CHAPTER I
INTRODUCTION

In order to meet the food needs of the alarmingly growing population, "Green revolution" came as an answer. Green revolution in India has witnessed a jump in agricultural production with the introduction of high yielding varieties (HYVs) of various crops and by following intensive cultivation practices with the use of fertilizers, pesticides and other inputs. The cropping intensity has also increased during green revolution period, wherever water is available a second crop was introduced. Consumption of chemical fertilizers and pesticides increased tremendously over the years.

Economic status of the people in country like India mostly depends upon the agricultural production. Need for more intensive and economic agricultural production led to indiscriminate use of high doses of chemical fertilizers, pesticides etc., Relentless use of these chemicals not only alter the eco-system but also claim death to many lives every year due to their hazardous nature.

Biofertilizers are used to improve the fertility of the land by using biological wastes and biological wastes do not contain any chemicals which are harmful to the living soil. Biofertilizers generate plant nutrients like nitrogen and phosphorus through their activities in the soil and make available to plants in gradual manner. They are beneficial in enriching the soil with microorganisms which increases quality of nutrient in soil and also impart strength to combat with diseases (Savci 2012). The main sources of biofertilizers are bacteria, fungi and cyanobacteria. The most striking relationship that these microorganisms have with plants is symbiosis in which the partners derive benefits from each other. The most important microorganisms which have symbiotic relationship with plants are Mycorahiza, Rhizobium and Cyanobacteria. These delivers number of benefits including plant nutrition, disease resistance and tolerance to adverse soil and climatic conditions.

Biofertilizers are defined as preparations containing living cells or latent cells of efficient strains of microorganisms that help crop plants to uptake of nutrients by their interactions in the rhizosphere when applied through seed or soil. They accelerate
certain microbial processes in the soil which augment the extent of availability of nutrients in a form which easily assimilated by plants. In arid and semi-arid area where the moisture is limiting factor there is no chance or sometime less chances of giving top dressing of fertilizers. In such situation biofertilizers are the cheap source to maintain fertility as well as soil moisture.

In semi-arid regions of tropical and subtropical countries, the soils are nutritionally deficient and due to moisture limitation, chemical fertilizers cannot be applied in adequate quantities. Crops grown in such areas, therefore, the supply of nitrogen is largely dependent on biological nitrogen fixation. In rainfed agriculture, these inputs gain added importance in view of their low cost, as most of the farmers are small and marginal and cannot afford to buy expensive chemical fertilizers. Biofertilizers are also ideal input for reducing the cost of cultivation and for practicing organic farming.

Very often microorganisms are not as efficient in natural surroundings as one would expect them to be and therefore artificially multiplied cultures of efficient selected microorganisms play a vital role in accelerating the microbial processes in soil.

Poor microbial load, higher contamination and use of improper strains resulted in mixed response of biofertilizers. Here the research institutes have a great responsibility towards ensuring the correct and high quality product enters the market along with government and thereby ensuring that substandard product do not enter the market. New practices take time to pick up success or failure of new products entering the market will depend on the proper marketing, branding, promotional policies of government for which study needs to be conducted at every level of production, consumption and factors affecting them.

Keeping in view the continued demand of crop nutrition and its biological availability through microbes, Government of India, Ministry of agriculture, and Department of agriculture & cooperation initiated “National project on development and use of biofertilizers” in 1983 accordingly; a national centre and six regional centres were created to cater the needs of biofertilizer developmental activities in India. Initially the availability of biofertilizers in different parts of the country was meager. The project was aimed to provide quality biofertilizers like *Rhizobium* for crop specific legume and
Introduction

oil seeds, *Azotobacter* and *Azosprillum* for cereals, millets, sugarcane, vegetables, plantation, Phosphate Solubilizing Microorganisms for all major crops and soils.

Junagadh Agricultural University developed *Rhizobium, Azotobacter* and Phosphate Solubilizing Bacteria as ‘Sawaj’ trade name. University provide facility to buy ‘Sawaj’ biofertilizers at university campus, KVKs (Krishi Vigyan Kendra) and various NGOs (Non-Government Organizations) to the farmers.

Table: 1 Production and selling of ‘Sawaj’ biofertilizers from Junagadh Agricultural University.

