General Knowledge Today

Agriculture-1: Current Data & Overview of Major Crops

Integrated IAS General Studies:2016-17

Last Updated: August 11, 2016
Published by: GKTODAY.IN

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Mains Model Questions

Model Questions for Mains

1. In most of the five year plans, India missed the growth targets in agriculture. Analyze the key reasons for low agriculture growth in the country.
2. Objectively compare the trends in India's food grain production during pre-green revolution period and post-green revolution period.
3. What do you understand by an Agricultural Worker? Critically examine the trend population of agriculture workers in India's total population since independence.
4. From 1990s onward, the share of farm exports in India's total exports has gone down gradually. Analyze the reasons for the same.
5. Explain the terms subsistence farming, commercial farming, intensive farming, extensive farming, plantation farming, mixed farming.
6. Explain the various cropping patterns with reference to the rice cultivation in India.
7. "The Rice-Fish Farming system can not only bring higher crop and water productivity; but has potential to answer food security question in some areas of the country." Discuss.
8. Several rice varieties organically grown in the waterlogged coastal regions of Kerala have been provided protection under Geographical Indications. Discuss with examples.
9. Coarse cereals have been gradually edged out of diet basket of Indians. Critically examine the reasons. In your view, why coarse cereals should be promoted?

10. In recent years, pulses have become the main drivers of food prices inflation in India. Why? What are the main constraints in expanding pulse production in India. Examine.
11. Critically examine the trend of edible oil in India's international trade. To what extend the policy impetus to oilseed production in India has been able to influence these trends. Discuss.
12. "The answer to alarming import dependency in edible oil lies in Oil Palm." Discuss citing major constraints to palm oil production in India.
13. What do you understand by Roundtable on Sustainable Palm Oil (RSPO) and Green Palm. Discuss in the light of environmental issues created by constant increase in production and demand of oil palm globally.
14. What are the major regions of Sugarcane production in India. Analyze the reasons of shift of sugar Industry from Northern to Peninsular India in recent times.
15. There has been a long pending demand for complete decontrol of the sugar industry. But successive central governments have hesitated to decontrol sugar. Discuss the issue and government's policy stance on the same.
16. What do you understand by Sustainable Sugar Initiative (SSI)? Discuss its main principles and methods.

17. China and India produce almost equivalent quantity of cotton, but while China is a net importer of Cotton; India is a net exporter. Discuss making case if India should follow China model in its cotton sector.
18. The British planted tea in not only Assam but other regions as well across Himalaya and Western Ghats. Why these plantations succeeded only in limited areas? Discuss.
19. Discuss the trends, scope and challenges of India's tea exports.
20. "In recent times, Nepal tea is not only affecting the export prospects of Darjeeling tea but also have infiltrated into India's domestic market." Examine the issue.
21. "Kangra Tea Industry had a golden history but today it is struggling to survive." Discuss throwing light on measures taken to protect Kangra Tea.

Introduction & Key Data

In the 1950s, India's agriculture was marked by stagnation and low growth. The growth in crop was around 0.4% and in grain production was around 0.1%. In 1950-51, India produced around 50 million tonnes of Foodgrain, which was not enough to feed our 350 million people. Due to this, India had to import food grains. The farms were characterised by a low yield, which lingered around 580 kg per hectare.

In 1960s, India ushered into the green revolution era when it imported some 18,000 tonnes of High Yield Variety (HYV) of seeds from Mexico. The HYV seeds in conjunction with increased use of fertilizers and irrigation resulted in a significant spike in production and India thus ushered into an era of Green Revolution. By early 1970s, India attained food security and reduced import of food grains.

Green revolution was possible because of the pioneering work of our agricultural scientists and also due to the audacity of Indian farmer who took the risk to adopt the new technology. Between 1980s to 2000s, India saw an expanding cereal production. The Government introduced economic reforms brought greater encouragement to exports. In these two decades, India turned itself from a net importer of agricultural products to net exporter. Today, our country is largest producer of spices, pulses, milk, tea, cashew, jute etc. and the second largest producer of wheat, rice, fruits and vegetables, sugarcane, cotton and oilseeds.

Gross Cropped Area and Net Cropped Area

- India's total geographical area is 329 million hectares. Out of this, 195 million hectare is gross cropped area and 141 million hectare is net sown area. On the other hand, net irrigated area is only 65.3 million hectares. Rest of the land is rainfed.
- Kindly understand the difference between Gross Cropped Area and Net Sown Area here. Gross Cropped Area (GCA) is the total area sown once as well as more than once in a particular year. When the crop is sown on a piece of land for twice, the area is counted twice in GCA. On the other hand, Net Sown Area is the area sown with crops but is counted only once.
- This implies that if we deduct net sown area from gross cropped area; what we find is those areas where crops are cultivated for more than once in a particular agriculture year.

The share of agriculture in GDP of India

- Agriculture and Allied Sector contributed approximately 13.9% of India's GDP (at constant 2004-05 prices) during 2013-14. However, when CSO released the new GDP numbers in early 2015, the share of these sectors went up to 18% at 2011-12 prices; mainly due to base

effect. This figure of 18% comes by addition of share of crops (11.4%, maximum), Livestock (3.9%), Forestry and Logging (1.4%) and Fishing (0.9% minimum).

- In 1950-51, the share of agriculture in GDP was around 55%. While secondary and tertiary sectors got momentum under various five year plans; the agriculture was left behind; partially due to the fact that agriculture is a state subject and states had the responsibility to carry out centre's plans well.
- While share of agriculture in India's national income has gradually fallen; the share of service sector has increased gradually and India is on the path of becoming a truly service economy.

The share of agriculture in GCF (Gross Capital Formation)

- According to Economic Survey 2014-15, the share of agriculture & allied Sectors in total GCF was 7.9%. This number is made of Crops (6.6%), Livestock (0.7%), Forestry & logging (0.1%) and Fishing (0.5%).
- By gross capital formation (GCF) we mean investment. The percentage of the investment made each year out of the total GDP is called Gross Capital Formation. Rate of Gross Capital Formation is arrived as follows:

Rate of Capital Formation = (Investments /GDP) X 100.

- **Importance of GCF:** The high rate of GCF brings high GDP because GCF is that component of GDP which helps in growth of GDP itself.

Importance of Agriculture in economy

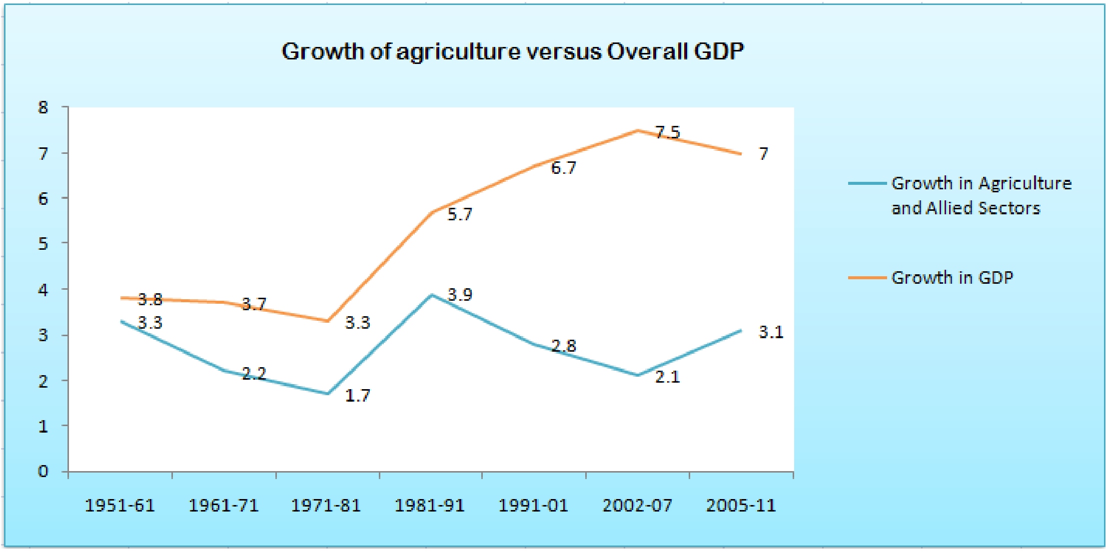
Importance of agriculture in the national economy can be summarized in the following points:

- 22-27% of population and half of the labour force dependent on agriculture
- 18% of India's GDP comes from this sector as per latest numbers
- Good crops increase purchasing power of the farmers, which leads to greater demand for manufactured products. Thus prosperity of farmers leads to prosperity of other industries. We note that rural markets are a large segment of market for durable products also.
- Failure of agriculture can derail the whole economic planning. This lesson was learnt during second and third five year plans and also in early 2000s.
- Most of the internal trade in the country is in agricultural products.
- Agricultural growth has direct impact on poverty eradication; it is important factor in containing inflation; raising farm wages and employment generation.
- Allied sectors such as horticulture, animal husbandry, dairy and fisheries have an important role in improving the overall economic conditions and health and nutrition of the masses.

Growth trends in Indian Agriculture

Rights since India's independence, the growth in agriculture has been roughly in the range of 1.7

to 4%. The below graphics shows the growth of agriculture sector vis-à-vis the growth in overall GDP in different decades.



One notable point is that out of all the five year plans India made so far; growth targets in agriculture was achieved only in sixth plan. In that plan, the annual growth rate of 4.3% was achieved against the target of 3.8%. For rest of the plans, agriculture growth remained around 2 or 3%. Even for the first three years of the 12th Five-Year plan (2012-17), the rate of agri-GDP growth was a meagre 2 percent per annum against a target of at least 4 percent. In 2014-15, the growth in Indian agriculture was only 1.1%. Further, except food grains, India has never seen a spectacular growth in any other agricultural commodities.

The highest growth in agricultural sector was achieved during the mature green revolution period between 1980-81 and 1989-90. The growth was mainly due to impressive rise in productivity or yield. After that, land under cultivation of most crops declined except Rice, Wheat and other crops supported by either government or market incentives. This was particularly true for North West India where market incentives were in force in terms of price support, assured government procurement for wheat and rice and favourable policy environment for providing inputs to farmers at subsidised rates. Despite growth in yield, the negative growth in area led to fall in production of several crops including coarse cereals.

The other key reasons for low agriculture growth include

- Population pressure and mindless urbanization that leads to conversion of cultivable land to non-agricultural purposes.

- Slow rate of conversion of a wasteland to cultivable land.
- Average farm holding size is declining
- The higher rate of growth of the non-agricultural sectors; these sectors outperformed agriculture.
- Faulty, stereotyped policies of the Government
- Lack of institutional credit to farmers.
- Obsolete Agricultural Techniques and slow adaptation of new techniques
- Inadequate irrigation and dependency on rains
- Declining soil health due to unbalanced use of fertilizers.

Agricultural Productivity

Prior to Green revolution, the yield per hectare in India was low for all important crops. The introduction of modern agricultural practices and HYV seeds; there was a jump in the productivity of most food grains. The following table shows the per hectare yield of main food crops since 1950-51:

Crop	1950-51	1964-65	2010-11
Rice	7.1	10.8	22.4
Wheat	6.6	9.1	29.4
Coarse Cereals	4.3	5.1	14.18
Pulses	4.0	5.2	6.9
Data Quintal Per Hectare			

The above table makes it clear that while robust yield growth was seen in Rice in pre-green revolution period; the same was seen in wheat in post-green revolution period. In most of the other crops, the average annual growth yield has been low.

In comparison to other countries such as Brazil, US, Australia and China, productivity in crops, particularly **food grains** is very low in India. For example, India fields produce only a third of the wheat per hectare in comparison to France or half in comparison to China. Further, growth in **productivity** is also stagnant at around 2% per annum. There are several reasons behind low productivity including small land holdings; disguised unemployment; low marginal productivity; inadequate modernization of agriculture; low skill development; increased cost of production; price risks; inadequate irrigation facilities; slow pace of land reforms; inefficient institutional delivery of

credit; inefficient marketing of farm produce and so on.

To increase productivity, there is a need of significant and widespread improvements in agricultural practices because India does not have large swathes of land available for agriculture like Brazil. Whatever land area is available for farming is shrinking because of urbanisation; industrialisation and successive fragmentation of land holdings with each generation. Further, Agriculture and Land being state subjects under 7th schedule of the constitution; onus for increasing productivity is largely in state governments. Some improvements which can raise productivity include:

- Introduction of better and efficient irrigation facilities
- Promotion of agricultural mechanization which can help an average farmer to manage without hired labour.
- Introduction and upgrading of large scale irrigation
- Improve promotion and transport of farm produce
- Remove problems in marketing of farm produce including addressing the issues around APMC act.
- Improving storage facility, tenant security, supply of better quality seeds
- Promote multiple cropping

Further, we must be more open and receptive to the idea of judicious experimenting and use of genetically modified (GM) crops provided they don't bring disaster to already stressed farmers.

Agricultural Workers as part of Population

There are two types of farm workers in India viz. Cultivators and Agricultural Labourers. Cultivators are those who work in their own land; Agricultural Labourers are those who work on the land of others for wages. An agricultural labourer has no right of lease or contract on land on which she/he works. Now, let's analyze the trend in these two types of farm workers in India.

Year	1951	1961	1971	1981	1991	2001	2011
Total Population	361.1	439.2	548.2	683.3	846.4	1028.7	1210.6
Cultivators	69.9	99.6	78.2	92.5	110.7	127.3	118.7
Cultivators as % of total agricultural workers	71.9	75.9	62.2	62.5	59.7	54.3	45.1
Agricultural Labours	27.3	31.5	47.5	55.5	74.6	106.8	144.3

Year	1951	1961	1971	1981	1991	2001	2011
Agricultural Labours as % of Total Agriculture workers	28	24	37.7	37.5	40.2	45.6	54.8
Total Agricultural Workers	97.2	131.1	125.7	148	185.3	234.1	263
Total agricultural workers as % of Total Population	26.9	29.8	22.9	21.6	21.9	22.7	21.7

The above table shows that:

- Agricultural workers as fraction of India's total population have decreased only marginally since in 1951. While 27% of the people were agricultural workers in 1951; their fraction stands 21.7% as per Census 2011 data.
- Out of the total agricultural workers; the fraction of cultivators has gradually gone down from 72% in 1951 to 45.1% in 2011. On the other hand, the fraction of Agricultural Labourers has gradually gone up from 28% in 1951 to 54.8% in 2011.

This hints towards a disturbing trend that more and more people of India are losing their land and they are either becoming farm labours or moving to other sectors. Since most of these people are either low skilled or unskilled, they have not many options but to become labourers either under private / unorganized sector or under government schemes such as MGNREGA. That is where; skill development gets importance as one of the biggest challenges in our country.

The above data also demystifies the false notion that half of India's population is involved in agriculture.

Agricultural Workers as part of Labour Force

In our country, 54 per cent of total workers and 42% of rural workers is still part of the agriculture sector but they are not all farmers or cultivators. They include those who are either wage labours in others' field or those engaged in related activities such as fisheries etc.

India's Agricultural Exports

In 2012-13, the share of agricultural commodities and food products in India's overall export basket was 10.66%. This figure was around 20% in 1990s while 7.9% in late 2010s. Thus, from 1990s onwards, the share of farm exports in India's total exports went down, and it has only improved in recent years marginally. The reason is not adverse performance of farm sector but is robust performance of other sectors particularly service sector. Thus, the key reason is that service exports outperformed agricultural exports in last two decades.

The key information about India's farm exports is given below:

- India's share in global farm/ food exports and imports is around 2.07% and 1.24% respectively. Thus, India is a net exporter of agricultural products. In terms of global agricultural and food exports, India's rank is 10.
- The largest export product in farm sector in India is Basmati Rice; while largest import product includes edible oils. Place of marine products comes only after Basmati rice in India's farm exports.
- India is one of the leading exporters of some farm products such as tea, sugar, oilseeds, tobacco, spices and products with agricultural content (jute, cloth and sugar products).
- In recent times, Buffalo meat and Guar gum exports have seen significant volume growth in exports of India.
- Further, the share of processed food such as mango pulp, dried & preserved vegetables, meat and poultry items has also increased.

Recent Upward trends in Farm Exports

For the last few years, farm exports of India have shown upward trend and this trend is expected to sustain due to several reasons such as reduced transaction costs, time, increased demand overseas and policy impetus to agriculture; sufficient stock of wheat / rice in central pool, increased importance to food processing industry etc.

India's Agricultural Imports

Although India is a net agricultural exporter; yet a huge burden on India's import bill is due to agricultural imports. The largest agricultural exports of India are Edible oil; wood products and pulses. India also keeps importing Sugar, onion etc every now and then. Edible oil is India's largest import farm commodity mainly because of its higher consumption and lower production. Oilseeds and edible oils are also essential commodities.

Overview of Major Crops: Part-1

On the basis of nature and purpose of farming; there are several types of farming systems in India such as subsistence farming, commercial farming, intensive farming, extensive farming, plantation farming, mixed farming and so on.

- In **subsistence farming**, entire production is for only consumption. There is not surplus to sell in markets. Such type of farming is adopted by small and marginal farmers on fragmented land holdings. The cultivated crops and generally food crops; and the methods of farming are generally archaic.
- **Commercial farming** is opposite to subsistence farming. Its objective is to sell the produce in the market. It is done with modern tools and techniques, irrigation, chemical fertilizers,

insecticides, pesticides and High Yielding Varieties of seeds. Cultivated crops include food crops such as food grains, oil seeds etc. as well as non-food crops such as Cotton, Jute etc.

- **Extensive farming** is done on large patches of land. The large swathes are able to output huge amount of produce but production per unit of land may be low. Such farming is done in those countries where large size of landholding is available e.g. United States, Canada etc. Extensive farming is almost absent in India except in some states such as Punjab, Haryana and Uttar Pradesh.
- The focus of **intensive farming** is to produce maximum output per unit of land. It is common in India as well as South East Asian countries such as Thailand, Vietnam, and Indonesia etc.
- **Plantation Farming** is the farming in an estate where single cash crop is grown for sale. Examples are Tea, Coffee, Rubber, Banana, Spices.
- **Mixed farming** refers to the raising of animals along with the crops. The farmers engaged in mixed farming are economically better.

We can also divide the crops of India in four segments on the basis of purpose as follows:

- **Food Grains:** This includes Rice, Wheat, Maize, Coarse Cereals and Pulses
- **Cash Crops:** This includes Cotton, Jute, Sugarcane, Tobacco and Oilseeds. Oil seeds include ground nut, Rapeseed & Mustard, Sun-flower, Soyabean etc.
- **Plantation Crops:** This includes Tea, Coffee, Coconut, Rubber etc.
- **Horticulture:** This includes Fruits and Vegetables.

Further, the crops of India can also be divided in three types on the basis of their seasons viz. Rabi, Kharif and Zaid.

- The Kharif crop is the summer crop or monsoon crop; usually sown with the beginning of the first rains in July, during the south-west monsoon season. Major Kharif crops of India include Millets (Bajra and Jowar), Paddy (Rice), Maize, Groundnut, Red Chillies, Cotton, Soyabean, Sugarcane, Turmeric etc.
- Rabi crop is the spring harvest or winter; sown in October last and harvested in March April every year. Major Rabi crops in India include Wheat, Barley, Mustard, Sesame, Peas etc.
- Zaid is grown in some parts of country during March to June. Prominent examples are Muskmelon, Watermelon, Vegetables of cucurbitacae family such as bitter gourd, pumpkin, ridged gourd etc.

Food Grains Production

Food Grains include Rice, wheat, maize, coarse cereals and pulses. In 2014-15, India's estimated food grain production stands at 257 million tonnes with 103 million tonnes rice; 96 million tonnes wheat, 23 million tonnes maize and 18.4 million tonne of pulses.

Historical Trend in Food grain Production

In 1947, India's population was 330 million and in those days, feeding people was biggest challenge. In the initial decades, India relied on supplies from the United States under its Public Law 480 (PL-480).

The reason as to why India relied on United States only and why not other countries – was that India did not have enough foreign currency to buy food grains from global markets. The PL-480 programme allowed India to buy in Rupee payments. At that time, India could by maximum 8MT of food grains from international markets (with available foreign currency) while under PL-480, it imported 10MT. Those were the days when India's food grain production hovered around 50 million tonnes, unable to feed the population.

A major problem arose in 1960s when United States suspended the supply of wheat to India due to some political differences; despite that India was facing back to back droughts in those years. The Indian leadership however, immediately learnt the lesson that India could even lose its freedom if self sufficiency in food production is not achieved.

- In 1966, India imported 18000 tonnes of high yielding varieties (HYV) of wheat from Mexico and ushered into the era of green revolution.
- From 330 million in 1947 to 1.25 billion today; India's population has increased by almost 3.8 times. In this period, India's food grain production increased from 50MT (1951) to 257MT in current year.
- During this period, production of wheat gone up by 15 times, rice by five times, maize by 14 times, milk by 8 times and so on.

The result is in front of all of us. Today, India is not only self sufficient but also a net exporter of food grains and largest exporter of rice in the world. The key stakeholders of this turn around were policy makers like C. Subramanian, scientists like M.S. Swaminathan. However credit should go to the Indian farmer, who took the risk of adopting new technologies.

Largest Food-grain Producing States in India

India's largest food grain producing state is Uttar Pradesh; which produces around 19% of total food grains in the country. Top three food grains producing states are Uttar Pradesh, Punjab and Madhya Pradesh.

- Top three rice producing states are West Bengal, Uttar Pradesh and Andhra Pradesh.
- Top three Wheat Producing states are Uttar Pradesh, Punjab and Madhya Pradesh.
- Top three Maize producing states are Andhra Pradesh, Karnataka and Maharashtra.
- Top three coarse cereals producing states are Karnataka, Rajasthan and Maharashtra. We note here that these three states keep changing their position with almost every year's data.

Rice

Rice (Oryza sativa), a member of grass family (Poaceae) is a tropical plant associated with the wet and humid climate. It is an important staple food crop for more than 60 per cent of the world people.

Important Facts about Rice

- Globally, two major verities of rice are grown viz. *Oryza sativa indica* and *Oryza sativa japonica*. Further, there are several varieties including of wild rice, all of which make a so called Oryza sativa complex.
- It's a true grass and its edible part grain is its seed. The dehulled rice grain is covered by an outermost layer called pericarp and such rice with pericarp is called Brown rice. It is removed when rice undergoes milling and polishing.
- It's a staple crop, rich in Carbohydrate (Starch) and poor in protein / lipids. Brown rice is rich in some vitamins mainly Thiamine and B1.
- Rice straw is used as cattle feed, used for thatching roof and in cottage industry for preparation of hats, mats, ropes, sound absorbing, straw board and used as litter material.
- Rice husk is used as animal feed, for paper making and as fuel source.
- Rice bran is used in cattle and poultry feed, defatted bran, which is rich in protein, can be used in the preparation of biscuits and as cattle feed.
- Rice bran oil is used in soap industry. Refined oil can be used as a cooling medium like cotton seed oil / corn oil.
- Rice bran wax, a byproduct of rice bran oil is used in industries.

Production of Rice

Top rice producing states are West Bengal and Uttar Pradesh. However, since it can be grown in all types of soil, almost all states of India have areas under rice cultivation. As per the fourth Advance Estimates for 2013-14, the production of rice in India is 106.5 million tonnes. Rice covers one third of total cultivated area of India and provides food to more than half of the Indian population. This makes it India's largest produced food crop both by area under cultivation as well as production. India is second largest producer of rice after China; produces one fifth of the world's rice; and is

largest exporter of rice. Rice is the staple crop in eastern and southern part of the country and is very important crop in terms of national food security.

Cultivation of Rice

There are three seasons of rice growing viz. autumn, winter and summer.

- Autumn Rice is Pre-Kharif rice sown during May to August; and harvested in September-October. Autumn rice crop accounts for only 7-8% of total rice grown.
- Winter Rice is the Kharif rice in India, sown in June-July and harvested in November-December. This accounts for 84% rice cultivation in India.
- Summer rice is also called Rabi rice sown from November to February and harvesting time is March to June. This accounts for 8-9% of total rice cultivated in India.

Thus, rice is predominantly a Kharif crop in India, grown in both irrigated areas as well as rain-fed areas with high rainfall. It requires hot and humid conditions for growing with 24° C mean temperature and 150-300 cm rainfall. The crop is predominantly labor oriented and is not much suitable for heavy farm mechanization.

With regard to the soil, rice is grown both in uplands and lowlands. On this basis, there are several methods of rice growing such as Dry or Semi-dry upland cultivation; Broadcasting the seed; Sowing the seed behind the plough or drilling; Wet or lowland cultivation; Transplanting in puddled fields; Broadcasting sprouted seeds in puddled fields etc.

Rice Cropping Patterns

With regard to the cropping patterns, India has varied climatic regions and rice is grown in different patterns as discussed below:

Rice-Rice-Rice Pattern

Under this pattern, three rice crops are grown in same field in one year. This is also called a cropping pattern of 300% intensity and is followed in areas with high rainfall and assured irrigation facilities. Examples of such pattern are the canal irrigated areas of Tamil Nadu.

Rice-Rice-Cereals / Pulses Pattern

In the areas where water is not adequate for taking a rice crop during summer, a cereal crop such as Ragi, Maize or Jowar or short duration pulses are cultivated once with two times rice in a year.

Rice-Groundnut Pattern

In states such as Andhra Pradesh, Tamil Nadu and Kerala, groundnut is grown in summer after harvesting the rice.

Rice-Wheat / Rice-Wheat-Pulses Pattern

Rice wheat crop rotation pattern is a dominant cropping pattern in the Northern parts India, particularly Indo-gangetic fields. In some other states, pulses such as green-gram, cow pea are cultivated in an order.

Rice-Fish farming system

In Eastern parts of the country, the farmers are marginal, poor and they usually end up with low productivity of rice. Wherever the field has sufficient water retaining capacity for a long period and free from heavy flooding, the farmers have developed a rice-fish farming system. There is a huge potential in proper development of an integrated rice-fish farming which can generate additional net returns to the farmers along with higher crop and water productivity.

GI Protected Rice Varieties of India

The major GI Protected varieties of India are as follows:

Navara Rice (Kerala)

- This rice variety is grown in Kerala and its cultivation. Palakkad in Kerala is the main land of Navara rice. This rice variety has not only nutritional and religious but also medicinal value. It received GI protection in 2007. This rice is used in Navarakizhi, a specialty traditional Kerala treatment of neuromuscular disorders.

Palakkadan Matta Rice (Kerala)

- Matta Rice or Rosematta rice or Palakkadan Matta rice is cultivated in Palakkad region of Kerala and is a GI protected variety. It has its own flavor and taste when cooked.

Pokkali Rice (Kerala)

- Pokkali rice is organically grown in the waterlogged coastal regions of Alappuzha, Thrissur and Ernakulam districts of Kerala. This rice variety has a unique tolerance to salinity and it is grown under a unique cropping pattern of **Rice-Prawn rotational** system. Rice is cultivated from June to November while Prawns are fetched in winter.

Wayanad Jeerakasala Rice (Kerala)

- This is a popular traditional aromatic rice variety grown in Wayanad District of Kerala. It is non-basmati rice yet has a unique taste and aroma.

Wayanad Gandhakasala Rice (Kerla)

- This is yet another GI protected rice variety of Kerala grown in Wayanad region.

Kalanamak Rice (Uttar Pradesh)

- Kalanamak Rice is named so because it has black husk and has some salty taste. It is cultivated in the Terai region of Eastern Uttar Pradesh in Siddharthnagar, Sant Kabirnagar, Mau and Azamgarh districts. This rice has its own historical importance and is linked to the life of Gautam Buddha; who as legeds say, visited Kapilvastu after attaining wisdom and when the villagers asked Prasada, he gave them seeds of this rice.

Kaipad Rice (Kerala)

- Kaipad Rice is organically cultivated in the brackish water tracts of the three districts of northern Kerala viz. Kannur, Kasaragod, and Kozhikode. Like Pokkali Rice, cultivation of

Kaipad rice is also done organically under salinity prone waterlogged fields. Due a unique cropping pattern or system called 'kaipad' system of rice cultivation has developed in Kerala. This is an integrated organic farming system in which rice cultivation and aquaculture go hand in hand. 'Orkayma' and 'Kuthiri' are two popular Kaipad varieties.

Basmati Rice

Basmati Rice verities give aroma pleasant flavour after cooking. Indian basmati rice is known for its extra-long superfine slender grains with a length to breadth ratio of more than 3.5. It is most preferred especially for Biryani and Pulao preparation on special occasion and is sold at high premium value in the national and international market. The important facts are:

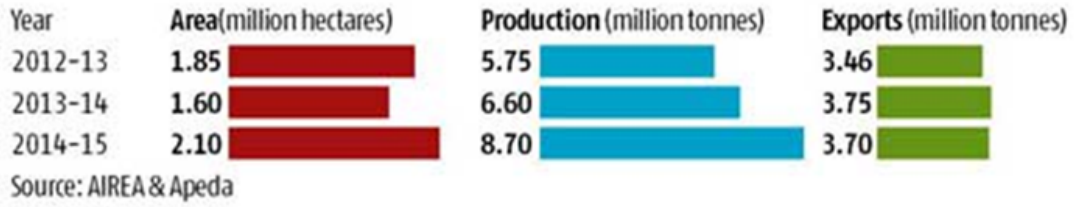
- Basmati rice is India's largest agricultural export commodity.
- In comparison to non-Basmati rice, Basmati rice cultivation consumes LESS water. This is the reason that some states such as Punjab encourage the farmers to grow more Basmati.

Cultivation and Export of Basmati Rice

The main Basmati producing areas are north and north western part of Indian sub-continent on both the sides of Indus valley. Thus, global supply of Basmati Rice is done by India (65%) and Pakistan (35%). In our country, the Basmati rice is grown in Punjab, Haryana, Rajasthan, Jammu & Kashmir, Himachal Pradesh, Delhi, Uttarakhand, Uttar Pradesh, Madhya Pradesh and Bihar. Punjab and Haryana account for about 70 per cent of total Basmati grown in India.

In Pakistan, most of the Basmati rice is grown in its Punjab state. Further, a brand name Texmati is grown in United States, which is not basmati exactly but something claimed to be similar to that.

In 2014-15, the total area under Basmati cultivation was 2.1 million hectares, compared to 1.6 million hectares in 2013-14 — an increase of 31 per cent. Further, exports from India registered a nominal drop in 2014-15 compared to last year. The latest Basmati figures are shown below:



From the above table, we note that in 2014-15, the export of Basmati Rice from India has decline despite of a higher production. The reason was that Iran is one of the largest importers of India's Basmati Rice and several issues including economic sanctions on that country led to this fall.

Important Basmati Varieties

Important Indian Basmati Rice varieties include Basmati 386 , Basmati 217 , Ranbir Basmati , Karnal

Local/ Taraori Basmati, Basmati 370, Type-3 (Dehradooni Basmati), Pusa Basmati-1, Pusa Basmati 1121, Punjab Basmati-1, Haryana Basmati- 1, Kasturi, Mahi Sugandha etc.

