

CHAPTER – II

HISTORY OF INDIAN AGRICULTURE

2.1 INTRODUCTION

Indian agriculture has long, old and beyond memory history which begins the Indus valley civilization. One of the most old water regulating structure in the world is Grand Anicut dam on river Kaveri (1st-2nd Century CE)^[1].

Indian agriculture began by 9000 BCE as a result of early cultivation of plants, and domestication of crops and animals. Settled life soon followed with implements and techniques being developed for agriculture. Double monsoons led to two harvests being reaped in one year. Indian products soon reached the world via existing trading networks and foreign crops were introduced to India. Plants and animals—considered essential to their survival by the Indians—came to be worshiped and venerated.

The middle ages saw irrigation channels reach a new level of sophistication in India and Indian crops affecting the economies of other regions of the world under Islamic patronage. Land and water management systems were developed with an aim of providing uniform growth. Despite some stagnation during the later modern era the independent Republic of India was able to develop a comprehensive agricultural program.

Reference 1: Stein, Burton (1998), *A History of India*, Blackwell Publishing, ISBN 0-631-20546-2

2.2 HISTORY OF INDIAN AGRICULTURE

2.2.1 Early History

Wheat, barley and jujube were domesticated in the Indian subcontinent by 9000 BCE. Domestication of sheep and goat soon followed. This period also saw the first domestication of the elephant. Barley and wheat cultivation—along with the domestication of cattle, primarily sheep and goat—was visible in Mehrgarh by 8000-6000 BCE. Agro pastoralism in India included threshing, planting crops in rows—either of two or of six—and storing grain in granaries. By the 5th millennium BCE agricultural communities became widespread in Kashmir. Zaheer Baber (1996)^[1] writes that 'the first evidence of cultivation of cotton had already developed'. Cotton was cultivated by the 5th millennium BCE-4th millennium BCE. The Indus cotton industry was well developed and some methods used in cotton spinning and fabrication continued to be practiced till the modern Industrialization of India. A variety of tropical fruit such as mango and muskmelon are native to the Indian subcontinent. The Indians also domesticated hemp, which they used for a number of applications including making narcotics, fiber, and oil. The farmers of the Indus Valley grew peas, sesame, and dates. Sugarcane was originally from tropical South Asia and Southeast Asia. Different species likely originated in different locations with *S. barberi* originating in India and *S. edule* and *S. officinarum* coming from New Guinea. Wild *Oryza* rice appeared in the Belan and Ganges valley regions of northern India as early as 4530 BCE and 5440 BCE respectively. Rice was cultivated in the Indus Valley Civilization. Agricultural activity during the second millennium BC included rice cultivation in the Kashmir and Harrappan regions. Mixed farming was the basis of the Indus valley economy. Denis J. Murphy (2007)^[2] details the spread of cultivated rice from India into South-east Asia:

References 1 : Baber, Zaheer (1996), *The Science of Empire: Scientific Knowledge, Civilization, and Colonial Rule in India*, State University of New York Press, ISBN 0-7914-2919-9.

Reference 2: Murphy, Denis J. (2007), *People, Plants and Genes: The Story of Crops and Humanity*, Oxford University Press, ISBN 0-19-920713-5.

Several wild cereals, including rice, grew in the Vindhyan Hills, and rice cultivation, at sites such as Chopani-Mando and Mahagara, may have been underway as early as 7000 BP. The relative isolation of this area and the early development of rice farming imply that it was developed indigenously....Chopani-Mando and Mahagara are located on the upper reaches of the Ganges drainage system and it is likely that migrants from this area spread rice farming down the Ganges valley into the fertile plains of Bengal, and beyond into south-east Asia.

Irrigation was developed in the Indus Valley Civilization by around 4500 BCE. The size and prosperity of the Indus civilization grew as a result of this innovation, which eventually led to more planned settlements making use of drainage and sewers. Sophisticated irrigation and water storage systems were developed by the Indus Valley Civilization, including artificial reservoirs at Girnar dated to 3000 BCE, and an early canal irrigation system from circa 2600 BCE. Archeological evidence of an animal-drawn plough dates back to 2500 BC in the Indus Valley Civilization.

2.2.2 Vedic period – Post Maha Janapadas period (1500 BCE – 200 CE)

According to Gupta (2004) ^[1] the summer monsoons may have been longer and may have contained moisture in excess than required for normal food production. One effect of this excessive moisture would have been to aid the winter monsoon rainfall required for winter crops. In India, both wheat and barley are held to be *Rabi* (winter) crops and—like other parts of the world—would have largely depended on winter monsoons before the irrigation became widespread. The growth of the *Kharif* crops would have probably suffered as a result of excessive moisture. Jute was first cultivated in India, where it was used to make ropes and cordage. Some animals—thought by the Indians as being vital to their survival—came to be worshiped.

Reference 1: Gupta, Anil K. (2004), "Origin of agriculture and domestication of plants and animals linked to early Holocene climate amelioration", *Current Science*, 87 (1), Indian Academy of Sciences.

Trees were also domesticated, worshiped, and venerated—*Pipal* and *Banyan* in particular. Others came to be known for their medicinal uses and found mention in the holistic medical system *Ayurveda*.

In the later Vedic texts (c. 1000–500 BC), there are repeated references to iron. Cultivation of a wide range of cereals, vegetables, and fruits is described. Meat and milk products were part of the diet; animal husbandry was important. The soil was plowed several times. Seeds were broadcast. Fallowing and a certain sequence of cropping were recommended. Cow dung provided the manure. Irrigation was practiced.

The Mauryan Empire (322–185 BCE) categorized soils and made meteorological observations for agricultural use. Other Mauryan facilitation included construction and maintenance of dams, and provision of horse-drawn chariots—quicker than traditional bullock carts. The Greek diplomat Megasthenes (c. 300 BC)—in his book *Indika*—provides a secular eyewitness account of Indian agriculture:

2.2.3 Early Common Era – High Middle Ages (200–1200 CE)

The Tamil people cultivated a wide range of crops such as rice, sugarcane, millets, black pepper, various grains, coconuts, beans, cotton, plantain, tamarind and sandalwood. Jackfruit, coconut, palm, areca and plantain trees were also known. Systematic ploughing, manuring, weeding, irrigation and crop protection was practiced for sustained agriculture. Water storage systems were designed during this period. Kallanai (1st-2nd century CE), a dam built on river Kaveri during this period, is considered the as one of the oldest water-regulation structures in the world still in use.

Spice trade involving spices native to India—including cinnamon and black pepper—gained momentum as India starts shipping spices to the Mediterranean. Roman trade with India followed as detailed by the archaeological record and the *Periplus of the Erythraean Sea*. Chinese sericulture attracted Indian sailors during the early centuries of the common era. Crystallized sugar was discovered by the time of the Guptas (320-

550 CE), and the earliest reference of candied sugar come from India. The process was soon transmitted to China with traveling Buddhist monks. Chinese documents confirm at least two missions to India, initiated in 647 CE, for obtaining technology for sugar-refining. Each mission returned with results on refining sugar. Indian spice exports find mention in the works of Ibn Khurdadbeh (850), al-Ghafiqi (1150), Ishak bin Imaran (907) and Al Kalkashandi (fourteenth century).

Noboru Karashima's research of the agrarian society in South India during the Chola Empire (875-1279) reveals that during the Chola rule land was transferred and collective holding of land by a group of people slowly gave way to individual plots of land, each with their own irrigation system. The growth of individual disposition of farming property may have led to a decrease in areas of dry cultivation. The Cholas also had bureaucrats which oversaw the distribution of water—particularly the distribution of water by tank-and-channel networks to the drier areas.

2.2.4 Late Middle Ages – Early Modern Era (1200–1757 CE)

The construction of water works and aspects of water technology in India is described in Arabic and Persian works. The diffusion of Indian and Persian irrigation technologies gave rise to an irrigation system which brought about economic growth and growth of material culture. Agricultural 'zones' were broadly divided into those producing rice, wheat or millets. Rice production continued to dominate Gujarat and wheat dominated north and central India. The Encyclopedia Britannica details the many crops introduced to India during this period of extensive global discourse:

Introduced by the Portuguese, cultivation of tobacco spread rapidly. The Malabār Coast was the home of spices, especially black pepper, that had stimulated the first European adventures in the East. Coffee had been imported from Abyssinia and became a popular beverage in aristocratic circles by the end of the century. Tea, which was to become the common man's drink and a major export, was yet undiscovered, though it was growing wild in the hills of Assam. Vegetables were

cultivated mainly in the vicinity of towns. New species of fruit, such as the pineapple, papaya, and cashew nut, also were introduced by the Portuguese. The quality of mango and citrus fruits was greatly improved.

Land management was particularly strong during the regime of Akbar the Great (reign: 1556-1605), under whom scholar-bureaucrat Todarmal formulated and implemented elaborated methods for agricultural management on a rational basis. Indian crops—such as cotton, sugar, and citric fruits—spread visibly throughout North Africa, Islamic Spain, and the Middle East. Though they may have been in cultivation prior to the solidification of Islam in India, their production was further improved as a result of this recent wave, which led to far-reaching economic outcomes for the regions involved.

2.2.5 Colonial British Era (1757–1947 CE)

In 1857 a Rampur canal on river Sutlej was constructed and a number of irrigation canals are located on the Sutlej river. Few Indian commercial crops—such as Cotton, indigo, opium, and rice—made it to the global market under the British Raj in India. The second half of the 19th century saw some increase in land under cultivation and agricultural production expanded at an average rate of about 1 percent per year by the later 19th century. Due to extensive irrigation by canal networks Punjab, Narmada valley, and Andhra Pradesh became centers of agrarian reforms. There was influence of the world wars on the Indian agricultural system^[1].

