Bio fertilizer industry in india

Bio-fertilizers are contain live such beneficial microorganisms which on application to seed, root or soil mobilize the availability of nutrients by their biological activity in particular, and help build up the micro-flora and in turn the soil health in general. An increasing number of farmers and agriculturists are turning to the use of bio-fertilizers as these are gentler on the soil as against chemical fertilizers.

It is easier to fully appreciate the importance of bio-fertilizers when we know how harmful the chemical fertilizers for the soil and the crops are. Chemical fertilizers are meant to boost the growth of plants and increase the fertility of the soil; however they cause significant damage to the environment and also human health by increasing the day by day concentration of toxic chemical in food. These chemical based fertilizers also make use of nitrogenous fertilizers or chemicals, are expensive and not as conveniently available. Unlike other environmentally harmful chemical fertilizers, bio-fertilizers work on naturally building up the resistance and enhance the nutritional value of the soil and the host plant by adding primary nutrients.

Application of high input technologies has resulted in significant increase in agricultural productivity. There is, however, a growing concern about the adverse effects of indiscriminate use of chemical fertilizers on soil productivity and environmental quality. For those looking at organic farming, bio-fertilizers make the perfect choice. A large number of people are realizing the value and benefit of living an eco-friendly life, and therefore the demand for organic products is ever increasing. Using bio-fertilizers is a great way to produce organic products and promote good health.

The current research study is based on using the secondary data for the analysis or market of bio-fertilizer in India. Market analysis includes the annual requirement and production of different bio-fertilizers state wise in India and to find the root cause behind tremendous gap between requirement and production. This study will analyse the major bio-fertilizer producing states and identify major government and non government manufacturers. In this report we also analysis the market revenue of bio-agri (bio-fertilizer) and constant increasing demand and growth rate of this industry in India. And also analysis the strategies used by the industry to increase the market of bio-fertilizer. Also, this study will contribute in building a trend analysis for the production of bio-fertilizers in India over the last 10 years.

EXECUTIVE SUMMARY

In the current scenario one of the major concerns faced by the agriculture industry is the contamination and pollution of soil. The use of chemical fertilizers and pesticides has caused tremendous harm to the environment. There seems to be a growing concern about the adverse effects of indiscriminate use of chemical fertilizers on soil productivity and environmental quality. An answer to this is the bio-fertilizer, an environmentally friendly fertilizer now used in most countries. Bio-fertilizers contain micro-organisms that enrich the nutrient quality of soil. These micro-organisms supply in addition to nitrogen, considerable amount of organic matter enriching quality of soil. Inoculants of these micro-organisms have proved their technical feasibility, economic viability and social acceptability. They are therefore called as `bio-fertilizer’. Hence the term `bio-fertilizer’

may be defined as those fertilizer which containing living or latent cells of efficient strains of the nitrogen fixing, phosphorous solubilising or cellulolytice micro-organism.

For those looking at organic farming, bio-fertilizers make. The perfect choice a large number of people are realizing the value and benefit of living an eco-friendly life, and therefore the demand for organic products is ever increasing. Using bio-fertilizers is a great way to produce organic products and promote good health.

This research study based on analysing the annual requirement and production of different bio-fertilizers state wise in India identified Tamil Nadu as the major biofertilizer producing state of India. Other regions of production of biofertilizers are Madhya Pradesh, Punjab, Chennai & karnataka. The root cause behind tremendous gap between requirement and production is existence of very few Biofertilizer producing organizations and less awareness of benefits of using biofertilizers over chemical fertilizers. This research study also identified the major government and non government organizations producing biofertilizers. Data enlisted in this report contributes in building a trend analysis for the production of biofertilizers in India over the last 10 years.

