# CHAPTER –2

# An Overview of Agri- input Industry in India

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**An Overview of Agri- input Industry in India-**

**2.1.1 An Overview of Seed Industry**

**2.2.1 An Overview of Fertilizer Industry**

**2.3.1 An Overview of Plant Protecting Chemicals Industry**

**2.4.1 Introduction to Maharashtra**

**2.5.1 Profile of Satara District**

# CHAPTER NO. 2

# AN OVERVIEW OF AGRI-INPUT INDUSTRY IN INDIA

## 2.1 Seed Fertilizer, Pesticide, Industry

India is primarily agriculture oriented country and its economy is highly dependent on the agrarian produce. Developments pertaining to different industries are being made on a massive scale to change the country's economy. The agricultural input industry has immense scope in India. The agricultural input industry mainly consists of industries pertaining to main agricultural inputs viz., seed, fertilizer, pesticides or agro chemicals, farm machinery and food processing. To get an overview of agricultural input industry in the country, it is essential to understand seed industry, fertilizer industry, pesticide industry, farm machinery industry and food processing industry.

### 2.1.1 An Overview of the Seed Industry

Seed is the most cost efficient means of increasing agricultural production and productivity. An improved seed has a special place amongst all the inputs required for agricultural production. The use of inputs like irrigation, fertilizers, and pesticides depends on rainfall situation. This is not in case with of improved seeds. The farmers plan and commit themselves purchase to the improved seed much in advance on set of season. The seed production and distribution planning is thus different and much more important to the farmers. Till early fifties, most of the farmers used to be largely independent in respect of seed. Taluka seed multiplication farms were established in the IInd Five Year Plan with an object of producing foundation seed to be multiplied on the farms of registered seed growers and made available to the farmers for general cultivation. With the advent of hybrid technology, the seed scenario changed radically.

Following are the important milestones in the development of seed sector.

1. Signing of agreement by ICAR with Rockfeller Foundation to establish All India Coordinated Crop Improvement Projects in 1957.
2. Release of first four hybrids in Maize in the year 1961, followed by Sorghum in 1962, Bajra in 1963.

3. Introduction of high yielding varieties of Wheat in 1964, Paddy in 1965 and Cotton hybrids in 1968.
4. Adoption of High Yielding Varieties programme by GOI in 1965 and ushering of "Green Revolution" in mid sixties.
5. Establishment of National Seeds Corporation in 1963 for undertaking systematic production of breeder, foundation and certified seeds and guidance to Seed Industry.
6. Passing of Seeds Act 1966 and adoption of Seed Rules 1968
7. Establishment of Central Seed Certification Board in 1969.
8. Establishment of State Seed Certification Agency in Maharashtra in 1970.
9. Establishment of Maharashtra State Seeds Corporation in 1976 under NSP.
10. Establishment of autonomous Maharashtra State Seed Certification agency in 1982.
11. Introduction of New policy of seed development by GOI in October, 1988.
12. Implementation of Seed (Control) Order 1983 with effect from July, 1994.

### 2.1.2 Different Classes of Seed and its Growth in Maharashtra

In Seed multiplication programme, actually, three kind's seeds are produced. These are breeder seed, foundation seed and certified seed. The growth of these seed in Maharashtra is narrated as below.

#### 1. Breeder Seed

Breeder seed is produced from nucleus seed. The seed quality standard of breeder seed like genetic purity, germination capacity, physical purity and seed health are determined or controlled by the originating or sponsored breeder. The breeder seed requirement in the State has increased manifold with the increase in the use of certified seed. The production of breeder seed in the State has registered steep growth.

#### 2. Foundation Seed

Foundation seed is the progeny of breeder seed or foundation stage-I seed. Foundation seed is an intermediate in the generation system of seed production by seed companies both Public and Private, Department of Agriculture, Agricultural Universities and also individual seed farmers for eventual production of certified seed.

### 3. Certified Seed

Certified seed is the progeny of foundation seed or certified stage-I seed. It is the ultimate output of seed production chain. Certified seed production is undertaken by Public and Private Sector Seed Companies. Department of Agriculture and seed growers. The production of certified seed in Maharashtra rase from 1.39 lakh quintal in 80-81 to 4.13 lakh quintals in 97-98. The quantities produced in the State in the year 1980-81to 2006-07 are as under,

### 2.1.3 Role of Public Sector in Certified and Labelled Seed Distribution

Certified / labeled seed distribution prior to 1976 was done mainly through Government Institutions and total quantum was less than 1 lakh quintals. The total seed distribution which was 2.29 lakh quintals in 1984.85 has gone upto 10.22 lakh quintals in 2006-07. Thus, the certified /labeled seed use has tripelled in the last 20 years.

Seed Replacement Ratio (SRR):-

The achieved SRRs in most of the crops in State are ones above the targets fixed at national level. Barring Groundnut and Gram crops because of higher seed rate per hectare and cost of seed is not affordable to small and marginal farmers.

### 2.1.4 Role of Private Sector in Seed Distribution

Certified/ labelled seed distribution through private sector has also gone up considerably. There has been fourfold increase in total seed distribution in the last 20 years. The private sector is leading in supply of hybrids, where as public sector is leading in straight varieties. Recent seed distribution trend showed nearly 50 percent share of private sector in total seed distribution.

### 2.1.5 Perspective for the Future

The emphasis on seed production was given mostly on food, oilseeds and fibre crops. The vegetable and flower seed production did not receive the attention it deserved. Advancement of seed technology, particularly the tissue culture techniques, true potato seed, coupled with investment friendly environment have created opportunities for

entrepreneur to produce disease free and true to type saplings/ seeds in a big way. The technology has obvious benefits for the farmers. As a result fifteen tissue culture units have become operational in a recent years in M.S. producing disease free saplings of Banana, Sugarcane, Strawberry, Gerbera, Carnations, Roses etc. A true potato seed production unit has also become functional in the State. The quality planting material produced with these techniques will have to be made available to the farmers to the largest possible extent.