Reference 1:

Roy, T. (2006), "Agricultural Prices and Production, 1757–1947", *Encyclopedia of India (vol. 1)* edited by Stanley Wolpert, pp. 20–22, Thomson Gale, ISBN 0-684-31350-2.

Agricultural performance in the interwar period (1918–1939) was dismal. From 1891 to 1946, the annual growth rate of all crop output was 0.4 percent, and food-grain output was practically stagnant. There were significant regional and intercrop differences, however, nonfood crops doing better than food crops. Among food crops, by far the most important source of stagnation was rice. Bengal had below-average growth rates in both food and nonfood crop output, whereas Punjab and Madras were the least stagnant regions. In the interwar period, population growth accelerated while food output decelerated, leading to declining availability of food per head. The crisis was most acute in Bengal, where food output declined at an annual rate of about 0.7 percent from 1921 to 1946, when population grew at an annual rate of about 1 percent.

The British regime in India did supply the irrigation works but rarely on the scale required. Community effort and private investment soared as market for irrigation developed. Agricultural prices of some commodities rose to about three times between 1870-1920.

A rich source of the state of Indian agriculture in the early British era is a report prepared by a British engineer, Thomas Barnard, and his Indian guide, Raja Chengalvaraya Mudaliar, around 1774. This report contains data of agricultural production in about 800 villages in the area around Chennai in the years 1762 to 1766. This report is available in Tamil in the form of palm leaf manuscripts at Thanjavur Tamil University, and in English in the Tamil Nadu State Archives. A series of articles in *The Hindu* newspaper in the early 1990s authored by researchers at The Center for Policy Studies led by Shri Dharampal Dharampal highlight the impressive production statistics of Indian farmers of that era.

2.2.6 Republic of India (1947 CE onwards)

Bhakra Dam (completed 1963) is the largest dam in India. Special programs were undertaken to improve food and cash crops supply. The Grow More Food Campaign (1940s) and the Integrated Production Programme (1950s) focused on food and cash crops supply respectively. Five-year plans of India—oriented towards agricultural development—soon followed. Land reclamation, land development, mechanization, electrification, use of chemicals—fertilizers in particular, and development of agriculture oriented 'package approach' of taking a set of actions instead of promoting single aspect soon followed under government supervision. The many 'production revolutions' initiated from 1960s onwards included Green Revolution in India, Yellow Revolution (oilseed: 1986-1990), Operation Flood (dairy: 1970-1996), and Blue Revolution (fishing: 1973-2002) etc. Following the economic reforms of 1991, significant growth was registered in the agricultural sector, which was by now benefiting from the earlier reforms and the newer innovations of Agro-processing and Biotechnology.

Due to the growth and prosperity that followed India's economic reforms a strong middle class emerged as the main consumer of fruits, dairy, fish, meat and vegetables—a marked shift from the earlier staple based consumption. Since 1991, changing consumption patterns led to a 'revolution' in 'high value' agriculture while the need for cereals is experienced a decline. The per capita consumption of cereals declined from 192 to 152 kilograms from 1977 to 1999 while the consumption of fruits increased by 553%, vegetables by 167%, dairy products by 105%, and non-vegetarian products by 85% in India's rural areas alone. Urban areas experienced a similar increase.

Agricultural exports continued to grow at well over 10.1% annually through the 1990s. Contract farming—which requires the farmers to produce crops for a company

under contract—and high value agricultural product increased. Contract farming led to a decrease in transaction costs while the contract farmers made more profit compared to the non-contract workforce. However, small landholding continued to create problems for India's farmers as the limited land resulted in limited produce and limited profits.

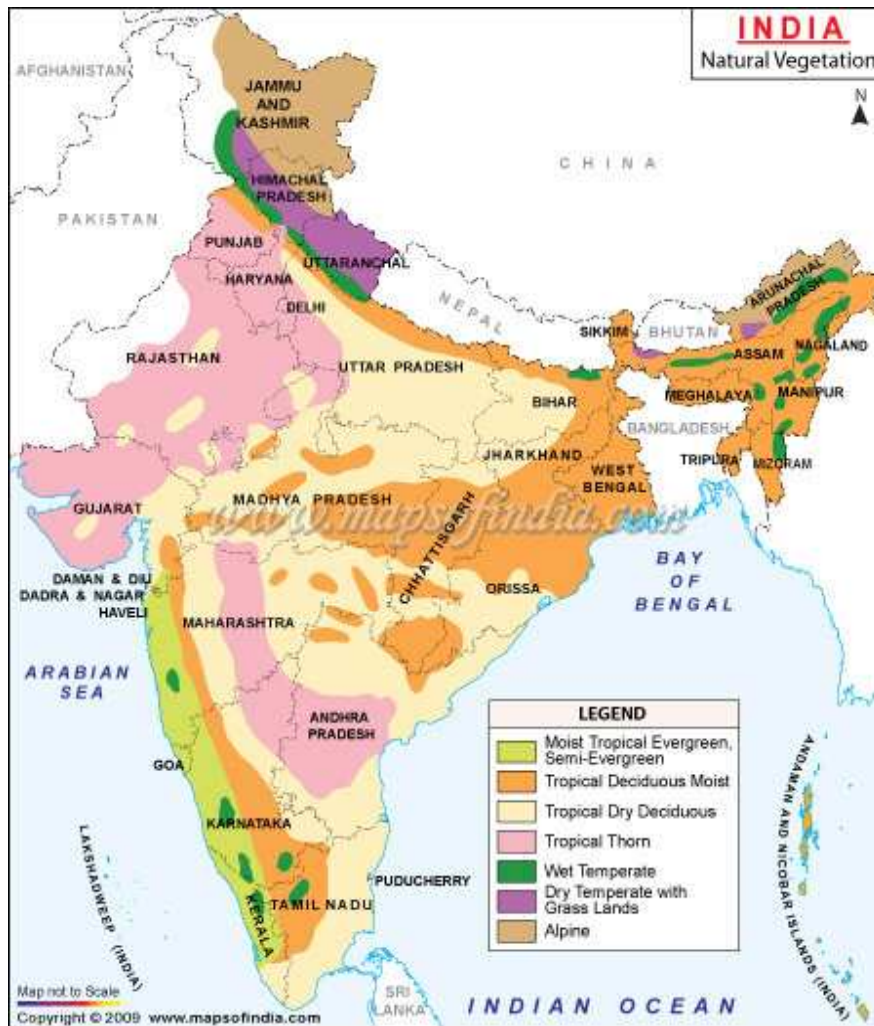
Since independence, India has become one of the largest producers of wheat, edible oil, potato, spices, rubber, tea, fishing, fruits, and vegetables in the world. The Ministry of Agriculture oversees activities relating to agriculture in India. Various institutions for agriculture related research in India were organized under the Indian Council of Agricultural Research (est. 1929). Other organizations such as the National Dairy Development Board (est. 1965), and National Bank for Agriculture and Rural Development (est. 1982) aided the formation of cooperatives and improved financing.

The contribution of agriculture in employing India's male workforce declined from 75.9% in 1961 to 60% in 1999–2000. Dev (2006)^[1] holds that 'there were about 45 million agricultural labor households in the country in 1999–2000.' These households recorded the highest incidence of poverty in India from 1993 to 2000. The green revolution introduced high yielding varieties of crops which also increased the usage of fertilizers and pesticides. About 90% of the pesticide usage in India is accounted for by DDT and Lindane (BHC/HCH). There has been a shift to organic agriculture particularly for exported commodities.

- **Reference 1 :Dev, S. M. (2006), "Agricultural Labor and Wages since 1950", *Encyclopedia of India (vol. 1)* edited by Stanley Wolpert, pp. 17–20, Thomson Gale, ISBN 0-684-31350-2.**

Figure 2.1

India's Natural vegetation



Source: ICAR report 2006-2007

2.3 Indian Agriculture under Five Year Plans

On the eve of first plan (1951-1956) agriculture was in a hopeless and deplorable condition. Our farmers were heavy debt to the village money-lenders. They were having small and scattered holdings. They had neither the money nor the knowledge to use proper equipment, good seeds and chemical manures. Except in certain areas, they were dependent upon rainfall and upon the vagaries of the monsoons. Productivity of land as well as of labour had been declining and was generally the lowest in the world. In spite of the fact that nearly 70% of our working population was engaged in cultivation, the country was not self-sufficient in food grains but had come to depend on imports of food grains. Besides, the partition of the country in 1946 worsened the agricultural situation as India was allotted more people but less land to support.

2.3 (A) Objectives of Economic Planning for the Agricultural Sector

While planning to develop the agricultural sector, the Planning Commission has kept four broad objectives^[1]:

(a) Increase Agricultural Production - The aim has always been

- i) To bring more land under cultivation,
- ii) Raise the per hectare yield through intensive application of such agricultural inputs as irrigation, improved seeds fertilizers, etc. and thus
- iii) Bring about increased agricultural production.

(b) Increase Employment Opportunities – Apart from increase in production, the agricultural sector has to generate additional employment opportunities and provide scope for increasing the incomes of the poorer sections in our villages.

© **Reduce the Pressure of Population on Land** - Another basic objective of planning in the agricultural sector has been to reduce the number of people working on land, on the assumption that there are too many people working on land. The surplus labour on land should be shifted to secondary and tertiary sectors, preferably in rural land semi-urban areas.