CHAPTER – 01

INTRODUCTION

SALES &MARKETING OF BIOFERTLIZERS IN INDIA

INTRODUCTION

One of the major concerns in today's world is the pollution and contamination of soil. The use of chemical fertilizers and pesticides has caused tremendous harm to the environment. An answer to this is the biofertilizer, an environmentally friendly fertilizer now used in most countries. Biofertilizers are organisms that enrich the nutrient quality of soil. The main sources of biofertilizers are bacteria, fungi, and Cynobacteria (blue-green algae). The most striking relationship that these have with plants is symbiosis, in which the partners derive benefits from each other. Plants have a number of relationships with fungi, bacteria, and algae, the most common of which are with Mycorrhiza, Rhizobium, and Cyanophyceae. These are known to deliver a number of benefits including plant nutrition, disease resistance, and tolerance to adverse soil and climatic conditions. These techniques have proved to be successful biofertilizers that form a health relationship with the roots. Biofertilizers will help to solve such problems as increased salinity of the soil and chemical run-offs from the agricultural fields. Thus, biofertilizers are important if we are to ensure a healthy future for the generations to come. These micro-organisms supply in addition to nitrogen, considerable amount of organic matter enriching structure of soil. Inoculants of these micro-organisms have proved their technical feasibility, economic viability and social acceptability. They are therefore called as `biofertilizer'. Hence the term `biofertilizer' or microbial inoculants may be

defined as preparations containing living or latent cells of efficient strains of nitrogen fixing, phosphorous solubilising or cellulolytice micro-organism.

There is, however, a growing concern about the adverse effects of indiscriminate use of chemical fertilizers on soil productivity and environmental quality. For those looking at organic farming, biofertilizers make the perfect choice. A large number of people are realizing the value and benefit of living an eco-friendly life, and therefore the demand for organic products is ever increasing. Using biofertilizers is a great way to produce organic products and promote good health.

Therefore, the current research study is based on analysing the annual requirement and production of different bio-fertilizers state wise in India to find the root cause behind tremendous gap between requirement and production. This study will analyse state wise production of various biofertilizers and identify major government and non government manufacturers meeting the requirements. Results from this research study would draw inference on major government and non government manufacturers as well as find out the major state in India producing biofertilizers. Also, this study will contribute in building a trend analysis for the production of biofertilizers in India over the last 10 years.

1. 1 OBJECTIVES:

To analyse the annual production and sale of Biofertilizers in India

Estimate state wise production and consumption of Biofertilizers

Analyse Marketing conditions in the Biofertilizers’ market of India

To predict the future production and consumption by Trend analysis

1. 2 RESEARCH PLAN : The study will begin with collecting raw data of all the material available on the internet, published articles, and various journals and thereafter tabulate the data collected to perform an ordered analysis of major biofertilizer producing states of India, check the prevalent trend in the production and sales during the last ten years. Time consideration to collect extensive amount of data would be three months and the research results shall be demonstrated statistically in the form of graphs and charts so as to ease the understanding of the gap between production and availability of biofertilizers in the Indian market.

1. 3 METHODOLOGY : This research study is primarily based on extensive secondary research data available in the various published research reports and annual reports of various government and non-government organizations. The study begins with collecting raw data out of all the material available on the internet, published articles, and various journals and thereafter tabulating the data to construct graphs and charts to bring about various analysis of state wise production and sales of the major biofertilizers.

1. 4 LIMITATIONS OF THE RESEARCH

Since the data collected is secondary data, no primary research results could be utilized deciphering that certain amount of data could be outdated or obsolete.

No research study or survey has been conducted till date to rate the top 10 or top 5 Biofertilizer producing companies on India although top 20 companies producing chemical fertilizers can be enlisted.

No research study has been conducted to analyze the contribution of sales of biofertilizers to the economy of India.

There exist various research gaps to statistically estimate the trend of biofertilizer production since the first year of its commercial production in India.