The crop research in vegetables and forage crops both in (Input Seed:General Information) public and private sector has assumed greater significance. A number of new hybrids and varieties are becoming available. The systematic efforts would be Needed to strengthen the production chain in order to reach the varieties to the farmers in shortest possible time. New crops particularly Sunflower and Soyabean have been introduced and established in the state in the last two decades. Inspite of impressive growth in production there is a considerable gap which remains to be bridged between the actual yield obtained by the farmer and the potential yield. The area under soyabean and sunflower would go up substantially, requiring certified seed in greater magnitudes.

To meet the food requirement of increasing population it is necessary to increase the food grains, Oilseeds and agricultural production. As the potential for area expansion is limited, development and use of new varieties of seed and ensuring their availability to farmers are of crucial importance to increase production. The seed replacement rates of all crops will have to be stepped up. Special care will have to be taken to see that certified seed use spreads in remotely accessible areas too.

Maharashtra has a rich tradition of taking lead in introduction of hybrids in different crops. This has led to the development of strong seed industry.

Following opportunities could be availed by the Maharashtra Seed Industry which would help attain distinction for the State as a major seed producing State in the country.

A) Hybrid Rice: With the development of stable male sterile systems in India the possibility of hybrids has become a reality. The emphasis on hybrid seed production technology by the Govt. and production of commercial quantities of hybrid rice has further confirmed this possibility. Karjat rice hybrid varieties developed recently by KKV,Dapoli holds promise to bring about remarkable improvement in the rice productivity of the state.

B) Biotechnology in general and particularly the recombinant DNA technology offers a way for introducing genes of non plant origin into plants which may be economic and add value significance for the farmers. Technology for imparting insect resistance, particularly to Lepidopteran pests has been developed, evaluated and is commercialised in the United States of America. A gene from bacteria Bacillus thuringensis which leads to the manufacture of a protein has been cloned. This has been introduced into cotton plant by transformation with the use of a vector. The protein so manufactured by the gene in reference when ingested by above insect leads to the perforation of the insect gut and death of the insect. This technology has tremendous potential.
Besides adding value, this leads to the reduction in pesticide use which is of great concern all over the world. Such technologies are also being developed/have been developed for resistance to sucking pests (soft bodied insects), fungal and viral diseases etc. In the State context, this technology can find application in case of crops like Cotton, Pigeonpea, Castor, Potato,Tomato etc. where Lepidopteran pests cause economically significant damage.

C) Technology for imparting tolerance to crop plants against certain class of chemicals like weedicides which are bio-degradable have also been developed and can find application.

D) Technology for improving the shelf life of farm produce like tomatoes have been commercialised and have potential for the Indian market.

There are other technologies which have specific relevance to food processing industry like increasing the TSS in the Potato, Tomato, improving the quality of edible oil altering the structure of starch in Maize, Potato, and Cassava etc.

All these technologies will need to be delivered to the farmers as and when they are ready to be commercialised and delivery through seed/planting material is the ideal and cost effective way. These developments offer tremendous opportunities for the seed industry in Maharashtra.

### 2.1.6 Constraints in Production

Kharif Jowar area is mainly concentrated in Marathwada and Vidharbha regions. These regions generally receive rains at the time of Kharif Jowar flowering to harvest stage resulting in blackening of seed grains ultimately affecting the seed quality. This has shifting of Jowar seed production from Maharashtra to Andhra Pradesh.

Uncertainty in production and supply of Breeder seed of All India Notified varieties. Irregular production and supply of breeder and foundation seed of parental lines of public bred Maize hybrids. As a result of this, Maize hybrids have not become popular in Maharashtra affecting certified seed production and supply. Paucity of public bred hybrids in Sunflower has adversely affected the certified seed production and availability of Sunflower hybrid seeds in public sector.

Vegetable seed production by State Seed Corporation has remained at miserably low level compared to private sector as a result of poor research back up.

The quality seed production and supply of Nagli and minor Millets, Mustard, Linseed and forage crops has remained almost neglected; which need special attention henceforth.

Inadequate post harvest handling, processing and packaging research back-up specially in respect of Soyabean. Lack of financial arrangements for Buffer Stocking of breeder and foundation seed.

### 2.1.7 Thrust Areas

The areas of concern for promoting certified seed use to the desired extent would be as under:

**I) Seed Production and Distribution**

1) The demand for different varieties must be based on a realistic assessment of the desirable and achievable levels of seed replacement rates (SRR). While projecting the levels of SRRs which are to be achieved, there must be a clear strategy and package of measures worked out to reach the desired levels of SRRs separately for each crop for the state.

2) Quality breeder seed production is the key stone for the entire seed production programme. Though the infrastructure for breeder seed production has improved significantly in recent years, there have been problems with the quality of breeder seed notwithstanding the monitoring mechanism which are in place. It should be ensured that breeder seed conforms to higher standards than those prescribed for foundation seed.

3) Cooperatives and non Governmental organizations should be encouraged to take up seed production particularly in remote areas and for this purpose; subsidies which are available to Public Sector Corporation and State Seed Farms should be made available.

4) Special production programmes may have to be taken up for production of seeds of Cotton, Horticulture, Vegetables and Forage crops. These programmes would have to be effectively monitored to ensure that demand of the seeds of these crops is met during XIth Plan. For horticulture crops, the emphasis will have to be on large scale multiplication of planting material through tissue culture techniques. The existing tissue culture units will have to attain economics of scale. It would also be necessary to develop Minimum Seed Certification Standards for horticultural and plantation crops so that they can be brought under the purview of certification.