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Year</th>
<th>Azotobactor (Bottles) (500 ml)</th>
<th>Rhizobium (Bottles) (500 ml)</th>
<th>PSM (Bottles) (500 ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2011-2012</td>
<td>4500</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>2012-2013</td>
<td>13088</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>2013-2014</td>
<td>889</td>
<td>189</td>
<td>513</td>
</tr>
<tr>
<td>5</td>
<td>2015-2016</td>
<td>2857</td>
<td>2857</td>
<td>2857</td>
</tr>
<tr>
<td>6</td>
<td>2016-2017*</td>
<td>2716*</td>
<td>2994*</td>
<td>4520*</td>
</tr>
</tbody>
</table>

*Upto 28th February, 2017

Source: [www.jau.in/coa/index.php/department/plant-pathology](http://www.jau.in/coa/index.php/department/plant-pathology)

*Rhizobium* are soil bacteria that fix Nitrogen after becoming established inside root nodules of legumes (Fabaceae). There are several different genera of Rhizobia, all of them belong to the Rhizobiales, a probably-monophyletic group of Proteobacteria and they are soil bacteria characterized by their unique ability to infect root hairs of legumes and induce effective ‘N’ fixing nodules to form on the roots. They are rod shaped living plants which exist only in the vegetative stage. Unlike many other soil microorganisms, Rhizobia produce no spores and they are aerobic and motile. (Baset et al. 2010)

*Azotobacter* is a genus of usually motile, oval or spherical bacteria that form thick-walled cysts and may produce large quantities of capsular slime. They are aerobic, free-living soil microbes which play an important role in the nitrogen cycle in
nature, binding atmospheric nitrogen, which is inaccessible to plants, and releasing it in the form of ammonium ions into the soil (nitrogen fixation). In addition to being a model organism for studying diazotrophs, it is used by humans for the production of bio fertilizers, food additives, and some biopolymers. (Sartaj et al. 2012)

Phosphate Solubilizing Bacteria has great role as for plant growth it is usually abundant in soil. Phosphate Solubilizing Bacteria plays a vital role in the formation of amino acids and proteins from ammonium ions, which are absorbed by roots, from the soil. It is also responsible for the transfer of carbohydrates, proteins, etc. from the level to the roots. It also plays a vital role in the uptakes of other elements particularly nitrogen, phosphorus and calcium, Phosphate solubilizing bacteria regulates the permeability of the cellular membrane. It activates number of enzymes, e.g. alcohol dehydrogenase and its deficiency decreases photosynthesis. Phosphate Solubilizing Bacteria increases the resistance of crops to hot and dry conditions and insect pest and diseases. It increases the stiffness of straw in cereals and therefore the loading of cereal is reduced. It improves the quality of fruits and grains. (Khosro and Yousef, 2012)

Biopesticides are certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals. Microbial pesticides consist of a microorganism like bacterium, fungus, virus or protozoan as the active ingredient. Microbial pesticides can control many different kinds of pests, although each separate active ingredient is relatively specific for its target pests and disease. (Abhilash and Singh, 2009)

Biopesticides are ecofriendly pesticides which are obtained from naturally occurring substances (Biochemicals), microbes and plants. The potential benefits to agriculture and public health programmes through the use of biopesticides are considerable. Not all natural products are biopesticides. Some are chemical pesticides if they act on nervous system of the pest. Through the use of biopesticides in a wider way, agriculture and health programmes can be beneficially affected. 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. India has a vast potential for biopesticides. Some biopesticides currently being developed may be excellent alternatives to chemical pesticides. Biopesticides being target pest specific are presumed to be relatively safe to
Introduction

non-target organism including humans. However, in India, some of the biopesticides like *Bt*, *NPV*, Neem based pesticides, *Trichoderma*, *Beauveria* etc. have already been registered and are being practiced.

Junagadh Agricultural University released two type of biopesticide *Trichoderma harzianum* and *Beauveria bassiana* as trade name ‘Sawaj’.

**Table: 2 Production and selling of ‘Sawaj’ trichoderma from Junagadh Agricultural University.**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Production(kg)</td>
<td>22670</td>
<td>53236</td>
<td>37216</td>
<td>58262</td>
<td>104800*</td>
</tr>
</tbody>
</table>

*upto 28th February, 2017*

Source: [www.jau.in/coa/index.php/department/plant-pathology](http://www.jau.in/coa/index.php/department/plant-pathology)

*Trichoderma harzianum* is a fungus that is also used as a fungicide. It is used for foliar application, seed treatment and soil treatment for suppression of various disease causing fungal pathogens. (Govindasamy and Balasubramanian, 1989)

*Beauveria bassiana* is a fungus that grows naturally in soils throughout the world and acts as a parasite on various arthropod species, causing white muscardine disease; it thus belongs to the entomopathogenic fungi. It is being used as a biological insecticide to control a number of pests such as termites, thrips, whiteflies, aphids and different beetles. Its use in the control of bedbugs and malaria-transmitting mosquitos is under investigation. (Malarvannan *et al.* 2010)

The biofertilizer and biopesticide technology is basically a microbial technology. The field extension workers are the link between the newly recommended technology and farmers. They have a major role to communicate this specialised technology to farmers. Accordingly, in order to acquaint about the developments regarding biofertilizer and biopesticide technology, the extension officials of the state governments are being trained in the project, about the current developments of biofertilizer and biopesticide technology.