Reference 1 : Indian Economy, Ruddar Datta, K.P.M Sundaram, S. Chand & Co.53rd Edition, ISBN : 81-219-2045-0

(d) Reduce Inequality of Incomes in the Rural Sector - The Government should remove the exploitation of tenants, and should distribute surplus land among small and marginal farmers in such a way that there would be some degree of equality and justice in the rural areas.

All these four objectives are generally followed in all our five year plans but in practice, agricultural planning in India has come to mean increase in agricultural production, viz., the achievement of the first objective; all other objectives have either been ignored or given lower priority.

2.4 Strategy Used in Agricultural Sector under Five Year Plans

To bring about increase in agricultural production and also increase in rural employment such as; setting up of community development programmes and agricultural extension services throughout the country, expansion of irrigation facilities, fertilizers, pesticides, agricultural machinery, high-yielding varieties of seeds and expansion of transportation, power, marketing, and of institutional credit. To reduce the pressure of population on land, the strategy used was to set up agro-based industries and handicrafts in rural areas, to promote rural transport and communications and to encourage the movement of people from agriculture to industries and service sectors. Finally, to bring about equality and justice in rural India, the strategy used was land reforms which included the removal of intermediaries, like the Zamindars, the protection of tenants through tenancy legislation, ceiling of land holding and distribution of surplus land among landless labourers and small and marginal farmers.

2.4.1 Pattern of Investment in the Agricultural Sector - The pattern of investment in the different five year plans is summarized in table 2.1 :

Table 2.1 Pattern of Government Outlay on Agriculture in the Plans (in Rs.)

Five Year Plan	Year	Total Plan Outlay	Outlay on Agriculture & Irrigation	% of Total Outlay
First Plan	1951-56	1,960	600	31
Second Plan	1956-61	4,600	950	20
Third Plan	1961-66	8,600	1,750	21
Fourth Plan	1969-74	15,780	3,670	23
Fifth Plan	1974-79	39,430	8,740	22
Sixth Plan	1980-85	1,09,290	26,130	24
Seventh Plan	1985-90	2,18,730	48,100	22
Eighth Plan	1992-97	4,85,460	1,02,730	20
Ninth Plan	1997-2002	8,59,200	1,70,230	20
Tenth Plan	2002-07	15,25,640	3,05,060	20

Source: Various Five Year Plan documents

It would be clear that the total outlay in each Plan had increased and, correspondingly, the outlay on agriculture and irrigation had also increased. However, the percentage of outlay on agriculture and irrigation to total plan outlay was the highest in the First Plan, viz, 31% but ranged between 20 to 24% in all other plans.

The Indian Planning Commission specified the various programmes for increasing agricultural production such as irrigation, soil conservation, dry farming and land reclamation, supply of fertilizers and manures, better ploughs and improved agricultural implements, adoption of scientific practices, etc. The Government gave considerable attention to institutional changes such as the setting up of community

development programmes and agricultural expansion of transportation, power, marketing and other basic facilities, improvement of the system of co-operative credit, etc. From the Third Plan onwards, the greatest emphasis was laid on irrigation, fertilizer, seed technology which led to green revolution.

2.4.2 Agricultural Progress under the Five Year Plans

We shall describe the progress made by India in the field of agriculture under the first nine plans. In the next section, we shall take up the progress of agriculture under the Ninth Plan separately.

a) First two Plans (1951-61)

The First Plan aimed at solving the food crisis India was facing at that time and ease the critical agricultural raw material situation, particularly the acute shortage of raw cotton and raw jute. Accordingly, it gave highest priority to agriculture, specially food production by allotting 31% of the total public sector outlay on agriculture, but it fixed rather modest targets of production. (**See the above table**). As a result of favourable weather conditions and the production targets in the agricultural sector were exceeded for instance, as against the target of about 62 million tones, actual production of food grains came to nearly 67 million tones. The targets fixed for other crops were not fulfilled.

The Planning Commission wanted the Second Plan to lay the foundations of industrialization and secure equal opportunities for all, particularly for the weaker sections of the people in the country. Out of total outlay of Rs. 4,600 crores during the Second Plan, a sum of Rs. 950 crores or about 20% was spent on agriculture. Despite the percentage reduction in Plan outlay on agriculture, the progress on the agricultural front was significant. For example, food grains production recorded nearly 80 million tonnes in 1960-61, as against the target of 81 million tonnes. Likewise the production of oilseeds, sugarcane, and cotton was much more in 1960-61. There was, however, a shortfall in the production of all groups of commodities, as against the target fixed, except in the case of sugarcane in which there was remarkable progress.

b) Third to Fifth Plans (1961-79)

Experience in the Second Plan had shown clearly that the rate of growth in agricultural production was a major limiting factor in the progress of the India economy. As the Government felt that the success of the agricultural sector was an essential condition for the success of entire plan, the Third Plan fixed ambitious targets of production for all agricultural crops.

It was during the Third Plan that the Government introduced the new agricultural technology known as Intensive Agricultural District Programme of using improved seeds, viz., High Yielding Varieties Programme (HYVP). The new agricultural technology was expected to usher in the green revolution. However, as a result of the extensive and serious drought conditions in 1965-66, agricultural production was adversely affected.

- a) None of the agricultural targets except sugarcane was achieved during the third plan period; and
- b) The actual output at the end of the Third Plan in the case of food grains, oilseeds and raw cotton was lower than the output at the end of the Second Plan, indicating that the Third Plan was a wash-out, as far as agriculture was concerned.

As the consequence of the shortfall in food production and serious famine conditions in many parts of the country, the Government was forced to import food grains extensively during the last of the third plan. Besides, for the first time, the public lost interest in the planning process and the Government adopted “plan holiday” for three years.

The experience of the Third Plan made the Planning Commission realize the bitter fact that economic Planning would be a failure unless agricultural production was increased rapidly. Accordingly, the Planning Commission assigned high priority to agriculture in the successive plans.

Table 2.2: Achievements in the Agricultural Sector in the Various Plans

Five Year Plans	Food grains		Oilseeds		Sugarcane		Cotton		Jute	
	Target	Achievement	Target	Achievement	Target	Achievement	Target	Achievement	Target	Achievement
First Plan	62	67	5.5	5.6	63	60	4.2	4.0	5.4	4.2
Second Plan	81	80	7.6	6.5	78	104	6.5	5.4	6.5	4.0
Third Plan	100	72	9.8	6.4	100	127	7.0	4.6	6.2	4.5
Fourth Plan	129	104	10.5	8.7	150	140	8.0	5.8	7.4	6.2
Fifth Plan	125	126	12.0	8.9	165	165	8.0	7.1	7.7	7.1
Sixth Plan	154	146	11.1	13.0	215	170	9.2	8.5	9.1	7.8
Seventh Plan	180	172	18.0	17.0	217	210	9.5	10.5	9.5	7.9
Eighth Plan	210	191	23.0	25.0	275	277	14.0	14.3	9.5	11.0
Ninth Plan	234	211	30.0	20.7	336	300	15.7	10.1	-----	11.6

Note: 1. Production of food grains, oilseeds and sugar cane in million tones
2: Production of cotton in millions of bales of 180 kgs each
3: Production of jute in millions of bales of 170 kgs each

Source: Plan documents and Economic Surveys

The approach to the Fourth Plan, for instance, emphasized the necessity to create favourable economic conditions for the promotion of agriculture and a systematic effort to extend the application of science and technology to improve agricultural practices.

Table above, however, reveals clearly that none of the targets fixed in agriculture in Fourth Plan was realized. For example, the target for food grains was 129 million

tonnes for 1973-74 but the actual production in that year was only 104 million tones the highest level of production was 108 million in 1970-71.

The Fifth Plan (1974-79) was prepared with great care, with total plan outlay at Rs. 39,430 crores out of which outlay on agriculture would be Rs. 8,740 crores (which was 22% of the total Plan outlay). The targets for production of various crops and necessary inputs to achieve these targets were also clearly set. Unfortunately, all the financial calculations went wrong because of the serious inflationary situation during 1973-74. The Fifth Plan period also witnessed the declaration of emergency (1975). Even though agricultural progress was steady and plan targets were being realized, the Janata Party which came to power at the Center suspended the Fifth Plan mid way and started preparing the Sixth Plan. (Refer to Table 2.1 for V Plan targets and actual achievements in the agricultural sector).

(D) Progress since the Sixth Plan

Of all the Plans, the Sixth Plan (1980-85) was hailed as a great success, particularly because of the success on the agricultural front. As against the annual growth rate of 3.8 for agriculture, the actual growth rate was 4.3%. The production of food grains in 1983-84 was 154 million tonnes (against the target of 154 million tonnes) and was hailed by the Indian Government as the *second green revolution*. While the First Green Revolution from 1967-68 arose from the introduction of new high yielding varieties of Mexican Wheat and dwarf rice varieties, the Second Green Revolution from 1983-84 was said to be from expansion in supplies of inputs and services to farmers, agricultural extension and better management.

While the First Green Revolution was confined mainly to Punjab, Haryana and Western U.P., the Second Green Revolution had spread to eastern and central states including West Bengal, Bihar, Orissa, Madhya Pradesh and Eastern U.P. These states had made tremendous progress in recent years.

However, it is important to emphasize the fact that, despite all the great claim of the Government, none of the targets (except in oilseeds) of agricultural production was achieved during Sixth Plan (Refer Table).

The Seventh Plan (1985-90) and the Eighth Plan (1992-97) laid emphasis on specific projects in the field of agriculture. They included a special rice production programme for rain fed agriculture, national oilseeds development project, social forestry, etc.

The Seventh Plan was not successful in the sense that the targets fixed for various sectors (except cotton) were not achieved. However, the level of production at the end of the Seventh Plan was much higher than the beginning of the Seventh Plan.