5) Seed Production has become a concentrated activity in many clusters. Seed production by the farmer requires substantial investment and intensive management. It may be desirable to introduce a pilot scheme for seed insurance. The GIC has already formulated a draft scheme

for seed insurance and this could be the basis for the development of a new scheme. By protecting farmers against losses due to natural calamities, seed insurance will encourage more farmers to take up seed production. The crop insurance in which the designated area is treated as the unit, for seed insurance, it may even be possible to treat individual holdings as units.

6) The private sector has started playing a significant role in seed production particularly for vegetable crops and hybrids of certain cereals and cotton. It is necessary to give access to the private sector to term finance from commercial banks for setting up seed production facilities. For this purpose, financing norms which are suited for seed production need to be developed.

### 2.1.8 Seed Research

Seed research in the XIth Plan will take place in the context of a system of plant variety protection and protocols on exchange of germplasm based on the convention of Bio-diversity and the International Undertaking being prepared by the Commission on Plant Genetic Resource. Indian breeders will have to thoroughly familiarise themselves with different aspects of the IPR regime so that they can obtain effective protection for the varieties evolved by them

Research is necessary for prolonging the viability of functional life of different categories of seed under different storage methods. Vegetable, flower, forage and fodder seeds should also receive equal priority.

Appropriate tests are also needed to be developed for ascertaining viability of the seed to guide seed agencies and farmers. Treatment of seeds with different fungicides/pesticides for control of different seed-borne pathogens is another priority area for research.

Research must also focus on a review of isolation distances, planting ratios and the generation of data required for revision of minimum seed certification standards, grow-out test norms etc.

The applied research on following aspects needs to be carried out to provide specific answers to the present problems.

a) Off season seed production technology especially in the food and oilseed crops.

b) Soya bean post harvest handling, processing and packing.[8]

**1. Agencies Producing Foundation Seeds**

1. State Departments of Agriculture
2. State Seeds Corporations
3. National Seeds Corporation
4. State Farm Corporation of India Ltd
5. Private Sector
6. State Agricultural Universities

**2. Agencies Producing Certified Seeds**

1. State Departments of Agriculture
2. State Seeds Corporations
3. National Seeds Corporation
4. State Farm Corporation of India Ltd
5. Private Sector

### 2.1.9 Seed Marketing

Seed marketing is more complicated and specialized process as compared to marketing of other inputs and of agriculture products. Production of good quality of seed is of no value if it does not reach the farmer in time. Seed is a biological entity. In most cases, seeds are produces away from the consumption centers. Further seed production in one season is supplied to farmers in following season. Hence it requires proper storing. Moreover it has to be taken for sale to the farmers during the sowing period. Any delay in the supply by a few days may mean accumulation of unsold seed stocks. There are chances of loss in the germination percentage if it is to be stored for another year. As the marketing of seeds involves procurement, distribution, sales promotion and linking credit with sales, effective

[8] http://mahaagri.gov.in/level3detaildisp.aspx?id=2&subid=1&sub2id=1

coordination of all the related agencies is necessary to achieve the objective of making available good quality seeds to the farmers in time.

The seed marketing involves taking of bags of certified seeds to the needy farmers through the network of sales outlet of government, co operative societies and private agencies. The sale of certified seeds of cereals, pulses and oilseeds handled by the private sector as well as government and co operative organizations. The national Seeds Corporation as also the State Seeds Corporations has their own sales point for seed marketing. In some states, Department of Agriculture also sells seeds through their field staff. The sales of seeds of vegetables, flowers and other crops are mostly handled by private traders.

The Agro-Industries Corporations of the states encourage private entrepreneurs to establish agro-service centres in rural areas by providing them with training and arranging supplies of farm inputs for subsequent sales to the farmers. Over the years, private trade has come up in the seed marketing activity in a big way.

Seed companies market most of their seed through a network of private dealers. There are hundreds of private seed companies operating in the country but they differ significantly in terms of type and quantity of seed sold. A majority of them small local companies who do not have their own breeding programs and sell only seeds of popular varieties or hybrids. Larger seed companies produce and sell seeds of proprietary hybrids. They also produce seeds of popular varieties and hybrids. [9]

### 2.1.10 Indian Seed Industry

Seeds form the fundamental and crucial input for sustained growth in farm production, often stimulating the use of new methods, machinery and yield-enhancing agro-inputs. India is the fifth-largest seed market in the world with an estimated size of about US$1,500 million and growing at 12–13% annually. Governmental agencies only catered to the seed market until the easing of regulations and implementation of a new seed policy in 1988, after which the

[9] Acharya S.S. & Agarwal N.L. Agricultural Marketing in India. 2009,4th edition. pp.225.226

private-sector seed companies started to play a major role in seed development and marketing. The New Policy on Seed Development (NPSD), established in 1988 with the objective of augmenting productivity and output quality. The seed industry was probably half this size in the early part of the 1990s (Shiva and Crompton, 1998). It has therefore grown rapidly in the last decade.

The government regulates the seed industry and the seed trade in various respects. The Seed Act of 1966, the Seeds Control Order of 1983, and the Seeds Policy of 1988 are the major components of policy specific to the industry. The Seed Act of 1966 and the Seeds Control Order of 1983 provide statutory backing to the system of variety release, seed certification and seed testing. There have been two recent developments. In September 2001, the Plant Variety Protection and Farmer's Rights Act came into being. In June 2002, the government announced a new seeds policy that significantly alters the framework of regulation. Major changes in this system of regulation proposed in the National Seeds Policy of 2002 are-

- Variety registration will now be mandatory for all varieties, new and extant.
- The evaluation will be done over three seasons of field trials.
- However, certification will continue to be voluntary.
- The emphasis on registration in the new seeds policy ties in with the demands of
- The Plant Variety Protection and Farmer's Rights Act passed in 2001.
- This Act provides for plant breeder's rights, which requires extant and new plant
- Varieties to be registered on the basis of characteristics relating to novelty,
- Distinctiveness, uniformity and stability.