Wheat

Wheat is being cultivated in India for more than 5000 years and the original species *Triticum sphaerococcum* was grown in Indus Valley Civilization. This species is now disappeared and has been replaced by present day species- *Triticum aestivum* or the common Bread Wheat, *Triticum durum* or the Macaroni wheat and the *Triticum dicoccum* or the Emmer Wheat.

At the time of independence India was dependent on import of wheat from US; but today India is second largest producer of Wheat in the world after China with about 12% share in total world Wheat production.

Cultivation

As per the fourth Advance Estimates for 2013-14, the production of wheat is likely to be 95.9 million tonnes. Thus, Wheat is second most important crop after rice and is main Rabi crop in many parts. With rice, it makes the most important cropping pattern of the country called Rice-Wheat cropping pattern. According to 2014 data, top three Wheat Producing states are Uttar Pradesh, Punjab and Madhya Pradesh.

About Plant

Wheat is a true grass and a plant of poaceae family. It is a winter crop and needs low temperature. Ideal temperature is between 10-15°C at the time of sowing and 21-26°C at the time of harvesting. Wheat thrives well in less than 100 cm and more than 75 cm rainfall. The most suitable soil is well drained fertile loamy soil and clayey soil. Plain areas are most suitable. The wheat crop is highly mechanization oriented and may need less labour.

Important Varieties

Kalyansona, Sonalika, Lerma Rojo, Chhoti Lerma, Arjun, Sujata etc. are some of the wheat varieties with peculiar names that might be asked in exams.

Coarse Cereals / Millets

Coarse cereals are a broad sub-group of several short duration warm weather (Kharif) crops such as Jowar (Sorghum), Bajra (Pearl Millet), Maize, Ragi (Finger Millet) etc. They are used in food, fodder, fuel; value added products and also fast food products.

Cultivation of Coarse Cereals

In our country, the coarse cereals are mainly grown in poor agroclimatic regions, particularly rainfed areas of the country. These crops are grown in areas with high temperature and are called dryland crops because can be grown in areas with 50-100 cm rainfall. These crops are less sensitive to soil

deficiencies and can be grown in inferior alluvial or loamy soil.

Currently, India holds 4th position in the world in coarse cereal production after USA, China & Brazil but the amount produced is only 3.6% of the global coarse cereal production. As per 2014 figures, Karnataka, Rajasthan and Maharashtra are the top coarse cereal producer states of India.

Trends in Consumption Pattern of Coarse Cereals

Coarse cereals like sorghum (Jowar), pearl millet (bajra), finger millet (ragi) and other coarse staples like maize, barley, oats had been traditionally an important component of Indian food basket. Regrettably, they have been gradually edged out of the food chain. There are two main reasons behind this:

- Firstly, coarse cereals are considered to be inferior grains in comparison to rice and wheat. Rising income of the people led to a change in the consumption pattern and people moved to rice, wheat, pulses and fruits in place of these cereals. It is true that coarse cereals not match rice and wheat in grain quality, but they certainly score over them in terms of nutritional value. They have equivalent protein content to wheat and are richer in vitamin B, iron, calcium, phosphorous and many other key micronutrients. Further, they also serve as gluten-free alternatives to finer cereals which make them alkaline rather than acidic in nature. That is why they are called nutri-cereals and are preferred staple food in many parts of the world and India.
- Secondly, with the increased government support to wheat and rice both at demand side and supply side led to constriction in the area under coarse cereals. On demand side, government provided cheap wheat and rice under public distribution system while on supply side, it supported wheat and rice via system of minimum support prices.

However, despite of policy neglect, coarse cereals have survived as livestock and bird feed, and growing industrial uses such as for production of starch and alcoholic beverages.

Why coarse cereals should be promoted?

Successive governments at the centre have launched initiatives to promote use of coarse cereals mainly because of their nutritious value. For example, to promote cultivation and consumption of millets, Government of India allocated Rs. 300 crores in 2011-12 under Rashtriya Krishi Vikas Yojana for promotion of millets as Nutri-cereals. This was to be done via a scheme called "Initiative for Nutritional Security through Intensive Millet Promotion (INSIMP)". During the UPA regime, the National Advisory Council (NAC) had moved a proposal for supply of millet and other coarse cereals through the public distribution system. The key logic is that that millet is nutritious and can bridge the food gap likely to be created in implementation of the food

security law. Apart from that the following qualities make a case for promotion of coarse cereals:

- The coarse cereals require much less water to grow than rice and wheat
- They can be successfully cultivated in semi arid tropics and poor soils
- They are more efficient converter of energy and plant nutrients into biomass.
- Some of them are capable to deliver higher yield per hectare in comparison to whet and rice if there is a proper use of modern farm technology and hybrid seeds.

In summary, coarse cereals have a potential to bring rainfed green revolution in the country provided proper policy is in place.

Pulses

Key Facts about Pulses Production, Consumption and International Trade

Pulses are leguminous crops that constitute an essential part of Indian diet because nearly 43% of all Indians are vegetarian (urban-48% rural-41%) and pulses are important protein source. The main pulses grown in India include chickpea or Bengal gram, pigeon pea or red gram or arhar, lentil (masur in Hindi), urdbean or black gram, mungbean or green gram, moth bean, horse gram, pea, grass pea or khesari, cow pea, broad etc.

Production

As per the fourth Advance Estimates for 2013-14, the production of pulses is projected to be 19.3 million tonnes. India is largest pulse producer of the world accounting for 25% of world's pulses production. Among various pulse crops, chickpea dominates with over 40 percent share of total pulse production followed by pigeonpea (18-20%), mungbean (11%), urdbean (10-12%), lentil (8-9%) and other legumes (20%). According to 2014 figures, Madhya Pradesh is India's largest pulse producing state with 26% share in overall production. It is followed by Maharashtra and Rajasthan.

Area under pulses Production

Between 2009 and 2013, the average area under pulses production was 23.9 million hectare. This is around 12-13% acreage among all crops.

Growth trends in pulse area / production

In last 60 years, neither the acreage nor the yield has grown substantially. The total production of pulses in recent years has been around 17-19 million tonnes; while area under pulses production has been between 22 and 26 million hectares.

Consumption and Import dependency

Against the production of 17-19 million tonnes, consumption of pulses in India has been around 22-23 million tonnes. Thus India needs to import pulses every year to fulfil the domestic demand. India's import dependency in pulses is always around 16-20%. This is evident with the data from a recent Assocham study.

India's Pulses Balance Sheet				
Year	Production	Import	Consumption	Import Dependency
2012-13	18.34	4	22.34	18%
2013-14	19.25	3.7	22.95	16%
2014-15	17.2	3.7	20.9	16%
2015-16*	18.32	5	23.32	21%
* Estimates				

The above information shows that India is world's largest producer as well as consumer as well as importer of the world.

Export Figures

India is also one of the largest exporters of pulses in the world. Chickpeas contribute the single largest share in India's export basket of pulses registering 97.18% and 85.64% share in the total pulses export during 2013-14 and 2014-15 respectively.

Production

In India, pulses are produced in Kharif, Rabi as well as Zaid Seasons. Chickpea, lentil, and dry peas are grown in the Rabi season, while pigeonpea, urdbean, mungbean, and cowpea are grown during the kharif season. Moongbean and Urad also also grown in Zaid season. Most of the pulses in India are produced in Rainfed areas.

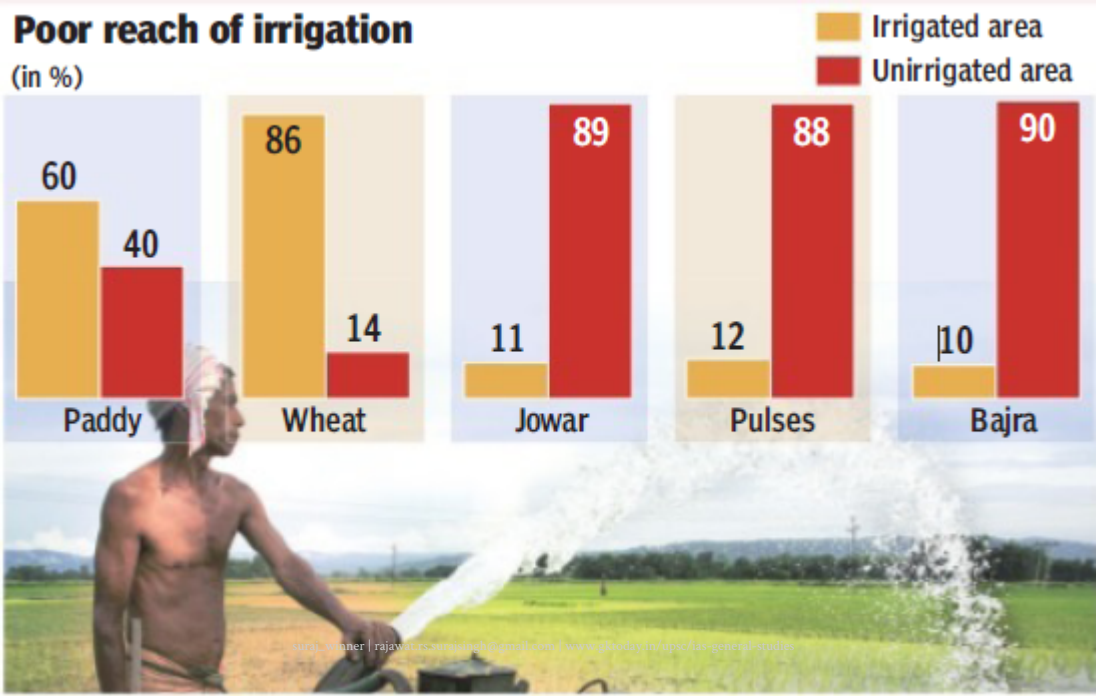
Why pulses are drivers of Inflation?

In recent years, pulses have become the main drivers of food prices inflation in India. There are three reasons behind this:

- High demand-supply gap. The above data shows that despite being largest producer of pulses, India is dependent on import of pulses to bridge the demand supply gap.
- Low productivity and low growth in productivity. The average yield per hectare of total pulses has grown by less than one per cent annually, on average, since 1950s. This has naturally been outstripped by population growth.

Constraints to increase pulse Production

Production of major pulses is constrained by both biotic / abiotic stresses and socio-political problems. The main biotic stresses that block pulse productivity include various pests. We note here that legume crops are rich in N and P and it makes them attractive for insect pests and diseases. Most of the pulses in India are grown in low fertility, problematic soils and unpredictable environmental conditions. More than 87% of the area under pulses is rainfed as shown in below graphics:



In these areas, issue is of availability of water. Thus, areas of pulse production in India are subject to drought and heat stress of arid and semi arid regions, which brings down its yield. Further, the arid and semi arid areas of the country face problem of alkaline and acidic soils. Since long, governments gave little importance to pulses in comparison to staples. Only in recent times, government started providing MSP support to pulses viz. Gram, Lentil, Urad, Tur and Moong. Despite of this, farmers in India treat pulses as secondary crops. The cost of input in case of pulses is higher in comparison to staple crops. Farmers have low purchasing power and they would give first priority to staple cereals and cash crops. Due to this, pulses in our country continue to be grown on poor soils with low inputs.

How to Increase Pulse Production?

Successive governments have done efforts via a variety of schemes to improve pulse production in the country. These include National Food Security Mission on Pulses (NFSM-Pulses), Integrated Scheme of Oilseeds, Pulses, Oilpalm & Maize, macro-management of agriculture, integrated development of 60,000 pulses villages in rainfed areas, minimum support prices to the pulses and so on. However, these schemes have made a slow headway towards addressing the problem. Some of the efforts which can be done to increase pulse production are as follows:

Development and Promotion of Drought Tolerant varieties

Since pulse crops in India are generally grown in arid and semi-arid areas of the country, there is need to develop more short-duration, high-yielding varieties of pulses, matching the crop maturity duration to soil moisture availability. This would avoid drought stress. Using this strategy, nine fold jump was recorded in Andhra Pradesh in a decade 2000-2009.

However, the availability of better seeds to the poor farmers is a major problem. The accessibility of smallholder farmers to quality seed of improved pulses varieties is constrained by both inadequate demand creation and limited supply.

Using Rice-pulse cropping pattern

A large part of the Indo-gangetic plains used for rice production remains fallow in winter season. The Rabi pulses can be grown in such fallows. Some agricultural universities in India have shown that the short duration pulses varieties can be successfully grown with reasonably high yield in such regions.

Pigeonpea in rice-wheat cropping systems

In the Indo-gangetic plains, the most popular cropping pattern is the Rice–wheat cropping system. The continuous production of cereals has lead to depletion of soil fertility and increased incidence of pests and diseases, and is posing a serious threat to sustainability of the entire rice-wheat cropping system. If legumes are included in the rice–wheat cropping system; it would not only help to restore soil fertility but also reduce other associated problems.

Better Management of operations

There is a need to promote mechanized field operations and effective management of pests.

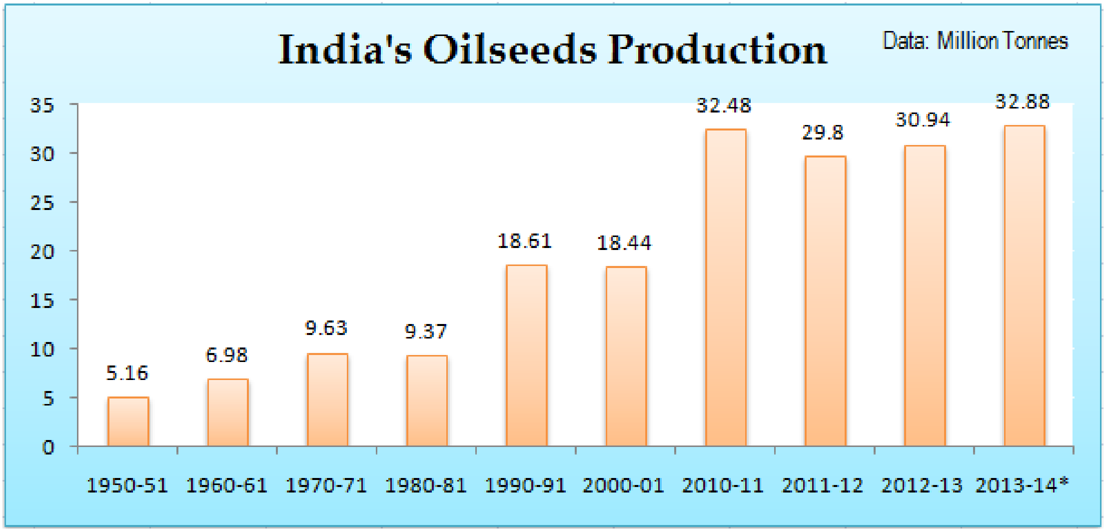
Oilseeds

A large variety of oil seeds are produced in India such as groundnut, castor seed, sesamum, rapeseed and mustard, linseed, Soyabean, sunflower, nigerseed and safflower.

- India holds a significant share in world oil seed production. It is second largest producer of groundnut after China and third largest producer of Rapeseed after China and Canada.
- In 1970s, India produced around 9 million tonnes of oil seeds. This figure has grown up to 25 million tonnes in nineties.

Production & Acreage

As per the fourth Advance Estimates for 2013-14, India's oilseeds production is expected to be 32.9 million tonnes. The oilseed production in India has seen remarkable progress since 1951 when India produced a meagre 5.16 million tonnes of them. Currently, oil seeds share 14% of the area under major crops.



- India's largest oilseed producing state is Gujarat, thanks to its position as top groundnut producing state of India.
- Rajasthan is India's top Rapeseed & Mustard producing state, followed by Madhya Pradesh and Haryana. Almost half (48.12%) of Rapeseed and Mustard is produced by only Rajasthan.
- India's top Soyabean producing state is Madhya Pradesh with a share of 44% in India's total production of this protein rich crop. Among other oil crops, Karnataka is largest producer of Sunflower.

India's Oilseed Factsheet				
Period →	'71-72 to '80-81	'81-82 to '90-91	'91-92 to '00-01	'01-02 to '10-11
Average area under oilseed (million hectares)	17.01	20.09	25.5	25.67
Average oilseed production (million tonnes)	9.17	13.6	21.33	25.08
Average oilseed yield (Kg/hectare)	538.2	670.6	835.8	971.19
Source: Directorate of Economics and Statistics, Department of Agriculture and Cooperation				

Alarming Import Dependency in Edible Oil

Despite of increased output and productivity, there is a demand –supply gap in the oilseeds in India, particularly in Edible oils. Currently, India is world's largest importer of edible oil. The

demand supply gap is such huge that India has 60-65% import dependency in case of edible oils. Between October 2013 and November 2014, India imported around 11.8 million tonnes of edible oil. Import dependency worsens during the unfavourable monsoon years.

The reason is clear that domestic demand for vegetable oils and fats has been rising rapidly at the rate of 6% per year but domestic output has been increasing at just about 2 per cent per annum. In India, the average yields of most oilseeds are extremely low as compared to those other countries of the world. The cultivation of oilseeds in India is in high risk regions where there are uncertain returns on the investments.

Issues in Oilseed Production

The policy impetus to oilseed production in India came for the first time in 1986 when the government launched Technology Mission on Oilseed. This was a golden period for oilseed production in India when productivity jumped from 670 kg per hectare in the eighties to 835 kg per hectare in the nineties. However, after that there has been a slow pace of growth. Today, the major problem in oil seeds production is low productivity. India is way behind the developed countries and neighbouring countries like China in its productivity of oil seeds per hectare. Since the increase in production could not keep pace with increased demand, India became more and more dependent on edible oil imports. One of the biggest constraints to raising oilseed output has been that production is largely in rain-fed areas. Only one fourth of the oilseed producing area in the country remains under the irrigation.

Measures to improve Oilseed Production

Key measures to improve oilseeds production include

- Bringing additional oilseed areas under irrigation
- Promotion of modern crop technology and better dry farming
- Promoting oil palm cultivation.
- Further, there is a need to enlarge the scope of research, technology diffusion and institutional intervention to re-energize the oil sector. This would include increase public research spending in oilseed crops for development of biotic and abiotic stress tolerant varieties.
- Strengthen the oilseed crop seed chain, particularly in groundnut to match the variety specific demand for higher yield.
- Provide incentives to private sector participation in processing and value addition in oilseed crops. Also, constraints for low capacity utilization should be addressed.
- Ensure availability of key physical (fertilizers, pesticides), financial (credit facilities, crop

insurance) and technical inputs (extension services) in major crop ecological zones for oilseed crops.

- Implement market reforms and policies, such as contract farming and public-private partnership in production and processing, to ensure a competitive market for oilseeds and edible oil along with adequate protective measures to avoid unfair competition from the international markets.

Groundnut

Groundnut is most important oil seeds of India accounting for half of the major oilseeds produced in the country. Groundnut is predominantly a Kharif crop but is also sown as a Rabi crop. 90-95% of the total area is devoted to kharif crop. It is a legume which thrives best in tropical climate and requires 20°C to 30°C temperature; 50-75 cm rainfall. The crop is highly susceptible to frost, drought, continuous rain and stagnant water. It needs dry winder at the time of ripening. Well drained light sandy loams, red, yellow and black soils are well suited for its cultivation.

Production Figures

In 2013-14, India produced 9.67 million tonnes of groundnut which makes India second largest producer after China. Top three states producing ground nut are Gujarat, Andhra Pradesh and Tamil Nadu.

Oil Palm

Palm oil is principally obtained from Oil Palm (*Elaeis* guineensis) also known as African oil palm or macaw-fat. This perennial crop originated in West Africa and spread in different parts of the world from there. Two types of oil is produced from this plant viz. **palm oil** from mesocarp of its fruit while **palm kernel oil** from its seed kernel. Both these oils are used in culinary as well as industrial purposes.

Importance of oil Palm

The import bill for edible oil is around $10 billion which is India's third-highest overseas spending after oil and gold. This has many problems. It widens the current account deficit and it poses a challenge to the economy. There is a dire need to increase domestic production of edible oils. This can be done by two ways. One is to increase the productivity of existing oilseeds such as mustard, groundnut etc. or promote cultivation of a crop which surpasses all of them in productivity. Such crop is oil palm.

The palm oil plant is known for its high yield of edible oil. While productivity in other oil seed plants is less than 1 tonne per hectare; oil palm gives around 4 to 6 tonnes per hectare of palm oil and

400 to 500 kilo palm kernel oil from its 4th year to 25th year. It has price advantage and good digestibility make it readily acceptable as cooking medium. It is also used as a raw material to manufacture oleochemicals used in making soaps, candles etc.

Production worldwide

Although the plant originated in West Africa, it has naturalized in the tropical regions within 20° of the equator. The plant is most abundant in South East Asian countries because of favourable climatic conditions there.

Global production of palm oil is around 50-52 million tonnes of which 85% is produced by Indonesia and Malaysia. With 28.4 million tonnes of palm oil production in 2013, Indonesia is world's largest producer currently. These two countries also supply most palm oil imports of India.

The importance of Palm oil in global edible oil economy can be gauged from the fact that it accounts for one third of total global edible oil production from only 6 % of the total global Oilseeds Harvested Area. It has about 60% share of the world's trade in Edible Oil.

Consumption and Import in India

Currently, India is world's largest importer of edible oil. The demand supply gap is such huge that India has 60-65% import dependency in case of edible oils. The import bill for edible oil is around $10 billion which is third-highest overseas spending after oil and gold. Palm Oil, imported from Indonesia and Malaysia, accounts for about 80 % of total Edible Oil imports.

Production in India

India's share of palm oil production is small, accounting for 0.2% share in the total world produce on 1% of the global acreage. However, the acreage has been growing at a significant rate of 20% in last few years. Under various government schemes, palm oil production in India has also grown but as of now, India will remain net importer of this oil.

Currently, area devoted to oil palm is around 200,000 hectares and output is around 70,000 tonnes a year. Largest area was under Andhra Pradesh (including Telangana). These states & UTs include Andaman & Nicobar Islands, Andhra Pradesh, Chhattisgarh, Goa, Gujarat, Karnataka, Kerala, Maharashtra, Mizoram, Odisha, Tamil Nadu and Tripura. By 2013 figures, Andhra Pradesh is the leading palm oil producing state in India contributing approximately 86 % of country's production, followed by Kerala (10%) and Karnataka (2%).

Government Policy towards Oil Palm Promotion

The first major policy initiative of the government of India was the Oil Palm Development Programme launched in 1991-92 under the Technology Mission on Oilseeds and Pulses (TMOP). The objective of this programme was to expand the area under oil palm cultivation. From 2004-2005, the scheme is being implemented under Integrated Scheme of Oilseeds,

Pulses, Oil Palm & Maize" (ISOPOM). Currently, this scheme provides support for oil palm cultivation in 12 states viz. Andhra Pradesh, Assam, Gujarat, Goa, Karnataka, Kerala, Maharashtra, Mizoram, Orissa, Tamil Nadu, Tripura & West Bengal.

In 2011-12, the government also rolled out a new scheme called Oil Palm Area Expansion (OPAE) Programme in order to bring an additional 60,000 hectares area under oil palm cultivation. Further, government has announced various subsidies for oil palm growers for planting, buying pump set and drip-irrigation systems, partial compensation in case of loss during the gestation period and support for processing units.

Current Government Stance on Oil Palm

The current NDA government is pushing to make India self sufficient in edible oils in this decade. The government is planning to spend $1.5 billion in the next three years to help farmers grow oil palm trees.

Protection of Oil Palm Cultivators – The Oil Palm Acts

Once planted, the oil palm tree has a productive life beginning at 4th year and ending at 25 to 30 years. The oil is extracted from the mesocarp of its fruit and its seed kernel. Each palm tree produces around 5-12 fruit bunches every year. Each bunch weighing average 25 kilogram has around 2000 fruits.

One of the key requirements of this cultivation is that the Fresh Fruit Bunches (FFBs) of oil palm are highly perishable and need to be processed within 24 hours after harvesting. If there is delay in processing, quality and quantity both will suffer. This implies that oil palm plantation must go hand in hand with the development of processing facility. However, at farm level this facility can not be viable owing to small size of farms in India. Due to this, some states have enacted laws to mandate the nearby factory to immediately purchase all FFBs produced in the area.

Such acts are in force currently in Andhra Pradesh, Tamil Nadu, Goa and Mizoram. Andhra Pradesh was the first state to promulgate such legislation. This act empowers the state government to declare by notification any area as "factory zone" for the purpose of supply of the Frech Fruit Bunches by the farmers to the factory. The farmers in that area will supply all FFB to a designated factory and not anyone else. This factory needs to buy all FFB produced by all farmers in the factory zone at a price not less than fixed by the government. If the factory fails to buy the FFB without any valid reason, it will be liable to pay compensation to farmers.

Major constraints in domestic cultivation of oil palm

There are several constraints in domestic cultivation of oil palm in India. These are discussed briefly here.

Geographical location:

Although the tree has naturalized in the tropical regions within 20° of Equator; yet the most ideal location for oil palm tree are within the 8° latitude north and south of equator. Thus, India's mainland is not ideal geographical position for oil palm cultivation.

Irrigation

The oil palm tree needs regular rainfall, a characteristic of tropical climates. The hydrology of most states in India is such that it does not support the abundance of oil palm.

Long gestation period

Although oil palm has high productivity in comparison to other crops such as mustard. Yet, the cultivator needs to wait for four years for trees to start yielding oil.

Small farm holdings

The farmers in India have small farm holdings and this makes palm cultivation challenging.

Unstable policy

Domestic prices of Oil Palm are significantly affected by cheaper imports from Malaysia and Indonesia, thus demoralising the production. Further, there is only an ad-hoc and un-remunerative FFB price fixing formula. Further, the financial support and institutional credit to this sector has been insufficient.

Limited investments by private sector

Unlike Malaysia and Indonesia, the entry of large corporate into planting has been limited in India and subject to much regulation including Land ceiling rules.

The Land Ceiling Issue in Oil Palm Cultivation

Contrary to the captive plantation in Malaysia, the Oil Palm is cultivated in small holdings in India. Land is a state subject in India and various state governments have passed the land reforms acts. Such acts restrict the size of land holdings by individual farmers and purchase of land by non-agriculturists. This land ceiling problem occurs with only Oil Palm because so far Oil palm has not been recognized in India as a plantation crop like tea, coffee and rubber. This means that large scale cultivation is not possible by private / firms / individuals because oil palm needs massive land to be cultivated in economically viable way. The logic of the states to limit palm coverage is that the corporations might take over large tracts of the land at the cost of other crops. This is an important reason as to why land ceiling laws don't allow commercial cultivation of oil palm by private companies in India.

Palm Oil Cultivation and Sustainability Issues

In recent times, there has been a constant rise in demand of palm oil from all parts of the world. This has led to a high rate of growth in oil palm production at a CAGR of more than 6% both by high yield and high acreage. But this has raised several sustainability issues globally. The major

problems created include deforestation; loss of biodiversity; climate change; misuse of pesticides etc.

One example is that in Indonesia and Malaysia, almost one third forest was lost in only last one decade due to expansion of the oil palm. Forests are cleared and peat swamps are drained, also burnt which causes air pollution (haze) in large areas and ultimately contributes to global warming. Loss of natural forests results in loss of several ecosystem services; loss of livelihoods; and also imperils the wild species because their natural habitats are being destroyed. Some of the most affected species include Sumatran Rhino, Sumatran Tiger, Elephant and Orangutan.

Here, the notable point is the Oil Palm itself is not a problem. The problem is how it is cultivated and palm oil is produced. If it is done right – for example, degraded land is used to grow oil palm instead of bringing down forests; it can serve as a catalyst to growth of livelihoods and enhance biodiversity. **Roundtable on Sustainable Palm Oil (RSPO)** and **Green Palm** are such initiatives that promote the sustainable production of palm oil.

Roundtable on Sustainable Palm Oil (RSPO)

Roundtable on Sustainable Palm Oil (RSPO) is a multi-stakeholder platform established in 2004 to address the key issues and concerns towards promotion of the production of sustainable palm oil. It included major palm oil players such as AAK, KLK, Sainsbury's, Unilever, WWF etc.

RSPO has developed a set of standards for production of Sustainable Palm Oil, which are called RSPO Principles and Criteria. It has also come up with a certification system to support the production and trade in so called Certified Sustainable Palm Oil (CSPO). Today, CSPO has become a commercial reality and around 6.7 MT of CSPO is being produced. The key RSPO Principles and Criteria include the following:

- There should be no conversion of primary forest or socially or ecological valuable areas for plantations
- Protection of endangered animals and plants
- Protection of ecosystem services such as water, soil and air (including a ban on the use of fire for clearing land)
- No child labour and the creation of educational opportunities for children living on the plantation
- Inclusion and support of smallholders
- Regular assessment of plantations by independent accredited certifiers

In summary, RSPO makes sure that the valuable tropical forests are not cleared and environmental and social safeguards are met in production of palm oil.

RSPO standards include

- Not to clear primary forests or ecologically important lands for plantations
- Biodiversity Conservation
- Protection of environment and not to clear forests by fire
- Absolute avoidance of child labour and creation of educational facilities for children living on plantations
- Regular surveys and assessments by certified inspectors
- Create public awareness about irresponsible palm oil production
- Purchase of GreenPalm certificates which stand for certified palm oil.

However, under normal conditions; the purchasers of the palm oil will not know exactly from where their oil has come from and how it was produced. To solve this issue a trading programme called Green Palm (Book and Claim) was started which gives the consumers flexibility to purchase sustainable palm oil certificates. The RSPO certified palm oil producers register a part of their output with the GreenPalm programme. They are awarded one GreenPalm certificate on sustainable production of one tonne of palm oil. These certificates can be put on sale on the GreenPalm web based trading platform. The manufacturers or retailers can then bid for and buy those certificates online, in order to be able to claim that they have supported the sustainable production of palm oil.

Sugarcane

In terms of production, Sugarcane is the world's largest crop. In 2012, around 1.83 billion tons of sugarcane was produced worldwide. Top sugar producing countries are Brazil, India, China, Thailand, Pakistan and Mexico.

About Sugarcane plant

Taxonomically, Sugarcane belongs to Poaceae family of true grasses. It is a tropical and perennial grass which attains a length of 10 to 20 feet. A single plant of sugarcane has 'many stems' in a tuft. There are five different species of Sugarcane viz. *Saccharum officinarum, Saccharum barberi, Saccharum sinense, Saccharum spotaneum* and *Saccharum robustum*. The first one *Saccharum officinarum* is most grown and last two species viz. *Saccharum spotaneum* and *Saccharum robustum*. are wild.