CHAPTER – 02

LITERATURE REVIEW

2. ROLE OF BIOFERTILIZERS

Biofertilizers have definite advantage over chemical fertilizers. Chemical fertilizers supply not only nitrogen whereas biofertilizers provide in addition to nitrogen certain growth promoting substances like hormones, vitamins, amino acids, etc., crops have to be provided with chemical fertilizers repeatedly to replenish the loss of nitrogen utilized for crop growth. On the other hand biofertilizers supply the nitrogen continuously throughout the entire period of crop growth in the field under favorable conditions. Continuous use of chemical fertilizers adversely affects the soil structure whereas biofertilizers when applied to soil improve the soil structure. The deleterious effects of chemical fertilizers are that they are toxic at higher doses. Biofertilizers, however, have no toxic effects. It may be borne in mind that biofertilizers are no substitute for chemical fertilizers. At present, the use of chemical fertilizers is far below the recommended level. Therefore, the

aim and object of spread of biofertilizers technology as a Industry has to build up efficiency in use of chemical fertilizers supplemented by low cost inoculants to the extent possible. Main constraints in spread of biofertilizers as an Industry are production and supply of efficient cultures of microorganisms to farmers well before sowing. Secondly, Quality control aspect and lack of publicity, etc. Besides, whatever biofertilizers are prepared are not reached to farmers prior to sowing. At many places they are given free of cost, which lowers down the importance of product and farmers don’t use them carefully. Sometimes, biofertilizers are supplied after expiry date and hence expected results are not obtained. A quality control aspect is the most important in biofertilizers. Now a day most of the products sold in the market are below standard. A few entrepreneurs possess ISI mark for their products. The government has no control over manufacturers of biofertilizers in any of the states of India. Hence farmers are confused about rates, quality and expiry dates of biofertilizers. Similar is the case of prices; they are varied from place to place. (Panlada Tittabutra, et. Al., 2006)

Organic farming has emerged as an important priority area globally in view of the growing demand for safe and healthy food and long term sustainability and concerns on environmental pollution associated with indiscriminate use of agrochemicals. Though the use of chemical inputs

in agriculture is inevitable to meet the growing demand for food in world, there are opportunities in selected crops and niche areas where organic production can be encouraged to tape the domestic export market. Bio-fertilizers are being essential component of organic farming are the preparations containing live or latent cells of efficient strains of nitrogen

fixing, phosphate solubilizing or cellulolytic micro-organisms used for application to seed, soil or composting areas with the objective of increasing number of such micro-organisms and accelerate those microbial processes which augment the availability of nutrients that can be easily assimilated by plants. Biofertilizers play a very significant role in improving soil fertility by fixing atmospheric nitrogen, both, in association with plant roots

and without it, solubilise insoluble soil phosphates and produces plant growth substances in the soil. They are in fact being promoted to harvest the naturally available, biological system of nutrient mobilization (Venkatashwarlu, 2008a). The role and importance of biofertilizers in sustainable crop production has been reviewed by several authors (Biswas et al. 1985; Wani and Lee, 1995; Katyal et al. 1994). But the progress in the field of BF production technology remained always below satisfaction in Asia because of various constraints. It may be noted, only 30 % of India’s total cultivable area is covered with fertilizers where irrigation facilities are available and the remaining 70 % of the arable land, which is mainly rain fed, very negligible amount of fertilizers are being used. Farmers in these areas often use organic manures as a source of nutrients that are readily available either in their own farm or in their locality. The North- Eastern (NE) region of India provides considerable opportunity for organic farming due to least utilization of chemical inputs. It is estimated that 18 million hectare of such land is available in the NE that can be exploited for organic production. With the sizable acreage under naturally organic/default organic cultivation, India has tremendous potential to grow crops organically and emerge as a major supplier of organic products in world’s organic market (Venkatashwarlu.

2008a) The report of Task Force on Organic Farming appointed by the Government of India also observed that in vast areas of the country, where limited amount of chemicals are used and have low productivity could be exploited as potential areas to develop into organic agriculture. Arresting the decline of soil organic matter is the most potent weapon in fighting against unabated soil degradation and imperiled sustainability of agriculture in tropical regions of India, particularly those under the influence of arid, semiarid and sub-humid climate. Application of organic manures particularly bio-fertilizers is the only option to improve the soil organic carbon for sustenance of soil quality and future agricultural productivity (Ramesh, 2008).