The overall emphasis of the new seed policy seems more favourable to the private sector than in the past. The goal seems to be to facilitate private enterprise rather than to control it.
The seed industry is its heterogeneity in many dimensions. The product segments correspond to all the major field crops and vegetables. The seed industry consists of a large public sector and a growing private sector. Seed firms, whether in the private or public sector, outsource the production of seeds to contract growers. These growers are supplied with the foundation seed that is used to produce commercial seed. The seed industry is one of the earliest examples of contract farming in India.

India has sizeable public and private sector seed businesses. Giant public sector players include the National Seeds Corporation (NSC), the State Farms Corporation of India (SFCI) and the fourteen State Seed Corporations (SSCs). NSC was the first public sector organization, established in 1963, and remained virtually the only agency for seed production for around 13 years. These corporations engage principally in production and marketing of seeds of high yielding and hybrid varieties developed by the public sector (ICAR & SAU). R&D in public-sector companies is dependent on public research institutions that are under the aegis of the Indian Council of Agricultural Research (ICAR) and state agricultural universities (SAUs) and is separate from seed production & marketing.

The public-sector companies are mostly confined to certified seeds of high-volume, low-value products such as pulses, wheat and soybean. About 75% of farmers use farm-saved seeds and the balance use commercial seeds.

Private seed companies in India are highly fragmented and are both organized and unorganized. There are no firm estimates of their numbers but unofficial estimates vary between 200 and 500. Private companies give high importance to R&D, investing 5–10% of their turnover in such activities. Unlike the public sector, where research is separate from seed production and marketing, these functions are integrated in private firms. The private sector has been focusing on development of hybrids/high-yield varieties, as these are of a higher value and offer better margins. The private sector accounts for about 70% of the total commercial seeds turnover. Most companies in the seed industry were primarily into agrochemicals and diversified into seeds, which has now become an important part of their portfolios.

The regulatory environment in India allows mass selling of seeds (that are not genetically modified) at market determined prices. Genetically modified (GM) seeds except for cotton are disallowed for cultivation. However, research on genetically modified seeds is under way in many public-sector institutions. India has some advantages when it comes to vegetable seed production like varied agro-climatic conditions and availability of skilled labour.

Furthermore, India is endowed with second largest area of farmland, and the largest area of irrigated land, in the world and, with its huge germplasm diversity, its seed industry is well placed and has potential to serve both domestic and international markets.

### 2.2.1 An Overview of the Fertilizer Industry

**Chemical Fertilizers, Organic Manure, Green Manure and Bio-Fertilizers**

The package of practices followed for replenishing the nutrient losses from the soil as a result of cultivation to maintain the fertility of the soil involves use of organic manure, green manure, chemical fertilizers and bio-fertilizers.

**1. Chemical Fertilizers**

The term chemical fertilizers refer to chemical compounds which are manufactured in factories and are used as soil nutrients. These are further classified as "macro nutrients" which supply nitrogen (N), phosphorus (P) and Potash (K) and "micro nutrient" fertilizers which supply Zinc, Manganese, Copper, Iron, Aluminium etc. The popular macro nutrient fertilizers are Urea, Diammonium Phosphate (DAP), Muriate of Phosphate (MOP), Calcium Ammonium Nitrate (CAN) and a number of complex fertilizers and the physical mixtures of these.

**2. Organic Manure**

The organic manure is usually not manufactured in chemical factories and is produced by the farmers in their fields using various types of agricultural wastes. Sometimes these are also prepared using the sewage silt or municipal waste in urban areas. Organic manure is usually bulky material and is transported in trolleys. The types of manures covered in this group would be Farm Yard Manure (FYM), which is prepared by putting agricultural wastes in a pit for decomposition and composting. This would also include the Vermi Compost. Various forms of oil cakes, which are used as fertilizers, would also fall in this category.

### 3. Bio-fertilizers

Bio-fertilizers are sold in small packets and they are required to be stored at specified temperature. These carry some living bacteria on organic base. The examples of bio-fertilizers are Rhizobium, Azetobactor, Blue-green Algae and Phosphate Solubalising Bacteria (PSB). When bio-fertilizers are put in the soil, the bacteria contained in the fertilizer packet are spread in the soil and start their activity, i.e., fixing the nitrogen from air to soil. Hence, bio-fertilizers are not soil nutrients in themselves; rather they act as catalysts/direct agents for making the soil nutrients available. These types of fertilizers are not very common among farmers and only some progressive farmers use them. Also, because of their storage requirements these are not available everywhere.

### 4. Green Manure

Green manure refers to cultivation of a specific type of vegetation with the intention of ploughing it back in the soil when the leaves are tender and easily decomposable. The popular types of green manure used by the farmers include Sesbania (Dhencha), Sunhemp (Sanai), Indigo, Urdand Cowpea. There is also a practice of ploughing back the leafy portion of leguminous crops in the field after first or second picking for the purpose of green manuring. All such cases will be counted for the purpose of obtaining area under green manure.[10]

## 2.2.2 Fertilizer Distribution and Credit

In 1944, the Government of India established the "Central Fertilizer Pool" as the official agency for the distribution of all available fertilizers at fair prices throughout the country. All fertilizers, whether domestically produced or imported, were pooled together and distributed through state agencies. In 1966, manufacturers were allowed to market 50 percent of their production. By 1969, the domestic manufacturers had been given complete freedom in marketing. However, this was short-lived. Fertilizer shortages in the early 1970s led the Government to pass the Fertilizer Movement Control Order in 1973, which brought the distribution of fertilizers under government control.

