3. Which type of pesticide do you use?

i. Chemical pesticides
ii. Bio-pesticides
iii. Both

4. If only chemical pesticides,

I. **What are the advantages and disadvantages (if exist) of using it ?**
II. **Have you ever heard about bio-pesticide?**
    i. Yes
    ii. No
III. **If yes, what are the reasons of not adapting bio-pesticides?**

5. If only bio-pesticides,

I. **Name the advantages and disadvantages of using it?**

II. **Which brand/ company of bio-pesticide do you use and why?**

III. **Rate the following major criteria for bio-pesticides:-**

Availability –

i. Frequently available
ii. Sometime available
iii. Rare

Price-

i. Very high
ii. High
iii. Average
iv. Low
v. Very low

Efficiency-

i. Very high
ii. High
iii. Same as chemicals
iv. Low
v. Very low

Production-

i. Very high
ii. High
iii. Same as chemicals
iv. Low
v. Very low

Profit -

i. Very high
ii. High
iii. Same as conventional
iv. Low

v. Very low

6. Does the Govt. conduct training program for farmers'?

i. Yes
ii. No
iii. Not aware

7. If yes, have you attended any of them?

i. Yes (if yes, mention No. of programs attended)
ii. No

8. Support services by Govt.

i. Subsidies
ii. Field tour system
iii. Field demonstration
iv. Schemes
v. Financial assistance/ loan
vi. Others

9. Support services received by bio-pesticide companies (if any)

i. Discounts/ coupons
ii. Bonus
iii. Training & visit
iv. Free products
v. Others-

10. Promotional activities by companies

i. Leaflets
ii. Newspaper
iii. Booklets
iv. Poster/banner
v. Other

11. Mention the followings w.r.t the use of bio-pesticides

i. Strength

ii. Weakness
iii. Opportunity
iv. Threat

12. Would you like to continue using bio-pesticide?

i. Yes
ii. No
iii. Don’t know

13. Any suggestions:

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