The Eighth Plan (1992-97) was basically sound in its approach in the strategy of development and in the targets of agricultural crops. Fortunately, weather and climate conditions were favourable and broadly many of the targets could be fulfilled. For instance, the actual outputs in 1996-97 of oil seeds, of sugarcane, of cotton and of jute were higher than the targets for these crops in the Eighth Plan. The only exception was food grains the Eighth Plan target was 210 million tonnes but the actual production was 199 million tonnes. In fact, the production of food Grains at 199 million tonnes was the highest output registered by India till the date.

The Ninth Plan (1997-2002) treated more elaborately in the next section was not much of a success, as far as the agricultural targets were concerned. For instance, the Ninth Plan fixed the target of food grains production at 234 million tonnes in 2001-02; but the actual production was only 212 million tonnes. The same story of under – achievement was to be noted in other sectors of agriculture also. One is inclined to ask the question: why should the planners fix unrealistic and unrealizable targets?

2.5 India's Rainbow Revolution

Rainbow revolution concept is a combination of Green Revolution, White Revolution, Blue Revolution, Yellow Revolution and Brown Revolution. It was after these revolutions, the Indian agriculture slowly shifted from traditional behaviour to scientific behaviour. So, it is necessary to understand these revolutions in brief. The following chart shows various revolutions related to various produces of Indian agriculture. Here we are discussing mainly Green Revolution, White Revolution, Blue Revolution and Yellow Revolution in brief

Revolution	Production
Black Revolution	Petroleum production
Blue Revolution	Fish production
Brown Revolution	Leather/non-conventional(India)/Cocoa production
Golden Revolution	Overall Horticulture development/Honey Production
Golden Fiber Revolution	Jute Production
Green Revolution	Food grain (Cereals, Wheat & Leguminous plant) production
Grey Revolution	Fertilizer production
Pink Revolution	Onion production/Pharmaceutical (India)/Prawn production
Red Revolution	Meat & Tomato production
Round Revolution	Potato production
Silver Fiber Revolution	Cotton production
Silver Revolution	Egg/Poultry production
White Revolution	Milk/Dairy production (In India - Operation Flood)
Yellow Revolution	Oil Seeds production

2.5.1 Green Revolution

The introduction of high-yielding varieties of seeds after 1965 and the increased use of fertilizers and irrigation are known collectively as the Green Revolution, which provided the increase in production needed to make India self-sufficient in food grains, thus improving agriculture in India. Famine in India, once accepted as inevitable, has not returned since the introduction of Green Revolution crops.

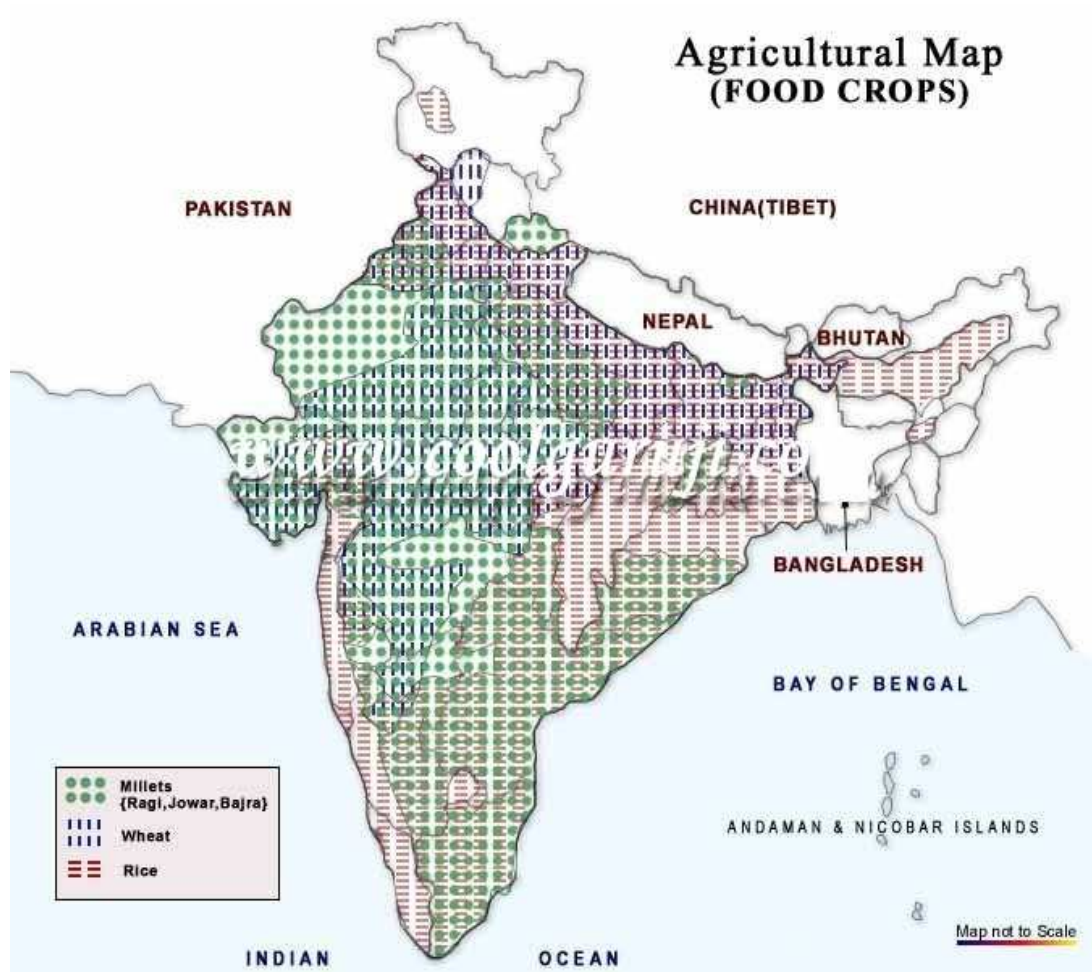
Of the high-yielding seeds, wheat produced the best results. All India Radio (AIR) played a vital role in creating awareness for these methods. Along with high yielding seeds and irrigation facilities, the enthusiasm of farmers mobilized the idea of agricultural revolution and is also credited to All India Radio.

The major benefits of the Green Revolution were experienced mainly in northern and northwestern India between 1965 and the early 1980s; the program resulted in a substantial increase in the production of food grains, mainly wheat and rice. Food-grain yields continued to increase throughout the 1980s, but the dramatic changes in the years between 1965 and 1980 were not duplicated. By FY 1980, almost 75 percent of the total cropped area under wheat was sown with high-yielding varieties. For rice the comparable figure was 45 percent. In the 1980s, the area under high-yielding varieties continued to increase, but the rate of growth overall was slower. The eighth plan aimed at making high-yielding varieties available to the whole country and developing more productive strains of other crops

The map no.2 shows the total food grain cultivation in India. From the map we see that the foodgrains such as wheat and rice are majorly cultivated in Punjab, Haryana, Himachal Pradesh, Uttaranchal, Jharkhand, Uttar Pradesh for wheat and Andhra Pradesh, Tamilnadu, Karnatak and Kerala for rice. We see a crowded foodgrain cultivation of Bajra, Jowar and Maize in the states of Maharashtra and Karnataka.

Figure no. 2.2

Agricultural Map of India (Food crops)



Source :-Indian Economy,Agriculture report 2007-2008

From the above map we see that rice is majorly cultivated on the western coastal line completely, in some parts of Andhra Pradesh, Tamilnadu, Orissa, West Bengal and North-Eastern states. Wheat is densely cultivated in the states of Punjab, Haryana, Jharkhand and in some parts of Maharashtra, Madhya Pradesh and Gujarat. Millets which constitute foodgrains such as Ragi, Jowar, Bajra is densely cultivated in the states of Tamilnadu, Andhra Pradesh, Karnataka and in some parts of Rajasthan, Gujarat and Himachal Pradesh.

The environmental impact of excessive use to chemical fertilizers and pesticides was only revealed as years passed by. In 2009, under a Greenpeace Research Laboratories investigation, Dr Reyes Tirado, from the University of Exeter, UK, conducted a study in 50 villages in Muktsar, Bathinda and Ludhiana districts that revealed chemical, radiation and biological toxicity was rampant in Punjab. 20% of the sampled wells showed nitrate levels above the safety limit of 50 mg/l, established by WHO. The study connected this finding with high use of synthetic nitrogen fertilizers. With increasing poisoning of the soil, the region once hailed as the home to the Green Revolution, now due to excessive use of chemical fertilizer, is being termed by one columnist as the "Other Bhopal". For example, Buddha Nullah, a rivulet which run through Malwa region of Punjab, India, and after passing through highly populated Ludhiana district, before draining into Sutlej River, a tributary of the Indus river, is today an important case point in the recent studies, which suggest this as another Bhopal in making. A joint study by PGIMER and Punjab Pollution Control Board in 2008, revealed that in villages along the Nullah, calcium, magnesium, fluoride, mercury, beta-endosulphan and heptachlor pesticide were more than permissible limit (MPL) in ground and tap waters. Plus the water had high concentration of COD and BOD (chemical and biochemical oxygen demand), ammonia, phosphate, chloride, chromium, arsenic and chlorpyrifos pesticide. The ground water also contains nickel and selenium, while the tap water has high concentration of lead, nickel and cadmium.

In addition to large inputs of fertilizers and pesticides, the Green Revolution in India was made possible in large part by a dramatic increase in irrigation, particularly from deep groundwater sources. The exploitation of groundwater resources allowed farmers

to double-crop (grow crops even during the dry season) and to grow water-intensive crops such as rice in areas that were traditionally unsuited for rice production.