Since ancient times, Sugar has been produced in the local units in India using traditional Khandsari process. Modern Sugar making was introduced in India probably by Dutch. The first Sugar Mill was started in India in Bihar in 1903; followed by another unit in 1904 in Uttar Pradesh. By mid of the

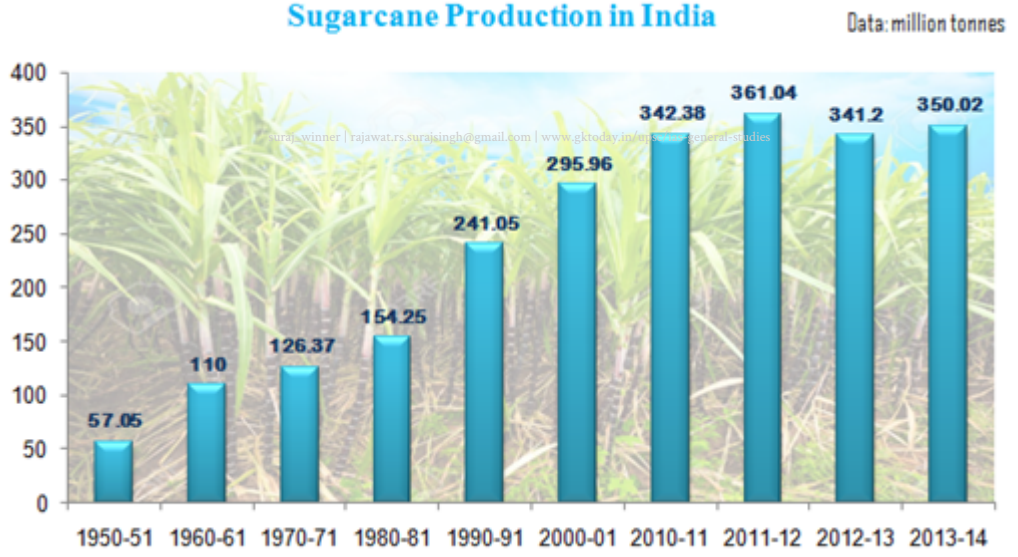
20th century Sugar Industry expanded and before India's independence there were 138 sugar mills in India. After partition around 67% sugar mills came in share of India and remaining in share of Pakistan.

Sugarcane Crop

In India, Sugarcane is grown as a Kharif Crop. It needs hot and humid climate with an average temperature of 21°C to 27°C. 75-150 cm rainfall is favorable for sugar cane cultivation. Irrigation needed for areas with lesser rainfall. Sugarcane can grow in any soil which can retain moisture. Ideal soil for sugarcane is deep rich loamy soil. The soil needs to be rich in nitrogen, calcium and phosphorus but neither it should be neither too acidic nor too alkaline.

Production Figures in India

Sugarcane is grown on around 2.8% of Gross Cropped Area of India. India produced around 350 million tonnes of sugar in 2013-14.



As per 3rd Advance Estimate (2014-15) of DAC released on 13/5/2015, India is expected to produce 356 million tonnes of Sugarcane and 25 million tonnes of sugar in 2014-15.

Year	Area	Sugarcane Production	Sugar Production	Sugarcane Yield
2005-06	42	2811.7	193.2	66.92
2006-07	51.5	3555.2	282	69.02

Year	Area	Sugarcane Production	Sugar Production	Sugarcane Yield
2007-08	50.6	3481.9	263	68.88
2008-09	44.2	2850.3	146.8	64.55
2009-10	41.7	2923	188	70.02
2010-11	48.8	3423.8	243.5	70.09
2011-12	50.4	3610.4	263.4	71.67
2012-13	49.99	3412	258.5	68.25
2013-14	50.12	3521.4	245.5	69.84
2014-15	50.32	3565.61#	250.46	70.86

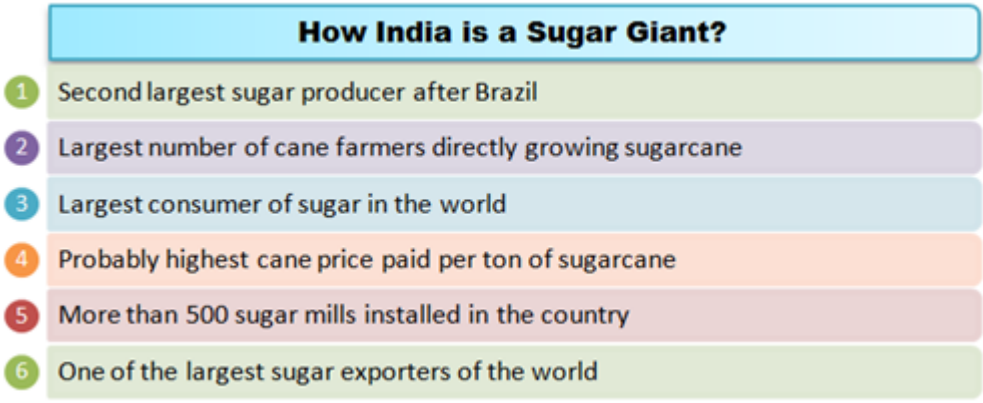
Area: Lakh Hectares
Production: Lakh Tonnes
Yield: Tonnes per hectare

As per 3rd Advance Estimate (2014-15) of DAC released on 13/5/2015
Source: Department of Food & Public Distribution (for Sugar Production) and Agricultural Statistics (for production and area of Sugarcane).

India's sugar production has increased in last 10 years at CAGR of 2.63 percent. During the same period, India's sugarcane production has increased at CAGR of 2.40 percent and area under cultivation at CAGR of 3.19 percent.

Sugarcane producing areas in India

India is the second largest sugarcane producing country after Brazil. Largest sugarcane producing state of India is Uttar Pradesh, which has 38.61% share in overall sugarcane production as per 2013-14 figures. The second and third largest states are Maharashtra and Karnataka. Other main sugarcane producing states of India include Bihar, Assam, Haryana, Gujarat, Andhra Pradesh and Tamil Nadu.



In India, sugarcane is produced in both tropical and subtropical regions. There are three distinct geographical regions in which sugarcane is produced. These are:

- Satluj-Ganga plain from Punjab to Bihar containing 51% of the total area and 60% of the country's total production.
- The black soil belt from Maharashtra to Tamil Nadu along the eastern slopes of the Western Ghats.
- Coastal Andhra Pradesh and Krishna river valley.

We note here that sugarcane gets more or less ideal condition for its growth in the tropical regions. The plant needs long hours of sunshine, cool nights with clear skies. Due to this productivity of sugarcane is higher in Maharashtra and Gujarat in comparison to other areas.

Flat, plain and level plateau is an advantage for sugarcane cultivation because it facilitates irrigation and transportation of cane to the sugar mills. Sugarcane cultivation requires heavy manures and fertilizers because it exhausts the fertility of soils quickly and extensively. Sugarcane is Labour oriented crop and needs cheap labour.

Currently, largest sugar producing state is Maharashtra. Uttar Pradesh was top producer of both sugar and sugarcane traditionally but it lost its top slot to Maharashtra. The key reasons include relatively larger size of mills and higher productivity of cane in Maharashtra in comparison to Uttar Pradesh. Similarly, Bihar was once second largest sugar producing state but it has also lost its traditional position to peninsular states.

After Maharashtra and Uttar Pradesh; Tamil Nadu has emerged as one of the largest other states producing sugar in India in recent decades. Tamil Nadu has shown spectacular growth mainly due to per hectare high yield of sugarcane, higher sucrose content and long crushing season. Other sugar producing states include Karnataka, Andhra Pradesh, Gujarat, Haryana, Punjab and Bihar. Some

Sugar is produced in Rajasthan (e.g. Sriganganagar Sugar Mills), Madhya Pradesh (Bhind-Murena-Gwalior belt), Odisha, West Bengal, Assam etc.

Shift of Sugar Industry from Northern to Peninsular India

Uttar Pradesh and Bihar were top sugar producing states once upon a time. However, they have lost their position to states such as Maharashtra and Tamil Nadu. The sugar industry of India is gradually shifting from north India to peninsular India because of several better conditions prevailing there. These include:

- The tropical climate of Peninsular India results in higher yield per unit hectare of land
- Higher sucrose content in peninsular cane
- Long crushing season in south. In North India, it lasts from November to February (4

months); while in South it lasts from October to May or even June (nearly 8 months)

The mills in peninsular India are larger. Though Uttar Pradesh has more sugar mills than Maharashtra yet Maharashtra's sugar mills are larger in size & Capacity. Further, the mills in cooperative sector in south are better managed.

Use of Sulphitation in Sugar Making Process

The process of the sugar factories has improved from an archaic process called Khandsari. In India the Sugar was produced in the Khandsari units and the produce was a yellowish color powder. In the mid of the 20th century this traditional Khandsari was replaced partially by Open Pan Sulphitation (OPS) which is actually using **the Sulphur compounds** (commonly Sulphur Dioxide -SO2) **to control the pH**, bacteria and color of the Sugar.

The SO2 in aqueous solution reacts with water to form H2SO3 (Sulphurous Acid) and thus more acidic solution is formed. It not only serves as a biocide but also gives crystalline and white sugar.

The reaction of SO2 with the carboxyl group of the Glucose and Fructose stops them to react with the amino acids (**called Maillard Reaction which is used in preparing food flavors**). Most factories burn the Sulphur to get SO2. The improved technique is Vaccum Pan Sulphitation (VPS) which is now used in most Modern Sugar Factories.

Sugar Industry Problems

India is second largest producer of Sugar in the word after Brazil. In the India, Sugar Industry is one of the largest farm based industry, only next to textiles and plays a very important role in the Indian Economy. The Industry affects the agriculture sector and the people related to it through the forward and backward linkages.

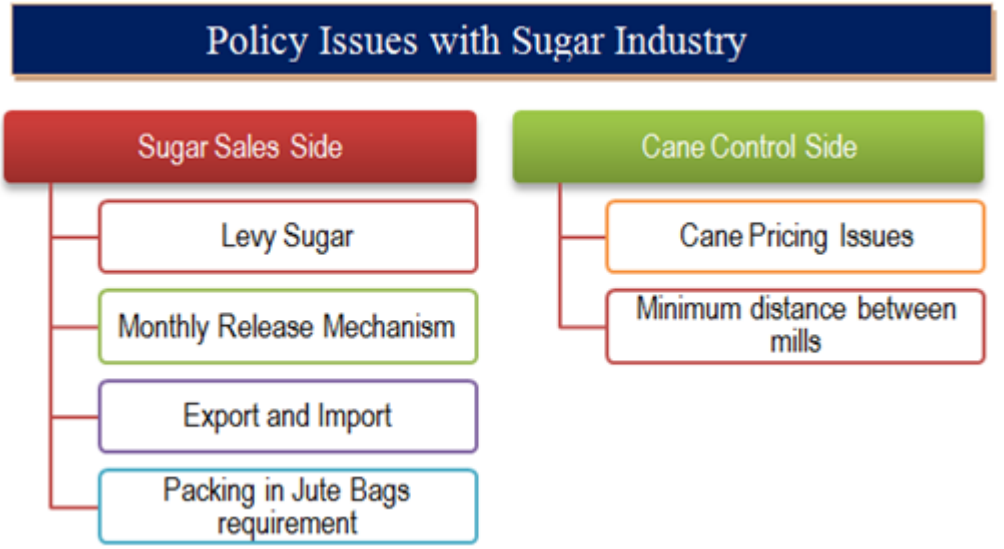
In 1930s Sugar was given protection. Since then, the industry has been traditionally called a "**Child of Protection**". The Industry grew after India's independence. From 143 factories in First Five Year plan, the number rose to 571 in the 11th five year plan. As a child of protection, government of India provided incentives for higher production and output of sugar. The result was that the sugar production, which was 11 lakh tonnes in 1951-56 periods, trebled in 3 plan periods.

But the journey from becoming a below average producer to a sugar giant saw a lot of fluctuations in the prices, frequent controls and decontrols by the government, mainly out of political compulsions.

Problems of the Sugar Industry – Before April 2013

The problems with the sugar industry can be broadly divided into two parts viz. natural issues and policy issues. Before dealing with them, we have to note that there are two policy scenarios viz. **before April 2013** and **Post-April 2013.** We can also call it *before Rangarajan* and *after Rangarajan* scenario. In the Pre-April 2013 scenario, various problems of the sugar industry can be summarized

in the following graphics.



Sugar- A Political Sensitive Commodity

The biggest problem of the Indian sugar industry is that it is *one of the most politically sensitive commodities*. Despite having a very small share in the monthly household budget, the slightest price increase can trigger inflation in other commodities. On the other hand, a large number of farmers grow sugarcane, and a fall in the price of sugarcane can shake the state governments, particularly in UP and Maharashtra. Sugar is also an essential commodity as per essential commodities act.

Cyclicality in Production

Another big problem of the sugar industry is the *cyclicality in the sugarcane production*. By cyclicality, we mean to say that the sugar cycle in our country gives three years of good production in a row followed by consecutive years of bad crop. This creates difficulties in policy making.

Levy Sugar and Minimum distance between mills

To check the frequent rise and fall in the prices of sugar, government had introduced dual price mechanism. Under the dual price mechanism, the government fixed the ratio of **Levy sugar** and free sale sugar quota. By doing so, every sugar mill was allocated a command area in its vicinity. This command area varied from 15-25 kilometers radius. The mill is bound to purchase any sugarcane grown in that area and the cane farmers are also expected to sell only to the designated mill. A part of produce of these sugar mills is required to be **sold to the Government**. This part is known as Levy Sugar. The levy sugar is sold to the consumers through fair price shops of the public distribution system. This ratio initially was fixed 45:55, later kept revising till reached 20:80, before finally getting

abolished in April 2013. *At present, there is no levy sugar in India.*

Monthly release mechanism

Under the Levy sugar regime, the sugar mills had to sell a part to the government. The remaining free sale quota was also under a different regime called Monthly Release Mechanism. Under this mechanism, the government would dictate the mills *how much sugar they could sell in the open market on a monthly basis*. Sugar factories could not sell over or below the amount stipulated by the Government.

Cane Pricing Issue

In most of the major sugar exporting countries, the sugarcane prices are linked to sugar prices. In our country, there is a disconnect between the two. This is mainly because at the same time, the *one cannot sustain the low sugar price, high cane price and a healthy flourishing sugar industry at the same time.*

Numerous committees have tried to design a formula linking sugar and sugarcane prices, but as of now, none of such formulae is perfect. The problem in arriving at a formula is as follows:

- If there is abundant supply of sugarcane, the mills will drop the prices to be paid to farmers.
- If there is an erratic supply of sugarcane, the mills will raise the prices to be paid to farmers.

Your never know, how will be trend of sugarcane supply.

Historically, first such formula was Bhargava formula, which said that if there is an erratic supply of the sugarcane, the farmers, under an agreement with the sugar mills will get a fraction of the profits of mills as incentives.

The FRP and SAP Issue

At present, the Central Government along with the CACP (Commission of Agricultural Costs and Prices) releases an all-India sugarcane price called 'Fair and Remunerative Price' (FRP) every year before the start of the sugar season. This FRP is a formula-linked cane price to encourage higher productivity. This FRP is what the mills would have to pay to the cane farmers.

But some states would like the mills to bleed more. They would fix a cane price over and above the FRP, which the mills would have to pay to the farmers. This price is called State Advised Price (SAP). The problem with the State Advised Price is that it is generally politically motivated. We take an example of Uttar Pradesh here. In that state, successive governments kept SAP high for electoral gains. Consequent to this, the Sugarcane became the most attractive crop to grow. On the one hand, farmers increased the cultivation of sugarcane crops, while on the other hand, the mills were forced to pay higher prices. The result was that arrears to farmers kept rising until they reached record high.

A few years ago, the Ministry of Food has made a proposal for curbing the state's political government's maneuvers regarding sugar prices. It said that if the state governments want to fix a

SAP over and above the FRP, they could do so, but instead of mills, the extra amount will have to be paid by the state government. This proposal finds place in dustbin as of now.

Partial Decontrol of Sugar

There has been a long pending demand for complete decontrol of the sugar industry. But successive central governments have hesitated to decontrol sugar. The prime reasons can be summarized as below:

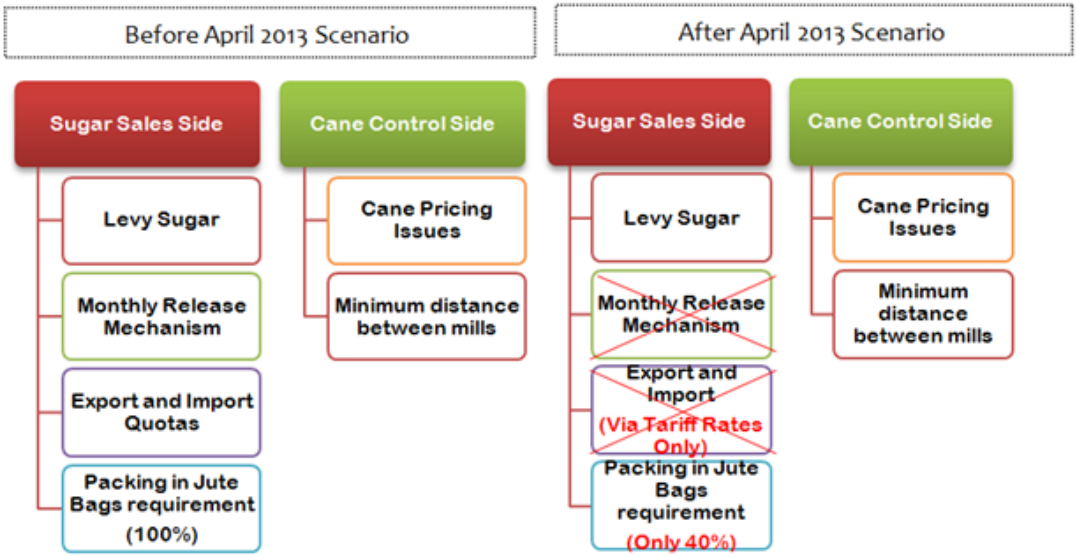
- Sugar Industry is an agro based industry and in India the output of agriculture is uncertain. If there is a surplus in the sugar cane crop, control is necessary to prevent the price collapse which may hurt the industry.
- If there is a short supply of sugarcane, protection of consumer's interest becomes essential for the government.

Rangrajan Committee

The Rangarajan Committee in November 2012 had made some salient recommendations on the basis of which, the previous UPA government took decision and declared some reforms. Some salient recommendations are shown in the below graphics:

Salient Recommendations of Rangarajan Committee	
1	Removal of levy sugar obligation from industry
2	Abolishing the regulated release mechanism for sugar sales
3	Export - Import policy – no quantity and time restrictions
4	Rationalisation of cane pricing policy
5	Linkage of cane price to value realised from sugar & by-products
6	Phasing out cane area reservation
7	Dispensing with "minimum distance criteria" between mills
8	Removal of controls on molasses & free up power sales
9	Removal of jute packing restrictions on sugar

In April 2013, the government announced partial decontrol of sugar. What was done exactly is seen in the below graphics:



The above graphics makes it clear that the partial decontrol of sugar announced in April 2013 has mainly four elements.

Abolition of the levy system

The government has abolished the 10% levy sugar for two years. Now, the levy sugar for the PDS will be procured by State governments from the open market at prevailing market prices. This will put additional subsidy burden to the government. However, the government did not increase the excise duty to fund its additional subsidy burden.

Dismantling of Monthly Release Mechanism

The government abolished the regulated release mechanism for non-levy sugar (or free sale sugar). Sugar factories are now free to sell any quantity to the market, depending upon the open market prices and their cash flow needs.

Export and Import via Tariffs only

The Rangarajan committee had recommended abolition of the quantitative controls on export and import of sugar, and no more outright bans on sugar exports. The committee had recommended that the companies should be free to sell in the export markets and also be allowed to import and sell in the open market and take advantage of price differential. The government has abolished the import and export quotas and now controls that via import duty and tariff only.

Relaxation in Jute bags use for packing requirements

To support the Jute industry, the government has given mandatory packaging in jute bags a minimum of 40% of the production of sugar and 90% of the production of foodgrains. The was 100%

earlier and was relaxed not in April 2013 but in November 2012 itself.

Current Status

It has been more than two years since April 2013, when the union government decided to lift some control on the sugar industry. Via this government scrapped the obligation to sell 10 per cent of a mill's output to the Public Distribution System at prices below the cost of production and also the government's power to control the supply of sugar to the open market.

However, two years down, the industry is still in problem. The current problem is that the industry is not able to pay the price of sugarcane to farmers, nor able to sell its sugar stocks.

The reason is that sugarcane is the raw material and sugarcane price is still decided by the state governments. The Fair and Remunerative Price proposed by the central government for cane was Rs 145 a quintal in 2011-12 while it is Rs 220 in 2014-15. The State Advised Prices are even higher than that. Even if there are bumper harvests, these prices keep the sugarcane to be an attractive crop for farmers. But as the sugar prices went down; sugar mills found themselves unable to make payments to farmers and arrears started accumulating. Year after year, sugar prices kept falling and arrears kept rising. At present, the total arrears are in the tune of Rs. 19000 crore.

The possible solutions to this problem are as follows:

- Fixing the price of raw material (cane) without considering the price of final product (sugar) is a bizarre phenomenon. Cane prices are attractive so farmers don't get any signal of imbalance caused by what they produce. Thus, taking the final product into consideration is needed. Recently, the Maharashtra and Karnataka government had announced a formula which gives weight to the price of sugar before fixing the cane price that industry has to pay to farmers. This needs to be done in other states also.
- The government can go for full decontrol of sugar. Ever since government went for partial decontrol; the sugar prices have gone down; but sugarcane price have risen.
- Government should create an strategic buffer reserve for sugar; incentivize more ethanol production and increase the liquidity of the mills from banking system. Currently, sugar mills face difficulty in accessing credit from banks.

Sustainable Sugar Initiative

Sugarcane is a water thirsty crop and enormous amount of water is needed in its production. The problem of optimal utilization of water becomes a major issue in those areas where irrigated crops and dryland farming are mixed. For example cultivation of irrigated crops such as rice/ sugarcane and dryland crops such as sorghum/millet on same watershed would result in a challenge to use the water optimally for both; because while former are water guzzling crops;

too much water to the later is waste of this scarce resource.

There is a need to explore every possible approach to reduce the water input to all crops, particularly those which excessively depend on scarce resources. Any water reduction to thirsty crops such as sugarcane will have a positive impact on the dry land agriculture in the same region. This is the basic philosophy behind the Sustainable Sugar Initiative (SSI) launched jointly by International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and by ICRISAT and World Wide Fund for Nature (WWF).

The major principles include the following:

Raising nursery using single budded chips

In the conventional method, 2-3 budded sugarcane setts are used for planting. However, in SSI, they use single budded chips from a healthy mother cane. This would give high percentage of germination depending on the agro climatic conditions.

Transplanting young seedlings

The single budded chips raised are transplanted within 25-30 days in the main field.

Maintaining wide spacing (5X2 feet) in the main field

In conventional methods, the distance between two rows is maintained at 1.5-2.5 ft and 44000 plants are sown per acre but unfortunately half of them are not millable in the end. On the other hand, SSI uses wide spacing to reduce seed usage and support easy air and sunlight penetration in the crop canopy for better and healthy cane growth.

Providing sufficient moisture and avoiding inundation of water

Water management is the key issue in SSI. It emphasizes that sufficient moisture is provided rather than inundating the field with water because flooded condition will actually hinder the growth of the plant. SSI methods use furrow / alternate furrow / drip irrigation so that only required quantity of water is given. Overall, SSI saves around 40% of water.

Low chemical fertilizers and more organic methods

Although SSI does not put an end to use of chemical fertilizers; yet it discourages high application of chemical fertilizers and use of pesticides and weedicides. It promotes more use of organic manures, bio-fertilizers and follow biocontrol measures. However, it does not ask for a sudden switch to organic cultivation.

Practicing intercropping for effective utilization of land

SSI promotes intercropping in sugarcane with crops like wheat, potato, cowpea, French bean, Chickpea, water melon, brinjal etc. In addition to effective utilization of land, this practice will reduce the weed growth up to 60% and give extra income to farmers.

Benefits of SSI methods

Sustainable Sugarcane Initiative is all about cultivating sugarcane mainly by changing the way the

inputs and methods are used. It involves less use of seeds; less user of water and optimum utilization of fertilizers and land; so that more yields is obtained with minimum use of inputs. Its basic premise is to obtain "more with less" in agriculture. By changing the way of raising nursery, it brings down the cost up to 75%. It reduces plant mortality rate; helps in increasing the length and weight of cane. However, SSI is farmer driven method; and its advantages are dependent on the efforts of cultivator himself rather.

Cotton

Earliest evidences of cotton are from Mehrgarh where cotton cultivated 7,000 years ago. During the Indus Valley Civilization, cotton was cultivated abundantly and cotton industry was well developed. Some methods used in the Indus Valley for the spinning and fabrication of the cotton continued to be used in India until modern industrialization came.

Cotton Species

Out of about 50 species of cotton plants in the world, only above four have been domestically cultivated for cotton fibres. India is the only country in the world which grows all the 4 species of the cotton cultivated. These species are

- Gossypium arboreum (Asian Cotton)
- Gossypium herbaceum (Asian cotton)
- Gossypium barbadense (Egyptian cotton)
- Gossypium hirsutum (American Upland cotton)

Gossypium hirsutum and Gossypium barbadense are the most commonly cultivated species of cotton in the world. Gossypium hirsutum variety is the most important agricultural cotton, accounting for more than 90% of world fibre production.

Among the above four, two are diploid (*Gossypium arboreum* and *G herbaceum*) and the other two tetraploid (*G hirsutum* and *G barbadense*). The diploid species referred to as the 'Desi' cotton, having low productivity and low quality cotton, contributes 25 – 30% of the country production. The tetraploids variety contributes remaining 70% of the cotton production in India. These varieties have fine quality fibre, and are normally used by the textile industry.

Apart from that, hybrid cotton is produced from crossing tetraploid species G hirsutum are also cultivated in the central and southern zones.

Cotton Crop in India

Cotton is grown as a kharif crop in India. The planting period of cotton normally is from March to September, while the harvesting period is from October to February. The peak marketing season for the crop is during November to March. There are mainly three cotton-producing

zones in India viz.

- Northern zone (Hirsutum and Arboreum Zones), comprising Punjab, Haryana and Rajasthan.
- Central zone (Hirsutum, Arboreum, Herbaceum and Hybrid Zones), comprising Maharashtra, Madhya Pradesh and Gujarat.
- Southern zone (Hirsutum, Arboreum, Herbaceum, Barbadense and Hybrid Zones) comprising Andhra Pradesh, Karnataka and Tamil Nadu.

About 70% of total cotton is produced in Gujarat, Maharashtra and Andhra Pradesh.

State	Production*	% Share in Production
Gujarat	10.95	29.93
Maharashtra	8.52	23.29
Andhra Pradesh	7.14	19.51
All – India	36.59	100
* million bales of 170 Kg each; Source: India Agricultural Statics Pocketbook 2014		

The northern region produces short and medium staple cotton; the southern region normally produces long staples cotton, while the central region produces long and medium staples. Names of Some Popular Hybrid Varieties of Cotton: *Assam Comilla, Bengal Desi, Jayadhar, Marathwada & Khandesh , Jhurar, Bunny Brahma, Brahma, Bunny, Suvin.*

For a healthy growth, cotton requires uniformly high temperature (21°C to 30°C) and at least 210 frost free days in a year. Since it requires modest rainfall; a large part of cotton is grown in India in rainfed areas. The best soil to growth cotton are Black soils of Deccan and Malwa plateau; however, cotton also grows well in alluvial soils of the Satluj-Ganga plain and red and laterite soils of the peninsular region. Since cotton farming is less mechanized in India, it needs cheap labour.

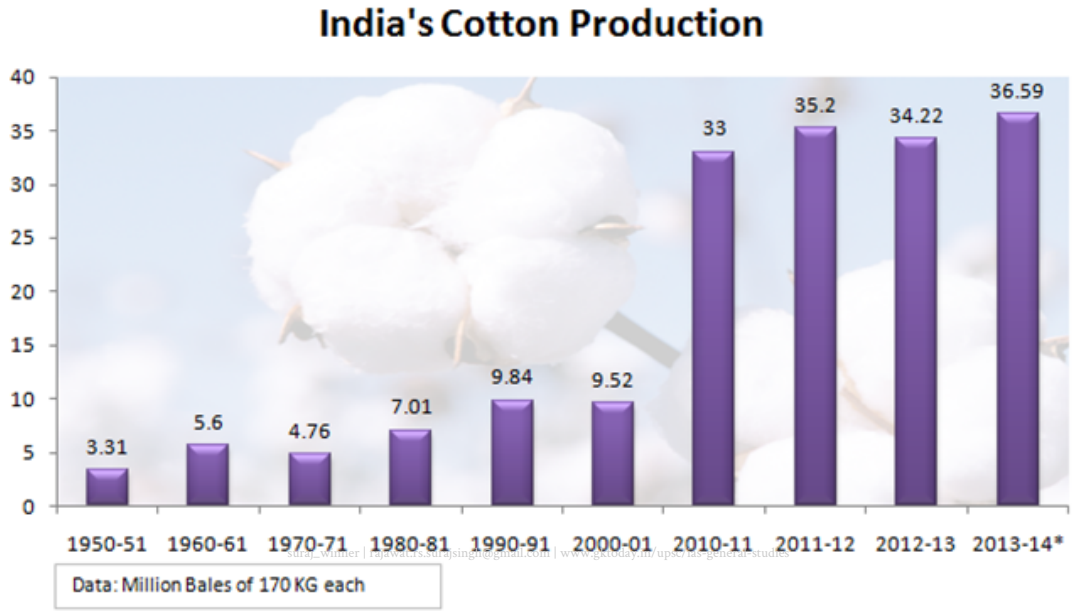
Global Production Figure

- Globally, around 110 million bales (25 million tonnes) of cotton is produced of which maximum share is of China with 38 million bales, followed by India with near 37 million bales of 170 Kg each. However, in terms of cultivation area, India is first in world.
- Most of the cotton produced in China is consumed domestically. Due to this, China is not a large exporter of cotton. World's largest cotton exporting country is United States; followed by India.

Production in India

India is first country in the word in terms of cultivation area and **second in the world in terms of**

production, next to China. Starting with a humble figure of 3 million bales; India has attained the status of second largest producer country today with a production of 36.59 million bales in 2013-14.