2. 1 WHY TO EXPLORE BIO-FERTILIZERS

Indiscriminate use of synthetic fertilizers has led to the pollution and contamination of the soil, polluted water basins, destroyed micro-organisms and friendly insects, making the crop more prone to diseases and reduced soil fertility. Demand is much higher than the availability. It is estimated that by 2020, to achieve the targeted production of 321 million tonnes of food grain, the requirement of nutrient will be 28. 8 million tonnes, while their availability will be only 21. 6 million tones being a deficit of about 7. 2 million tones. Depleting feedstock/fossil fuels (energy crisis) and increasing cost of fertilizers. This is becoming unaffordable by small and marginal farmers. Soil fertility depletes due to widening gap between nutrient removal and supplies. There is a huge concern about such environmental hazards which increases threat to sustainable agriculture. Besides the above facts, the long term use of bio-fertilizers is economical, eco-friendly, more efficient,

productive and accessible to marginal and small farmers over chemical fertilizers (Venkataraman and Shanmugasundaram, 1992)

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2. 2 Balanced use of Chemical & Bio-fertilizers

The annual requirement and production of different bio-fertilizers has clearly demonstrated tremendous gap in this area. Thus, a strategy for judicious combination of chemical fertilizers and biofertilizers will be economically viable and ecological useful. It should be recommended that biofertilizers are not a substitute, but a supplement to chemical fertilizers for maximizing not only the yield but also agro system stability.

2. 3 Characteristic features of some Bio-fertilizers

Rhizobium:- Belongs to family Rhizobiaceae, symbiotic in nature, fix nitrogen 50-100 kg/ha. With legumes only. It is useful for pulse legumes like chickpea, red-gram, pea, lentil, black gram, etc., oil-seed legumes like soybean and groundnut and forage legumes like berseem and lucerne. It colonizes the roots of specific legumes to form tumour like growths called root nodules, which acts as factories of ammonia production. Rhizobium has ability to fix atmospheric nitrogen in symbiotic association with legumes and certain nonlegumes like Parasponia. Rhizobium population in the soil depends on the presence of legume crops in the field.

Azospirillum:- Belongs to family Spirilaceae, heterotrophic and associative in nature. In addition to their nitrogen fixing ability of about 20-40 kg/ha, they also produce growth regulating substances. The Azospirillum form associative symbiosis with many plants particularly with those having the

C4-dicarboxyliac path way of photosynthesis (Hatch and Slack pathway), because they grow and fix nitrogen on salts of organic acids such as malic, aspartic acid (Arun, 2007a). Thus it is mainly recommended for maize, sugarcane, sorghum, pearl millet etc. They do not, however, produce any visible nodules or out growth on root tissue.

Azotobacter-: Belongs to family Azotobacteriaceae, aerobic, free living, and heterotrophic in nature. Azotobacters are present in neutral or alkaline soils and A. chroococcum is the most commonly occurring. species in arable soils.. The number of Azotobacter rarely exceeds of 104 to 105 g-1 of soil due to lack of organic matter and presence of antagonistic microorganisms in soil. The bacterium produces anti-fungal antibiotics which inhibits the growth of several pathogenic fungi in the root region thereby preventing seedling mortality to a certain extent. The isolated culture of Azotobacter fixes about 10 mg nitrogen g-1 of carbon source under in vitro conditions. The occurrence of this organism has been reported from the rhizosphere of a number of crop plants such as rice, maize, sugarcane, bajra, vegetables and plantation crops, (Arun, 2007a).