[10] http://mahaagri.gov.in/level3detaildisp.aspx?id=2&subid=2&sub2id=1

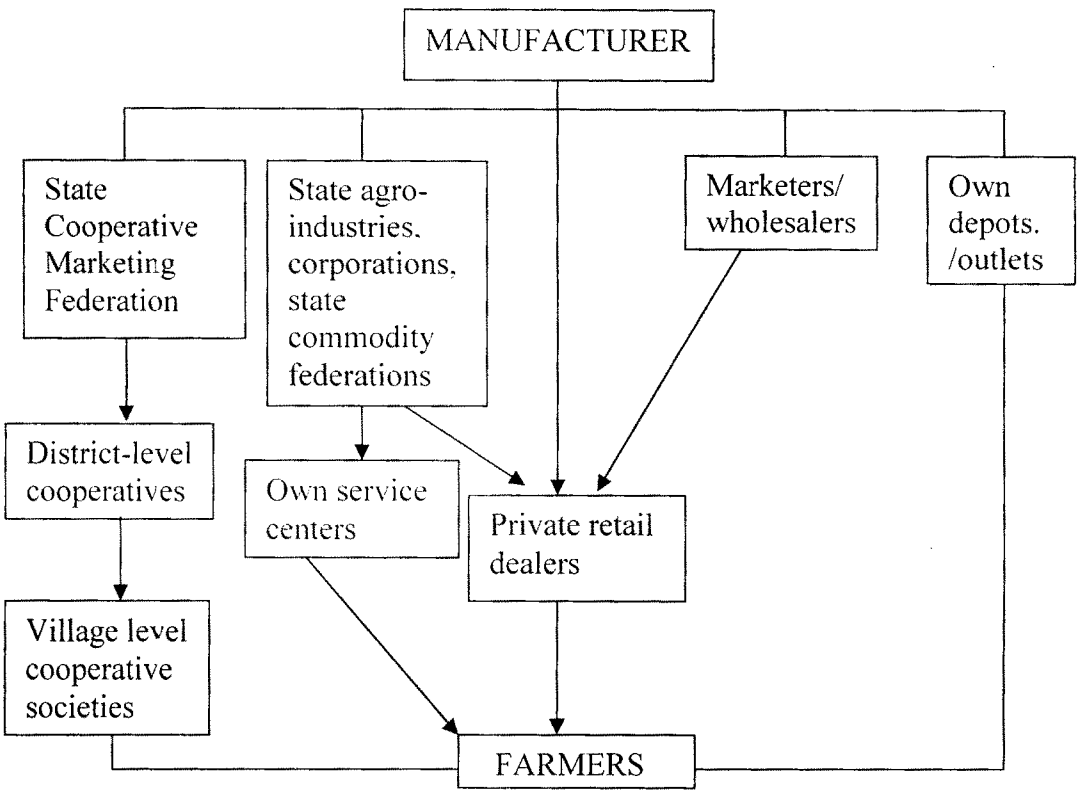
In the mid-1970s, the supply and distribution of fertilizers were regulated under the Essential Commodities Act (ECA). Manufacturers were allocated a quantity of fertilizers in different states according to a supply plan. All the fertilizers were distributed by the manufacturers according to their ECA allocation during the two cropping seasons, kharif and rabi. This system continued up to August 1992. Thereafter, all P and K fertilizers were decontrolled. AS, CAN and ammonium chloride (ACL) were also decontrolled. All these fertilizers were free from distribution control. Only urea continued to remain under control.

With effect from 1 April 2003, the Government implemented the "New Fertilizer Policy", which allowed urea manufacturers to market initially 25 percent and subsequently 50 percent of their production outside the purview of distribution control. This practice continues today. Urea manufacturers can now market 50 percent of their production as they wish.

The total quantity of fertilizer materials distributed annually increased from 0.3 million tonnes in 1951 to 34.9 million tonnes in 2003/04. This large volume of fertilizer is distributed through a well-developed marketing network spread throughout the country. Cooperatives supply almost 35 percent of the total quantity available from domestic production and importation. Private channels distribute the balance (65 percent). As on 31 March 2004, the total number of sale points was 282 468. Of these, 77 percent were privately owned and 23 percent were in cooperatives and other institutional channels.

**Diagram. 2.2.2.1**

**Fertilizer Marketing and Distribution Channels**




Currently, about 75 percent of the total quantity of fertilizer is moved by rail and the remaining 25 percent by road. The average distance of fertilizers moved by rail is about 850 km. However, within a radius of 200 – 250 km from the plant, most of the fertilizer materials are moved by road. The economics of movement favours road transportation up to this distance.

Diagram. 2.2.2.1shows the present system of fertilizer marketing and distribution. Indigenous fertilizers are distributed through institutional channels (cooperative societies, agro-industry corporations, state commodity federations, etc.) and private trade. The cooperative marketing structure varies from state to state (two to four tiers). Handling agents distribute imported urea. State agencies and domestic manufacturers distribute imported DAP and complex fertilizers, MOP and SOP.