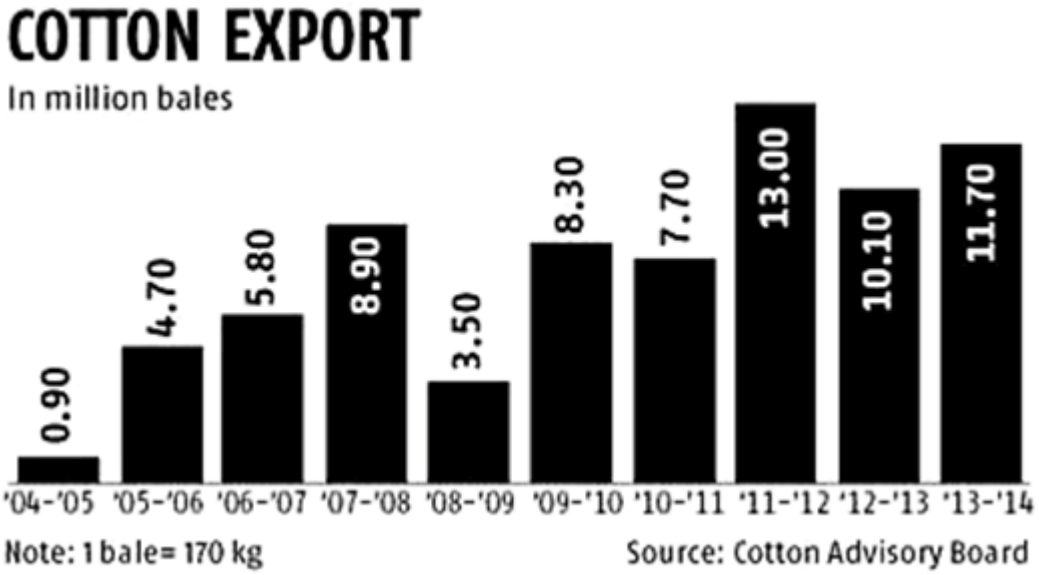
India has area under cotton cultivation ranging between 110 to 121 lakh hectares and constitutes around 25% of the total area under Cotton Cultivation in the world. Out of this around 65% is rainfed area and remaining around 35% is irrigated area. Thus, *cotton is an important* ***rainfed*** *crop in India.*

Gujarat is India's largest cotton producing state with production of 11 million bales that is equivalent to 30% share in total production. Gujarat is followed by Maharashtra and Andhra Pradesh.

India's Cotton Exports

India is world's largest cotton exporter after United States. Till 2003-04, India was net importer of cotton; however after that India has been a net exporter thanks to liberalization of cotton export; increased production of cotton due to use of Bt Cotton.

In 2013-14, India exported 11.7 million bales of cotton, which is almost one third of the total cotton produced in the country.



Out of the above exports, around 2/3 part goes to China and rest to Thailand, Bangladesh and Pakistan. All these countries have flourishing garment manufacturing industries. In recent times, Vietnam is also emerging as a major importer of India's cotton.

Liberalization of Cotton Exports

India is a Cotton surplus and Yarn surplus country. Government of India had liberalized raw cotton exports since July 2001, dispensing with the system of allocation of cotton export quota in favour of different agencies and traders. Exports of cotton from the country are under Open General License (OGL) since July 2001. OGL is a term from 1970s and 80s and as such does not exist today. Today, it refers to no restriction of import and export.

Role of Cotton in Indian Economy

Cotton provides direct employment to around 60 Lakh farmers and indirect employment to around 4-5 Crore People via cotton based industries. It is also one of the largest foreign exchange earner commodities of India. It is base of cotton textile industry which plays pivotal role in Indian economy by its employment generation, export earning and industrial output.

India vs. China: Should India follow China Model in cotton?

China and India produce almost equivalent quantity of cotton. While China is largest producer; all of its cotton is consumed locally by industries and China is a net importer of Cotton. On the other hand, India is second largest producer but also a large exporter of cotton.

- Although exports of cotton earn foreign exchange; yet it is one of the main imports of China

from India. About 70% of our agri export to China is raw cotton.

- The Indian cotton is converted into value added textiles in China and then exported to several countries of the world.
- Further, since a huge amount of cotton and cotton yarn is exported to China; any slump in demand from China affects Indian cotton prices and farmers badly.

Thus, if India was able to consume more domestically grown cotton to produce value-added fabrics; it could have a great impact on the trade imbalance between the two countries in favour of India.

It is interesting to note that China is the largest importer of rice in the world and India is the largest exporter but China does not import rice from India J.

Cotton Corporation of India

Cotton Corporation of India was established in **1970** under Companies Act 1956. It's a Government of India's corporate agency, engaged in diverse activities related to trade, procurement, and export of cotton. CCI is governed by Textile Policy 1985 issued by Ministry of Textiles, Government of India. CCI operates in the following states as of now – Punjab, Haryana, Rajasthan, Gujarat, Maharastra, Madhya Pradesh, Andhra Pradesh, Karnataka , Tamil Nadu and Orissa.

Tea

Brief Historical Account

Tea as well as tea consumption was prevalent in China (also in North East India) for thousands of years. Tea made inroads into Europe mainly via two routes. In Eastern Europe, it entered from China & Persia through Russia. In Western Europe, it entered by sea around the Cape of Good Hope through the Dutch and British East India company facilities.

East India Company and China Tea Trade

The pioneer work in the development of India tea was done by East India Company. The efforts to encourage tea cultivation began as early as from the times of Governor General Warren Hastings, who in 1776 had instructed one of the officers to prepare notes on cultivation of new crop into India. But no one in the company bothered much until 1833 because till that time, East India Company enjoyed monopoly in tea & silk trade with China, making huge profits. China used to provide these two commodities to East India Company in return for silver and bullion. But in 1833, the Chinese did not renew the agreement with British and thus their monopoly ended. With this, one of the most lucrative businesses of East India Company ended. This was beginning of serious efforts to cultivate tea commercially in India.

The first discovery of a wild tea plant is ascribed to Robert Bruce, who found it in 1821

in interior Assam. But it is beyond doubt that it wild tea plants were abundantly available in India also in upper Assam jungles and there local tribes such as Singhpos and Khamtis used to drink brew from tea leaves, which was called **Finap**.

The first tea garden was started in 1835 in Lakhimpur district of Assam. England received first chest of Assam tea in 1838. However, the early years of tea plantations were marked by several failures including wrong selection of sites and wrong way of manufacturing. For 13 years, even the monopolistic Assam Tea Company (ATC) had provided no dividends. But by 1850s, there was a huge extension of tea cultivation and production. Gradually, Indian tea started making inroads not only into international but also domestic market. Slowly it entered into the food culture of India and increased domestic consumption gave a boost to development of tea.

Success of British Tea Gardens

Tea was not only planted in Assam but also many other sites. Tea gardens were developed all along Shivaliks and Lesser Himalayas from Assam to Himachal Pradesh wherever the climatic conditions and terrain lent itself to plantation of tea shrubs. But the success of plantations was in limited. The areas where tea plantation succeeded included the regions located in monsoon belt – Assam, West Bengal and the foot hills of the Himalayas in the North and the moist slopes and the plateaus of the Western Ghats in the south. Not much success was received in other areas such as Himachal Pradesh, Ranchi, Doon valley etc. There were various geographical as well as other reasons of why the tea plantation was not successful in these areas. The Ranchi gardens have poor soil not suitable for tea cultivation. The rainfall, temperature and humidity needed by tea were not available in Himahchal Pradesh and Dehradun although soil in Dehradun is equivalent to that of Assam. Tea needs relatively low temperature for its growth, but not very low, that can adversely affect cultivation of tea. For example, the Kangra valley lies in the foot hills of Himalayas and here climate is too cold. Additionally, tea requires high rainfall of around 150-250 cm along with well drained slopes. The combination of all these factors exists in the areas of North East, Assam and areas near Darjeeling; as well as in Nilgiri hills.

Further, there was one more reason of failure of tea plantation in Kangra valley. In Kangra, the first tea estate began in 1852. The quality of the Kangra tea was readily accepted in Europe and it was even awarded. But then in 1905, this area was struck by an Earthquake, which ruined the tea plantations. This caused panic into the British planters and they sold their estates to locals and move away. The local people could not maintain the plantations because of technical knowhow.

About Tea Plant

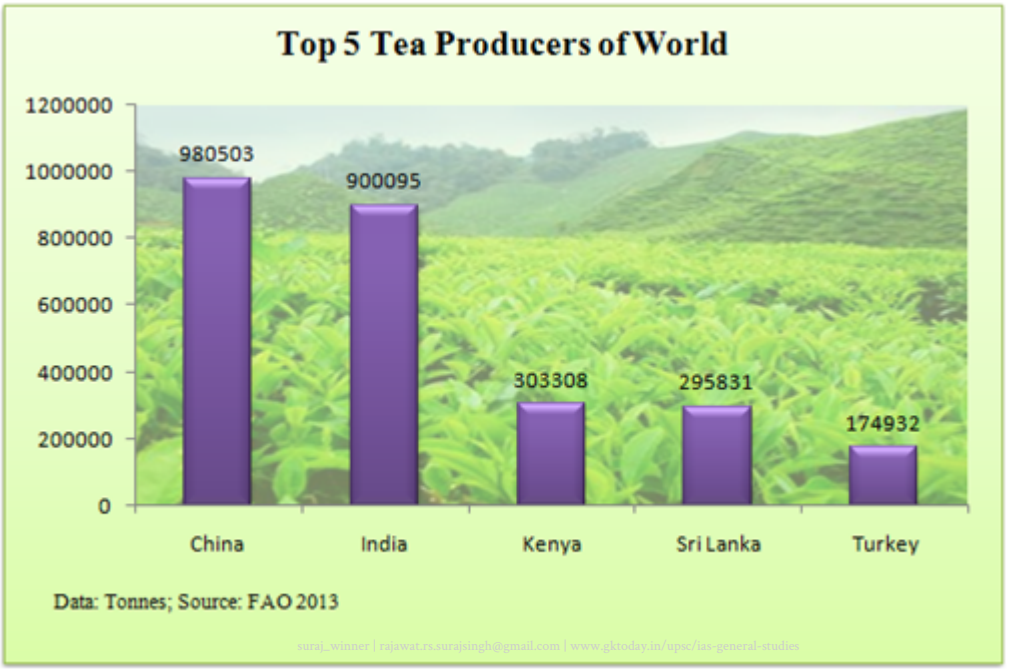
Botanical name of Tea is *Camellia sinensis.* After water, tea is the most widely consumed beverage in the world. Tea is an evergreen plant that mainly grows in tropical and subtropical climates. It is thought to have originated in East Asia somewhere between China and Burma. Commercial cultivation of tea started in India from British era when one Robert Bruce in 1823 discovered tea plants growing wild in Upper Brahmaputra valley. In May 1838 the first Indian tea from Assam was sent to England for public sale.

About the crop

- Tea grows in a moderately hot and humid climate, which is preferred for better yield, crop distribution and quality. An ambient temperature within 13°C and 28-32°C is conducive for growth of tea. Temperature above 32°C is unfavourable for optimum photosynthesis. It is synergically disastrous for the crop if it is accompanied by low humidity.
- In India, the temperature in winters is around or below 12°C and there is hardly any growth during this period. This is called **Winter Dormancy**. Flushing in the tea plants starts from March with the rise in temperature.
- The *Acidic Soil with around 4.5-5.5 pH is most suitable for Tea*. Well-drained fertile acid soil on high lands with moderate to high rainfall.

Production Figures

India is world's second largest tea producer after China. In 2013, India's estimated tea production was 900 million kilograms, which counts for around 23-24% of global tea production. The top five producer countries of tea are China, India, Kenya, Sri Lanka and Turkey.



In 2007, in India, there was an area of 579353 hectares under tea cultivation. Out of these 459613 hectares was in North India and 119740 hectares in South India. Around 4.16 Lakh hectares was under big growers and around 1.62 Lakh hectares was under small growers.

Important Tea Producing Areas of India

India is the largest producer and consumer of black tea in the world. Tea is grown in 16 states in India. Assam, West Bengal, Tamil Nadu, and Kerala account for about 95 per cent of total tea production.

India's major Tea Producing Districts/ Areas are as follows:

- Assam: Darrang, Goalpara, Kamrup, Lakhimpur , Dibrugarh, Nowgong, Sibsagar, Cachar , Karbi Anlong , North Cachar
- West Bengal : Darjeeling, Terai (west Dinajpur), Doors (Cooch Bihar) .
- Tamil Nadu: Kanyakumari, Tirunelveli, Madurai, Coimbatore , Nilgiris
- Kerala: Cannanore, Palghat, Kozhikode, Malapuram, Trichur, Trivandrum, Quilon, Kottayam, Ernakulam, Idukki, Wynaad
- Karnataka: Chikmagalur, Coorg, Hassan

The Largest state with area under Tea Plantations in India is Assam.

Data on Tea Production

The following table shows the states in India with Tea Plantations. Area under Tea Production in India is shown in below:

TEA AREA as on 31-12-2013 & PRODUCTION IN 2013-14

State / Districts	Area under tea (in Th. Hectares)	Production (Million Kgs)
Assam Valley	270.92	581.03
Cachar	33.48	48.02
Total Assam	**304.40**	**629.05**
Darjeeling	17.82	8.91
Dooars	72.92	177.85
Terai	49.70	125.34
Total West Bengal	**140.44**	**312.10**
Other North Indian States (Includes Tripura, Uttarakhand, Bihar, Manipur, Sikkim, Arunachal Pradesh, Himachal Pradesh, Nagaland, Meghalaya, Mizoram and Orissa)	12.29	23.92
TOTAL NORTH INDIA	**457.13**	**965.07**
Tamil Nadu	69.62	174.71
Kerala	35.01	63.48
Karnataka	2.22	5.52
TOTAL SOUTH INDIA	**106.85**	**243.71**
ALL TOTAL	**563.98**	**1208.78**

Foreign Trade in Tea

India is world's fourth largest tea exporter after China, Sri Lanka and Kenya. India exported 222 million Kg tea in 2010; but in recent years, these figures are slipping. In 2014, India exported 207.44 million kilograms of tea. Largest importers of Indian tea are Russia, UAE and Britain.

Despite being the world's largest producer with a geographical indicator all to itself (Darjeeling Tea), India has been losing share to other aggressive players like Kenya and Sri Lanka. In 2006, India's global market share was 14 per cent. Currently it stands 11%. Kenya and Sri Lanka are able to sell the tea at cheaper price with the same quality level. This has been explained below.

India faces stiff competition from Kenya (which is world's largest tea exporter) and Sri Lanka in tea

exports. We note here that tea processing is of two kinds viz. orthodox and non-orthodox. The non-orthodox is also called CTC (crush, tear, curl). Kenya's entire tea production is as CTC tea while Sri Lanka's entire production is via orthodox method. Further, most of the tea prepared via orthodox method is consumed while via CTC method is exported. Thus, India's Assam CTC Tea faces competition from Kenya while orthodox tea faces competition from Sri Lanka & Mozambique. Since qualities are similar, it's the price and production which matter in exports.

Further, most of the tea (□90%) exported from India is bulk tea (other is value added tea). Both bulk tea and value added tea earlier enjoyed 5% benefit by their inclusion in the Vishesh Krishi Gram Udyog Yojana. However, later bulk tea was included in the Merchandise Exports from India Scheme, whereby the export benefit was reduced to 3%. This is one factor that adversely affects the competitiveness of tea industry.

Tea Varieties in India

In India, there are three distinctly different tea growing regions. These regions are geographically separated, thereby producing three entirely different teas both in style and in taste/flavor. The three regions are:

- Darjeeling (North-Eastern India),
- Assam (far North-East India)
- Nilgiri (South India).

Further, we have a small **Kangra Tea industry** also which is made of 5,900 tea gardens spread over an area of 2312 hectares between Shahpur-Palampur-Baijnath-Jogindernagar in Himachal Pradesh.

Darjeeling Tea

Darjeeling Tea aka the **Champagne of Teas** is cultivated, grown, produced, manufactured and processed in certain hilly areas of Sadar, Kalimpong, Kurseong, Siliguri and Darjeeling at altitudes ranging from 600 to 2,000 meters. Its unique muscatel flavour comes due to the cool and moist climate, the soil, the rainfall and the sloping terrain. These natural factors give Darjeeling tea a distinction which is not found anywhere else in the world. Eventually, it was the first Indian product to be given GI tag in 2004-05.

Production Figures & Varieties

According to India Tea Association figures, Darjeeling tea production from 57 gardens in all stands roughly at 8.5 million kg or 0.7 per cent of India's total production. Out of this, 6 million kilograms is exported. Since Darjeeling tea is produced via orthodox method, there are several varieties on the basis of the harvesting time such as first flush, second flush, autumnal flush etc.

The best export quality is **first flush**, which is harvested in March, immediately after the spring

rains. Second flush is harvested in June. Monsoon and Autumnal rains are the last one and least exported. 90% export quantity is of Darjeeling tea is from First Flush. If there is some delay or deficiency in spring rains, the export trade of Darjeeling is affected. Such affect is seen in current year also.

Issues related to Darjeeling Tea

There are two major issues related to Darjeeling tea. First is the challenge its facing from Nepal and second is related to the wages of the tea workers.

Challenge from Nepal Tea

So far, Darjeeling tea is world's most expensive tea and has enjoyed its unique place. But in recent times, it's facing stiff competition from Nepal tea grown in border areas of Nepal near Darjeeling. These areas have same geographical and topographical conditions as the Darjeeling and the quality, aroma of Nepal tea is somewhat similar to Darjeeling tea but is not lasting. However, it's available at a price half than India's Darjeeling tea.

Thus, Nepal tea is not only affecting the export prospects of Darjeeling tea but also have infiltrated into India's domestic market. Thus, it's giving tough competition to premium Darjeeling tea in the domestic market India also. Worse is that it is being sold as Darjeeling tea!

To stop this menace, although the Indian government has tightened import rules of tea; but the problem is that it's really difficult to segregate the Darjeeling tea from Nepal tea at retailer level. Now, the Darjeeling Tea association demands the government to get all tea imports from Nepal to be registered with Tea board.

Problem of minimum wages

Currently, the wages of the Darjeeling tea workers is Rs. 95 per day. This price was fixed in 2011 after an agreement between the trade union and planter's organizations. The tea garden trade unions had a demand to increase these wages and sync them with minimum wages act. Two largest tea garden trade unions viz. Darjeeling Terai Dooars Plantation Labour Union (DTDPLU) and Progress Tea Workers Union (PTWU) have been proactive in these agitations. Out of them DTDPLU is politically linked to Gorkha Janmukti Morcha while PTWU is linked to Adivasi Vikash Parishad. Both these thus have strong political backing.

Their main demand include land rights for team workers, implementation of minimum wages act in Darjeeling, Terai and Dooars and opening the closed tea gardens in Dooars. In April 2015, this wage was hiked to Rs. 122/- but the agitation continued. In September 2015; the central government has released a draft notification which suggests the states to offer Rs.321 as the minimum wage to workers. However the trade unions look at this draft sceptically.

Assam Tea

Assam is the single largest contiguous tea growing area in the world. The Assam tea is generally known as Breakfast tea or English Breakfast Tea. The variety is C. sinensis var. assamica

Nilgiri Tea

Nilgiri Tea is grown in the hills of the Nilgiri district of Tamil Nadu as well as some other parts of South India. They are a picturesque range of undulating hilly landscapes where tea is grown at elevations ranging from 1,000 meters to 2,500 meters. Rainfall varies from 60 inches to 90 inches annually. Roughly 50% of the Nilgiri tea produced in India is exported.

Kangra Tea

Kangra Tea Industry had a golden history but today it is struggling to survive. Kangra was one of the sites where British introduced the China tea in the initial days of modern tea plantation in India in mid of 19th century. It was introduced by abiologist and soldier Jameson; who had brought tea bushes from China and planted them on experimental basis in Kullu, Mandi, Chamba, Palampur and Dharamsala areas. The bushes failed to survive in Kullu, Chamba and other areas but took root in Palampur and Dharamsala.

Due to its quality, the tea was readily accepted in Europe and had won gold & silver medals in exhibition of tea in Europe during 1886-95. However, first jolt to the Kangra tea plantations came in 1905, when this area was struck by an Earthquake, which ruined the tea plantations. This caused panic into the British planters and they sold their estates to locals and moved away. The local people could not maintain the plantations because of technical knowhow. Despite that the Industry survived in 20th century and remained as one of the leading suppliers to Afghanistan and Pakistan.

But despite its protection under land tenancy law; the industry has failed mainly due to absence of professional knowhow and faulty government policy.

Current Area and Production

At one time, Kangra tea industry covered more than 5,000 hectares of land and supported more than 1,600 families, but it has now shrunk considerably. It is currently grown in 5,900 tea gardens spread over an area of 2312 hectares between Shahpur-Palampur-Baijnath-Jogindernagar of Himachal Pradesh. Its current production is around 9 Lakh Kg, which used to be in the range of 16-17 Lakh Kg in 1990s.

Why Kangra Tea is struggling?

Kangra tea is facing a crisis and many of the tea growers in Kangra valley are abandoning the tea gardens. The key reasons of this crisis are discussed here:

Lack of quality planting material and technical knowhow

The Kangra valley growers are unable to find good quality planting material and they are not knowledgeable about the performance of the crop and nursery plants they are planting. The government apathy and policy blunders resulted in absence of any formal channel of imparting latest knowhow to the planters.

Labour problem

Non-availability of labour during plucking period adversely affects the productivity and quality of gardens. Then, the workers have no knowhow of correct plucking operation.

Lack of Mechanization

Most of the planters undertake hand plucking. Tea mechanization and farm mechanization process have not occurred in these gardens.

Urbanization

The faster pace of urbanization in Kangra district is luring the planters to sell their land for handsome cash.

Competition and other reasons

Kangra's tea industry is struggling to compete with Sikkim and Assam varieties in the market. The steep rise in cost of inputs and falling margins are another reasons. Further, Kangra region is also witnessing a slow invasion of apple trees in the tea plantations. The tea planters are now banking on apple to change their fortunes.

According to a report published in The Tribune, the industry also facing a policy problem whereby the marketing and development of tea industry in Himachal Pradesh was shifted from Industries department to Agriculture Department. The planters allege that the Agriculture Department failed to deliver the goods and neglected the development and marketing of tea in the region.

Measures taken to protect the Kangra Industry

Kangra Tea is one of the GI protected commodities in India. The state government along with Union Government has made some efforts to provide a niche based market for Kangra tea.

What should be done?

- Kangra tea needs better government policy, adoption of technology in production and brand promotion. A roadmap should be prepared for only Brand Promotion of Kangra tea.
- Kangra tea is unique in its quality and has potential to compete in international market on account of its special flavour. But the growing area is very small. Governments need to encourage farmers to grow the tea in Kangra as well as nearby areas of Kullu, Mandi etc. The state government had formulated such scheme but so far this scheme is not in operation.

- The state agricultural university and Tea Board of India should come forward to enlighten the farmers in terms of productivity and quality. This can be done by organizing camps in selected areas for latest knowledge dissemination.
- Labour problem can be corrected by creation of a labour bank and a centralized facility with skill manpower and machines.
- The Self Help Groups and Cluster approach and reviving the Kangra Tea Planters Association.

Tea Board of India

In 1903 Indian Tea Cess Bill was passed which provided for levying a cess on tea exports – the proceeds of which were to be used for the promotion of Indian tea both within and outside India. It was a predecessor to present Tea Board of India.

The Tea Board of India was set up under section 4 of the Tea Act 1953 was constituted on 1st April 1954. It has succeeded the Central Tea Board and the Indian Tea Licensing Committee which functioned respectively under the Central Tea Board Act, 1949 and the Indian Tea Control Act, 1938 which were repealed.

The Board is constituted of 31 members (including Chairman) drawn from Members of Parliament, tea producers, tea traders, tea brokers, consumers, and representatives of Governments from the principal tea producing states, and trade unions.

It is reconstituted every 3 years and its head office is located at Kolkata.

Main functions of Tea Board of India

- Rendering financial and technical assistance for cultivation, manufacture and marketing of tea.
- Export Promotion
- Aiding Research and Development activities for augmentation of tea production and improvement of tea quality.
- Extend financial assistance in a limited way to the plantation workers and their wards through labour welfare schemes.
- To encourage and assist both financially and technically the unorganised small growers sector.
- Collection and maintenance of Statistical data and publication
- Such other activities as are assigned from time to time by the Central Government.

Tea as National Drink of India

Role of British in Tea Industry of India

There has been a consistent demand from the Tea Industry for declaring Tea as 'national drink' of India. In August 2012, a parliamentary standing committee on commerce recommended that the beverage be given the status of 'national drink'. The view of the committee was that tea is an integral part of the socio-cultural milieu of the country and enjoys a space in the hearth of every home irrespective of caste, class, religion and economic status of the person. So far this status has not been given to tea.

Coffee

Coffee is prepared from the roasted seeds called as Coffee beans. Coffee is grown in more than 70 countries of the world. Due to Caffeine, it gives stimulating effects. It originated in Ethiopia and its cultivation expanded from the Arab world to other parts of the world.

About Coffee Plant

Taxonomically, Coffee plant belongs to Rubiaceae family. *The plant is* an evergreen shrub. The flowers bloom simultaneously and are followed by oval berries of about 1.5 cm. The berries are Green when immature, ripen to yellow and get crimson before they get black on drying. Berries ripen in seven to nine months. Coffee is generally propagated by vegetative methods just to maintain the new strains. Cuttings, grafting, and budding are the usual methods of vegetative propagation. However, Coffee can be grown by seeds as well. The traditional method of planting coffee is to put 20 seeds in each hole at the beginning of the rainy season, out of which half are eliminated naturally.

- Coffee needs hot and humid climate with temperature varying between 15°C and 28°C. It is generally grown under shady trees.
- Strong sun shine, high temperature above 30°C, frost and snowfall are harmful for coffee cultivation.
- Dry weather is necessary at the time of ripening of berries
- Rainfall between 150 to 250 cm is favourable for coffee cultivation.
- Well drained, rich friable loamy soil with humus and minerals are ideal for coffee cultivation.
- Coffee also needs cheap and skilled labour.

Important Varieties

There are more than 100 species of coffee but only a few are grown commercially. In our country *Coffea robusta* (or Coffea canephora) and *Coffea arabica are grown.*

Robusta Coffee

Robusta Coffee or *Coffea canephora* is mostly grown in Africa and Brazil but also grown in South Asia and South East Asia. On the account of this coffee only, Vietnam has become one of the largest

producers and exporter of coffee in the world. Though, it is considered inferior to Coffea arabica, it requires lesser care. It has twice amount of caffeine than Arabica.

Coffea Arabica

Coffea arabica is indigenous to Ethiopia and Arab world. It is also known as Coffee Shrub of Arabia and is believed to be the first variety of Coffee to be cultivated. It naturally contains little caffeine.

Coffea liberica

Coffea liberica is a species that originated in Liberia. The plant grows up to 9 meters and produces larger cherries. Its variety Baraco is a major crop in Philippines.

Coffea charrieriana

Coffea charrieriana is a coffee that is free of caffeine. It is found in Cameroon.

Mocha Coffee

Mocha Coffee or Cafe mocha is derived from Coffea Arabica. **This name derived from the Mocha town of Yemen.** Yemen was the largest producer and exporter of Mocha Coffee in some 15th and 16th century.

Comparison of Robusta Coffee and Arabica Coffee

Arabica is more popular as a drink in comparison to Robusta mainly because of the taste. Robusta is robust and has almost double the caffeine than Arabica but this higher caffeiene content results in inferior taste.

Around 20-25% of all the coffee produced around the world is Robusta while rest is Arabica; since rest of the varieties grown have negligible production.

Factors	Arabica	Robusta
Soil	Both need Deep, rich in Organic matter , well drained and slightly acidic soil with pH around 6.0 -6.5	
Slopes	Gentle to Moderate Slopes	Gentle Slopes and plains
Elevation	1000-1500 meter	500-1000 meter
Temperatire	15°C to 25°C, Cool & Temperate	20° C to 30° C, hot and humid
Relative Humidity	70-80%	80-90%
Annual Rainfall	1600-2500 MM	1000-2000 MM

Production Figures

The latest coffee year (October-September) has just ended and Coffee Board has released its final data of 2014-15.

State & Districts	Final Estimate 2014-15		
	Arabica	Robusta	Total
Karnataka			
Chikmagalur	38,200	40,880	79,080
Kodagu	18,030	1,04,090	1,22,120
Hassan	18,525	13,505	32,030
Sub total	74,755	1,58,475	2,33,230
Kerala			
Wayanad	0	56,675	56,675
Travancore	880	7,370	8,250
Telliampathies	1,175	1,600	2,775
Sub total	2,055	65,645	67,700
Tamil Nadu			
Pulneys	7,300	325	7,625
Nilgiris	1,550	3,850	5,400
Shevroys (Salem)	3,400	50	3,450
Anamalais (Coimbatore)	900	500	1,400
Sub total	13,150	4,725	17,875
Non Traditional Areas			
Andhra Pradesh	7,370	55	7,425
Odisha	550	0	550
Sub Total	7,920	55	7,975

State & Districts	Final Estimate 2014-15		
North Eastern Region	120	100	220
Grand Total (India)	98,000	2,29,000	3,27,000
Data: Metric Tonnes; Source:Coffee Board			

The above table makes it clear that India produced 3, 27,000 tonnes of coffee in 2014-15 of which 233 thousand tonnes was produced by Karnataka alone. The next top producer states are Kerala and Tamil Nadu. We note here that India accounts for only 4-5 per cent of the world's output, but exports 70-80 per cent of its produce. Italy, Russia and Germany are the top three buyers of Indian coffee. With 4% share in world output, India is ranked 6th in the world. The top five countries are Brazil, Vietnam, Colombia, Indonesia and Ethiopia.

Comparison of Robusta and Arabica Production

The production of Robusta coffee in India is almost double to that of Arabica; while notably both share equal cropped area viz. Robusta 52% and Arabica 48%. Further, while Karnataka and Kerala produce more Robusta; Tamilnadu produces more Arabica. In Kerala, almost all coffee grown in Robusta. In other parts of India such as Andhra Pradesh and Odisha, mostly Arabica Coffee is grown.

Coffee Growers of Karnataka and Tamil Nadu shifting from Arabica to Robusta

Every year, the white stem borer pest destroys thousands of tonnes of coffee in Karnataka and some other coffee producing states of India. This has forced many of the arabica growers to go for robusta, which is more resilient to the pest. Further, Robusta requires less shade and labour.

Coffee Board of India

Coffee Board of India is an autonomous body, functioning under the Ministry of Commerce and Industry, Government of India. It was set up under an Act of the Parliament of India in the year 1942. It focuses on research, development, extension, quality upgradation, market information, and the domestic and external promotion of Coffees of India.

Baba Budangiri

Dattagiri or Baba Budangiri is a mountain in the Dattagiri Hill Range / Baba Budan Giri Range of the Western Ghats in the Chikkamagaluru District of Karnataka. There is a shrine of Baba Budangiri , a place of pilgrimage for both Hindus and Muslims. Baba Budangiri is known as birth place of Coffee Plantations in India. Legend has it that it is the place where seven coffee beans were planted by one Sufi savant Bababudan in 1670 AD after he "smuggled" the coffee from Yemen. Today it has special place in the multi-billion-dollar Indian coffee industry.