Blue Green Algae (Cyanobacteria) and Azolla -These belongs to eight different families, phototrophic in nature and produce Auxin, Indole acetic acid and Gibberllic acid, fix 20-30 kg N/ha in submerged rice fields as they are abundant in paddy, so also referred as ‘ paddy organisms’. Most N fixing BGA are filamentous, consisting of chain of vegetative cells including specialized cells called heterocyst which function as micro nodule for synthesis and N fixing machinery. BGA forms symbiotic association capable of fixing nitrogen with fungi, liverworts, ferns and flowering plants, but the

most common symbiotic association has been found between a free floating aquatic fern, the Azolla and Anabaena azollae (BGA). Besides N-fixation, these biofertilizers or biomanures also contribute significant amounts of P, K, S, Zn, Fe, Mb and other micronutrient. India has recently introduced some species of Azolla for their large biomass production, which are A. caroliniana, A. microphylla, A. filiculoides and A. mexicana.

Phosphate solubilizers -Several reports have examined the ability of different bacterial species to solubilize insoluble inorganic phosphate compounds, such as tricalcium phosphate, dicalcium phosphate, hydroxyapatite, and rock phosphate. Among the bacterial genera with this capacity are pseudomonas, Bacillus, Rhizobium, Burkholderia, Achromobacter, Agrobacterium, Microccocus, Aereobacter, Flavobacterium and Erwinia. There are considerable populations of phosphatesolubilizing bacteria in soil and in plant rhizospheres. These include both aerobic and anaerobic strains, with a prevalence of aerobic strains in submerged soils. A considerably higher concentration of phosphate solubilizing bacteria is commonly found in the rhizosphere in comparison with non rhizosphere soil (Raghu and Macrae, 2000). The soil bacteria belonging to the genera Pseudomonas and Bacillus and Fungi are more common. The major microbiological means by which insoluble-P compounds are mobilized is by the production of organic acids, accompanied by acidification of the medium.

Phosphate absorbers Mycorrhiza (an ancient symbiosis in organic agriculture)- The term Mycorrhiza denotes “ fungus roots”. It is a symbiotic association between host plants and certain group of fungi at the root system, in which the fungal partner is benefited by obtaining its carbon

requirements from the photosynthates of the host and the host in turn is benefited by obtaining the much needed nutrients especially phosphorus, calcium, copper, zinc etc.,

Zinc solubilizers – The nitrogen fixers like Rhizobium, Azospirillum, Azotobacter, BGA and Phosphate solubilizing bacteria like B. magaterium, Pseudomonas striata, and phosphate mobilizing Mycorrhiza have been widely accepted as bio-fertilizers (Subba Roa, 2001a). However these supply only major nutrients like zinc, iron, copper etc., zinc being tmost important is found in the earth’s crust to the tune of 0. 008 per cent but more than 50 per cent of Indian soils exhibit deficiency of zinc with content must below the critical level of 1. 5 ppm of available zinc (Katyal and Rattan, 1993). There appears to be two main mechanisms of zinc fixation, one operates in acidic soils and is closely related with cat ion exchange and other operates in alkaline conditions where fixation takes by means of chemisorptions, (chemisorptions of zinc on calcium carbonate formed a solid-solution of ZnCaCO3), and by complexation of organic ligands (Alloway, 2008). The zinc can be solubilized by microorganisms viz., B. subtilis, Thiobacillus thioxidans and Saccharomyces sp. These microorganisms can be used as bio-fertilizers for solubilization of fixed micronutrients like zinc (Raj, 2007). The results have shown that a Bacillus sp. (Zn solubilizing bacteria) can be used as bio-fertilizer for zinc or in soils where native zinc is higher or in conjunction with insoluble cheaper zinc compounds like zinc oxide (ZnO), zinc carbonate (ZnCO3) and zinc sulphide (ZnS) instead of costly zinc sulphate (Mahdi et al. 2010).