This growth in irrigation has led to an alarming drop in the water table in a number of key agricultural Indian states, such as Punjab, where the water table is reportedly falling by about 1 meter per year. In other states, the problem is worse; in Gujarat, the water table is falling by as much as 3-5 meters per year.

What this means is that without a dramatic change in agricultural practice, groundwater resources could be depleted within a few years. In the case of Gujarat and other coastal areas, intrusion of seawater could render underground aquifers useless for human consumption or agriculture.

2.5.2 White Revolution

White Revolution was a rural development programme started by India's National Dairy Development Board (NDDB) in 1970. One of the largest of its kind, the programme objective was to create a nationwide milk grid.

It resulted in making India the largest producer of milk and milk products, and hence is also called the White Revolution of India. It also helped reduce malpractices by milk traders and merchants. This revolution followed the Indian Green Revolution and helped in alleviating poverty and famine levels from their dangerous proportions in India during the era.

Operation Flood has helped dairy farmers, direct their own development, placing control of the resources they create in their own hands. A 'National Milk Grid', links milk producers throughout India with consumers in over 700 towns and cities, reducing seasonal and regional price variations while ensuring that the producer gets a major share of the price consumers pay.

The bedrock of Operation Flood has been village milk producers' cooperatives, which procure milk and provide inputs and services, making modern management and technology available to members. Operation Flood's objectives included :

- Increase milk production ("a flood of milk")
- Augment rural incomes
- Fair prices for consumers
- Based co-operation "Anand Milk Union Limited", often called Amul, was the engine behind the success of the programme, and in turn became a mega company based on the cooperative approach. Tribhuvandas Patel was the founder Chairman of Amul, while Verghese Kurien was the chairman of NDDB at the time when the programme was implemented. Verghese Kurien, who was then 33, gave the professional management skills and necessary thrust to the cooperative, and is considered the architect of India's 'White Revolution' (Operation Flood). His work has been recognised by the award of a Padma Bhushan, the Ramon Magsaysay Award for Community Leadership, the Carnegie-Wateler World Peace Prize, and the World Food Prize.
- Operation Flood was implemented in three phases.

Phase I of White Revolution

- Phase I (1970–1980) was financed by the sale of skimmed milk powder and butter oil donated by the European Union (then the European Economic Community) through the World Food Programme. NDDB planned the programme and negotiated the details of EEC assistance.
- During its first phase, Operation Flood linked 18 of India's premier milksheds with consumers in India's major metropolitan cities: Delhi, Mumbai, Kolkata and Chennai. Thus establishing mother dairies in four metros.
- Operation flood, also referred to as “White Revolution” is a gigantic project propounded by Government of India for developing dairy industry in the country. The Operation Flood – 1 originally meant to be completed in 1975, actually spanned the period of about nine years from 1970–79, at a total cost of Rs.116 crores.

- At start of operation Flood-1 in 1970 certain set of aims were kept in view for the implementation of the programmes. Improvement by milk marketing the organized dairy sector in the metropolitan cities Mumbai(then Bombay), Kolkata(then Calcutta), Chennai(then Madras), Delhi. The objectives of commanding share of milk market and speed up development of dairy animals respectively hinter lands of rural areas with a view to increase both production and procurement.

Phase II of White Revolution

- Operation Flood Phase II (1981–1985) increased the milksheds from 18 to 136; 290 urban markets expanded the outlets for milk. By the end of 1985, a self-sustaining system of 43,000 village cooperatives with 4,250,000 milk producers were covered. Domestic milk powder production increased from 22,000 tons in the pre-project year to 140,000 tons by 1989, all of the increase coming from dairies set up under Operation Flood. In this way EEC gifts and World Bank loan helped promote self-reliance. Direct marketing of milk by producers' cooperatives increased by several million litres a day.

Phase III of White Revolution

- Phase III (1985–1996) enabled dairy cooperatives to expand and strengthen the infrastructure required to procure and market increasing volumes of milk. Veterinary first-aid health care services, feed and artificial insemination services for cooperative members were extended, along with intensified member education.
- Operation Flood's Phase III consolidated India's dairy cooperative movement, adding 30,000 new dairy cooperatives to the 42,000 existing societies organized during Phase II. Milksheds peaked to 173 in 1988-89 with the numbers of women members and Women's Dairy Cooperative Societies increasing significantly.
- Phase III gave increased emphasis to research and development in animal health and animal nutrition. Innovations like vaccine for Theileriosis, bypassing protein feed and urea-molasses mineral blocks, all contributed to the enhanced productivity of milch animals.

2.5.3 Blue Revolution

The fisheries-based blue revolution can become real and sustainable if the production potential of available water resources can be efficiently managed. But there are several areas of concern that need to be addressed to realize this goal. The marine fish production, which at one stage constituted the bulk of the total fish output, is showing practically no growth for nearly a decade. Much of the growth in the fisheries sector is coming chiefly from the inland fisheries, which is also beset with some formidable problems, including the environmental degradation of inland waters and the paucity of fish seed. Indeed, at present, hardly 40 per cent of the country's fresh water resources are being used for fisheries. The output of the inland fisheries sector could, therefore, be stepped up by two-and-half times just by utilizing all the available water bodies. Similarly, most of the fisheries potential of deep sea waters is going abegging for want of suitable fishing vessels and curbs on joint ventures for deep sea fishing. The fish stocks of these waters are being either clandestinely harvested by ships belonging to countries or are remaining unexploited. On the other hand, the coastal waters, predominantly drawn upon by the traditional fishing communities, are being over-exploited, leading to the fast depletion of fisheries resources of this zone. This is also reflected in gradual shrinking of fish catches in the coastal waters. Even shrimps-based aquaculture, which has till recently been witnessing a fast, largely exports-driven, growth, has now begun flagging due to the imposition of various kinds of non-tariff trade barriers by the importing countries. Besides, the vulnerability of shrimps to diseases is causing problems for the shrimp industry.

Equally worrisome is the poor post-harvest handling of fish, which is resulting in huge wastage of this nutritious food. While these losses are reckoned at a huge 25 per cent in the marine sector, these are around 8 per cent in inland fisheries. The total value of the losses is assessed at a colossal Rs 1,000 crore annually.

2.5.4 Brown Revolution

Brown revolution means turn garbage which is brown into gold and fertilizer which is totally organic or bio or worm compost.

A '***Brown Revolution***' is happening in the tribal areas of Visakhapatnam district. The tribal people are taught and encouraged to grow "socially responsible and environment friendly" coffee to cater to the demand from developed countries.

The Coffee Board has embarked upon the challenging campaign of promoting the coffee grown in these remote areas as niche coffee for markets in the West. Niche coffee, determined by consistent quality and the socio-economic well-being of the local people, is a \$55-billion market world-wide.

Although the tribal people of Visakhapatnam district have been growing coffee since the 1970s, it is only recently, particularly after eyeing the organic market, that it is being given a thrust. Some 30,000 tribal people of Andhra Pradesh, who once practised slash-and-burn 'Podu' (shifting) cultivation, are now growing coffee as a shade crop under the canopy of silver oak.

What the tribal people of Visakhapatnam are cultivating may be a minuscule part of India's annual coffee production of around three lakh tonnes. But, according to the Coffee Board, what is significant is that apart from regenerating the forest cover in those parts of the Eastern Ghats where it is cultivated, coffee has helped at the micro level by boosting the income of the tribal people. Their per hectare income from coffee is estimated at Rs.15,000 compared to Rs.10,000 for pineapple, Rs.1,500 for niger seeds and Rs.1,000 for maize.

The Coffee Board cites the instance of 50-year-old Linganna Padal who owns a demonstration coffee plot, which has generated enough income for him to own a house and educate his children. His success is now sought to be replicated throughout the Integrated Tribal Development Agency areas of the district.

However, it is not just a case of the good intentions of the Coffee Board and the ITDA of Paderu to help the tribal people. Some argue that there could even be a sound marketing base to all this. World over, there is a burgeoning demand for organic coffee. In those areas of Karnataka, Tamil Nadu and Kerala where over 90 per cent of India's coffee is grown, any shift to organic coffee cultivation would necessitate a break in cultivation as the soil has to be left fallow for a few years to wash out traces of chemicals. But the tribal areas of Visakhapatnam can cultivate organic coffee as no chemical fertilizers or pesticides are used, as much owing to financial constraints as the lack of exposure to modern methods of cultivation.

Trying to turn this into an advantage, the Coffee Board and the ITDA launched the programme to grow coffee in the Araku Valley. Coffee Board officials, however, say that it seems far-fetched for Araku Valley coffee to sell in London or New York. But the process is moving in that direction. The Coffee Board has even created a logo for the "Araku Valley Coffee" brand.