General Knowledge Today

Agriculture-2: Major Crops, Cropping Patterns and Cropping Systems

Integrated IAS General Studies:2016-17
Last Updated: February 15, 2016
Published by: GKTODAY.IN

Contents

Model Questions

Prelims MCQ Topics
Key production areas of Soyabean, Natural Rubber, Natural Rubber Industry Issues, Key horticulture crops, Crop rotation, Intercropping, Sequential Cropping, Rice-Wheat Cropping systems

Mains Model Questions

1. Discuss the cropping pattern in terms of Soyabean and Sugarcane in India. Justify the recent shift of sugarcane farmers to soyabean in some parts of India.
2. Before 1980s, Soyabean was not a significant crop in terms of production and area in India. However, today Soyabean has become a major export earner. What are the key factors that underpin this exceptional growth? Examine.
3. "For almost three decades – from the later part of XIX century through second decade of the XX century – natural rubber underpinned one of the most important development booms in Brazil." Discuss.
4. "Control of certain raw materials assumed an enhanced significance during the Second World War." Elucidate with example of Natural Rubber.
5. In recent years, natural rubber production in India is facing sharp decline. Critically discuss the problems and government efforts made in this direction so far.
6. Differentiate between Cropping Pattern and Cropping System. Examine the key factors that affect Cropping patterns.
7. "Cropping pattern is a dynamic concept." Discuss.
8. What do you understand by Relay cropping? Discuss its advantages and disadvantages vis-a-vis other cropping patterns.
9. "Rice-Wheat cropping pattern is cornerstone of India's food security." Discuss Critically.
10. Critically discuss the existing imbalance in the cropping pattern of the food grains in India.

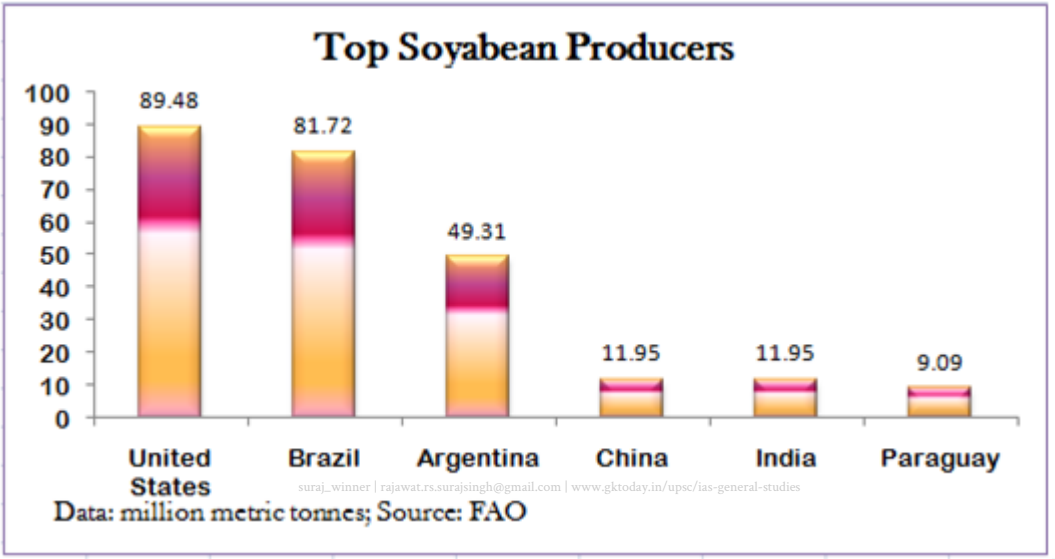
Overview of Major Crops-2

Soyabean

Since time immemorial, Soyabean has served as meat, milk, cheese, bread as well as oil for the people of China and East Asia; and the ancient literature of those countries called it as "gold from soil". Off late, its versatility was recognized by the west, which called it "golden bean" or "miracle bean". Due to its immense potential as food, feed, fodder, fuel and industrial production; Soyabean is said to have revolutionized the agricultural economy of west, particularly of United States.

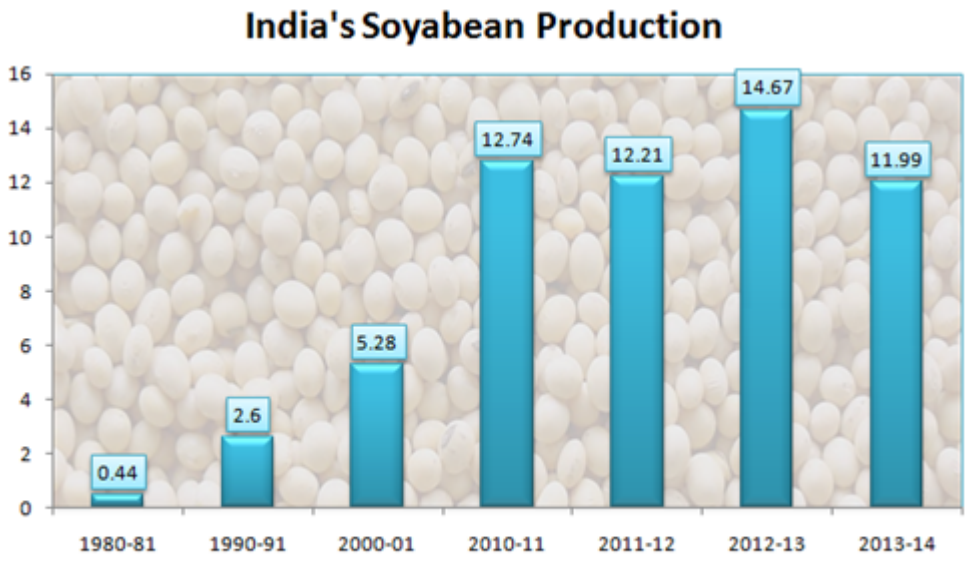
Global Production Figures

Currently, United States is world's largest Soyabean Producer with 89 million tonnes production every year. United States is followed by Brazil and Argentina. The below chart shows that most of the Soyabean of the world is produced in Americas only. China and India are next large producers.



Production in India

With 12 million tonnes of production; Soyabean is one of the fastest growing crops in India. Soyabean is grown as a Kharif Crop in India. The top three largest Soyabean growing states are Madhya Pradesh, Maharashtra and Rajasthan. Madhya Pradesh and Maharashtra have 45 and 40% share in production respectively.



Data: Million Tonnes; Source: Indian Agriculture Statistics 2014

Importance of Soyabean

Soyabean is recognized as one of the premier crops around the world. It's a major source of vegetable oil, protein and animal feed. Due to high protein content (>40%) and high oil content (>20%), Soyabean is considered to be an important food commodity. The Soya Protein is called complete protein because it supplies sufficient amount of amino acids. *Soyabean oil contains no cholesterol.*

Exceptional Growth of Soyabean in India

Soyabean is India's one of the fastest growing crops and a significant foreign exchange earner. With a humble start of meagre 0.44 million tonnes production in 1980-81; Soyabean has become a major export earner today. Government started its Soyabean development programme in 1960s; and there was a rapid expansion in acreage (24 fold increase) between 1972 and 1984. Yields per hectare also achieved significant growth in that period.

There were several reasons of this exceptional growth. Firstly, there was a development of those varieties that suited well to India's soils, particularly in rainfed areas. Then, the utilization of Kharif fallows was advantageous. Further, prices of soya products are linked to global prices; so this commodity has exceptional price realization. Finally, Indian Government's aggressive Soyabean development programme helped it to grow by leaps and bounds. We note here that the government programme was basically focussed to promote Soyabean so that it can offset the import dependency in edible oil.

Soyabean in India: Shifts in Area and Production Share

In 1970s, the highest share of Soyabean production in India was that of Maharashtra (56%) followed by Madhya Pradesh (24%) and Uttar Pradesh (18%). However, from that decade onward, Madhya Pradesh outperformed all states and emerged as India's Soy State. Today, Madhya Pradesh has 45% share in Soyabean Production in the country. Hoshangabad, Indore, Betul, Ujjain and Dewas are some of the Soy districts of that state.

State	Production	%share in Production
Madhya Pradesh	5.37	44.79
Maharashtra	4.79	39.95
Rajasthan	0.98	8.17
All - India	11.99	100

Production Data: Million MT; Source: Agriculture Statistics Pocket Book 2014-15

Problems of Soyabean

At present, India exports 55% of its soya meal. However, the Soya industry of the country is crippled by low yield, limited domestic demand, inadequate irrigation and infrastructure / marketing bottlenecks. Most of the Soyabean is produced in rainfed areas.

The country can overcome these bottlenecks by doubling yields through mechanized sowing and harvesting; improving market access for cultivators; improving irrigation in farms. Governments can also promote the domestic consumption of Soya as integral part of a high protein diet.

Natural Rubber

Before we delve into its production and other details; let's take two world history topics related to rubber.

Story of Amazon Rubber Boom and Rubber Theft

Amazon Basin covers almost 40% of the South American continent and it is shared by *eight countries viz. Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela*. Out of these, Brazil, Bolivia, Venezuela and Peru were the ONLY exporters of natural rubber before the Hevea plants were cultivated anywhere else in the world. For at least thirty years (1879–1912) Natural Rubber is known to have underpinned one of the most important development booms in these countries particularly Brazil.

This so called Amazon Rubber boom happened at a time when industrial revolution was expanding. Rubber was used in many products but when **Goodyear** developed vulcanization process, there was a huge jump in the demand of rubber from automobile sector because now the vulcanized rubber

could be used to make tyres of the cars. This is how the rubber boom really got started. The huge demand was met by the rubber trees of Amazonia. The region which was hitherto poor and sparsely populated suddenly saw heaps of wealth. Many banks and companies opened in Brazilian towns of Belem and Manaus; and the poor jungle towns soon become rich, sophisticated, progressive urban centres, with a cosmopolitan population that patronized the theatre, literary societies, and luxury stores, and supported good schools. In Brazilian history, this period is called "Belle Époque" period and its splendour has been widely portrayed in art and literature of that country.

With a 42,000 tonnes of rubber output, Brazil became the ruler of the world rubber market by the end of 19th century. However, in the meantime, Rubber Tree seeds were smuggled by British from Amazonia to the Botanical gardens of London. There, more resistant varieties were developed through grafting and then they were sent to British Colonies in Asia, particularly Malaysia, Singapore and Ceylon (now Sri Lanka). {Brazilians still lament on this episode and call it Rubber Theft.}

The British skilled agronomy was the significant factor that led to fast development of Rubber in Asian countries. They planted the Rubber trees only 4 meters away from each other, so that it was easy to collect latex. On the other hand, in Brazil, the plants were located away from each other; sometimes even miles away. Thus, the well organized plantations of Asia with their high productivity started giving stiff competition to Brazil and the boom stated to bust. Some mistakes were done by the Brazilian government in those days. They never bothered to take measures to increase productivity. Despite much rhetoric and failed attempts, rubber plantations never succeeded in Brazil / Amazonia. Brazilian government's lack of will to switch to more efficient means of production, made the production costly and less efficient. The exports shrank and so did the economic boom. Brazilian efforts to resurrect the industry in collaboration with Ford through the production line fell flat again. Slowly, the companies that had set shops in Brazil moved away in more productive areas.

The WW-II Natural Rubber Crisis

The importance of rubber production from strategic and security reasons was realized during World War –II when Japan moved to conquer Southeast Asia, and made 90% of the world's natural rubber (Hevea) unavailable to the allies. Rubber was used in tires and other components of military vehicles; and its strategic importance was realized during the world war-II.

Between December 1941 and March 1942, Japan seized South East Asia in its lightning campaigns. This resulted in loss of over 90% of world's cultivated *Hevea brasiliellsis* trees to the allies. Rubber was one of the two components of the allies' war machine, another being oil from Middle East. Such was

the crisis that it had brought the allies to the brink of military catastrophe. To meet the contingency, Britain shared rubber from Ceylon; it's last remaining source of Rubber. This was the time when efforts to create new synthetic rubbers were on war scale.

At that time, India's Rubber production was not even able to meet the domestic consumption. The rubber growers in India were encouraged to produce the maximum rubber required use during war. After the war, there were growing demands from the growers for setting up a permanent organisation to look after the interests of the industry. Thereupon the government set up an ad-hoc committee in 1945 to study the situation and to make appropriate recommendation. On the recommendation of this ad-hoc committee, the government passed the Rubber (Production and Marketing) Act, 1947, on 18th April 1947, and the "Indian Rubber Board" was constituted forthwith. The Rubber Production and Marketing (Amendment) Act, 1954, amended the name of the Board as "The Rubber Board".

Global Production

Global natural rubber production stood at around 12 million tonnes in 2014 and Thailand, Indonesia and Vietnam are the top natural Rubber Producing countries. Vietnam is the new entry at third place, which was earlier held by Malaysia. Overall, the nine big rubber producing countries are Thailand, Indonesia, Malaysia, India, Vietnam, China, Sri Lanka, Philippines and Cambodia. Out of them, India, Malaysia, and Sri Lanka have witnessed a decrease in rubber production while Vietnam and China witness increase in last two years.

World's Top Natural Rubber Producing Countries		
1	Thailand	4070000
2	Indonesia	3200000
3	Malaysia	1043000
4	Vietnam	1043000
5	India	849000
6	China	856000
7	Sri Lanka	128300
8	Philippines	116400
9	Cambodia	85400

World's Top Natural Rubber Producing Countries
Data: Million Tonnes; Source: ANRPC

Commercial cultivation of natural rubber was introduced in India by the British. Although, the experimental efforts to grow rubber on a commercial scale in India were initiated as early as 1873 at the Botanical Gardens, Calcutta; yet the first commercial *Hevea* plantations in India were established at Thattekadu, in Kerala in 1902.

Production in India

According to Association of Natural Rubber Producing Countries (ANRPC), India produced 849,000 tons of rubber in 2013, which is 7.6% down from the previous years. Kerala accounts for more than 90 per cent of the total rubber production in the country. The total area under rubber cultivation in the state is 5.45 lakh hectares. Rest of the natural rubber is produced in Tamil Nadu and North East states.

Problems of Natural Rubber Industry

In recent years, natural rubber production in India is facing sharp decline. Currently, India is world's fifth largest natural rubber producer and fourth largest consumer behind China, the US and Japan. In 2012, however, India was on 4th rank after Thailand, Indonesia and Malaysia. Before that India ranked third on the production table after Thailand and Indonesia. The major reason for fall in production includes:

- A serious fall in the productivity per hectare of rubber
- Constant fall in prices of natural rubber, coupled with high labour cost has forced many of the growers (75 per cent small and marginal farmers) to keep away from tapping

Further, this industry is marred by several problems such as:

- Conflict of interests of Rubber Growers and Tyre Companies. The unrestricted massive imports by larger tyre companies pushed down domestic demand; however at the same time; MSME and other small industries which depend on domestic supply of natural rubber demand for urgent measures.
- Other reasons including high input costs; bizarre duty structure, cheap imports and signing of Free Trade Agreements with countries from which import of finished rubber products to India is encouraged.

Government Schemes on Natural Rubber

The government policy towards natural rubber can be divided into two parts viz. Support to traditional regions (Kerala & Tamil Nadu) and support to non-traditional regions (includes North East India and any other place beyond Kerala & TN). These are implemented by Rubber Board.

Non-traditional region

- Financial assistance to Rubber Producers Societies (RPS) and Self Help Groups (SHGs) of rubber producers for procurement of equipments
- Plantation development and extension programmes, which are aimed at productivity enhancement and quality upgradation.
- There is a government scheme called Rubber Development in North East (RDNE), which focuses on new plantation of rubber in North East region.

Traditional Region

- For Kerala, Tamil Nadu and non-traditional regions other than North East (mainly Karnataka, Maharashtra, Andhra Pradesh, Goa, Odisha and West Bengal), there is a Rubber Plantation Development (RPD) scheme. This scheme provides financial support for planting of new rubber plants and technical assistance by means of planting subsidy; planting material assistance; providing HYV of planting materials / clones and better agro-management practices. Government had released two high yielding varieties viz. RRII417 and RRII 422 during 11th RSS-4 & RSS-3 are other important varieties of rubber in India.

Other Government Measures for the safeguard of Rubber cultivators

- To protect the interest of the growers, government increased basic custom duty on imported Natural Rubber. But this has aggravated the problem of domestic buyers, because on one side they are facing erratic supply of domestic rubber while on other side, they have to pay higher price for imported rubber.
- The NDA government has also created an expert committee of various stakeholders to draft a National Policy on Rubber.

Rubber Board of India

The Rubber Board is a statutory body constituted by the Government of India, under the Rubber Act 1947, for the overall development of the rubber industry in the country. It is located in Kottayam.

What else should be done?

Natural rubber is one of the key productive assets of our country. There is a need to encourage growers by not only protection of their interest by means of imposing duty; but also to help them take periodic stock, planting and replanting initiatives.

National Policy on Rubber

In June 2014, the NDA government had decided to set up an Expert Committee consisting of representative of various stakeholders in the Rubber Sector to examine the issues relating to production, development and exports of rubber and related products. This committee is mandated to draft a **National Policy on Rubber** covering production, consumption and import of all types of

rubber i.e. Natural Rubber (NR), Synthetic Rubber (SR) and Reclaimed Rubber (RR).

Horticultural Crops

There has been a common myth that India produces more food grains than fruits & vegetables. The fact is that fruits & vegetables are grown more than food grains in India. In 2012-13, food grain production was 257 million tonnes but the total horticulture production was 268.9 Million Tonnes. Also, India now produces and consumes (also wastes) more fruits and vegetables than rice & wheat. In fact, in recent times, horticulture has become the growth driver of India's agriculture with India's emergence as second largest producer of fruits and vegetables in the world after China. That is where the importance of Food Processing Industry gets importance from.

Key Facts about Horticultural and Plantation production

- India's top state in terms of overall horticultural production is West Bengal. The top position of West Bengal in overall production is mainly due to the fact that it is India's largest vegetable producing state also.
- However, in overall fruits production; Andhra Pradesh led all other states in 2012-13 with 17% share, followed by Maharashtra with 12% share. Since Andhra Pradesh has been bifurcated now; we can safely assume that the next set of official data from the government will place Maharashtra as top fruits producing state.
- In terms of flowers production; while Tamil Nadu has the highest share of production of flowers (loose); West Bengal has highest share in cut flowers.
- Further, Andhra Pradesh is top spices producing state; Tamil Nadu stands first in total plantation crops.
- India's top produced fruit is Banana (32%), followed by Mango (21%). On the other hand, Mango is cultivated on largest area in comparison to any other fruit. Top cultivator state of Banana is Tamil Nadu; and of Mango are Uttar Pradesh (24.4%) and Andhra Pradesh (24.5%).
- India's largest produced vegetables are Potato, followed by Tomato. Among vegetables, largest area under cultivation is that of Potato.
- India's largest produced plantation crop is coconut while India's largest produced spices crop is Chillies.
- Maharashtra is India's largest Cashew and Grape producer; while Karnataka is largest Areca nut producer. Kerala is largest Cocoa producer. Madhya Pradesh is largest Guava producer.
- Tamil Nadu is India's largest Coconut producing state, while Kerala is India's largest Cocoa producing state.
- Jammu & Kashmir is India's largest apple producing state, followed by Himachal Pradesh and

Uttarakhand.

The following table presents the information for a crisp overview of various states having first position in production in various farm commodities.

Agricultural Commodity	Top Producer State*	Agricultural Commodity	Top Producer State*
Total Food Grains	Uttar Pradesh	Cut Flowers	West Bengal
Rice	West Bengal	Total Spices	Andhra Pradesh
Wheat	Uttar Pradesh	Total Plantation Crops	Tamil Nadu
Maize	Andhra Pradesh	Banana	Tamil Nadu
Coarse Cereal	Karnataka	Guava	Madhya Pradesh
Oilseeds	Gujarat	Grapes	Maharashtra
Rapeseed & Mustard	Rajasthan	Apple	Jammu & Kashmir
Soyabean	Madhya Pradesh	Areca Nut	Karnataka
Sunflower	Karnataka	Cocoa	Kerala
Sugarcane	Uttar Pradesh	Coconut	Tamil Nadu
Sugar	Maharashtra	Cashew nut	Maharashtra
Cotton	Gujarat	Citrus, Lemon, Mosambi	Andhra Pradesh
Jute	West Bengal	Orange	Punjab
Horticulture Products	West Bengal	Litchi	Bihar
Vegetables	West Bengal	Mango	Uttar Pradesh & Andhra Pradesh
Fruits	Andhra Pradesh	Pineapple	West Bengal
Loose Flowers	Tamil Nadu	Brinjal	Odisha
Data Source: Pocket Book of Agricultural Statistics 2014 & Indian Horticulture Database-2013			
*Andhra Pradesh has been now bifurcated. The data is of 2013, 14 so includes Telangana also.			

Production Status of Key Fruit Crops

Apple

Around 20 Lakh tonnes of Apple is produced in India every year. The top apple producing states of India are Jammu & Kashmir, Himachal Pradesh, Uttarakhand & Arunachal Pradesh with their respective shares of 70%, 21.5%, 6.4% and 1.6%. Further, apple is also produced in Mizoram, Sikkim, Tamil Nadu and Nagaland also. Key apple varieties include: Michal, Mollies Delicious, Maayan, Anna, Chaubattia Anupam, Rich-e-Red, Gala, Firdous, Lal ambri , Kinnauri Apple etc.

Banana

With an annual production of 265 Lakh tonnes; Banana is most produced fruit of India. Main Banana producing states are Tamil Nadu, Maharashtra, Karnataka, Gujarat, Andhra Pradesh, Bihar, Assam and Madhya Pradesh. Key varieties of Banana include Dwarf Cavendish; Robusta; Rasthali; Poovan; Nendran; Red Banana; Karpurvalli; Pachanadan; Virupakshi etc. Further, five varieties of Banana have been given GI protection in India. These include:

- Nanjanagud Banana and Kamalapur Red Banana from Karnataka
- Virupakshi Hill Banana & Sirumalai Hill Banana from Tamil Nadu
- Chengalikodan Nendran Banana from Kerala

Orange

India produces around 29 Lakh tonnes of Orange every year. Top orange producing states of India are Punjab, Madhya Pradesh, Andhra Pradesh, Maharashtra Rajasthan, Assam and Karnataka. The major varieties of Orange produced in India include Coorg mandarin, Khasi mandarin, Nagpur mandarin and Kinnow. Coorg Orange, Nagpur Orange and Arunachal Wackro Orange have been given GI protection.

Wakro is a location in Lohit district of Arunachal Pradesh. The buyers from Assam used to come here and purchase these oranges at low rates. Then, they were neatly packed and sent to Bangladesh, rebranded as Bangladeshi products and exported to West Asian countries. It is hoped that GI protection would save the brand originality of Wakro oranges.

Grapes

Around 25 Lakh tonnes of grapes are produced in India every year. The top Grapes producing states include Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh and Mizoram. The most grown variety of grapes is Thompson Seedless and its clones. The grapes varieties which have been given GI protection are Nashik Grapes and Bangalore Blue Grapes.

Guava

Top Guava producer states of India are Maharashtra, Madhya Pradesh, Uttar Pradesh, Bihar, West Bengal, Punjab,Gujarat & Karnataka.

Litchi

India produces around 6 Lakh tonnes of Litchi mainly in Bihar, Uttarakhand, West Bengal and Jharkhand. Bihar alone accounts for nearly half of the country's total litchi output. This is one of the fruits of India whose domestic marketing as well as export potential are yet to be tapped.

We note here that some Litchi grown in India is of high quality and high pulp-to-stone ratio (makes it suitable for exports). Further, Indian litchi is harvested between Mid-April to June; when good quality litchi is not available from other countries such except some countries such as Thailand. On the other hand, other Litchi exporters such as Madagascar, South Africa and Australia harvest Litchi in November / February while Israel in October. Thus, Indian litchi does not need to compete with the other exporters. But the problem is of paucity of infrastructure, cold stores and other components of cold chain management.

Main varieties of Litchi include Shahi, Elaichi, Rose scented, Bombai, Purbi, Calcuttia etc.

Mango

India produced some 180 Lakh tonnes of Mango with major production in Uttar Pradesh, Andhra Pradesh, Karnataka and Bihar. There are hundreds of varieties of Mango in India which include Alphonso; Banganapalli; Bombay Green; Chausa; Dashehari; Fazli; Gulab Khas; Himsagar; Kesar; Kishen Bhog; Langra; Mankurad; Neelum; Pairi; Totapuri; Mulgoa; Imam Pasand; Suvernarekha; Van raj; Zardalu; CIHS, Lucknow (Hybrid); Ambika; Mallika; Amrapali; Pusa Arunima; Pusa Surya etc.

GI Protected Mango varieties

There are six varieties of Mango that have been protected under Geographical Indications registry in India. These are as follows:

- Laxman Bhog Mango, Khirsapati (Himsagar) Mango and Fazli Mango of Malda district – West Bengal
- Mango Malihabadi Dusseheri – Uttar Pradesh
- Appemidi Mango – Karnataka
- Gir Kesar Mango – Gujarat

India's Mango Exports

India exported 41,000 tonnes of Mango in 2013-14. The export quantity of Mango is often fluctuating year-on-year basis due to many reasons including erratic domestic supply, fluctuating demand. Further, in recent times, Indian Mango has suffered bans in EU countries and some other countries. Largest customer of Indian Mango is UAE, followed by UK, Saudi Arabia and Kuwait.

Papaya

With some 54 Lakh tonnes of Papaya production every year; India is world's largest producer of this

fruit. The largest Papaya producing states include Andhra Pradesh, Gujarat, Karnataka, West Bengal, Madhya Pradesh & Maharashtra. Three notable varieties of Papaya include *Pusa Delicious, Pusa Dwarf* and *Pusa Nanha.* However, India's share in Papaya exports is minimal. Further, the low productivity is one of the major issues in our country, mainly due to traditional cultivation practices of local varieties. Other issues related to Papaya cultivation include pests such as 'mealy bug', lack of knowhow on post harvesting; lack of correct marketing strategies, non-availability of HYV seeds etc.

Production of Key Vegetable Crops

Potato

With 415 Lakh tonnes production; India is third largest producer of Potato after China and Russia. Top potato producing states of India are Uttar Pradesh, Gujarat, Assam, Madhya Pradesh, Punjab and West Bengal. Most of the varietries of Potato grown in India currently havce been developed by Central Potato Research Institute, Kufri (Himachal Pradesh) so their names are prefixed with Kufri e.g. Kufri Sindhuri, Kufri Chandramukhi, Kufri Jyoti, Kufri Lauvkar, Kufri Badshah, Kufri Bahar, Kufri Swarna, Kufri Ashoka, Kufri Pukhraj, Kufri Kanchan and so on.

Onion

With some 194 Lakh tonnes of Onion Production in 2013-14; India is second largest producer of Onion in the world. India's largest onion producing states are Maharashtra, Bihar, Karnataka and Gujarat. Key Onion varieties include Pusa White Flat, Pusa White Round, Pusa Madhavi, Arka Kalyan, Arka Niketan, etc.

	Onion		Potato	
Year	Area	Output	Area	Output
2011-12	1,087	17,511	1,907	41,483
2012-13	1,052	16,813	1,992	45,344
2013-14	1,204	19,402	1,973	41,555
2014-15*	1,192	19,357	1,990	42,175

*1st advance estimates; Note: Area in '000 ha and output in '000 tonnes
Source: National Horticulture Board

Constraints in vegetables production

1. Lack of planning in Production
2. Non-availability of seeds of improved varieties.
3. High cost of basic production elements
4. Inadequate plant protection measures and non-availability of resistant varieties.
5. Weak marketing facilities
6. Transportation limits

7. Post harvest losses
8. Abiotic stresses.

Cropping Patterns & Cropping Systems

Cropping Pattern refers to the proportion of total cropped area allocated to different crops. Any change in this proportion amounts to change in cropping pattern.

Difference between Cropping Pattern and Cropping System

'Cropping pattern' and 'cropping system' are two terms used interchangeably; however these are two different concepts. While cropping pattern refers to the yearly sequence and spatial arrangement of crops or of crops and fallow in a particular land area; Cropping system refers to cropping pattern as well as its interaction with resources; technology, environment etc.

Thus, a cropping system comprises cropping pattern plus all components required for the production of a particular crop and the interrelationships between them and environment. Cropping system is a critical aspect in developing an effective ecological farming system to manage and organize crops so that they best utilize the available resources.(soil, air, sunlight, water, labour, equipments). It represents cropping patterns used on a farm and their interaction with farm resources and farm enterprises and available technology which determine their makeup. It is executed in the field level.

Factors Affecting Cropping Patterns

For any particular region, the current cropping pattern is a result of past and present decisions of the cultivators, communities as well as governments. These decisions are governed by various factors such:

Productivity & profit for the cultivator

The potential productivity of a particular crop and its monetary benefits are the key guiding principles of a cropping pattern anywhere.

Resource and Infrastructure availability

Resource availability included irrigation, fertilizers, equipments, other inputs. Infrastructure include transport, storage, post-harvest handling and processing facilities; marketing & promotion facilities.

Agroclimatic factors

These include Geo-climatic parameters such as terrain, topography, slope, soils etc.

Socio-economic and political factors

These include Socio-economic; historical, political factors such as land ownership and use, size and types of land holdings, labour & capital availability etc. For example, fixed procurement price has induced farmers to shift the cultivation to cash crops like sugarcane. Further, Food Crop Acts, Land use Acts, intensive schemes for paddy, cotton, oil seed etc. all these bring sharply into focus the

possibility that while each individual measure may push the crop pattern in the direction intended to, but if the overall effect of all measures taken together on the entire crop pattern is taken, it may not be in accordance with national requirements.

Technological Factors

Technological factors include availability of improved seeds; farm mechanization; information technology etc.

Thus, there are so many factors affecting cropping pattern. Basically, *cropping pattern is a dynamic concept* as it keeps changing because no fixed cropping pattern is ideal for all times for a particular field.

We can take recent examples of Maharashtra and Himachal Pradesh here. In the Latur, Osmanabad and Solapur districts of Maharashtra; the farmers were cultivating sugarcane for many years. However, unpredictable monsoon coupled with depletion of the groundwater forced them to rethink on what they were cultivating. The government also encouraged them to cultivate soya bean, tur and horticulture via its "Beyond Sugarcane" campaign. The key drivers of this change were – farmer's profitability; climate change and resource availability. Similarly, in Himachal Pradesh, more and more Kangra tea cultivators are now relying on apple because of stressful cultivation of the Kangra tea. The drivers of this change also include profitability; government policy etc.

Types of Cropping Systems

There are several types of cropping systems based on resources and technology available. These are as follows:

Monocropping

When only one crop is grown season after season; it's called Monocropping. The key disadvantage of Monocropping is that it would reduce soil fertility and damage the soil structure. Due to poor soil nutrients, the cultivator is needed to use chemical fertilizers to encourage production. The chemical fertilizers would disrupt the natural makeup of the soil and further aggravate the problem. Monocropping also allows spread of the pests and diseases.