Potential role of bio-fertilizers in agriculture – Nitrogen-fixers (NF's) & Phosphate solubilizers (PSBs)

The incorporation of bio-fertilizers (Nfixers) plays major role in improving soil fertility, yield attributing characters and thereby final yield has been reported by many workers (Subashini et al. 2007a; Kachroo and Razdan, 2006; Son et al. 2007). In addition, their application in soil improves soil biota and minimizes the sole use of chemical fertilizers (Subashini et al. 2007a). Under temperate conditions, inoculation of Rhizobium improved number of pods plant-1, number of seed pod-1 and 1000-seed weight (g) and thereby yield over the control. The number of pods plant-1, number of seed pod-1 and 1000-seed weight (g) recorded were 25. 5, 17. 1 and 4. 7 per cent more over the control, respectively which was statistically significant Bhat et al. (2009). In rice under low land conditions, the application of BGA+ Azospirillum proved significantly beneficial in improving LAI and all yield attributing aspects. Grain yield and harvest index also exhibit a discernable increase with use of biofertilizers (Dar and Bali, 2007). Afzal, (2006) found that seed and straw yield of green gram increased significantly up to single inoculation with Rhizobium under 20 kg N + 45 kg P2O5 ha-1 fertility level. Field trials carried out in different locations have demonstrated that under certain environmental and soil conditions inoculation with azotobacteria has beneficial effects on plant yields. The effect of Azotobacter chroococcum on vegetative growth and yields of maize has been studied by numerous authors (Hussain et al., 1987; Martinez Toledo et al., 1988; Nieto and Frankenberger, 1991; Mishra et al., 1995; Pandey et al., 1998; Radwan, 1998), as well as the effect of inoculation with this bacterium on wheat (Emam et al., 1986; Rai and Gaur, 1988; Tippanavar and Reddy, 1993,

Elshanshoury, 1995; Pati et al., 1995; Fares, 1997a). Alkaline phosphatase activity in the peach roots was highest with Azotobacter chroococcum + P fertilizer (Godara et al., 1995). Results of a greenhouse pot experiments with onion showed that application of G. fasciculatum + A. chrooccocum + 50% of the recommended P rate resulted in the greatest root length, plant height, bulb girth, bulb fresh weight, root colonization and P uptake (Mandhare et al. 1998). Inoculation with Azotobacter + Rhizobium + VAM gave the highest increase in straw and grain yield of wheat plants with rock phosphate as a Pfertilizer (Fares, 1997a). Elgala et al. (1995) concluded that with microbial inoculation rock phosphate could be used as cheap source of P in alkaline soils and that combined inoculation could reduce the rate of fertilizer required to maintain high productivity. It is an established fact that the efficiency of phosphatic fertilizers is very low (15-20%) due to its fixation in acidic and alkaline soils and unfortunately both soil types are predominating in India accounting more than 34% acidity affected and more than seven million hectares of productive land salinity/alkaline affected (Yawalkar et al., 2000). Therefore, the inoculations with PSB and other useful microbial inoculants in these soils become mandatory to restore and maintain the effective microbial populations for solubilization of chemically fixed phosphorus and availability of other macro and micronutrients to harvest good sustainable yield of various crops. Commercial exploitation of phosphatic microbial inoculants can play an important role particularly in making the direct use of abundantly available low grade phosphate possible. Among the bacterial genera with this capacity are pseudomonas, Bacillus, Rhizobium, Burkholderia, Achromobacter, Agrobacterium, Microccocus, Aereobacter, Flavobacterium and Erwinia. Beside N-fixation and P-

solubilization, the incorporation of nitrogen fixing bacteria (Azotobacter spp.) under the commercial name ‘ cerealien’ and phosphate dissolving bacteria (Bacillus megaterium) ‘ phosphorien’ has shown the highest degree in inducing the degree of the physiological tolerance to salinity which enables the stressed plants of the Seets cultivar of wheat to be adapted and keep better performance against all applied levels of salinity (3000, 6000 and 9000 ppm). This performance was reflected by the increase in growth, dry matter accumulation, yield as well as chemical constituents. All chemicals constituents including N, P, K+, sugars, proline and were increased as compared to their control treatments in the cultivar Seets. Mohmoud and Mohamad, 2008.