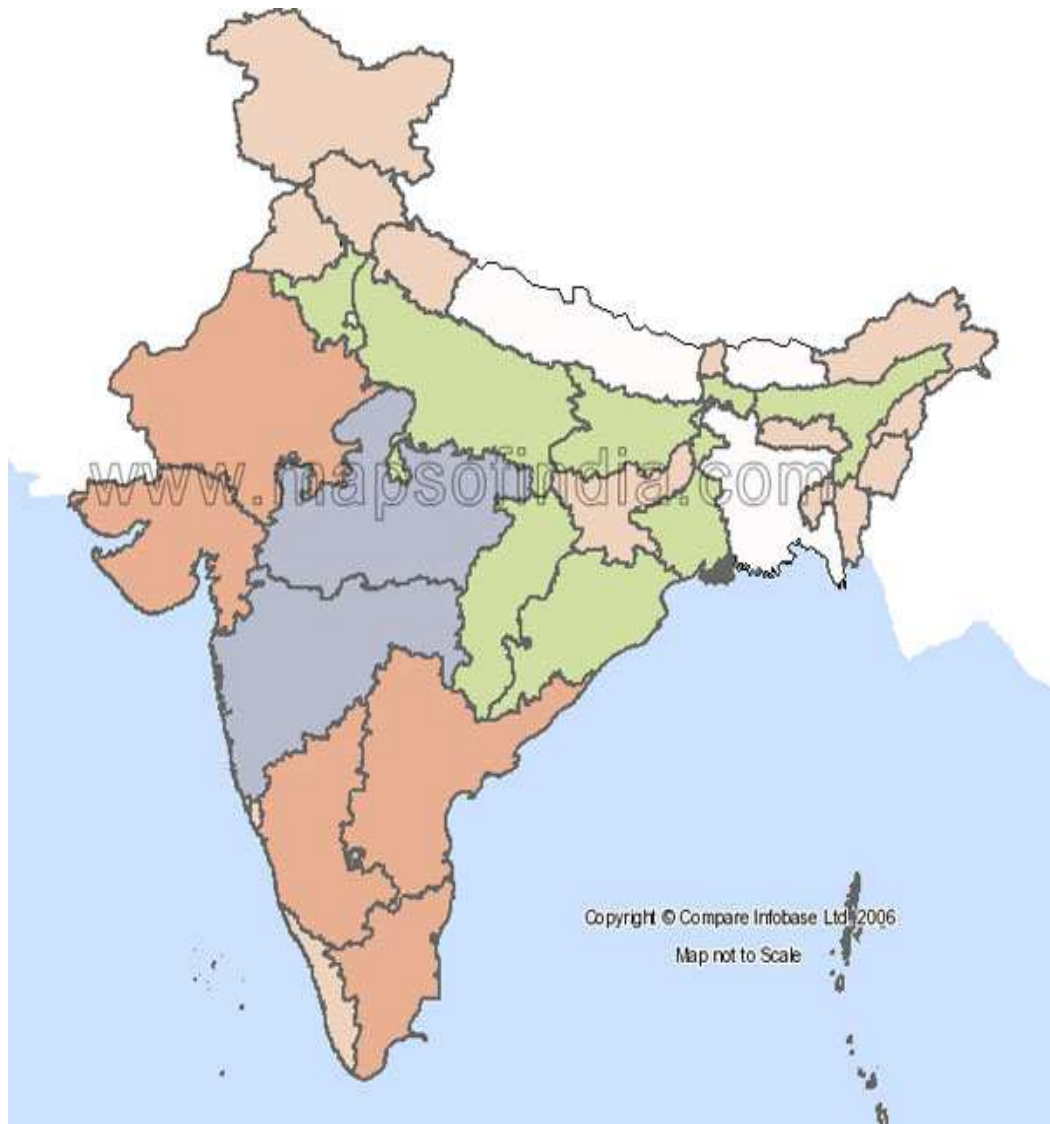
According to the Coffee Board, the quality of Araku Valley coffee will be improved through systematic development of on- and off-farm processing facilities. Self-help groups of tribal farmers are to be strengthened to facilitate pooling of coffee so as to offer consistent and larger quantities. A physical platform for auctioning is expected to give a fillip to marketing and the prospects of exporting coffee to Japanese, Australian and American markets through Visakhapatnam port are to be pursued. Araku coffee is turning out to be a potent brew indeed.

2.5.5 Yellow Revolution

Yellow revolution means the cultivation of mustard as a part of crop rotation. It prevents the soil from getting eroded and at the same time gives a rich crop of oil seeds. The use of mustards is to build soil organic matter and to eliminate the need for chemical soil fumigants. The yellow revolution man of Vaishali is Bindeshwar Prasad Singh (67), a farmer owning just 2.5 acre of land but still making gold. No matter he was not chosen for last year's Kisan Samman by Bihar government, the Indian Vegetable Research Institute at Varanasi gave him silver medal. The growth, development and adoption of new varieties of oilseeds and complementary technologies nearly doubled oilseeds production from 12.6 mt in 1987-88 to 24.4 mt in 1996-97, catalyzed by the Technology Mission on Oilseeds, brought about the Yellow Revolution.

Figure 2.3

Map shows production of Oil seeds in India



Source : ICAR Report 2007-2008

 >100'000 tonnes	 100'000-1000'000 tonnes	 1000'000-2000'000 tonnes
 2000'000tonnes >		

The map no.3 shows the amount of production of Oilseeds in India. From the map it is clear that the states of Himachal Pradesh, Jammu & Kashmir, Uttarkhand, Haryana, North-Eastern states, Jharkhand and Kerala have a production of less than 1 lakh tones. The states of Uttar Pradesh, Bihar, Chattisgarh, Orissa and West Bengal produce oilseeds upto 10 lakh tones, while the states of Rajasthan, Gujarat, Karnataka, Andhra Pradesh and Tamilnadu have production of oilseeds in the range of 10 lakh to 20 lakh tones. The highest oilseed production of above 20 lakh tonnes is seen in the states of Maharashtra and Madhya Pradesh.

The growth, development and adoption of new varieties of oilseeds and complementary technologies nearly doubled oilseeds production from 12.6 mt in 1987-88 to 24.4 mt in 1996-97, catalyzed by the Technology Mission on Oilseeds, brought about the Yellow Revolution. The term also stands for the People Power Revolution in Phillipines in 1986 against then President Ferdinand Marcos. It was a series non-violent protests where demonstrators used yellow ribbons during the arrival of Ninoy Aquino. Around this time of the year, bright yellow flowers carpet the fields in scores of villages in Bihar's Vaishali district. They are not mustard crops waiting to burst into full bloom but cauliflower seeds that have ushered in a revolution of sorts — locals term it 'Yellow Revolution' — in the region. These seeds — which fetch high prices as they are completely organic — are sold across Bihar, Rajasthan, Madhya Pradesh and Maharashtra under an exclusive brand called Vaishali under various names like satya beej, green seeds and jawahar seeds. While over three dozen villages under Hajipur, Mahnar and Lalganj blocks in Vaishali cultivate cauliflower seeds along with other crops, the entire Chakbara village near Hajipur is devoted to cauliflower seed cultivation. The cumulative earning of around 50 farmers from the sale of seeds last year was about Rs 50 lakh.

2.5.6 Results of Rainbow Revolution

After effective implementation of Green Revolution, White Revolution, Blue Revolution, Yellow Revolution and a combined concept of Rainbow Revolution has certain programmes such as

1. To increase the annual growth rate in agriculture over 4%
2. To give greater private sector participation through contract farming
3. To enable price protection for farmers
4. To launch National Agriculture Insurance Scheme for all farmers and for all crops
5. To dismantle the restrictions on movement of agricultural commodities throughout the country

The new agriculture policy which was presented in 2000 aimed to achieve the above said objectives through Rainbow Revolution. Today, India ranks second worldwide in farm output. Agriculture and allied sectors like forestry and logging accounted for 16.6% of the GDP in 2007, employed 52% of the total workforce^[1] and despite a steady decline of its share in the GDP, is still the largest economic sector and plays a significant role in the overall socio-economic development of India.

Today India is the largest producer in the world of fresh fruit, anise, fennel, badian, coriander, tropical fresh fruit, jute, pigeon peas, pulses, spices, millets, castor oil seed, sesame seeds, safflower seeds, lemons, limes, cow's milk, dry chillies and peppers, chick peas, cashew nuts, okra, ginger, turmeric guavas, mangoes, goat milk and buffalo milk and meat. Coffee. It also has the world's largest cattle population (281 million). It is the second largest producer of cashews, cabbages, cotton seed and lint, fresh vegetables, garlic, egg plant, goat meat, silk, nutmeg, mace, cardamom, onions, wheat, rice, sugarcane, lentil, dry beans, groundnut, tea, green peas, cauliflowers, potatoes, pumpkins, squashes, gourds and inland fish. It is the third largest producer of tobacco, sorghum, rapeseed, coconuts, hen's eggs and tomatoes. India accounts for 10% of the world fruit production with first rank in the production of mangoes,

papaya, banana and sapota. India's population is growing faster than its ability to produce rice and wheat.

2.6 Scenario of Agriculture in 2008-09

The performance of the agricultural sector influences the growth of the Indian economy. Agriculture (including allied activities) accounted for 17.8 per cent of the Gross Domestic Product (GDP-at constant prices) in 2007-08 as compared to 21.7 per cent in 2003-04. Notwithstanding the fact that the share of this sector in GDP has been declining over the years, its role remains critical as it accounts for about 52 per cent of the employment in the country. Apart from being the provider of food and fodder, its importance also stems from the raw materials that it provides to industry. The prosperity of the rural economy is also closely linked to agriculture and allied activities. Agricultural sector contributed 12.2 per cent of national exports in 2007-08. The rural sector (including agriculture) is being increasingly seen as a potential source of domestic demand; a recognition, that is shaping the marketing strategies of entrepreneurs wishing to widen the demand for goods and services.

In terms of composition, out of the total share of 17.8 per cent in GDP in 2007-08 for the agriculture and allied activities sector, agriculture alone accounted for 16.3 per cent of GDP followed by fishing at 0.8 per cent and forestry and logging at 0.7 per cent of GDP (Table 2.3).