Crop rotation

In crop rotation, crops are changed from year to year according to a planned sequence. Crop rotation is considered to be a key principle of conservation agriculture for, it improves the soil structure and fertility. It also helps to control weeds, pests and diseases.

Sequential cropping

Sequential cropping refers to growing of two or more crops in sequence on the same piece of land in a farming year. On the basis of number of crops in a year, it is called double, triple or quadruple cropping. Examples of double cropping are Rice-Potato; Rice-mustard; Examples of tripple

sequential cropping include Rice-Potato-Groundnut.

Intercropping

Intercropping refers to growing of two or more crops in same field at the same time. Example of intercropping is planting alternating rows of maize and beans, or growing a cover crop in between the cereal rows.

Intercropping is different from crop rotation because two or more crops are grown one after other. On the basis of spatial arrangement; the intercropping can be of different types such as:

- **Row intercropping** when cropping involves the component crops arranged in alternate rows. The benefit of this include optimum utilization of land space and suppression of weeds during the juvenile stage of the main crop.
- **Strip Intercropping** involves growing of two or more crops in strips that are wide enough to allow separate management of the two crops; but close enough for the crops to interact.
- **Mixed intercropping**or mixed cropping refers to growing of two or more crops at the same time with no distinct row arrangement.
- **Relay intercropping**or **relay cropping** is a system in which a second crop is planted when an existing crop has just flowered but before harvesting. Thus relay cropping has minimal temporal overlap of two or more crops. In India, Rice-Cauliflower-Onion-summer gourds is one example of relay cropping.

Cropping Systems in India

India is a land of multiplicity of cropping systems. Since food crops are predominantly grown in the country, the various cropping systems are named as per main crop. Thus, main food crops based cropping systems of India include Rice based cropping system; Sorghum based cropping system; Pearl millet based cropping system; Wheat and gram based cropping system etc. The commercial crops based cropping systems include cotton based cropping system; groundnut based cropping system; plantation based cropping system; vegetable based cropping systems etc.

There are more than 30 types of cropping systems found in the country such as rice-wheat, rice-rice, rice-gram, rice-mustard, rice-groundnut, rice-sorghum, pearlmillet-gram, pearlmillet-mustard, pearlmillet-sorghum, cotton-wheat, cotton-gram, cotton-sorghum, cotton-safflower, cotton-groundnut, maize-wheat, maize-gram, sugarcane-wheat, soybean-wheat, sorghum-sorghum, groundnut-wheat, sorghum-groundnut, groundnut-rice, sorghum-wheat, sorghum-gram, pigeonpea-sorghum, groundnut-groundnut, sorghum-rice, groundnut-sorghum and soybean-gram.

Rice-Wheat Cropping System

The Rice-wheat cropping system is India's most widely adopted cropping system practiced on an

estimated area of around 11 million hectares.

Rice-Rice Cropping System

This type of the cropping system is found in irrigated lands and coastal regions of Odisha, Tamil Nadu, Andhra Pradesh, Karnataka and Kerala. Due to Monocropping; these systems have suffered deterioration of the soil and micronutrient deficiency.

Rice-Groundnut Cropping system

Under this cropping system; groundnut is grown as Kharif crop and rice is grown in fallows. Groundnut being a legume; the rice-groundnut cropping system is more sustainable and remunerative. This system is practiced in parts of Tamil Nadu, Odisha, Maharashtra, Andhra Pradesh and Gujarat.

Rice-Pulses Cropping System

This cropping system is followed in parts of Chhattisgarh, Odisha and Bihar. This has resulted in both high productivity of rice as well as pulses; but the problem is of erratic supply of irrigation in these areas.

Pearl millet-Wheat / Pearl millet-Mustard Cropping System

These are important cropping system in western part of the country, particularly semi arid regions of Gujarat, Rajasthan and Haryana. Wheat is grown as Rabi crop and Pearl Millet (Bajra) is grown in Kharif season. This system is also facing issue of decreased soil fertility and lowering of the groundwater table. Pearl millet can deplete the soil of essential nutrient system.

Maize-Wheat Cropping System

In this cropping system; maize is a principal crop of Kharif season whole Wheat is a principal crop in Rabi season. This system is practiced in Uttar Pradesh, Rajasthan, Madhya Pradesh, Bihar, Punjab etc. Most of the area in the Maize-wheat system is under Rainfed area where uncertainty of rainfall is a major limitation.

Sorghum-Wheat Cropping System

This cropping system is prevalent in Rajasthan, Western Madhya Pradesh, and Western Maharashtra including Vidarbha, Southern Gujarat and Northern parts of Karnataka.

Sugarcane-Wheat Cropping System

Sugarcane Wheat cropping system is prevalent in Uttar Pradesh, Punjab, Haryana and Bihar. This system also faces problem of imbalance of nutrients.

Cotton-Wheat Cropping System

In this system, short duration cotton is grown in sequence with wheat in Punjab, Haryana, Rajasthan, Western UP and some other parts of central India.

Soybean – Wheat Cropping System

This is relatively new cropping system emerged only after 1980s when Soyabean was introduced as a Kharif crop in several parts of the country. This system is prevalent in Madhya Pradesh, Rajasthan

and some parts of southern Maharashtra.

Rice-Wheat Cropping System

The Rice-wheat cropping system is India's most widely adopted cropping system practiced on an estimated area of around 11 million hectares. This system is prevalent in Indo-gangetic plains (IGP) and is found in Indian states of Uttar Pradesh, Punjab, Haryana, Bihar, West Bengal, Madhya Pradesh etc.

Key Features of Rice-Wheat Cropping System

- Both rice and wheat have different soil requirements. For example, if rice needs stagnant water conditions; wheat needs well-pulverized soil balanced with moisture, air and thermal regime. Due to this, a key feature of Rice-wheat cropping system is the annual conversion of soil from aerobic to anaerobic and then back to aerobic conditions.
- Although this is an irrigated cropping system yet; yield are dependent on climatic situation in India mainly on south west monsoon
- Both Rabi and Kharif season are occupied by wheat and paddy crop rotation. The Rabi crop of wheat consumes more fertilizers than Kharif crop of rice.
- This system is known for high cropping intensity (Cropping Intensity is the ratio of Net Area Sown to the Total Cropped Area).
- Green fodder is easily available in rice-wheat cropping system and this in turns helps to support large livestock population
- Rice-wheat cropping system is known for plenty of methane generation and its contribution to global warming.

Key Current Issues about Rice-wheat Cropping Pattern

Rice-Wheat cropping pattern is cornerstone of India's food security and is most widely prevalent in not only India but in entire South Asia. This cropping system is a main feature of the Indo-Gangetic Plains. However, Cultivation of rice and wheat over a prolonged period has caused degradation of natural resources (groundwater, soil) to a great extent. Thus, the sustainability of rice-wheat system is affected due to overmining of vital nutrients from soil; declining groundwater levels; diseases / pests; disturbance in soil due to rice puddling etc. The governments have been promoting the alternate crops like Summer Moong, Sunflower and Maize in order to reduce the wheat and paddy crop rotation because legume crops have capability to increase soil nutrition.

Trends in Cropping Patterns

In India, there is an existing imbalance in the cropping pattern of the food grains because a large proportion of the area under food grains is occupied by rice and wheat. Further, there is a gradual

shift from non-food grains to food grains.

Reasons of imbalance in Crop Pattern

- Prices of food grains have been rising quite fast and the farmers have started growing food crops in the similar way they grow commercial crops like cotton, oil seed crops sugarcane etc.
- Cultivation of food grains has become highly remunerative and productive under the influence of new technology.
- Traditionally, the Minimum Support Prices for wheat and rice have been maintained reasonably high. This has helped the farmers to increase their production.
- There has been a change in the consumption pattern and people have moved from coarse cereals to wheat and rice for their main dietary grain. This is because of the increase in the income of the people and coarse cereals being the inferior goods.
- The strategic objectives of agricultural development in India have been changing over time.
    - In 1960s, it was to maintain the prices of food grains at low level. The government significantly supported the growth of wheat and rice cultivation via its policy intervention, procurement and technology.
    - In 1960s to 1980s, it was to maximize food production.
    - In 1980s to 1990s, it was to go for a demand driven production pattern.
    - Since 1990s, it was to reduce inputs of agricultural commodities.

General Knowledge Today

Agriculture-3: Allied Sectors and Green Revolution Part-1

Integrated IAS General Studies:2016-17
Last Updated: February 15, 2016
Published by: GKTODAY.IN

Contents

Model Questions

Prelims MCQ Topics
Distribution of Livestock in India, Livestock and the structural shift in the agricultural sector, Operation Flood, National Dairy Plan, consumption dynamics in Dairy products, Inland versus Marine Production, Inland Aquaculture & Blue Revolution, Institutional Structure for Support in Poultry, Basic Elements of Green Revolution.

Mains Model Questions

1. Critically examine the role of Livestock in farming economy of India. Do you agree with the view that in recent times, there has been a structural shift in the agricultural sector due to Livestock rearing? Substantiate your stand.
2. "Due to mechanization of agricultural operations and declining farm sizes; livestock have lost their position in Indian economy." Do you agree with this view? Argue.
3. "Distribution of livestock wealth is more egalitarian, compared to land in India." Explain.
4. Discuss the income elasticity of demand and consumption pattern in terms of animal products in India.
5. Enumerate the salient features of National Dairy Plan Phase-I.
6. What are the major problems of India's Dairy Sector? Do you agree that a unorganized dairy sector is reaping the benefits of favourable "consumption dynamics"? Opine.
7. "Traditionally, the output of marine fisheries used to be higher than that of inland fisheries. However, since 1991, India's Inland Fish production has increased gradually." Examine.
8. "Inland aquaculture holds the key to the blue revolution in the country." Discuss Critically.
9. Discuss the institutional status of National Egg Coordination Committee, throwing its role in India's poultry sector.
10. Critically examine the key elements of Green Revolution in India, throwing light on its impact on India's crops and cropping pattern.
11. Do you agree with the view that Green revolution strengthened the linkages between agriculture and industry? Opine.
12. Do you agree with the view that technological changes in agriculture have aggravated regional inequalities? Substantiate your answer.
13. Examine the labour augmenting and labour displacing -element in Green Revolution.
14. How did Green Revolution benefit the farmers? Discuss its drawbacks.

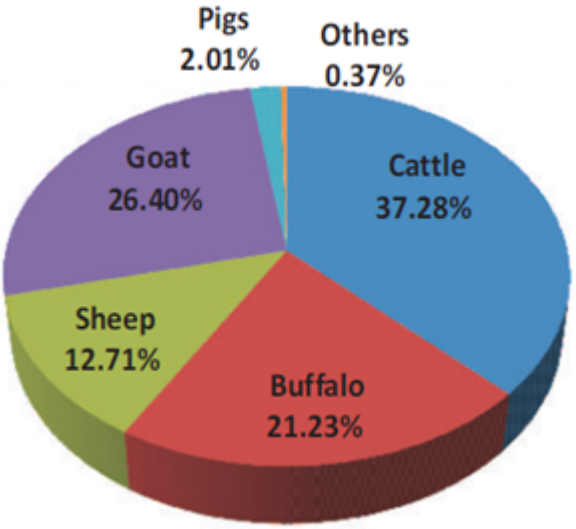
Animal Husbandry & Dairy Development

Agriculture and Allied Sector contributed approximately 18% of GDP at 2011-12 prices. Of this, one third (6.6%) share is of the allied sector which includes Livestock, Forestry & Logging and Fisheries. We begin our study by taking a look at the latest livestock data available.

Key points from 19 Livestock Census-2012

Livestock Census is done every five years since 1919. Last Livestock census (19th) was done in 2012 and next one (20th) is to be done in 2017. The official report is located here. Key facts are enumerated below:

- India's Livestock Census covers the animals viz. Cattle, Buffalo, Sheep, Goat, Pig, Horses & Ponies, Mules, Donkeys, Camels, Mithun and Yak. Their total number crosses 512 million. Further, Dogs, Rabbits and Elephants are also covered.
- India's three largest states with highest livestock population are Uttar Pradesh; Rajasthan and Andhra Pradesh (including Telangana). Three largest states with maximum poultry population are Andhra Pradesh (and Telangana), Tamil Nadu and Maharashtra.
- Bovine population refers to the population of Cattle, Buffalo, Mithun and Yak. This stands at 299 million. Out of them, Cows and Buffaloes are called milch animals. Cattle include cows, calves and bulls. Cattle accounts for 37.28% of India's total livestock population; while buffalo accounts for 21.23%. Thus, there are more cattle than buffaloes. On the other hand, there are more goats than sheep. While goat contributes 26.40%, sheep contributes 12.71% of total livestock population. Pigs and others account for remaining 2%.



Some other notable trivia are as follows:

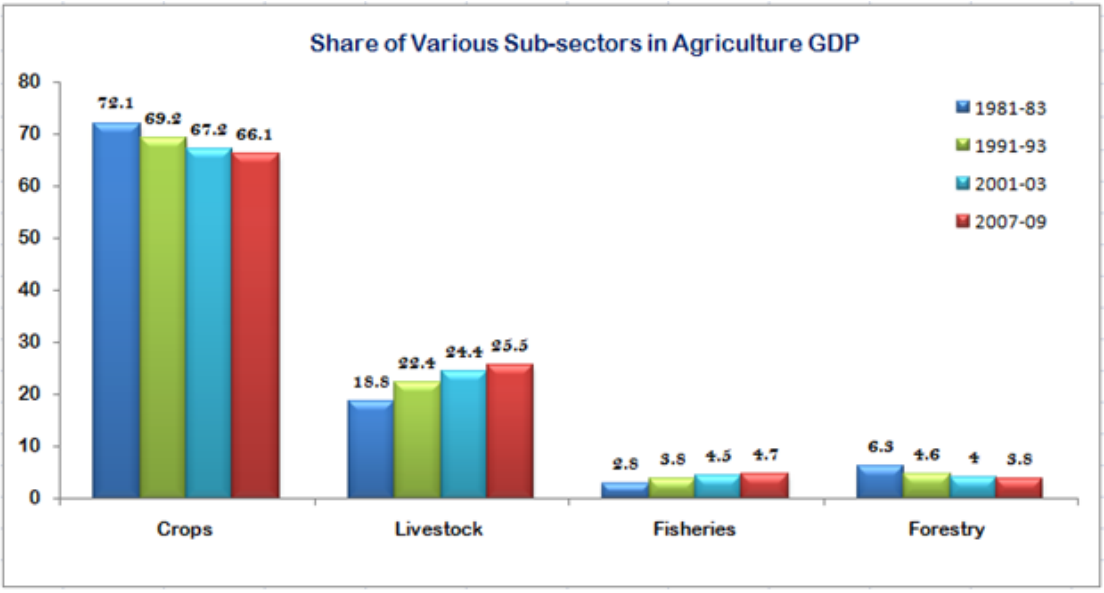
- Camel has a small fraction (0.08%) population in India. It is found in Rajasthan, Gujarat, Haryana and Bihar.
- The population of Mithun and Yak is slightly less than Camel (0.07%). Mithuns are mainly found in Arunachal Pradesh (maximum), Nagaland, Manipur, Mizoram, Himachal Pradesh. Yaks are found mainly in Jammu & Kashmir (Maximum), Arunachal Pradesh, Sikkim, Himachal Pradesh and West Bengal.
- Poultry consists of generally three categories namely Fowls, Ducks and Turkey & others. Of this, 95% share is of fowls.

Key Observations in Livestock Sector

Livestock and the structural shift in the agricultural sector

India has world's largest dairy herd (cows and buffaloes) and world's largest milk producer. The agricultural system of our country is predominantly a mixed crop-livestock farming system in which crop production is combined with the rearing of livestock, which supplements the farm incomes by providing employment, draught animals, and manure.

In recent decades, Livestock's contribution to agriculture output is growing and its growth rate has also remained higher. The below graphics shows that share of livestock & fisheries has been consistently growing in total agricultural GDP.



Also, it is interesting to note that today economic / monetary contribution of the livestock is more

than the food grain crops! It is interesting because traditionally, the crops were driver of farm growth and food grain crops were major part of it; and this was the reason that the government policy and programmes were focussed on crops. But slowly and gradually, the increased contribution of livestock is hinting towards a structural shift in the agricultural sector in the country. The policy makers are now recognising livestock as the engine of agriculture growth. Both livestock and fisheries components have been growing faster than the crops component for a decade. Livestock now controls a quarter of the agriculture gross domestic product (GDP).

There are several reasons of this phenomenon, enumerated as below:

- Livestock are the best insurance against the vagaries of nature like drought, famine and other natural calamities. They supplement family income and generate gainful self-employment, particularly for landless labourers, small and marginal farmers and women.
- Livestock Sector not only provides essential proteins and nutritious human diet through milk, eggs, meat etc., but also plays an important role in utilization of non-edible agricultural by-products. Livestock also provides raw material by-products such as hides, skin, blood, bone, fat etc.
- Animals are natural capital, which can be easily reproduced to act as a living bank with offspring as interest, and an insurance against income shocks of crop failure and natural calamities.

Changes in utility of Livestock

But the question is – earlier the animals were important in the farming because of their 'draught power'. Due to mechanization of agricultural operations and declining farm sizes; they have lost importance. Their dung was used as fertilizer but that is now replaced by Chemical fertilizers. Then how come, their contribution is increasing?

The answer is that there are changes in the utility of the livestock for farmers and also in food consumption. Due to rising income of the middle class, more and more people are consuming the livestock products such as milk, meat and eggs. This is evident from the increased share of animal products in the total food expenditure of the people both in urban as well as rural India. This is new economy and policy makers are taking a serious note of this. [currentuser_id]

Distribution of livestock wealth is more egalitarian, compared to land

In our country, the distribution of livestock is more equitable than that of land. We take example of the marginal farmers here. A marginal farmer is one who holds less than 1 hectare of land. In our country, marginal farmers control around one fourth of the land, but they also rear more than half of cows and buffaloes. These livestock serves as insurance against vagaries of nature to which Indian farming is always subject to. Further, bovine economy has also been a greater poverty alleviating

factor in comparison to the farming in rural parts of several states such as Rajasthan, Uttar Pradesh, Madhya Pradesh and Bihar. Since distribution of livestock wealth is more egalitarian, compared to land; it should be an important component in the poverty alleviation programmes of the government.

Demand for livestock products is income elastic

The animal products have positive income elasticity of demand. This implies that as the consumers' income rises, more their consumption pattern will change and more they will demand the animal products such as meat, eggs and milk. This is one reason that despite reduced importance of livestock as draught animals, they still hold a prominent and growing place in farm economy. As the income of Indian middle class is expected to remain upbeat; the demand for animal products is also expected to rise. This demand is to be mainly fulfilled by domestic supply and that's why there is a need to sustain the current production and growth.

Milk Production and Dairy Sector

From a humble player in 1950s, India has steadily and firmly cruised to become number one in list of milk producing countries around the world. This success story has been written mainly by our smallholder milk producers; but the **Operation Flood Programme** implemented by the National Dairy Development Board was much instrumental in bringing the white revolution. Increasing incomes, changed lifestyle and food habits, urban culture etc. have been mainly instrumental in making Indian dairy industry a truly demand driven, highly diversified business proposition. There has been a paradigm shift in the way milk and dairy products are consumed. The consumers have slowly moved from loose milk to tetra packs, value added products such as flavoured milk, cheese, butter, curd, icecream etc.

India ranks first in milk production, accounting for 17 per cent of world production. During 2013-14, milk production peaked at 137.69 MT, thus becoming an important secondary source of income for 70 million rural households engaged in dairying. The average year-on-year growth rate of milk, at 4.18 per cent vis-à-vis the world average of 2.2 per cent, shows sustained growth in availability of milk and milk products for the growing population. [Economic Survey 2014-15]

The key features of India's dairy sector are as follows

- About 80 per cent of milk produced in the country is handled in the unorganized sector; remaining 20 per cent is equally shared by cooperatives and private dairies.
- Over 1.33 lakh village-level dairy cooperative societies, spread over 265 districts in the country, collect about 25.1 million liters of milk per day and market about 20 million liters.

The efforts of the Government in the dairy sector are concentrated in promotion of dairy activities

in non-Operation Flood areas with emphasis on building cooperative infrastructure, revitalization of sick dairy cooperatives and federations and creation of infrastructure in the States.

National Dairy Development Board (NDDB)

National Dairy Development Board, located at Anand, Gujarat, is a premier institution in Dairy Sector in India. National Dairy Development Board (NDDB) was created in 1965, fulfilling the desire of the then Prime Minister of India – the late Lal Bahadur Shastri – to extend the success of the Kaira Cooperative Milk Producers' Union (Amul) to other parts of India. It was set up by Dr. Verghese Kurien to accelerate the pace of dairy development on cooperative lines in the country.

Current Schemes in Dairy Sector

Currently the below three schemes are being implemented for the development of dairy sector. These are:

- National Dairy Plan Phase I(NDP I)
- National Programme for Bovine Breeding and Dairy Development (NPBB&DD)
- Dairy Entrepreneurship Development Scheme (DEDS)

National Dairy Plan

In 2012, the UPA government had approved the National Dairy Plan Phase-I for a period of six years from 2011-12 to 2016-17 as a Central Sector Scheme. This plan was launched to cover 14 major milk producing States viz. Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal which account for over 90 per cent of the country's milk production, having 87 per cent of breedable cattle and buffalo population and 98 per cent of the fodder resources.

In June 2015, the union government has included three more states viz. Uttarakhand, Jharkhand and Chhattisgarh and it has been extended up to 2018-19.

Salient Features

- It's a Central Sector Scheme, to be fully funded and implemented by Union.
- Covers 17 states currently.
- Objective is to increase productivity of the milch animals and thereby increase milk production to meet the rapidly growing demand
- Another objective is to help rural milk producers achieve greater access to the organized milk processing sector.
- Implementation wholly by National Dairy Development Board through milk co-operatives and state agencies. Private dairy sector has been excluded from the implementation currently.

Components of National Dairy Plan

There are three main components of NDP Phase-1 viz. Productivity Enhancement, Village based

milk procurement systems and Project Management and Learning. Under the Productivity Enhancement component, the NDDB provides 100% grant-in-aid for nutrition and breeding activities. It provides financial as well as technical assistance for production of high genetic merit (HGM) cattle and buffalo bulls and import of Jersey/ HF Bulls for semen production. Under the Village based milk procurement systems the NDDB strives for providing facilities of Milk weighing, testing and collection, Milk cooling at the village level and also support for creating institutional structure at that level. Under Project Management and Learning, it has ICT Based MIS and Learning & Evaluation parts.

National Programme for Bovine Breeding and Dairy Development

National Programme for Bovine Breeding and Dairy Development (NPBBDD) was launched by the union government in February 2014 after merging four erstwhile schemes viz. National Project for Cattle and Buffalo Breeding (NPCBB), Intensive Dairy Development Programme (IDDP), Strengthening Infrastructure for Quality and Clean Milk Production (SIQ and CMP) and assistance to cooperatives.

This scheme with Rs. 1800 crore outlay in 12th plan period aims to integrate the milk production and dairying activities in a scientific and holistic manner for attaining higher levels of milk production and productivity, to meet the increasing demand for milk in the country.

Components

There are two components of this scheme:

- National Programme for Bovine Breeding (NPBB): This component focuses on Field Artificial Insemination (Al) Net work; conservation of indigenous breeds and establishment of breeders' associations and societies to encourage conservation and development of recognized indigenous breeds. For artificial insemination, this component focuses on establishment / appointments of some 5000 MAITRI. MAITRI stands for Multi-purpose AI Technician in Rural India. These MAITRIs will deliver the breeding inputs at doorstep.
- National Programme for Dairy Development (NPDD): This component focuses on developing infrastructure at the grassroots by providing financial and technical assistance for production, procurement, processing and marketing by milk unions/federations and also extension activities including training of farmers.

Proposed Outcomes of the programme by 2018-19

- 5,000 MAITRI will be established on self sustainable basis to deliver breeding inputs at the farmers' doorstep
- 36,418 dairy cooperative societies will be organised with membership of two million farmers.
- The programme will also create milk chilling capacity of 2.8 million litres of milk per day and

processing capacity of 3.01 million litres per day.

- The programme will also set in motion specific action to conserve genetic diversity among cattle and buffalo in the country.
- The programme will also put in place the policy- strategy- programme framework to transform breeding into an economic activity

Rastriya Gokul Mission

The Union Government has also launched **Rashtriya Gokul Mission** under the same programme for conservation and development of indigenous breeds in a focused and scientific manner. Under this mission, government plans to establish integrated cattle development centres "Gokul Grams" to develop indigenous breeds including up to 40% nondescript breeds.

Dairy Entrepreneurship Development Scheme (DEDS)

The Dairy Entrepreneurship Development Scheme (DEDS) is a credit linked subsidy scheme of government of India to promote the setting up of modern dairy farms. This scheme is a modified version of an earlier 2004 scheme called Dairy/Poultry Venture Capital Fund. The applicant / entrepreneur has to make arrangement for minimum 10% of the total money needed for setting up a modern dairy farm. For rest, the government provides 25% capital subsidy (33.33% for SC/ST) and remaining amount is provided as loan (minimum 40%) by the Commercial Banks, Cooperative Banks, Regional Rural Banks and Urban Banks. The nodal implementation agency for this scheme is NABARD.

Eligible beneficiaries of the scheme include agricultural farmers, individual entrepreneurs and groups of unorganized and organized sector. Group of organized sector, includes self-help groups, dairy cooperative societies, Milk unions, milk federation, etc.. This scheme shall also help in employment generation at village level as well as Dairy Co-operative Society level.

Current Trends in Dairy Sector

The most basic feature of Indian dairy sector is that it is still predominantly unorganized. Of the total milk produced in India, only 18-20% is channelized via the organized sector. The unorganized sector is yet to participate into the modern processing infrastructure.

However, there is gradual and steady shift in positive direction *because of favorable "consumption dynamics" led by increasing demand* for packaged milk and value added products. Despite being largest producer and consumer of milk, India's per capita dairy consumption levels are significantly lower than developed countries. India is neither an active importer nor an active exporter in Milk sector. Most of the produced milk is consumed domestically; despite that the eastern part of the country is milk deficient and thus, the industry is to remain demand driven for a long term.

The main challenges faced by dairy industry are in sourcing and logistics. This is because

procurement of the fresh milk is the most crucial element of this business. It is not feasible to procure milk beyond a 200 kilometers radius; because of perishability of the product. Another challenge is low productivity and yield. For example, New Zealand has three times more productivity than India. The cold storage and supply chain infrastructure bottlenecks are ubiquitous in entire farm sector in India. There is a need to develop these infrastructure facilities at least at tier-3 centres.

Fisheries

Fisheries sector occupies a very important place in the socio-economic development of the country. It has been recognized as a powerful income and employment generator as it stimulates growth of a number of subsidiary industries, and is a source of cheap and nutritious food besides being a foreign exchange earner.

Contribution to Economy

Fisheries sector currently constitutes about 1 per cent of the GDP of the country and 4.75 per cent of agriculture GDP.

Production Figures

India's total fish production during 2013-14 was 9.58 MT, an increase of 5.96 per cent over 2012-13. With these figures, India is second largest fish producer in the world after China. However, India's production of fish is only 10% of its nearest competitor China. This is mainly due to the reason that India's aquaculture is limited to few species (<10) while in China there are more than 100 species being cultured commercially.

Inland versus Marine Production

Traditionally, the output of marine fisheries used to be higher than that of inland fisheries. However, since 1991, India's Inland Fish production has increased gradually. In 2000-01, inland fisheries overtook marine fisheries in terms of production and the trend has endured since then. While the marine fish capture has increased only by about 36 per cent since then; there was a 234 per cent rise in the inland fish production. The situation today is that the marine fisheries sector has virtually ceased to grow even as inland fisheries continue to expand. Fish catch (capture fisheries) from rivers and other open water bodies in the inland fisheries sector and from the oceans in the marine fisheries sector are either stagnant or declining. Thus, the growth of the fisheries sector in India is mainly being sustained by inland aquaculture (fish farming).

- At present share of Inland fish production in India's total fish production is more than marine. Since 1991.
- Punjab and Haryana are two largest states in India in terms of freshwater fish production.

The success of Freshwater aquaculture is because of the efforts done by the scientists for developing

technologies for scientific aquaculture, and the efforts of the farmers for making full use of new techniques for producing bumper fish harvests. The adoption of scientific fish farming practices has led to an over five-fold increase in the mean national fish productivity. The other factors helping the Inland aquaculture in India are the burgeoning consumer demand, convenient marketing and good returns.

Challenges to Fisheries Sector

The main critical gaps / challenges for fisheries development in India include the following:

- Lack of a reliable database relating to aquatic and fisheries resources
- Limited number of species grown / cultured, mainly due to weak linkages between research and development and fish farmers community.
- Weak multi-disciplinary approach in fisheries and aquaculture
- Inadequate attention to the environmental, economical, social and gender issues in fisheries and aquaculture,
- Inadequate HRD and specialized manpower in different disciplines.
- Weak marketing and extension network
- Decline in fish catch and depletion of natural resources due to over exploitation of coastal fisheries.
- Water pollution; unscientific management of aquaculture and contamination of indigenous germplasm resources.
- Poor yield optimization, problems in harvest and post-harvest operations, landing and berthing facilities for fishing vessels and issues in welfare of fishermen.

Institutional Structure for Support of Fisheries

There is a huge institutional network in the country to support fisheries sector. This includes Indian Council of Agricultural Research (ICAR); Ministries of Agriculture, Commerce and food processing industries; CSIR; State agricultural universities etc. Further, the government established **National Fisheries Development Board (NFDB)** in 2006 with its **headquarter at Hyderabad** to realize the untapped potential of fisheries sector, fish culture, processing & marketing of fish, application of modern tools of research & development for optimizing production and productivity in fisheries. It is executing various programmes to enhance the national fish production and to augment the fish processing and marketing infrastructure in the country.

There is also a statutory body called **Coastal Aquaculture Authority,** established by Coastal Aquaculture Authority Act, 2005. Its main work is to regulate coastal aquaculture activities in order to endure sustainable development without causing damage to the coastal environment. The

Authority is empowered to make regulations for the construction and operation of aquaculture farms in coastal areas, inspection of farms to ascertain their environmental impact, registration of aquaculture farms, fixing standards for inputs and effluents, removal or demolition of coastal aquaculture farms, which cause pollution etc.

Further, currently, the below schemes are being implemented by the Government.

- Development of Inland Fisheries and Aquaculture.
- Development of Marine Fisheries, Infrastructure and Post Harvest Operations.
- Strengthening of Database and Geographical Information System (GIS) of the Fisheries Sector
- National Scheme of Welfare of Fishermen.

The fisheries sector in India has made rapid strides and its role in food supply, employment and raising nutritional standards of the population has expanded in recent decades. It has been one of the largest foreign exchange earner sectors also for the country. However, this sector, particularly the inland fisheries needs proper policy support to tap its untapped potential.