Mycorrhizae

The fungi that are probably most abundant in agricultural soils are arbuscular mycorrhizal (AM) fungi. They account for 5- 50% of the biomass of soil microbes (Olsson et al., 1999). Biomass of hyphae of AM fungi may amount to 54-900 kg ha-1 (Zhu and Miller, 2003), and some products formed by them may account for another 3000 kg (Lovelock et al., 2004). Pools of organic carbon such as glomalin produced by AM fungi may even exceed soil microbial biomass by a factor of 10-20 (Rillig et al., 2001). The external mycelium attains as much as 3% of root weight (Jakobsen and Rosendahl, 1990). Approximately 10-100 m mycorrhizal mycelium can be found per cm root (McGonigle and Miller, 1999). The mineral acquisition from soil is considered to be the primary role of mycorrhizae, but they play various other roles as well which are of utmost important.

CHAPTER – 03

BIOFERTILIZER SECTORS IN INDIA: OVERVIEW

Bio-fertilizers sector in India: An Overview

Indian Biotechnology industry is considered as one of the sunrise sectors in India. The industry can be classified into five different segments. Biopharma, Agri-biotech, Bioinformatics, Bio-industrial and Bio services with each concentrating on a particular area.

Bio pharma deals with the production of vaccines, therapeutics and diagnostics, while the end products of the biotech industry find two different kinds of buyers.

Agri-biotech comprises of hybrid seeds and transgenic crops, biopesticides and biofertilizers.

Bio informatics creates and maintains the extensive electronic databases on various biological systems.

Bioservices market usually deals with clinical trial, contract research and manufacturing activities.

Bio Industrial industry comprises of enzyme manufacturing and marketing companies and these enzymes are used in detergent, textile, food, leather, paper and pharmaceutical industry.

Agri-biotech comprises of hybrid seeds and transgenic crops, biopesticides and biofertilizers.

Agri-biotech comprises of hybrid seeds and transgenic crops, biopesticides and biofertilizers.

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Bio-Agri is deals with the hybrid seeds and transgenic crops, biopesticides and one most important biofertilizer. Biofertilizer market in India growing with the rate of 12% by 2011-12. The first documented production of bio-fertilizers in the form of Rhizobium in India was in 1934 by M. R. Madhok (Yadav & Raychaudhuri, 2004), but the first commercial production was initiated only in 1956 at the Indian Agricultural Research Institute, New Delhi and Agricultural College and Research Institute, Coimbatore. Growth in production remained very slow till the mid sixties (Tewatia, Kalwe and Chaudhuri, 2007). Introduction of Soybean along with ‘ Nitragin Soybean inoculant’ imported from USA in 1964 was the first major event in bio-fertilizers history of India. Encouraged by the success of Rhizobium inoculation in Soybean, efforts were made to replace the requirement of imported inoculant with locally produced inoculants for soybean in the first phase. This was the extended to other pulses and legume oilseeds in the second phase. During 1965-1990 around 30 bio-fertilizers production laboratories were set up in the country to meet the demand (Venkataraman & Tilak, 1990) and lot of schemes were formulated to popularize their use in different legume crops. Starting from few tonnes, production and consumption increased gradually and reached a moderate figure of 1000MT by 1988-89. During this period Rhizobium inoculants was dominating with other bio-fertilizers also starting to make their presence felt such as Azotobacter. Nineties saw a dramatic surge in bio-fertilizers industry with

adding of new bio-fertilizers such as Azotobacter, Azospirillum, PSBs added to the list and total production jump from 1000MT(1989) to 10, 000MT (2000) (Dwivedi and Motsara, 2001; Bhattacharya & Dwivedi, 2004). The growth of bio-fertilizer started with the initiation of “ National Project on Development and use of Bio-fertilizers during 1983-84 which continued up