Table 2.3: Agriculture sector - Key indicators

S.No	Item	2007-08	2008-09
1.	GDP - share and growth (per cent at 1999-00 prices)		
	Growth in GDP in agriculture & allied sectors	4.9	1.6
	Share in GDP - Agriculture and allied sectors	17.8	17.1
	Agriculture	16.3	
	Forestry and logging	0.7	
	Fishing	0.8	
2.	Share in total gross capital formation in the country (per cent at 1999-00 prices)		
	Share of agriculture & allied sectors in total gross capital	6.7	
	Agriculture	5.7	
	Forestry and logging	0.1	
	Fishing	0.9	
3.	Agricultural imports & exports (per cent at current prices)		
	Agricultural imports to national imports	3.1	
	Agricultural exports to national exports	12.2	
4.	Employment in the agriculture sector as share of total employment in 2004-05 as per Current Daily Status (per cent)		52.1

Source: Central Statistical Organization & Dept of Agriculture and Cooperation

Gross capital formation in agriculture and allied sector

The Gross Capital Formation (GCF) in agriculture as a proportion to the total GDP has shown a decline from 2.9 per cent in 2001-02 to 2.5 per cent in 2007-08. However, the GCF in agriculture relative to GDP in this sector has shown an improvement from 11.23 per cent in 1999-2000 to 14.24 per cent in 2007-2008 (Table 2.3).

Table 2.4: Gross capital formation in agriculture (Figures in Rs. crore at 1999-2000 prices)

Year	GDP	Agriculture & allied activities		GCF/GDP in Agriculture & allied (%)	GCF in agriculture as % of total GDP
		GCF	GDP		
2004-05	2388768	57849	482446	12.0	2.4
2005-06	2616101	66065	511013	12.9	2.5
2006-07	2871120	73285	531315	13.8	2.6
2007-08	3129717	79328	557122	14.2	2.5

Source: Central Statistical Organization & Dept of Agriculture and Cooperation

The share of agriculture & allied sector in total GCF after showing a marginal increase during 1999-2000 to 2001-02 has been continuously declining. It stood at 10.2 per cent in 1999-2000, increased to 11.7 per cent in 2001-02 and thereafter declined to 7 per cent in 2006-07. The decline was mainly attributed to decline in the private sector despite increase in the share of public sector (Table 2.4).

Table 2.5: Share of agriculture & allied sector in total GCF (%) (at 1999-2000 prices)

Year	Public sector	Private sector	Total
1999-2000	6.0	11.9	10.2
2000-01	5.8	11.3	9.7
2001-02	6.7	13.7	11.7
2002-03	6.5	11.5	10.3
2003-04	7.4	9.2	8.8
2004-05	7.8	7.7	7.7
2005-06	7.9	7.1	7.2
2006-07	8.2	6.6	7.0

Source: Agricultural Statistics at a Glance 2008, Directorate of Economics & Statistics

Apart from production, the demand and distributional aspects of the agricultural sector, especially of food availability and food management, are of importance to the economy. The production performance of different segments of agriculture and allied activities covering, inter alia, horticulture, animal husbandry and fisheries as also the developments in the area of food management during the year 2008-09 is shown in the above tables

2.7 Indian Agri Export Scenario

Export of agricultural produces has taken a large leap after 1990-91, when Indian government went for economic reforms in all sectors. After the beginning of WTO and globalization of markets the Indian Agricultural Produces specially fruits, vegetables, spices and cash crops like cotton, jute, tea, coffee and rubber have exceeded the expectations and proved to be a great economical support for the country.

2.7.1 Exports of fruits since 1990

India is the second largest producer of Fruits after China, with a production of 44.04 million tonnes of fruits from an area of 3.72 million hectares (Table 2.6). A large variety of fruits are grown in India, of which mango, banana, citrus, guava, grape, pineapple and apple are the major ones. Apart from these, fruits like papaya, sapota, annona, phalsa, jackfruit, ber, pomegranate in tropical and sub-tropical group and peach, pear, almond, walnut, apricot and strawberry in the temperate group are also grown in a sizeable area. Although fruit is grown throughout of the country, the major fruit growing states are Maharashtra, Tamil Nadu, Karnataka, Andhra Pradesh, Bihar, Uttar Pradesh and Gujarat. It is seen that mango fruit is highly cultivated with large area of land cultivated under it. After mango, banana and citrus fruits are cultivated largely. Grapes are cultivated mainly in the district of Nasik of Maharashtra state. Area under grape cultivation is comparatively less as seen from the table. 2.6

Table 2.6**AREA, PRODUCTION AND EXPORT OF FRUITS IN INDIA AFTER 1990**

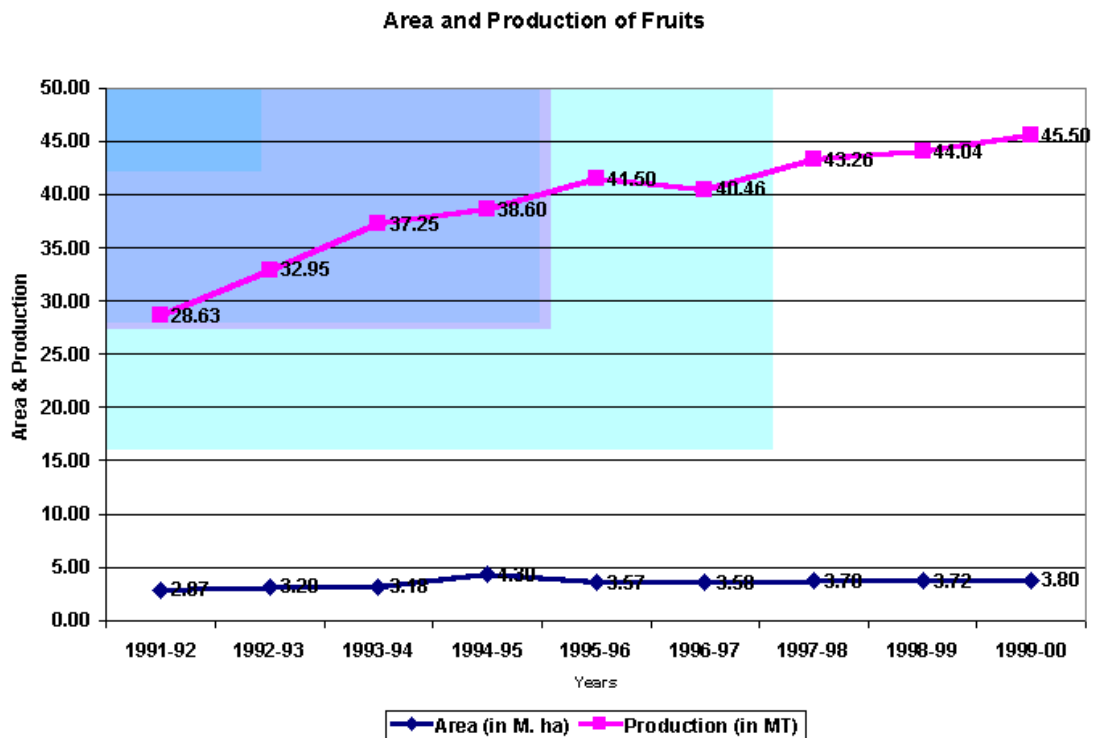
S.No	Fruits	Area (000 ha.)	Production (000 MT)	Exports (in million tones)
1	Apple	238.3	1047.4	375
2	Banana	490.7	16813.5	436
3	Citrus	526.9	4650.6	865
4	Grapes	44.3	1137.8	646
5	Guava	150.9	1710.5	230
6	Litchi	56.4	433.2	185
7	Mango	1486.9	10503.5	2634
8	Papaya	60.5	1666.2	346
9	Pineapple	75.5	1025.4	292
10	Sapota	64.4	800.3	76.3
11	Others	601.2	5707.6	932
	Total	3796.8	45496.0	7017.3

Source: Directorate General of Commercial Intelligence and Statistics, Kolkatta

The graph 2.1 shows the area, production of fruits from 1990 to 2000. From the graph we see that the area under cultivation of fruits has shown a constant area ranging between 2.5 million hectares to 3.5 million hectares. But by 2008-09 the area under fruit cultivation has increased slightly to 4.2 million hectares. Whereas the production of fruits has shown a steady growth from 28.63 million tonnes in 1992-93 to 45.50 million tonnes in 1999-2000. As per the agricultural report the growth in the

production of fruits had increased to 96.36 million tonnes by the end of 2009-10. The table also shows export of fruits in the 2008-09 in metric million tonnes.

Figure 2.1: Area and Production of fruits from 1991-92 to 1999-2000



Source: Central Statistical Organization & Dept of Agriculture and Cooperation

2.7.2 Export of Vegetables:

In vegetables production, India is next only to China with an annual production of 87.53 million tonnes from 5.86 million hectares having a share of 14.4 per cent to the world production. Adoption of high yielding cultivars and FI hybrids and suitable production technologies has largely contributed for higher production and productivity. Per capital consumption has also increased from 95 gram to 175 gram per day. More than 40 kinds of vegetables belonging to different groups, namely cucurbits, cole crops, solanaceous, root and leafy vegetables, are grown in different

agro-climatic situations of the country. Except a few, namely brinjal (egg plant), colocasia, cucumber, ridge gourd, sponge gourd, pointed gourd etc., most of the other vegetables have been introduced from abroad.