Inland Aquaculture & Blue Revolution

In last two decades, the inland aquaculture has emerged as a fast-growing enterprise and a viable alternative to the declining capture fisheries in India.

What is Blue Revolution?

The Blue Revolution envisages transformation of the fisheries sector with increased investment, better training and development of infrastructure on the lines of white revolution which transformed India's dairy sector.

Why growth has eluded in Marine and Capture fisheries?

In marine fisheries and capture fisheries, the growth has eluded because of many reasons. One reason is that the marine fishing activity remains confined to coastal waters, leaving most part of the sprawling exclusive economic zone – measuring 2.02 million sq km – under explored. The narrow coastal belt of around 50 metres from the seashore is being over-tapped by traditional fisher folk, causing considerable depletion of fish stock. Though the Motorised fishing vessels, which can operate beyond this zone, now account for about 85 per cent of the total marine fish catch, yet the deep-sea fishing activity remains rather low owing to the inadequacy of specialised deep-sea fishing vessels. Thus, if we want to grow marine fish production, we need to input huge investments in the deep sea fishing.

On the other hand, potential of inland aquaculture is still untapped in India; despite the fact that out of the current 10 million tonnes total fish production; the inland fisheries account for 56% while

marine fisheries for 34%. Given that India has large number of water bodies, reservoirs, lakes, ponds etc. the Inland aquaculture holds the key to the blue revolution in the country.

A small fraction of farmers are currently practicing the Inland aquaculture in some states such as Punjab, Haryana, West Bengal, Andhra Pradesh, Telangana etc. and virtually blue revolution is happening. By increasing the coverage of water area and the productivity of existing water bodies by 50 per cent, the total production from aquaculture could be doubled. However, there are some critical gaps that need to be addressed to achieve blue revolution in true terms. These are as follows:

Species Diversification

Bulk of inland aquaculture production in India comprises three major Indian fishes viz. **rohu, catla and mrigal**. Thus, diversification is badly needed for efficient growth. Today, India is second largest producer of fish through aquaculture next to China but the number of cultured species is less than 10 as against over 100 of China. Species diversity is one area which is yet not explored and has tremendous potential to increase production. There are a handful of farmers in the country who trying to experiment with exotic fishes such as silver carp, grass carp and common carp. There are efforts being done to diversify the species mix in freshwater aquaculture by introducing high-value catfish like magur and freshwater prawns.

Weak linkages in R&D and Unscientific Management

Some other key issues include unscientific management of aquaculture; contamination of indigenous germplasm resources; poor yield optimization, problems in harvest and post-harvest operations, landing and berthing facilities for fishing vessels and issues in welfare of fish farmers. The weak linkages between research and development and fish farmers community; and weak multi-disciplinary approach are critical gaps that need to be addressed to tap the full potentials.

Policy Suggestions

Key policy suggestions are as follows:

- Government must come out with a **National Inland Fisheries Policy** to provide support and strengthen inland fisheries sector.
- Establishment of **Fisheries Resources Centres** on the lines of Krishi Vigyan Kendras to provide technical / educational support.
- Involve Private sector, NGOs etc. In the development of this sector.
- Streamline the schemes, rules and regulations.
- Remove infrastructure bottlenecks and enhance marketing support.

Poultry Sector

Production Figures and Growth Trends

Egg production in India was around 73.89 billion in 2013-14, while poultry meat production was estimated at 2.68 MT. Poultry is one of the fastest growing segments of the agricultural sector in India.

In recent times, the poultry sector has seen consistent growth in India because

- The rising incomes have changed the **consumption pattern and consumption basket** of the Indian masses which means they are now purchasing more protein based food.
- There has been a steady rise in the prices of eggs that has helped poultry farmers tackle escalating feed costs.
- There is an emergence of vertically integrated poultry producers that have reduced production and marketing costs.
- Integrated production, market transition from live birds to chilled and frozen products, and policies that ensure supplies of competitively priced corn and soybeans are keys to future poultry industry growth in India.

Further, disease surveillance, monitoring and control will also decide the fate of this sector. However, still India's poultry sector is largely unorganized, but it is a potent tool for subsidiary income generation for many landless/ marginal farmers and also provides nutritional security to the rural poor.

Institutional Structure for Support in Poultry

Central Poultry Development Organizations

Government of India has established four Central Poultry Development Organisations (CPDOs) of four regions at Chandigarh, Bhubaneswar, Mumbai and Hessarghatt. These have been entrusted to implement the GOI poultry sector schemes. The provide training to farmers to upgrade their technical skills with an overall objective to improve productivity of poultry sector.

National Egg Coordination Committee

National Egg Coordination Committee is NOT a government organization. It is a trust registered under Indian Societies Registration Act and is basically a voluntary **Producers' association** with 25000 members. It works on cooperative spirit, though it is not a cooperative itself.

It was launched in 1982 with by Dr. B V Rao along with a group of farmers mainly to unite farmers to get better egg prices. Its slogan "My Egg, My Price, My Life" proved to be a mantra for poultry farmers across the country. Since most of the egg comes from its members, they are capable to fix egg prices and 'price declaration' is its main function.

Contribution of NECC to Poultry Sector

NECC has not only provided better prices to the poultry farmers of the country but also has taken care of their interests on national level. Apart from fixing egg prices, it also helps does market intervention, price-support operations, egg promotion campaigns and consumer education. The series of NECC TV commercials had caught the imagination of the nation and its success was really felt when egg consumption went up significantly and this benefited farmers across the country.

Green Revolution Part-1

The significant increase in agricultural production in 1960s consequent upon the adoption of new agricultural strategy and use of HYV seeds and chemical fertilizers is called Green Revolution. The key pillars of this revolution were high yielding variety (HYV) seeds, chemical fertilizers, pesticides and promoted irrigation facilities.

Green revolution was introduced as a package programme with seed-water-fertilizer-pesticide-technology components and was originally called High Yielding Variety Programme (HYVP). It was launched in Kharif of 1966-67 with an objective to attain self-sufficiency in food by 1970-71. The core philosophy of the programme was to increase the productivity of food grains by adopting latest varieties of inputs of crops. Introduction of new high yielding varieties of improved seeds and enhanced application of the fertilizers and extended use of pesticides were its main features. The farmers were also extended finance through a relaxed mechanism. The programme turned out to be a major breakthrough and a turning point in the history of agriculture development in India.

Role of Dr. Norman Borlaug

The term "Green Revolution" was first used in 1968 by then USAID director William Gaud. The HYV seeds were imported from Mexico, where they were developed by Dr. Norman Borlaug (1914-2009). Dr. Norman started the agricultural development in Mexico and made it a success. The sponsor of this programme was Rockefeller Foundation, whose office later became the "The International Maize and Wheat Improvement Center" or CIMMYT. The foundation later sought to spread it to other countries. It was his effort that these HYV seeds expanded from Mexico to India, Pakistan, Philippines and other parts of the world. Dr. Borlaug is called father of Green Revolution; he won the Nobel Peace Prize in 1970 and was honoured with Padma Vibhushan by the Government of India.

Role of Dr. Swaminathan

Dr. M. S. Swaminathan was the adviser of the Minister of Agriculture and he had invited Dr. Borlaug to India. Swaminathan is known for having lobbied with then Prime Minister Lal Bahadur Shastri to import 18000 tons of Mexican seed. He established National Bureau of Plant, Animal and Fish Genetic Resources of India and International Plant Genetic Resources Institute.

Basic Elements of Green Revolution

Many factors can be enumerated for green revolution. Some of them are discussed below:

Increased area under farmland

Although the area under cultivation was increasing ever since 1947; the green revolution accelerated it.

HYV seeds

High Yielding Variety Programme (HYVP) was launched in 1966 especially on five crops viz. wheat, rice, pearl millet, maize and sorghum. For Wheat Sona, PB-18 and Kalyan varieties were used; for Maize Ganga 101 and Ranjit varieties were used while for Jowar CSH2 was used mainly. Use of HYV seeds was the most scientific aspect for the Green Revolution. The role of Indian Agricultural Research Institute and agricultural universities should not be undermined in development of these seeds. We note here that the ICAR was originally established by the British in 1929 but had not done any significant research by 1960s. It was reorganized in 1965 and further in 1970s. Several new strains developed by it during 1960s and 1970s were drivers of green revolution.

Use of Chemical Fertilizers

The green revolution truly began when in 1967; Indira Gandhi government had imported 18000 tonnes of HYV seeds from Mexico. These seeds needed chemical fertilizers to maximize yield. The per hectare use of chemical fertilizers skyrocketed in those years; and this was the reason that some call green revolution as a chemical revolution in effect. That also posed a challenge for the government to make the chemical fertilizers affordable for the cultivators and government had to resort to fertilizers subsidy.

Expansion of Irrigation

In 1951, the well irrigated area accounted for only 17-18% of the total cultivated area; and majority of the farmers were dependent upon the rains. The government undertook many minor, major and multipurpose irrigation projects so that maximum area can be brought under irrigation. Dams were built to arrest large volumes of natural monsoon water which were earlier being wasted, simple irrigation techniques were also adopted.

Double Cropping

It was because of availability of the inputs and irrigation that the farmers could think of having two crops in a year. Thus, Double Cropping was the primary feature as well as outcome of the Green Revolution. Before that, one crop per year was a practice because there was only one monsoon rain per year. Double cropping was possible because of one natural monsoon and other artificial monsoon that came in the form of huge irrigation facilities.

Outcomes of Green Revolution

Although green revolution happened in other developing countries also in those days, but India was most successful among them. The record output of food grains of 131 million in 1978-79 established India as one of the largest agricultural producers of the world. No other country in the world which attempted the Green Revolution recorded such level of success. India also became an exporter of food grains around that time.

Not only in production, but also in productivity green revolution was a success. The yield per unit of farm land improved by more than 30 percent between 1947 and 1979. During first 10 years of Green Revolution, crop area under HYV seeds grew from 7% to 22%.

Impact on Cereal Production

The key achievement of the green revolution was boost in production of two major cereals viz. Wheat and rice. But it was also a major drawback. The revolution was mainly confined to High Yielding Varieties (HYV) cereals, mainly rice, wheat, maize and jowar. It did not cover other coarse cereals, millets and neither had it covered pulses.

Impact on Commercial Crops

Initially, green revolution was directed to increase the production of the food grains. It had no substantial impact on production of commercial crops such as sugarcane, cotton, jute, oil seeds, and potatoes until 1973-74. However, after that year, significant improve in output was seen in sugarcane, oilseeds and potatoes.

Impact on Cropping Pattern

Green revolution resulted in two significant changes in the cropping pattern of India. Firstly, since the output of the cereals has risen and output of pulses remained stagnant; there was a decline of importance of pulses in the foodgrains. This resulted in increased area under cereals crops and decreased area under pulses. Secondly, among cereals, importance of Wheat has grown; in fact doubled from 15% in 1950-51 to 38% in 2010-11 at the cost of not only cereals but also rice. This is evident from the below table.

Year	Rice	Wheat	Coarse grains	Total cereals
1950-51	48	15	37	100
1960-61	50	16	34	100
1990-91	46	34	20	100
2006-07	46	37	17	100
2007-08	45	36	19	100
2008-09	45	37	18	100
2009-10	44	40	16	100
2010-11	43	38	19	100

Impacts on Industry and economy

Since the crops that used the HYV seeds needed more water, fertilizers, pesticides, fungicides etc, there was a boom in the domestic manufacturing sector also. The industrial growth created new jobs and thus contributed to the economy. Further, the expansion of irrigation necessitated the development of dams and the water stored in them was used to create hydropower. This helped to boost quality of life as well as growth of industrial sector.

The adoption of new technology has also given a boost to agricultural employment because of diverse job opportunities created by multiple cropping and shift towards hired workers. At the same time, there has been displacement of agricultural labour by the extensive use of agricultural machinery.

Green revolution has also strengthened the linkages between agriculture and industry. Even under traditional agriculture, the forward linkage of agriculture with industry was always strong, since agriculture supplied many of the inputs of industry; but backward linkage of agriculture to industry – the former using the finished products of the latter was weak. Now, however, agricultural modernisation has created a larger demand for inputs produced and supplied by industries to agriculture and thus the backward linkage has also become quite strong. In this way, the linkage between agriculture and industry has got strengthened.

The new agricultural technology has made the farmer market-oriented. The farmers are largely dependent on the market for the supply of inputs and for the demand for their output. At the same time, the demand for agricultural credit has also increased as the new technology has increased the cash requirements of the farmer. Besides, modern technology has definitely proved its superiority over the traditional technology only in those areas where appropriate conditions prevail. But as mentioned above, these conditions prevail only in certain selected areas and the rest ofthe country is not yet suitable for advanced technology. What is, therefore, wanted is the evolution of a low-cost technology which can be adopted by all small farmers and which can use and exploit the local resources. [currentuser_id]

Green Revolution and growth of Capitalistic Farming in Indian Agriculture

The green revolution necessitated the heavy public expenditure in the seeds, fertilizers, pesticides and water domains of economy. From the farmer's side, it implied use of better and improved inputs of agriculture which needed more capital. Making investments in tube wells, pump sets, fertilizers and farm machinery was beyond the capacity of small and medium farmers. Despite of efforts of the government; Green Revolution helped growth of capitalist farming in India and it led to concentration of wealth in the hands of large farmers. The benefits of green revolution hardly trickled down to poor and marginal farmers.

The most glaring example of this was Punjab. This state saw a sudden rise of "Gentlemen farmers", the people such as retired servicemen, retired civil servants, and businessmen etc. who adopted farming as profession. Further, during and after green revolution; the need for institutional reforms in agriculture was not recognized. There was a need to take urgent measures on land reforms and tenancy reforms but that did not happen. Since bulk of the peasant population did not enjoy the ownership rights; they were forced to accept share cropping rather than being cultivator themselves. A typical capitalist principle of profit maximisation was put in place in which the owner-farmers reaped profit much more than the tenant cultivators. This ultimately resulted in widening of the disparities between the large farmers and landless labourers / tenant farmers.

Green Revolution and Regional Inequalities

HYVP was initiated on a small area of 1.89 million hectares in 1966-67 and was limited to the irrigated Punjab, Haryana and Western Uttar Pradesh. Naturally, the benefits of the new technology remained concentrated in this area only. Moreover, since green revolution remained limited to wheat for a number of years, its benefits mostly accrued to areas growing wheat. Even this is an overstatement because within the area under wheat in HYVP, only regions having assured water supply and a package of other inputs (on whose -availability the success of HYVP crucially depends) derived benefits from the new agricultural strategy. In fact, the combined share of Northern States (Punjab, Haryana and Uttar Pradesh) in total foodgrains production increased from 25.2 per cent during 1960-62 to 28.5 per cent during 1972-74 and further to 38.7 per cent during 2004-05 to 2006-07. As against this, the share of all other State-groups registered a decline. One account of the above reasons, it has been argued that the new agricultural strategy has led to an increase in regional inequalities.

Labour augmenting and labour displacing element in Green Revolution

There is a general consensus that the adoption of new technology in Green Revolution had reduced labour absorption in agriculture. The uneven regional growth was mainly responsible for the low absorption of labour within agriculture. In a large number of states, especially in those regions where there was abundant availability of labour, the growth of output was too slow to generate adequate employment opportunities. In high growth regions, labour was not plentiful and wage rates were high. The sudden rise in the demand for labour in these areas induced mechanisation and labour-saving practices in general. This happened despite the use of migrant labour from the less developed regions for certain operations.

Green Revolution and Environment Impacts

Intensive double and triple monocropping of rice caused soil degradation; increased pest infestations; depletion of micronutrients; reduction in nutrient carrying capacity of the soil; build up of the soil

toxicity; salinity and water logging.

General Knowledge Today

Agriculture-4: Green Revolution, Food Security

Integrated IAS General Studies:2016-17
Last Updated: February 15, 2016
Published by: GKTODAY.IN

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Mains Model Questions

1. To what extent, it is justified to call green revolution as an agricultural revolution? Examine.
2. It has been often argued that early part of Green Revolution led to a class polarization in the rural parts of the country. Discuss Critically.
3. "Although green revolution led to increased production and economic betterment of the well to do farmers, but at several fronts, our political and institutional dispensation failed miserably." Discuss. Critically.
4. "Barring few pockets, the green revolution virtually bypassed the eastern region of the country despite the fact that it has fertile soil and plenty of water." Explain.
5. Discuss various phases of Green Revolution and their impacts on social economy of India.
6. "The Cost-Risk structure in Indian agriculture must be paid attention while framing policies." Discuss.
7. Present a roadmap for improving farm productivity and profitability in perpetuity without ecological harm in India.
8. "The first green revolution ran out of steam mainly because it was focussed only on grain production." With this context, present a conceptual framework upon ushering India into Second Green Revolution.
9. What is BGREI Programme? Evaluate its role in Indian agriculture in recent times.
10. "The Bengal Famine of 1943 was a result of several malign natural and man-made factors." Discuss.
11. Discuss the current institutional framework around foodgrains management and Public Distribution System in India.
12. What are Buffer Norms and Buffer Stocks? Why they are needed?
13. Discuss the key recommendations of Shanta Kumar Committee in context with Restructuring of FCI.
14. What do you understand by Food Insecurity? Differentiate between Chronic and Transitory Food Insecurity.

15. The text of the National Food Security Act mentions it as an act to provide for food and nutritional security in "human life cycle approach". Expand the meaning of human life cycle approach in this context.
16. "There have been different concerns of various sections of the society with reference to the Food Security Act." Examine.
17. The implementation of National Food Security Act must be based on principle of self exclusion and culture of honesty. Discuss.

Green Revolution Part-II

In the previous module, we have discussed some of the basic elements of the green revolution and its impact on economy. In this module, we discuss some more questions.

Was Green Revolution a True Agricultural Revolution?

Green revolution was not an agricultural revolution in true sense. The new strategy brought a revolution in production of a few crops only. Initially it was limited to wheat, maize and bajra only. India's largest crop rice responded to green revolution much later. However, progress in major commercial crops viz. Oilseeds, cotton and jute remained much slow. The pulses accounting for 10% of the total food grains production did not register any increase in the production. Thus, it cannot be called an agricultural revolution because the upward trend in production was confined to a few crops and it was not pervasive in all major crops. Further, its spatial distribution was also uneven. It happened mainly in Punjab, Haryana, Western Uttar Pradesh and some districts of Andhra Pradesh, Maharashtra and Tamil Nadu. It spread to some other parts of the country too little and too late. This implies that the already better off areas were able to make their economic position still better. In many ways, the green revolution initiated a process of unbalanced growth in the country. Today, eastern part of the country is still to catch up with those which marched ahead. Unless these states enter the take-off stage; it will be really unjust to call green revolution an agricultural revolution.

Green Revolution / Red Revolution / Class Polarization debate

It has been often argued that early part of Green Revolution led to a class polarization in the rural parts of the country because rich peasants became richer at the cost of small peasants; because the later were not able to access modern inputs. This argument further says that resources were concentrated into those regions which were already well to do and thus it further accentuated the regional imbalance. The small peasants were further pushed to become landless labourers; and this created condition for agrarian unrest and revolt. Thus, "Green Revolution will lead to Red Revolution" was the slogan that was given by proponents of this theory in 1960s and 1970s.

What happened class polarization argument?

This argument was not fully unfounded and it was this argument which forced the political

dispensation to take measures so that the poor farmers could access to inputs. It led the Indira Gandhi government to launch *Garibi Hatao* campaign for rural poor. Some other programmes initiated during the 1970s included Small Farmers Development Agencies (SFDA), Rural Works Programme (RWP), Drought Prone Areas Programme (DPAP), Command Area Development Programme (CADP) etc. Government took proactive measures to make institutional credit reach to farmers. Entire banking system and cooperative system was mandated to give priority sector loans to farmers and poor.

What happened to Red Revolution argument?

The green revolution coupled with an array of government initiatives was successful in making self sufficient in foodgrains. It also had a major impact on rural poverty because of decline in prices of food. It led the government to create enough buffer stocks to meet the contingencies. In summary, it made substantial improvement in the life of Indians majority of who were still dependent on farming. The slogan of red revolution was false because green revolution did not cause any peasant revolts in the country. Whatever peasant militancy we see today is based upon a premise of systematic overthrow of the Indian government itself (e.g. naxalism). Government's role in making inputs available to poor farmers has been substantial because of subsidy programmes.

The dark side of green revolution

Although green revolution led to increased production and economic betterment of the well to do farmers, but there is a dark aspect of this development. On several fronts, our institutional and political dispensation failed miserably, leading to current farmer distress. They have been discussed as below:

- The improved dwarf varieties of wheat and rice required more water, use of chemical fertilizers and pesticides. The new development needed Integrated Pest Management and Integrated Nutrient Management. The large fertilizers, seeds and pesticides companies launched massive campaigns to sell their products and this led to inordinate use of these inputs resulting in alarming rate of groundwater depletion and soil degradation.
- The lack of coherence between institutional credit, price support system and cost of inputs led to peasant indebtedness. They got burdened with debts from banks or moneylenders / commission agents.
- The worst consequence of green revolution has been the terrific water pollution; salinity; water logging.

Dr M.S. Swaminathan had forewarned as early as 1968 that: "Intensive cultivation of land without conservation of soil fertility and soil structure would lead ultimately to the springing of deserts. Irrigation without arrangements for drainage would result in soil getting alkaline or saline. The

indiscriminate use of pesticides, fungicide and herbicide could….lead to an increase in the incidence of cancer and other diseases through the toxic residue present in the grains or other edible parts."

Why green revolution bypassed the Eastern Region?

Barring few pockets, the green revolution virtually bypassed the eastern region of the country despite the fact that it has fertile soil and plenty of water. There were several reasons for the same. Firstly, this region was bypassed due to institutional factors. It has been established that the best performing areas in Green Revolution were under Mahalwari region in Punjab. Although Zamindari system was abolished, yet its influence remained in the eastern parts of India.

Zamindari / Ryotwari/ Mahalwari regions

Due to many historical factors; India had become hodgepodge of several systems of land tenure, land tenancy and land revenue systems. In Bihar, Bengal, Odisha and Eastern Uttar Pradesh; the land was held by the Zamindars; so this was known as Zamindari region. Here, Zamindars paid permanently fixed revenue to the government. In Punjab, the land was held by the village communities who paid a land assessment that was revised by periodic new settlements of the revenue. This system was called Mahalwari system. The Ryotwari system prevailed in Bombay and Madras, where land was held by the peasant proprietors who paid land revenue directly to the State. Here, the revenue was assessed on each individual holding pieces of land separately.

More than 80% of the total land holdings in Eastern India were / are small and marginal land holdings. Even in Punjab and Haryana, the new technology was too expensive to adopt for small and marginal farmers; the cost of inputs was unaffordable for majority of the farmers in eastern region.

Secondly, the cropping pattern in Eastern India was traditionally dominated by rice and other low value crops. Rice responded late to new technology but meanwhile western region marched ahead with jumps in production of wheat, maize and bajra. Thirdly; given that Bihar and Odisha were most poor states in the Indian Union having substantial number of households below the poverty line, majority of the farmers practiced subsistence farming in low value crops.

Did Green Revolution totally bypass Eastern India?

It is not true that the Green Revolution did not reach at all to eastern India. Over a period, it has spread to large parts of the nation and has brought prosperity. On this basis, there are three distinct phases of Green Revolution.

- First is 1962-65 to 1970-73, when there was a sharp increase of yields of wheat in north-western region of Punjab, Haryana and western Uttar Pradesh. Generally we refer to this stage only as Green Revolution.
- The second phase was from 1970-73 to 1980-83 when rice yield started responding to the

HYV seed technology and the Green Revolution spread to other parts of the country notably Eastern UP, Coastal Andhra, some parts of Karnataka, Tamil Nadu, Maharashtra, Gujarat, Madhya Pradesh etc.

- The third phase of green revolution spread to the erstwhile low-growth areas of the eastern region of West Bengal, Bihar, Assam and Odisha during 1980–83 to 1992–95. During this phase, the southern region registered a higher growth of rate than the north-western region.

The third phase contributed little in reducing the regional inequalities but then, the euphoria of green revolution lasted only till that time. After that the growth levels and yield per hectare came down in comparison to earlier decades.

The National Commission on Farmers – 2004

In 2004, the UPA government had constituted a National Commission on Farmers under the chairmanship of Dr. MS Swaminathan.

This commission included a wide variety of people into definition of farmer. Farmers included landless agricultural labourers, sharecroppers, tenants, small, marginal and sub-marginal cultivators, farmers with larger holdings, fishermen and women, dairy, sheep, poultry and other farmers involved in animal husbandry, pastoralists, as well as those rural and tribal families engaged in a wide variety of farming related occupations such as sericulture, vermiculture, production of bio-fertilizers and bio-pesticides, and agro-processing. It also included the tribals who engaged in shifting cultivation and non-timber forest produce.

Emphasis on Cost Risk Structure

While making a statement of the problems of the farmers; the Swaminathan Panel gave special emphasis to the Cost-Risk structure in Indian agriculture. It said that the farmers frequently face fury of the nature in the form of drought, unseasonal and heavy rains causing extensive damage to crops. This coupled with weak institutional support, ever increasing cost of production and not so supporting minimum support prices (at that time) have led to an adverse cost-risk structure of farming. This led to peasant indebtedness and farmer's distress.

The committee also pointed out the inputs that did wonder during Green Revolution period have been giving diminishing returns since 1980s and the Capital formation in agriculture and allied sectors as percentage of Gross Domestic Product (GDP) declined for a long term , only reversing recently. Adverse irrigation and rural infrastructure have led the farmers to commit suicides in Vidarbha and other parts.

Agricultural Renewal Action Plan

Most of the recommendations of the National Commission on Farmers focussed on improving farm

productivity and profitability in perpetuity without ecological harm. It presented an **Agricultural Renewal Action Plan**, which called for introduction of mutually reinforcing packages of technology, services and public policies to bridge the gap between actual yields and potential yields. The Agricultural Renewal Action Plan had five components as follows:

Soil health enhancement

Agricultural Universities, research institutes, Krishi Vigyan Kendras, fertilizer companies, states department of agriculture and fanners' associations should aim at increasing the productivity potential of the soils by paying adequate attention to the chemistry and physics of soils (macro and micronutrients) and microbiology. Dry farming areas should receive special attention.

Irrigation Water Supply Augmentation and Demand Management

National Commission on Farmers made a very forthright declaration – "*Water is a public good and a social resource and not private property. The privatization of its distribution is fraught with dangers and could lead to water wars in local communities".* Improving supply through rainwater harvesting and recharge of aquifers should become mandatory.

It suggested that 10 million hectares of new area under irrigation should be developed; all existing wells and ponds should be renovated; seawater farming should be promoted in coastal areas through the cultivation of mangroves and other vegetation such as halophytic plants. Demand management through improved irrigation practices, including sprinkler and drip irrigation should receive priority attention.

Credit and Insurance

The panel emphasized that "*Credit reform is the primary pathway to enhancing small farm productivity and ending farmer suicides.*" In this direction, it suggested to:

- Reduce interest rates on crops to 4%
- The natural calamities such as droughts and floods lead the farmers to default on their loans. To meet the natural calamities, the union and state governments should come forward to create an "Agriculture Risk Fund" to provide relief to drought and flood hit farmers.

Technology

The performance of the new varieties of seeds should be judged on the basis of "net income per hectare" and not just in terms of yield per hectare. The governments should add **Post-harvest technology wing** to the Krishi Vigyan Kendras. Government should add Lab-to-land demonstrations in dry farming areas where millets, pulses, oilseeds and cotton are grown. The committee had also suggested to establish a National Biotechnology Regulatory Authority (Government established Biotechnology Regulatory Authority of India in 2008).

Marketing

The committee suggested that the market reform should begin with production planning, so that every link in the cultivation-consumption-commerce chain receives adequate and timely attention.

Five Point Action Plan

For revival of agriculture, the Swaminathan Commission on Farmers suggested a five point action plan.

These five points are as follows:

- Soil health enhancement
- Water harvesting and sustainable and equitable use of water
- Access to affordable credit and crop and life insurance reform
- Development and dissemination of appropriate technologies and improved opportunities
- Infrastructure and regulation for marketing of agricultural produce.

They have been discussed below:

- Undertake soil health enhancement through integrated measures in improving organic matter and macro-and-micro-nutrient content, as well as the physics and microbiology of the soil.

- Promote water harvesting, conservation, and efficient and equitable use by empowering gram sabhas to function as "Pani Panchayats". A sustainable water harvesting system should be established, particularly in rainfed areas lacking assured irrigation. This can be facilitated by mandatory water harvesting and greater attention to dry land farming.
- Immediately initiate credit reforms coupled with credit and insurance literacy. In chronically drought-prone areas, the repayment cycle should be extended to four to five years. Besides this, the credit delivery system should be made gender sensitive.
- Bridge the growing gap between scientific know-how and the field level do-how both in production and post-harvest phase of farming. This could be accomplished by organizing the training of agricultural workers as farm science managers, strengthening Krishi Vigyan Kendras (Agricultural Science Centres) in both production and post-harvest technologies and organizing nation-wide lab to land demonstrations in the areas of agricultural diversification, food processing, and value addition. In nutshell, low economic risk, high factor productivity and avoidance of ecological harm should form the fundamentals of all agricultural research and development strategies. Success in agricultural progress should be measured by growth rate in farmers' income and not just by production figures.
- The gap between what the rural producer gets and the urban consumer pays should be made as narrow as possible, as has been done in the case of milk by Dr. V. Kurien. At the same

time, there should be a Risk Stabilization Fund and a farmer-centric Minimum Support Price (MSP) and Market Intervention Scheme (MIS).

Call for Second Green Revolution

The call for second green revolution is not new. For the first time, the NDA government led by A B Vajpayee had called for "farm diversity" in the form of 'Kisan ki Azadi' in budget 2002-03. The government announced that of elected (again), it would launch a Second Green Revolution which will lead to Ever Green Revolution. In 2003, President Dr. A.P.J. Abdul Kalam called for the 'Second Green Revolution on the eve of 54th Republic day. In 2005, PM Manmohan Singh also called for Public Private Partnership (PPP) to usher India into Second Green Revolution.

Premise for Second Green Revolution

The first green revolution ran out of steam mainly because it was focussed only on grain production; it did not help the dryland farming and it was not scale neutral and thus helped only large farmers. The call for second green revolution focuses on these issues by adopting a different strategy to follow. In context with our country, the second green revolution has been called for in Eastern States via the BGREI programme in recent years. However, Second Green Revolution currently remains as a concept only. It has not translated into a reality so far.