### 2.2.3 Components of Marketing Costs

The marketing cost of urea is about Rs 1 000/tonne. Of this, freight accounts for 50 – 55 percent, the distribution margin accounts for 18 percent and handling and storage for 10 percent while fertilizer production is continuous throughout the year, its use is seasonal. In India, there are two main cropping seasons: (i) kharif (April–September); and (ii) rabi (October–March). Fertilizers are stored before the onset of each season. Consumption is characterized by a peak period followed by lean spells. Therefore, storage is an important factor in fertilizer marketing and distribution. There are about 2 060 central and state warehouses with an aggregate capacity of 30.1 million tonnes. In addition, the Food Corporation of India has a storage capacity of 23.95 million tonnes. The cooperatives have about 65 970 godowns with a capacity of about 14.12 million tonnes. These godowns are used for storage of food grains, fertilizer and other commodities.[11]

### 2.2.4 Indian Fertilizer Industry

Indian Fertilizer industry is one of the vital industries for the Indian economy, since it manufacturers a very critical raw material for agriculture. India fertilizer industry is one industry with immense scopes in the future. It is extremely important for the fertilizer industry India to have development in terms of technologically advance manufacturing process and innovative new-age products. The first fertilizer manufacturing unit in India was set up in the year 1906 at Ranipat in Chennai. The Indian fertilizer industry has played a pivotal support role to the Indian agricultural industry. The growth in the use of chemical fertilizers amongst farmers has been the secret of the nation's so called green revolution of the late sixties. The fertilizer industry in India has performed a vital role in enabling the necessary increase in the use of plant nutrients for achieving the objectives of self sufficiency in food grains production and accelerated and continuous agricultural growth.

In the present scenario, there are more than 57 large and 64 medium and small fertilizer production units under the India fertilizer industry. The main products manufactured by the fertilizer industry in India are phosphate based fertilizers, nitrogenous fertilizers, and

[11] http://www.fao.org/docrep/009/a0257e/A0257E07.htm (protection)

complex fertilizers. The fertilizer industry in India with its rapid growth is all set to make a long lasting global impression.

There are three major players in the Indian fertilizer industry namely the government owned public sector undertakings, private sector units and cooperative societies. The Government of India subsidized fertilizers to ensure that fertilizer is easily available to farmers and the country remains self sufficient in agriculture and food grain production. This is achieved by controlling the price of the fertilizer and the amount of production. The Indian Fertilizer Association is a body that coordinates with the Government of India to ensure that the government's macroeconomic objectives for Indian agriculture are met.

**1. Some of the Public Sector Companies in India Fertilizer Industry**

- National Fertilizers Limited
- Fertilizers & Chemicals Travancore Limited
- Rashtriya Chemicals &Fertilizers Limited
- Madras Fertilizers Limited
- Steel Authority of India Limited
- Neyveli Lignite Corporation Limited
- Paradeep Phosphates Limited
- Pyrites, Phosphates & Chemicals Limited
- Hindustan Fertilizer Corporation Limited

**2. Some of the Private Sector Companies in India Fertilizer Industry**

- Chambal Fertilizers & Chemicals Limited
- Ajay Farm-Chem Private Limited
- Balaji Fertilizers Private Limited
- Deepak Fertilizer and Petrochemicals Corporation Limited
- Bharat Fertilizer Industries Limited
- Coromandal Fertilizers Limited
- Gujarat Narmada Valley Fertilizer Co. Limited
- Meerut Agro Chemicals Private Limited
- Duncans Industries Limited

- Karnataka Agro Chemicals
- Godavari Fertilizers & Chemical Limited
- Shri Amba Fertilizers (I) Private Limited
- Tuticorin Alkali Chemi & Fertilizer Limited
- Gujarat State Fertilizers & Chemicals Limited
- Indo-Gulf Fertilizers & Chemicals Corporation Limited
- Southern PetroChemical Industries Corporation Limited
- Maharashtra Agro Industrial Development Corporation
- Zuari Industries Limited- Fertilizer Limited
- Mangalore Chemicals & Fertilizers Limited

### 2.2.5 Future Trends

- India's demand for fertilizers in 2007-08 was 26 MM tons, which went up to 29 MM tons in 2008-09 against a supply of 20 MM tons in 2008-2009.
- The demand for fertilizers in 2011-12 is forecasted to be around 35.5 MM tons.
- More fertilizer projects are in the pipeline.
- Gujarat is expected to play a leading role in fertilizer production.
- Indian companies have penetrated the overseas market, signaling a new phase for the industry.

Highlights:

1. India is the third largest producer and consumer of fertilizers in the world with an installed capacity of Nitrogen and Phosphate nutrients at 14 million tones p.a.
2. The Indian Fertilizer Industry is broadly divided into Nitrogenous, Phosphatic and Potassic segments. In addition to these, nutrients are combined to produce several complex fertilizers.
3. Urea, a nitrogenous type of fertilizer, is most widely consumed in India. Currently the urea capacity is 20.2 million tonnes while consumption is 21.7 million tonnes. The demand of urea is expected to grow at a CAGR of 4 percent. Urea segment currently subsidized under the Retention Price Scheme, with controls on distribution, to be decontrolled by 2006. First phase of reform in this segment initiated through a move towards Group Retention Scheme, as announced in FY02 Budget.

4. The total production of phosphate in the country was 3.36 million tonnes per annum in FY00–at 6 percent increase over FY99. Main phosphatic fertilizers produced in India are Di-ammonium Phosphate (DAP) and Single Super Phosphate (SSP).
5. Entire requirement of potassic fertilizers is imported. The major potassic fertilizer consumed in the country is Muriate of Potash (MOP).
6. Fertilizer production is highly energy intensive with cost of feedstock and fuel alone accounting for between 55 to 80 per cent of the cost of production. High cost feedstock and increased production / consumption have caused a steady increase in fertilizer subsidy.