Government has to ensure that the bio-organism based product entering the market must meet with the quality standard. Initially, government subsidised the
Introduction

biofertilizers and biopesticides, so that small and marginal farmers could easily be adopting it. A proper marketing strategy depending on the socioeconomic condition, market heterogeneity and buying capacity of the consumer need to be planned to decide on various intermediaries for distribution and adoption of new technology by the farmers. Later on awareness on the proper application procedures, limitations of product, and long term benefits of product needs to be created in farmers especially in interiors of the country. The government could also encourage the private firms and research institutes to come together, cooperate and promote training and extension activity at farm level for farmers.

1.1 Statement of the problem

There is great need to increase farm production to overcome the requirement of food for increasing population without damaging the environment. The more use of chemical fertilizers are harmful to living soil and therefore the use of biofertilizers and biopesticide are required to improve the soil fertility without any harmful effect to the soil also biopesticides are required to control of pest without harmful effect to environment.

Sometime, the technology is available however the farmers do not use the technology. There are certain reasons for not use of the technology. This might be due to lack of awareness, unfavourable attitude and lack of knowledge regarding the technology. The biofertilizer and biopesticide technology can help the farmers of arid and semi-arid areas of Junagadh district in increasing crop production especially in kharif season crops viz. groundnut, cotton, pulses, til, vegetables etc.

Looking to above facts a study entitled, “Knowledge and attitude of farmers towards ‘Sawaj’ biofertilizers and biopesticides in Junagadh district of Gujarat state” will be undertaken with following objectives.

1.2 Objectives of study

The main objectives of this study is to know the knowledge and attitude of farmers about specific activities about ‘Sawaj’ biofertilizers and biopesticides. Considering the main objectives, following specific objectives are formulated.

1.2.1 To study the selected characteristics of the respondents.
1.2.2 To measure the knowledge level of the respondents about ‘Sawaj’ biofertilizers and biopesticides.
1.2.3 To know the attitude of the respondents about ‘Sawaj’ biofertilizers and biopesticides.

1.2.4 To ascertain the relationship between knowledge and attitude level of respondents about ‘Sawaj’ biofertilizers and biopesticides with their selected characteristics.

1.2.5 To study the evaluative perception about ‘Sawaj’ biofertilizers and biopesticides.

1.2.6 To identify the constraints perceived by the respondents in use of ‘Sawaj’ biofertilizers and biopesticides and to seek suggestions.

1.3 Importance of study

The present investigation was mainly focused on knowledge and attitude of respondents about ‘Sawaj’ biofertilizers and biopesticides and to identify the constraints they perceived in use of biofertilizers and biopesticides.

It is expected that this study will be useful to the farmers in Junagadh district to promote biofertilizers and biopesticides. It will also be useful to the field extension functionaries of development department and State Agricultural Universities in designing their training programmes and extension activities as per farmers need. The study will also give certain guidelines to the scientists in social research to undertake the similar studies in different areas for more generalization of the findings of the study and also to conduct such studies on the other ancillary aspects of many industries for its development and progress.

1.4 Assumptions of study

This study was based on the following assumptions:

1.4.1 All and each farmer under study had an equal opportunity to be selected.

1.4.2 The farmers of this area are exposed to the biofertilizers and biopesticides technology.

1.4.3 A study of these farmers can be best done through personal and group interview techniques.

1.4.4 Use of biofertilizers and biopesticides practices also sustainable and compatible with the respondents of the area under study.
1.5 Limitations of study

Keeping in view the time and other available resources with the investigator, the study was undertaken with the following limitations.

1.5.1 Some selected characteristics of respondents were studied.
1.5.2 The study was restricted to select area of the Junagadh district of Gujarat state only.
1.5.3 The study was limited to only 120 farmers selected from Proportionate randomly selected three taluka of Junagadh district.
1.5.4 The study was based on only verbal responses of the respondents.
1.5.5 The major limitation of the present study was with regards to the time, study area and other research facilities usually faced by a single researcher.
1.5.6 The study was based on oral responses received from the respondents.