Potato is most widely grown vegetable crop in the country with a share of 25.7 per cent. The area under potato cultivation is 1.28 Million ha with total production of 22.49 MT. The main varieties of potato grown in the country are Kufri Chandramukhi, Kufri Jyoti, Kufri Badshah, Kufri Himalani, Kufri Sindhuri, Kufri Lalima etc. Uttar Pradesh is the leading potato growing state in the country with a production of 9.53 million tonnes followed by West Bengal and Bihar. **Tomato** occupies second position amongst the vegetable crops in terms of production. The total production of tomato in the country in 1998-99 was 8.27 MT from an area of 0.46 M. ha. The main varieties of tomato grown in the country are Pusa Ruby, Pusa Early Dwarf, Arka Abha, Arka Alok, Pant Bahar, Pusa hybrid-1, Pusa hybrid-2, MTH-6, Arka Vardan etc. Andhra Pradesh is the largest grower of tomato with a production of 2.05 MT. The other main tomato growing states are Bihar, Karnataka, Maharashtra and Orissa. **Brinjal** occupies the third position amongst vegetable crops. The production of brinjal in the year 1998-99 was 7.88 MT from an area 0.49 M.ha. The varieties of brinjal popular in the country are Arka Navneet, Pusa Ankur, Hybrid-6, Pusa hybrid-5, ARBH-1, ABH-1, Pusa Purple Long, Pusa Purple Cluster, Ritu Raj etc. West Bengal is the largest producer of brinjal followed by Maharashtra and Bihar. The other main state growing brinjal Karnataka, Maharashtra, Gujarat, Andhra Pradesh, Assam and Madhya Pradesh. **Cabbage** is the fourth most widely grown vegetable crop of our country. India is the leading country producing Cabbage. The area under Cabbage cultivation is 0.23 M.ha producing 5.62 MT. The main varieties of cabbage are Pusa Drum Head, Golden Acre, Pride of India, Pusa Mukta, Pusa Synthetic etc. West Bengal produces 1.84 MT and is the largest grower of the cabbage. Orissa and Bihar occupies second and third position respectively. The other major growers of cabbage are Assam, Karnataka, Maharashtra and Gujarat. The other important vegetable crops grown in the country are onion, chillies, peas, beans, okra, cabbage, cauliflower, pumpkin, bottlegourd, cucumber, watermelon, palak, methi, carrot and radish.

India, known as “Land of Spices”, is the largest producer, consumer and exporter of variety of spices in the world. The area covered under various spices in the country is estimated to be 25.17 lakhs ha with an annual production of 29.10 lakhs tonnes (Fig-8). More than 90% of the spices produced in the country is used for domestic consumption and the rest exported as raw as well as value added products. The important spices produced in the country are: Black pepper, ginger, turmeric, garlic, chillies, coriander, cumin, fennel, fenugreek, celery, clove, cassia, nutmeg, mace, cardamom, saffron, vanilla and a group of herbal spices. Chillies occupies the top position amongst spices with a share of 30 per cent. Total production of Chillies in the year 1998-99 was 2.31 lakh tonnes. The share of spices in the total agricultural export during 1998-99 was about 6% with an export of 2.31 lakh tonnes earning foreign exchange worth Rs. 1758 crores. The exports of spices and spice products during 1999-2000 was 2.09 lakh tonnes valuing Rs. 1861 crores. Pepper was the leader in export earning with 46% share followed by Oil & Oleoresins (15%), chillies (13%) and turmeric (6%).

2.8 Initiatives to Improve Agriculture sector

The required level of investment for the development of marketing, storage and cold storage infrastructure is estimated to be huge. The government has not been able to implement various schemes to raise investment in marketing infrastructure. Among these schemes are Construction of Rural Go downs, Market Research and Information Network, and Development / Strengthening of Agricultural Marketing Infrastructure, Grading and Standardization.

The Indian Agricultural Research Institute (IARI), established in 1905, was responsible for the research leading to the "Indian Green Revolution" of the 1970s. The Indian Council of Agricultural Research (ICAR) is the apex body in agriculture and related allied fields, including research and education. The Union Minister of Agriculture is the President of the ICAR. The Indian Agricultural Statistics Research Institute develops new techniques for the design of agricultural experiments, analyses data in agriculture, and specializes in statistical techniques for animal and plant breeding.

Recently Government of India has set up Farmers Commission to completely evaluate the agriculture program. However the recommendations have had a mixed reception.

2.8.1 Problems

There are many problems in Indian agriculture for example cotton flower in India. This is the main cash crop in Vidarbha region. Slow agricultural growth is a concern for policymakers as some two-thirds of India's people depend on rural employment for a living. Current agricultural practices are neither economically nor environmentally sustainable and India's yields for many agricultural commodities are low. Poorly maintained irrigation systems and almost universal lack of good extension services are among the factors responsible. Farmers' access to markets is hampered by poor roads, rudimentary market infrastructure, and excessive regulation.

According to World Bank Report 'India countryOverview 2007-08' The low productivity in India is a result of the following factors:

- According to World Bank, Indian Branch: Priorities for Agriculture and Rural Development", India's large agricultural subsidies are hampering productivity-enhancing investment. Overregulation of agriculture has increased costs, price risks and uncertainty. Government intervenes in labour, land, and credit markets. India has inadequate infrastructure and services. World Bank also says that the allocation of water is inefficient, unsustainable and inequitable. The irrigation infrastructure is deteriorating. The overuse of water is currently being covered by over pumping aquifers, but as these are falling by foot of groundwater each year, this is a limited resource.
- Illiteracy, general socio-economic backwardness, slow progress in implementing land reforms and inadequate or inefficient finance and marketing services for farm produce.
- Inconsistent government policy. Agricultural subsidies and taxes often changed without notice for short term political ends.
- The average size of land holdings is very small (less than 20,000 m²) and is subject to fragmentation due to land ceiling acts, and in some cases, family disputes.

Such small holdings are often over-manned, resulting in disguised unemployment and low productivity of labour.

- Adoption of modern agricultural practices and use of technology is inadequate, hampered by ignorance of such practices, high costs and impracticality in the case of small land holdings.
- Irrigation facilities are inadequate, as revealed by the fact that only 52.6% of the land was irrigated in 2003–04, which result in farmers still being dependent on rainfall, specifically the Monsoon season. A good monsoon results in a robust growth for the economy as a whole, while a poor monsoon leads to a sluggish growth. Farm credit is regulated by NABARD, which is the statutory apex agent for rural development in the subcontinent. At the same time over pumping made possible by subsidized electric power is leading to an alarming drop in aquifer levels.

2.8.2 India needs to improve food product standards

India needs to improve the standards of its food products to acquire a competitive edge in the global market, says Sanjay Dave^[1], the first Indian vice-chair of the Rome-based Codex Alimentarius Commission (CAC), an international organization that aims at promoting food safety globally. Dave, also the director of India's Agricultural and Processed Food Products Export Development Authority (APEDA), feels that his tenure as CAC vice-chair would see continuous deliberations to meet emerging challenges at home and abroad.

“There is no scope for any complacency when it comes to dealing with the issue of food product standards. International and domestic consumers are quite quality conscious. India and other developing nations need to improve standards of food products,” Dave told IANS in an interview.

India's farm and processed food products' exports have grown from Rs.6.47 billion in 1999-2000 to Rs.24.12 billion in 2006-07.

Major importers of Indian products like pomegranates, mangoes, onions and basmati rice are the United Arab Emirates, Saudi Arabia, Russia, Bangladesh, Turkey, Kuwait, Sri Lanka, Italy, Germany, Australia, Jordan, Bahrain, and Malaysia.

As capacity building is the key to ensuring food standards, the CAC intends to provide technical assistance to the developing nations so that the quality aspect is addressed right from the field. “From proper monitoring of pesticide residue to the processing units, there is a need to be vigilant at all levels so that the end product is healthy and well received by consumers,” Dave maintained.

Dave said he would act aggressively to implement Codex Plan-2008-13, a vision document that speaks of consensus building and understanding food safety needs. “For me, the vice-chair of CAC does not mean just holding a few meetings. I am committed to holding meeting and deliberating with all stakeholders throughout the year,” he said. The Food and Agriculture Organisation (FAO) and the World Health Organisation (WHO) created the Codex Alimentarius (Latin for food law or code) in 1963. The CAC aims at developing food standards, guidelines and related texts such as codes of practice under the food standards programme of FAO and WHO, two bodies under the aegis of the United Nations. His new position, however, does not mean that he will have less time for APEDA, the organization he has headed for long.

Reference 1: Article by Rajeev Ranjan Roy July 12th, 2008 ICT by IANS

“APEDA stands to benefit a lot from CAC and vice versa. Our great work at APEDA in managing quality of processed foods and agricultural products played a decisive role in my election,” he said. APEDA is an autonomous body under India’s ministry of commerce and industry dealing with quality management of agricultural and processed foods, and promoting their export.

2.9 CONCLUSIONS

Indian agriculture forms the back bone of Indian economy and despite concerted industrialization in the last six decades, agriculture occupies a place of pride. Being the largest industry in the country it provides employments to around 65% of the total workforce in the country. But in the recent year, its share in the GDP has declined to 18% in 2008-09. There is lot of scope for improvement in this sector. Summarizing the important points we can conclude that

1. Indian agriculture needs shift itself from traditional approach to scientific approach.
2. Indian agriculture should focus on market oriented produces rather than self sufficiency of food grains.
3. Indian agriculture needs to adapt technological and research oriented environment instead of struggling in traditional and superstitious environment.
4. Indian government should provide modern technology access to the rural farmers along with knowledge of markets and export potential.
5. Indian agriculture should aim to be free from trades and middle men dominant market and establish market access directly to farmers.
6. Indian agriculture shows a lot of potential because it has the largest diversity in physiography and climate and has highest amount of resources such as man power.
7. Indian agriculture should utilize these resources and develop the agriculture sector into one of the fastest growing, largest contributing sector of our economy.

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