### 2.3.1 An Overview of the Plant Protecting Chemicals Industry

**1. Integrated Pest Management**

Traditionally farmers have been adopting a number of practices for plant protection. These practices could be categorized in four groups, viz., agronomic and cultural control, mechanical control, biological control and chemical control. Usually, a specific approach keeping in view crop variety and agro-climatic conditions is adopted by the farmer for protection of his crops against insects and pests. The approach may be a combination of methods falling in one or more of the above four categories. For the best results the experts advise a judicious combination of these approaches and label it as Integrated Pest Management (IPM). The components of IPM programs outline below:

**2. Agronomic and Cultural Practices**

This is a preventive method which is based upon knowledge of life history and habits of pest. The practices covered in this category include: deep ploughing after harvesting a crop to expose the hiding or resting insects, weeding, removing and destroying of stubbles and other trash, adjusting the time of sowing to avoid peak incidence period of pests, clean cultivation, the removal of alternative wild hosts, crop rotation and choosing of insect and disease resistant varieties.

### 3. Physical and Mechanical Control

This is one of the oldest methods and includes measures such as collection of eggs and caterpillars (in active stages of pests), removal and destruction of infested part of the plant, beating of drums, lying of night traps and yellow traps. These methods are found effective at initial stage of the pest incidence when practiced by a large number of farmers in a particular area.

### 4. Biological Control

Most of the crops have their natural enemies in the form of parasites and predators and disease causing organisms. Large scale multiplication and liberation of such other agents, which naturally occur in environment but are enemies of enemies of crops (friends of crops) results ineffective control of the harmful organisms. These methods are often applied by specialized agencies in conjunction with chemical methods so that harmful effects of insecticide do not interfere with the activities of nature based enemies of pests.

### 5. Chemical Control

This method relates to use of insecticides, pesticides and weedicides, which are used as dusts, sprays and granules on the crops. Due to their nature of producing immediate results such chemicals are most popular among the farmers. Serious limitations, particularly those relating to residues on crops and destruction of useful insects, have been noted in recent years in usage of these chemicals.[12]

## 2.3.2 Marketing of Pesticides

For regulating the manufacture, import, sale and use of pesticides, the Insecticides Act, 1968 was operative in the country. Under this act, there is a provision of registration of pesticides with the Government of India (Ministry of Agriculture). Every formulation has to be registered after making a formal application in this regard to the government.

For marketing of pesticides, the manufacturers appoint distributors for each region. These distributors are mostly located in urban centers and are either in the co-operative or private

[12] http://mahaagri.gov.in/level3detaildisp.aspx?id=2&subid=3&sub2id=1

sector. They arrange to supply the plant protection chemicals to farmers through a network of dealers. The number of dealers varies from chemical to chemical and area to area. These dealers are either in private sector, including agro service centres, agri clinics and agri business centres or in the cooperative sector. The lack of technical know how on the part of farmers or dealers and the complementary requirement of such equipment as sprayer or dusters make the marketing of plant protection chemicals a difficult and skilled job.[13]

### 2.3.3 Indian Pesticide or Agrochemical Industry

Agrochemicals also known as Pesticides are substance or mixture of substances that are used to avert, destroy or control any kind of pests or unwanted type of plants or animals that cause harm to crops or hampers the normal growth process of a crop. As per a Government of India estimate of 2002, value of crop losses caused due to non-usage of pesticides was around Rs 90,000 crore. Thereon, assuming losses grew at an average 2%, total losses would have amounted to Rs 101,355 crore in 2009, a staggering 2.2% of India's GDP.

The pesticide industry in India started with import of BHC in 1952.By 1958 five basic pesticides was manufactured in India. As of now, 44 technical grade pesticides having 110 formulations are manufactured. Pesticides in India are manufactured by private sector as well as public sector companies or corporations. There are 25 large units apart from 450 smaller ones manufacturing Pesticides. Currently the level of production is 80,000 tonnes as against the capacity of 1.07 lakh tones. Presently the average per hectare consumption of pesticides is about 328 grams which is lower than the advanced countries USA- 1600 gms & Japan 2000gms/ hect. There has been rapid increase in the consumption of pesticides till 90's. However during 90's a greater emphasis was given to IPM and biological control. Therefore use of pesticides has not increased further. Of the total PP chemicals used in India 80% constitute insecticides, 12% fungicides and 5% herbicides.

The state wise consumption of pesticides indicates 33.6% of total consumption was in AP followed by Karnataka 16.2%. The crop wise consumption indicates 50% is used in cotton

[13] Acharya S.S. & Agarwal N.L. Agricultural Marketing in India, 2009,4th edition, pp.238.239

followed by paddy -18% and vegetables-14%. The studies have shown that for every one rupee spent on plant protection the crop worth about Rs. four is protected which otherwise would have been lost due to pests & diseases. The demand for PP chemicals is more compare to production as farmers are moving towards market oriented farming system. Our country imports 40 types of pesticides. For regulating the manufacture, import, sale and use of pesticides, the Insecticides Act, 1968 was operative in the country. Every formulation has to be registered with MoA GOI. For marketing of pesticides, the manufacturers appoint distributors for each region either in co operative or private sector and are supplied through dealers to farmers. Dealers may be from private sector, Agro service centers, Agri-clinics or Agribusiness centers or cooperatives.[14]

### 2.4.1 Introduction to Maharashtra

Maharashtra is one of the most industrialized states of India, it occupies the western and central parts of the country and extends over the Sahyadri mountains; a vast stretch of 720 kilometers of the Arabian sea coast providing it a beautiful backdrop. The present state of Maharashtra was formed on May 1, 1960 on uni-lingual principle by carving it out of the erstwhile Mumbai state, which included the predominantly Marathi-speaking areas as the former princely state of Hyderabad as well as the Central Provinces and Berar.

### 2.4.2 Geography of Maharashtra

Maharashtra is located in the northern center of peninsular India, surrounded by the Arabian sea in the west, Gujarat and Madhya Pradesh on the north, Madhya Pradesh in the east and Karnataka and Andhra Pradesh on the south. The state extends between the latitudes 15.6° North and 22.1° North and longitudes 72.6° East and 80.9° East.

As far as the geography of Maharashtra goes, much of the state consists of the high Deccan plateau, which is separated from the straight Konkan coastline by 'Ghats'. The Ghats are a succession of steep hills, periodically bisected by narrow roads, and which are often crowned by medieval forts. Given their altitude, it is not surprising that the Ghats are home to the

[14] http://www.angrau.net/StudyMaterial/AgExtension/AEXT391.pdf

state's hill stations. One of the three major regions of the state is the Sahyadri range with an elevation of 1000 meters.

The unique feature of this region is a series of crowning plateau. Lying between the Arabian Sea and the Sahyadri Range, Konkan is narrow coastal lowland, just 50 km wide and with an elevation below 200 meters. The third important region is the Satpura hills along the northern border, and the Bhamragad-Chiroli-Gaikhuri ranges on the eastern border form physical barriers preventing easy movement. These ranges also serve as natural limits to the state.

### 2.4.3 Brief History of Maharashtra

Jorwe in the Ahmadnagar district provides many evidences of ancient civilization in Maharashtra. The Chinese traveler Hiun Tsang, who visited this region in 640-641 BC, was quite appreciative of the prosperity of the region in his writings. During third and fourth centuries BC, the region of Konkan remained under the control of the Mauryans, whose policies led to great advancements in the fields of trade and Buddhist learning in the region. After the disintegration of the Mauryan Empire, the Satwahanas (230 BC - AD 225) came to rule this region. Pratishthan or modern Paithan was their capital. This great empire crumbled because of internal feuds in the ranks of vassals. In succession came the great rulers of the Vakataka, Chalukya, and Rashtrakuta empires making Maharashtra a great center of culture and ar..

Yadavas were the last of these kingdoms that lost their power in the early 12th century and a long period of Muslim rule started in Maharashtra. Allauddin Khilji was the first ruler to understand the value of the Deccan as the key to extending influence over south India and consecutive rulers from Delhi till the 17th century tried their best to keep this region under their control. From the middle of the 17th century, a new group of warrior people came to dominate the scene in Maharashtra and elsewhere in India called Marathas.

The origin of Marathas is still debatable, but what is known is that they stole the limelight from the great Mughals. It was only after defeating the Marathas that the English could establish their hegemony on India. Shivaji was the first great ruler of Marathas and it was he

who paved the way for future Maratha influence on India. The heroism and greatness of Shivaji is still remembered by the people of this country and his stories are now part of the great Indian folklores.[15]

### 2.5.1 Profile of Satara District

Satara District is a district of Maharashtra state in western India with an area of 10,480 km² and a population of 2,808,994 of which 14.17% were urban (as of 2001).[2] Satara is the capital of the district and other major towns include Wai, Karad, Koregaon, Koyananagar, Rahimatpur, Phaltan, Mahabaleshwar and Panchgani. This district comes under Pune Administrative Division along with Pune, Sangli, Solapur and Kolhapur Districts. The district of Pune bounds it to the north, Raigad bounds it to the North-West, Solapur the east, Sangli to the south, and Ratnagiri to the west.[3]

The Sahyadri range, or main range of the Western Ghats, runs north and south along the western edge of the district, separating it from Ratnagiri district. The Mahadeo range starts about 10 m. north of Mahabaleshwar and stretches east and south-east across the whole of the district. The Mahadeo hills are bold, presenting bare scarps of black rock like fortresses. The Satara district is part of two main watersheds. The Bhima River watershed, which is a tributary of the Krishna, includes the north and northeast of the district, north of the Mahadeo hills. The rest of the district is drained by the upper Krishna and its tributaries. The hill forests have a large store of timber and firewood.

The whole of Satara district falls within the Deccan Traps area; the hills consist of trap intersected by strata of basalt and topped with laterite, while, of the different soils on the plains, the commonest is the black loamy clay containing carbonate of lime. This soil, when well watered, is capable of yielding heavy crops. Satara contains some important irrigation works, including the Krishna canal. In some of the western parts of the district the average annual rainfall exceeds 5 m.; but on the eastern side water is scanty, the rainfall varying from 1 m in Satara town to less than 30 cm in some places farther east. The district is traversed from north to south by a railway line, which passes 15 km east Satara town.

[15] http://www.newkerala.com/states-of-india/maharashtra.php

Satara district consists of 11 talukas (tahsils). These are Satara, Karad, Wai, Mahabaleshwar, Phaltan, Man, Khatav, Koregaon, Patan, Jaoli and Khandala. There are ten Vidhan Sabha constituencies in this district. Phaltan, Man, Khatav, Koregaon, Wai and Satara are part of Satara Lok Sabha constituency and Jaoli, Patan, Karad (North) and Karad (South) are part of Karad Lok Sabha constituency.

| **Tehsils (Taluke) of Satara District at a Glance** | |
|---|---|
| **Taluka** | **Capital** |
| Satara : | Satara |
| Karad : | Karad |
| Wai : | Wai |
| Koregaon : | Koregaon |
| Jaoli : | Medha |
| Mahabaleshwar : | Mahabaleshwar |
| Khandala : | Khandala (Pargaon) |
| Patan : | Patan |
| Phaltan : | Phaltan |
| Khatav : | Vaduj |
| Man : | Dahiwadi |