The conceptual framework of second green revolution is based the below premises:

- Attaining food security and sustainable farm profitability by embracing the entire agro-economy from the farmer to consumer.
- Harness the bouquet of new technologies such as Information Technology, Nanotechnology, Biotechnology, Genetic Engineering, water efficient irrigation systems; environment friendly pesticides, precision agriculture/farming organic farming, biodynamic farming .
- It will focus not only on traditional farming but also on commercial farming and would promote horticulture, floriculture, sericulture, aquaculture, plantation crops, medicinal crops, aromatic crops, spices, etc.
- It keeps into view the local geographical and climatic position, soil fertility and productivity and nature, water, human resource and infrastructure availability and cost of production.
- It is expected to be careful towards prospective yields of supply price or cost of production of these crops so that productivity and production is fastly increased on minimum costs of production and minimum water as 'more crop with per drop' and fanners whether big or small or marginal can take benefit from this.
- Massive crop diversification and multiple cropping is one of the key features of second green revolution.

- It aims for achieving self-sufficiency in pulses and oilseeds and doubling horticulture and floriculture would be doubled in five years.
- It also results in the forward and backward linkages and embraces an ecosystem of food production, food processing and marketing.

What is needed to usher India into Second Green Revolution?

India needs second green revolution to bring food security to its billion plus population, to remove distress of farming community and to make its agriculture globally competitive. To achieve these goals, yield rates of foodgrains, pulses, oil seeds, dairying and poultry, horticultural crops, and vegetables need to be enhanced; and forward-backward linkages of agriculture with technology, food processing industry needs to be strengthened to match soil to seed and product to market. High productivity and better value addition by agro-processing are its key parameters.

The change in a farmer's mindset is also utmost necessary. A farmer typical believes that thetir role is limited to grow crops only. They must be realized that their scope can increase from grain production to food processing and marketing. Further, the farmers need to be encouraged to move to produce crops where they have natural advantage.

This is possible by concerted efforts towards bridging the technology gap and assuring remunerative prices for the produce. It will require new technologies and better farming practices. In this endeavour, marginal and small farmers and raising agricultural productivity in dry areas need special attention without compromising on preserving soil and water resources. This demands proper coordination, implementation and monitoring of the support policies in addition to allocation of resources.

BGREI

Bringing Green Revolution in Eastern India or BGREI scheme was launched in 2010-11 by the UPA government on the basis of recommendation of a Planning Commission task force. This task force focussed on the degrading soil / groundwater condition of western part of the country and then made a case for shifting the focus of agriculture to the eastern parts of the country by enhancing production of paddy, maize and other crops.

- It recommended that the water guzzling crops such as sugarcane, rice, aquaculture etc. should be gradually shifted from north-western India to Eastern states. It also suggested measures for water use efficiency; increasing irrigation potential; crop diversification etc.
- Further, it suggested that since farmers in eastern region are more prone to risks due to natural calamities such as floods, cyclones, drought etc. the farmers of these states should be protected against such disasters through appropriate safety nets such as effective warning

system; insurance coverage; contingent plans; soft loans etc.

- It also suggested that since the land holdings in Eastern India are small; the government should promote alternative income generating activities such as livestock (mixed farming); aquaculture; forestry etc. Government should also take proactive steps to promote judicious use of natural resources. { http://www.gktoday.in/bgrei/[currentuser_id]}

The BGREI programme is currently running in seven states of Eastern part of the country viz. Assam, Bihar, Chhattisgarh, Jharkhand, Eastern Uttar Pradesh, Orissa and West Bengal.

Evaluation of the BGREI Programme

The BGREI scheme was launched with the call of "Second Green Revolution" in the eastern region of the country and has done fairly in terms of Rice Production due to availability of plenty of water coupled with government efforts.

Rainbow Revolution

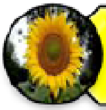
The various colors of the Rainbow Revolution indicate various farm practices such as Green Revolution (Foodgrains), White Revolution (Milk), Yellow Revolution (Oil seeds), Blue Revolution (Fisheries); Golden Revolution (Fruits); Silver Revolution (Eggs), Round Revolution (Potato), Pink Revolution (Meat), Grey Revolution (Fertilizers) and so on. Thus, the concept of Rainbow revolution is an integrated development of crop cultivation, horticulture, forestry, fishery, poultry, animal husbandry and food processing industry.

Green Revolution

- Food grain Production

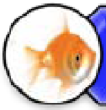
White Revolution

- Milk Production



Yellow Revolution

- Oilseeds Revolution



Blue Revolution

- Fisheries

Golden Revolution

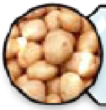
- Fruits

Black / Brown Revolution

- Non Conventional Energy

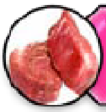
Silver Revolution

- Eggs



Round Revolution

- Potato



Pink Revolution

- Meat

Grey Revolution

- Fertilizers

Red Revolution

- Tomatoes

Foodgrains Management and Public Distribution System

Over 30 Lakh people of our country died due to starvation and malnutrition during the Bengal Famine of 1943, making it one of the greatest disasters in pre-independence India. This famine was a result of several malign natural and man-made factors during the World War-II period. These included – Japanese occupation of Burma (1942-45) cut off all supply to the region; damage to local rice crop due to tidal waves; an epidemic created by a fungal disease; hoarding of rice by the rich; failure of government in equitable distribution of available food crops; disruption of communication etc. The famine ended when Mother Nature bestowed with some better amount of rice in 1944.

After 1947 till death of Jawaharlal Nehru; India gradually entered into creation of scientific infrastructure for improvement of the agricultural productivity. During these years, India established several major and minor irrigation projects; fertilizers factories; agricultural universities etc. By 1968, India had already entered into the Wheat revolution.

The government intervention in public distribution had started in 1940s only but it was given impetus during periods of India-China and India-Pak wars when country face critical shortages of food grains.

The current form of public procurement and distribution of foodgrains aimed at enhancing food security and ensuring food affordability came into existence in 1964 with incorporation of Food Corporation of India to complement the green revolution.

Foodgrains management in the country is based on three basic objectives:

- **Procurement of food grains** from farmers at remunerable prices
- **Distribution of food grains** to the consumers & vulnerable sections of the society
- **Maintenance of a Buffer Stock** for adverse circumstances and maintenance of food security and price stability.

They have been discussed as follows:

Procurement of Foodgrains

Currently, the Public procurement of food grain (rice, wheat, coarse cereals) is undertaken by central government through Food Corporation of India (FCI) in conjunction with state government agencies. A farmer is free to sell foodgrains either at Minimum Support Price to FCI/State Agencies; or in open market if they get better price than MSP. Foodgrains procured by the State Governments and their agencies are ultimately taken over by the FCI for distribution throughout the country via the Public Distribution System.

Minimum Support Price Scheme

The Minimum Support Prices were announced by the Government of India for the first time in

1966-67 for Wheat in the wake of the Green Revolution and extended harvest, to save the farmers from depleting profits. Since then, the MSP regime has been expanded to many crops. Minimum Support Price is the price at which government purchases crops from the farmers, whatever may be the price for the crops. The MSP is announced by the Government of India for **25 crops currently** at the beginning of each season viz. Rabi and Kharif. Following are the 25 crops covered by MSP:

Kharif Crops		Rabi Crops	
1	Paddy	15	Wheat
2	Jowar	16	Barley
3	Bajra	17	Gram
4	Maize	18	Masur (Lentil)
5	Ragi	19	Rapeseed/Mustard
6	Arhar(Tur)	20	Safflower
7	Moong	21	Toria
8	Urad	**Other Crops**	
9	Cotton	22	Copra
10	Groundnut	23	De-Husked Coconut
11	Sunflower Seed	24	Jute
12	Soyabeen Black	25	Sugarcane
13	Sesamum		
14	Nigerseed		

Rationale behind MSP

If there is a fall in the prices of the crops, after a bumper harvest, the government purchases at the MSP and this is the reason that the priced cannot go below MSP. So this directly helps the farmers.

How MSP is decided?

The government decided the support prices for various agricultural commodities after taking into account the following:

- Recommendations of Commission for Agricultural Costs and Prices

- Views of State Governments
- Views of Ministries
- Other relevant factors.

Price Support Scheme (PSS) for Oil seeds and Pulses

The Department of Agriculture and Cooperation implements the Price Support Scheme for **Oil Seeds and Pulses** through the National Agricultural Cooperative Marketing Federation of India Ltd. (NAFED). NAFED is the nodal procurement agency for Oilseeds and pulses, apart from the Cotton Corporation of India. So, when the prices of oilseeds, pulses and cotton fall below MSP, **NAFED purchases them from the farmers.**

Distribution of Foodgrains

Distribution of essential commodities to larger section of the society, mostly vulnerable people, through a network of fair Price Shops on a recurring basis is done by the Public Distribution System (PDS). This system is jointly operated by the Central and State Governments. The Central government, through FCI has following responsibilities:

- Procurement, storage, transportation of food grains. Procurement is done at Minimum Support Prices.

- Bulk allocation of food grains to the State Governments, which in turn deliver the same to recipients. This is done at Central Issue Price (CIP)

Minimum Support Price (MSP) is the price at which central government procures the foodgrains from farmers. Central Issue Price (CIP) is the price at which government makes these foodgrains available to states. The states fix retail price to be charged at fair price shops.

The state government's responsibility in PDS is operational. It includes:

- Identification of families below the poverty line
- Issue of Ration Cards
- Supervision of the functioning of FPS.

The PDS commodities viz. wheat, rice, sugar and kerosene, **are allocated to the States/UTs** for distribution by the Central Government. Cloth, exercise books, pulses, salt and tea, etc. are distributed by the state governments.

RPDS and TPDS

Initially, the public distribution system was untargeted so any consumer could approach the Fair Price Shops to get the available commodities. This system was criticized due to ignorance of the poor and vulnerable. In 1990s, the system was first changed to Revamped PDS (RPDS) and then later to Targeted PDS (TPDS). The focus of TPDS is "poor in all areas". In this system the states were

allocated food grains meant only for BPL people. But since sudden withdrawal of APL from the TPDS was not appropriate; the central government also made a "Transitory Allocation" for APL population. The retail prices of the Transitory Allocation were set little higher than the BPL prices. Initially, the allocation for a BPL household was made to be 10 Kg per month. Later, the Vajpayee Government launched Antyodaya Anna Yojana (AAY) which increased this to 20 Kg. per family per month. This was further increased to 25 kgs in 2001 and currently stands as 35 kilogram.

Identification of Poor

Under the TPDS, the state governments had responsibility of identifying the poor. The states identified the poor on the basis of some planning commission formulae such as Lakdawala formula.

Maintenance of Buffer stocks

The Food Corporation of India is the main agency for procurement, storage and distribution of food grains. In addition to the requirements of wheat and rice under the Targeted PDS, the Central Pool is required to have sufficient stocks of these in order to meet any emergencies like drought/failures of crop, as well as to enable open market intervention in case of price rise.

What are Buffer Norms?

The Buffer norms are the minimum food grains the Centre should have in the Central pool at the beginning of each quarter to meet requirement of public distribution system and other welfare measures. The last changes in the Buffer norms were done in July 2013. According to the norm the buffer norms of food grains in the Central Pool are follows:

Revision of buffer norms of foodgrains in the Central Pool		
As on	Existing since April, 2005	Revised
1st April	21.2	21.04
1st July	31.9	41.12
1st Oct	21.2	30.77
1st Jan	25	21.41
in million tones		

The Central pool requires **maximum** 41.12 million tonnes o be maintained in the second quarter as on July 1. The FCI has been constructing storage capacity for holding buffer and operational stocks of food grains at nodal points in the country. The storage capacities available with FCI are mainly used for storage of food grains and partly for other commodities and general warehousing.

Objectives of Buffer Stocks

The buffer stocks are required to

- Feed TPDS and other welfare schemes,
- Ensure food security during the periods when production is short of normal demand during bad agricultural years
- Stabilize prices during period of production shortfall through open market sales.

What are the Current Buffer Stocks?

As against the buffer stock norm of 21.41 million tonnes of rice and wheat (as on 1January of each year), total central pool stocks were 61.6 million tonnes as on 1 January 2015. This shows India's comfortable position in the buffer stock. However, it has raised the questions over the storage capability of the FCI and rotting grains in the open god downs in the country. The issue of storage had also been taken to the Supreme Court, which suggested that government should distribute the grains free to the poor. The problem is immense, but solution of this problem is not instant. The FCI has to increase the storage capacity to accommodate the record procurement which is expected this year because of a very good monsoon.

Current Buffer Stock Policy of Government

The current buffer norms were revised in January 2015. According to the new norms, the central pool should have 41.1 million tonnes of rice and wheat on July 1 and 30.7 million tonnes on October 1 every year.

These limits were 32 million tonnes and 21 million tonnes earlier. The stocking norms for the quarters beginning January 1 and April 1 have been revised only marginally. The key drivers for increased buffer stocks were increased off take from the TPDS system and also enactment of National Food Security Act.

We note here that FCI buys almost one third of the total rice and wheat produced in the country at minimum support prices! It does not say no to any farmer who wants to sell his produce at MSP. But then it also needs to maintain an excessive, unmanageable and fiscally burdensome food inventory. Earlier, once the buffer norms were met, cabinet approval was needed to sell any part of it in the open market. But then, in January 2015; this situation changed.

The current policy is that Food Ministry is authorized to dispose the surplus stock into open market without seeking cabinet approval. This was a key policy decision and it was needed to iron out the problem of burdensome inventories at FCI and distortion created in market.

Key Issues with Food Corporation of India

About FCI

The Nodal Agency in Food Management is Food Corporation of India, which is responsible to

procure, store and distribute the foodgrains. FCI is a statutory body established via Food Corporation Act 1964 to meet the following objectives of the Food Policy:

1. Effective price support operations for safeguarding the interests of the farmers.
2. Distribution of food grains throughout the country for public distribution system
3. Maintaining satisfactory level of operational and buffer stocks of food grains to ensure National Food Security

For the purpose of its functions; FCI has divided the entire country into five zones viz. North, South, East, West and North-East with a zonal office in each zone. Out of them, the largest zone is North Zone comprising eight states including Punjab and Haryana.

FCI was established in 1964 to handle the shortage of food grains clubbed with black marketing of the food grains by hoarders was a reason for the government to take some action for the containment of rise in food grains prices and ensured access of food to **urban consumers**. The PDS network expanded in 1970s and 1980s, after the Green Revolution.

In the 1980s, the PDS coverage was extended to the rural areas. By 1985, efforts were made to make it available to all the tribal blocks of the country. Today, with the network of around 5 Lakh fair price shops PDS is virtually world's largest system of its kind.

Issues with Food Corporation of India

India has come a long way from the time it was struggling with food shortages way back in 1960. Now instead of shortages India faces a problem of plenty and lack of storage facilities.

- FCI which was entrusted the responsibility of providing benefits to farmers at the grass-root level has not been able to shoulder the same effectively leaving aside a few states.
- Also, there have many glaring leakages in the Targeted Public Distribution Scheme.
- Further on, the organization has not been to manage its expenses well and has high operational costs and has to pay a hefty sum as interest. The diseconomies of scale have seeped-in. The organisation needs to be more lean and expand to non-traditional food-grain producing states for procurement.
- Elections are time when government gives incentive to farmers by raising the MSP. The price recommendations are given by Commission for Agricultural Costs and Prices, but is implemented by the government. The FCI, has been ensuring a smooth procurement pattern irrespective of MSP. This has led to huge rotting stocks of food-grains due to lack of storage facilities. Such huge stocks pose the problem of subsidy (Subsidy is the difference between economic cost of procuring, storing and distributing food grains). The sales at issue prices (determined by government are monitored by FCI. Thus, FCI has little or basically no control

over either MSP or the Issue Price.

Shanta Kumar High Level Committee

The Central government in August 2-14 set-up a high level committee to study the core issues of FCI and make suitable recommendations to restructure FCI to improve its operational efficiency and financial management.

Key Recommendations of Shanta Kumar Committee

1. FCI should transfer all procurement operations atleast to states who have considerable experience and infrastructure. These are Andhra Pradesh, Chhattisgarh, Haryana, Madhya Pradesh, Odisha and Punjab. FCI should instead procure only the surplus which is contributed to the Central pool by these states to support farmers in distress due to small landholdings and thus have to settle with a sale price far below the MSP in states like UP, Bihar, West Bengal, Assam. In addition, it should channelize this surplus for various subsidy acts like NFSA.
2. There should be uniformity and rationality in procurement operations by implementing 3 points:
3. The Centre will not accept any additional/surplus food-grains from states who give subsidy/bonus to farmers above the MSP. Such states will have to bear all costs (storage and distribution) themselves.
4. Uniform statutory levies among all states around 3 or 4% of MSP.
5. Stringent quality checks at the when accepting food grains for Central pool.
6. Encourage and speeden the Negotiable Warehouse Receipt System (NWRS) under which farmers can park their produce in registered warehouses and even get upto 80% advance from banks @ MSP. This will considerably reduce the storage costs and responsibility of the government.
7. Prioritise pulses and oilseeds and their MSP should be taken seriously and implemented uniformly across the country. MSP has been largely operational in wheat and rice and that too only in some select states, while the other important food-grains have suffered in their backdrop. Also, Government should streamline trade policy and MSP.
8. NFSA should be revised with no subsidy to be offered to states which don't have computerised the list of beneficiaries (which can be verified) and have not set up vigilance committees to check pilferage. This has been done to plug leakages in the PDS whose range in some states has gone upto 70%.
9. The coverage of NFSA should be brought down from 67% population to 40%. This will comfortably cover the BPL population and even some above that. Also, the targeted

beneficiaries must be given 6 months ration in advance, right after the procurement season draws to a close. This will bring down storage overheads borne by government and procurement agencies.

10. Another landmark recommendation is the introduction of cash transfers in PDS in cities with a population of over 1 million. These can be done via Aadhaar numbers of Pradhan Mantri Jan Dhan Yojana.
11. FCI should outsource its food-grain stocking operations to agencies like CWC, SWC, private warehouses etc.
12. Direct Cash Transfers to farmers (@ INR 7000/ha) to help them raise productivity and overall food production in the country. This will empower them and reduce their dependence on money-lenders.
13. Complete end-to-end computerisation of the food management system in India.

Thus, though the recommendations may seem to plug-in many loopholes but such massive restructuring will not bear much fruit as the main issue of food pricing and storage are not done by suo moto decisions of FCI. Also, with NFSA in place it is highly unlikely that government can roll-back subsidies for the time-being. MSP has brought in obligations for better storage facilities. The underlying question is thus, how far these recommendations will be adopted, in face of stiff reluctance from some states.

Food Security & National Food Security Act

Since 1990s, the food security has been a consistent theme raised in specific contexts in various conferences convened by the United Nations and other organizations. The joint FAO/WTO Conference on Nutrition, Rome, 1992, made two important declarations as follows:

- "Hunger and malnutrition are unacceptable in a world that has both the knowledge and the resources to end this human catastrophe"
- "Access to nutritionally adequate and safe food is a right of each individual"

That every individual enjoys right to food, was also emphasized in the World Conference on Human Rights, Vienna, 1993. In 1994 at Cairo, the International Conference on Population and Development emphasized the linkage between Population Growth and Food Production and the need to evolve global measures to satisfy the ever-growing food needs.

Food Security: Definition and Basic Elements

The concept of food security has evolved over last three decades. According to a 1983 FAO concept; food security implies physical and economic access to the basic food to all the people at all the times of their need. Thus, **availability of food** and **ability to acquire it** are the essential elements of

Food Security.

A household is food secure when it has access to the food needed for a healthy life for all its members in adequate quality and quantity; and there is no undue risk to lose such access.

In a wider approach, Food security also includes livelihood security; access to safe drinking water; access to primary education, healthcare and sanitation.

Chronic and Transitory Food Insecurity

According to World Bank, Chronic food insecurity reflects continuous inadequate diet caused by the inability to acquire food. It affects household that persistently lack the ability to either buy food or to produce their own. On the other hand, transitory food insecurity is defined as a *temporary decline in the household's* access to enough food. It results from instability in food prices, food production and household income. The transitory food insecurity in its worst form produces famine.

Extent of Food Insecurity in India

India is on 55th place in Global Hunger Index – 2014. This rank is better than Pakistan and Bangladesh but trails behind countries like Thailand, China, Ghana, Iraq, Sri Lanka and Nepal. The key problem that puts India at such a low position is of underweight children. India ranks 120th among 128 countries with data on child under nutrition from 2009-2013. According to the annual "State of Food Insecurity in the World -2015" report by FAO released in May 2015, India has 194.6 million undernourished people, which is highest in the world. India's food insecurity problem is mainly aggravated by child and women malnutrition.

Genesis of Food Security Legislation

National Food Security Act was first proposed in 2010 by the National Advisory Council (NAC), an extra constitutional body in the times of UPA government, headed by Sonia Gandhi. In summary, the proposal was to provide food security to 75% of India's total population by means of an act of parliament. This 75% population was made of 90% rural and 50% urban population. The 75% beneficiaries were further divided into two groups viz. Priority Group and General Group. Priority group was BPL and General Group was APL. The proposed act provided that the Priority Group household would get 35Kg of food grain per month at Rs. 1/kg for millets, Rs. 2 /Kg for wheat and Rs. 3/Kg of Rice. On the other hand, the General Group household would get 20Kg of food grains per month at 50% of the Minimum Support Prices.

The proposals were criticised because they rendered 25% people ineligible for food security and created three fractions of Indian population: One- who were secure (25%) as per NAC, two-the priority group and three- the general group. Further, covering 75% of the population would put a huge burden on Government exchequer.

A draft bill was prepared and was scrutinized by C Rangarajan committee. This committee suggested

that at current (2011) levels of foodgrains production; it was virtually not possible to cover both BPL as well as APL population. So, it recommended only BPL to be covered in the act for legal entitlement of the subsidized foodgrains. The committee put forward that the subsidy bill to implement this act would be in the tune of Rs. 83,000 Crore if every household eligible lifts all for that it is entitled to.

With some changes into composition of the priority and general group, the cabinet approved the bill and was introduced for the first time in December 2011. This new bill came with several types of beneficiaries such as priority group; general group; destitute; homeless and so on. Obviously the bill would make identification of the beneficiaries' headache for the states. When the bill went to standing committee of the parliament, the committee rejected idea of several categories of the beneficiaries and recommended one uniform category; which includes the beneficiaries. Rest all would get 5Kg of subsidized foodgrains. Several other issues such as allocation of foodgrains to states; reforms in TPDS; Cash Transfers etc. were remained unaddressed.

The bill was finally revised as National Food Security Bill 2013 which, once becomes an act would give legal entitlement to 67% population under TPDS. Each beneficiary will be entitled to 5 kg of rice, wheat or coarse cereals at Rs. 3, 2 and Re. 1 a kg a month and will be identified by the States based on parameters prescribed by the Union government. At the same time, the 2.43 crore Antyodaya Anna Yojna beneficiary households will continue to get their quota of 35 kg grains a month under the TPDS.

Since election was not far away, the UPA government brought National Food Security Ordinance in 2013. On September 10, 2013, the National Food Security Act got president's assent and become an act. [currentuser_id]

Ordinance

An ordinance is an executive order to pass laws when Parliament is not in session. It remains effective for six months from the date of passage within which period it must be replaced with a permanent law that needs to be passed by both houses of Parliament.

Key Features and Current Status of NFSA-2013

National Food Security Act 2013 extends to whole of India and it was to be rolled out by the states within one year of its enactment. But, majority of the states were not able to do this mainly because it required computerization of the beneficiaries lists as a prerequisite. Currently, some 14-15 states have rolled out the act; and the last date to roll out the act is fixed 30th September 2015 by Union

Government. This deadline has been extended from time to time.

Who are Beneficiaries?

The act provides legal food security to 67% of population of India. The eligible person gets Rice @Rs. 3 per Kg, Wheat @Rs. 2 per Kg and Coarse Grains @Rs. 1 Kg per month subject to maximum 5Kg per month. These prices are fixed in the schedule of the act and can be amended after three years. However, the beneficiaries covered under Antyodaya Anna Yojana will keep receiving the 35Kg per household per month at same rates. Further, this act covers infants, children and lactating women with different entitlements for them. For example, it guarantees age appropriate meal, free of charge through local anganwadi for children up to 6 months and one free meal for children in age group 6-14 years in schools. Every pregnant and lactating mother is entitled to a free meal at the local anganwadi (during pregnancy and six months after child birth) as well as maternity benefits of Rs 6,000, in instalments. Maternal benefits not extend to Government employees.

Identification of beneficiaries

The identification of eligible households is left to state governments, subject to the scheme's guidelines for Antyodaya, and subject to guidelines to be "specified" by the state government for Priority households. The lists of eligible households are to be placed in the public domain and "displayed prominently" by state governments.

State Food Commissions

The act provides for the creation of State Food Commissions. Each Commission shall consist of a **chairperson**, **five other members** and a member-secretary (including at least two women and one member each from Scheduled Castes and Scheduled Tribes).

The main function of the State Commission is to monitor and evaluate the implementation of the act, give advice to the states governments and their agencies, and inquire into violations of entitlements (either suo motu or on receipt of a complaint, and with "all the powers of a civil court while trying a suit under the Code of Civil Procedure 1908"). State Commissions also have to hear appeals against orders of the District Grievance Redressal Officer.

Each state commission is required to prepare annual reports to be laid before the state legislature. Two or more states can have Joint Food Commissions with the approval of the Central Government.

The State Commission may forward "any case" to a Magistrate having jurisdiction, which shall proceed as if the case has been forwarded under Section 346 of the Code of Criminal Procedure 1973.

Two-tier grievance redressal structure

NFSA-2013 provides for a two-tier grievance redressal structure, involving the **District Grievance Redressal Officer (DGRO)** and **State Food Commission**. State governments also must put in place

an internal grievance redressal mechanism which may include call centres, help lines, designation of nodal officers, "or such other mechanisms as may be prescribed".

DGROS shall be appointed by state governments for each district to hear complaints and take necessary action according to norms to be prescribed by state governments. If a complainant (or the officer or authority against whom an order has been passed by the DGRO) is not satisfied, he or she may file an appeal before the State Food Commission.

Transparency Provisions

- Placing all PDS-related records in the public domain and keeping them open for inspection to the public
- Conducting periodic social audits of the PDS and other welfare schemes;
- Using information and communication technology (including end-toend computerisation of the PDS) "to ensure transparent recording of transactions at all levels"
- Setting up vigilance committees at state, district, block and fair price shop levels to supervise all schemes under the act.

PDS Reforms

- Doorstep delivery of foodgrains
- ICT applications and end-to-end computerisation
- Leveraging "aadhaar" (UID) for unique identification of entitled beneficiaries
- Full transparency of records
- Preference to public institutions or bodies in licensing of fair price shops
- Management of fair price shops by women or their collectives
- Diversification of commodities distributed under the PDS
- Full transparency of records
- Introducing schemes such as cash transfer, food coupons or other schemes to the targeted beneficiaries in lieu of their food grain entitlements" as prescribed by the central government.

Women Empowerment

- The eldest woman who is not less than 18 years of age, in every eligible household, shall be head of the household for the purpose of issue of ration cards.
- Where a household at any time does not have a woman or a woman of eighteen years of age or above, but has a female member below the age of 18 years, then, the eldest male member of the household shall be the head of the household for the purpose of issue of ration card and the female member, on attaining the age of 18 years, shall become the head of the household for such ration cards in place of such male member

Obligations of the Governments and Local Authorities

- **Central Government:** The main obligation of the Central Government is to provide foodgrains (or, failing that, funds) to state governments, at prices specified in Schedule I, to implement the main entitlements. It also has to "provide assistance" to state governments to meet local distribution costs, but on its own terms ("as may be prescribed"). The Central Government has wide-ranging powers to make Rules.
- **State Government:** The main obligation of state governments is to implement the relevant schemes, in accordance with the guidelines issued by the Central Government. State governments also have wide-ranging powers to make Rules. They are free to extend benefits and entitlements beyond what is prescribed in the act, from their own resources.
- **Local Governments:** Local Authorities and Panchayati Raj Institutions are responsible for proper implementation of the act in their respective areas, and may be given additional responsibilities by notification.

Key Topics around NFSA-2013

NFSA and Human Life Cycle Approach

The text of the National Food Security Act mentions it as an act to provide for food and nutritional security in "human life cycle approach, by ensuring access to adequate quantity of quality food at affordable prices to people to live a life with dignity."

Life cycle approach here implies that the Food Security Act has given legal entitlement to appropriate food throughout the life cycle of a human being beginning from pregnancy to old age. This means that the act provides "Right to Food" at every stage of a person's life as follows:

- **Right to Food at Pregnancy:** State Government shall provide all pregnant and nursing women the – Take-home rations or nutritious and freshly cooked meals, free of charge, during pregnancy and 6 months thereafter through the local Anganwadis so as to meet the nutrition standards as well as maternity benefits of Rs. 1000 per month, for a period of six month. (Women in Government service don't come under this rule).
- **Right to food for Children between 0-6 years:** State Government shall provide nutritious Take Home Rations and/or local and freshly cooked meals throughout the year through the local Anganwadi to all children in the age group of 0 – 3 years. The State Government will also provide the local and freshly cooked meal in the local Anganwadi, for at least 300 days in a year to all children in the age group of 3 to 6 years.
- **Children of 6-14 years:** State Government shall provide all children of the age group 6 to 14 years, at least one freshly cooked nutritious midday meal in all schools run by local bodies, government and government-aided schools up to Class 8 or beyond, as may be specified by

the central and state governments from time to time, everyday of the year, except school holidays, of equal or greater amount, as per norms specified. However, a child cannot be denied of food in whatever condition. Any child below the age of 14, including those that are out-of-school, may approach any feeding facility such as Anganwadis centre, school mid-day meal for a freshly cooked nutritious meal.

- **Above 14 Years**: The eligible person gets Rice @Rs. 3 per Kg, Wheat @Rs. 2 per Kg and Coarse Grains @Rs. 1 Kg per month subject to maximum 5Kg per month.

Key Issues around the Act

There have been different concerns of various sections of the society with reference to the Food Security Act. These have been discussed below:

Distortion of agricultural patterns

- Small farmers who go grow grains for personal consumption may shift to other crops to make more money and buy subsidised grain.
- Assured of cheap food, small farmers that produced grain for self consumption may stop cultivating cereals and shift to other crops. This can affect food grain output.

India could become massively dependent on imports

- India's commodity imports tend to move global prices. Should India be forced to buy grain from international market because of the food security law, it would have to pay heavy prices.

One-third population may have to pay steep prices

- The government will need to procure food grains in large quantities to meet the demands of the law. This would require sharp increase in minimum support prices to incentivise farmers. As a result there could be lower supply in open market.

Food subsidy bill will rise sharply

- The cost at which the Food Ministry will make additional grain available is an issue to be considered. A wide coverage and throwaway issue price for foodgrains under the scheme will increase food subsidy sharply.
- It may squeeze out private traders from the grain market, giving state agencies such as the Food Corporation of India total dominance in the trade.
- It may put a huge subsidy burden on the government, which can derail the fiscal situation.

Overall inflation will rise

- If a major rice-consuming State such as Tamil Nadu enters the open market, seeking to procure rice in huge quantities, the price of the commodity will naturally increase.
- Higher MSP for cereals and demand for other food items because of lower household spending on cereals will push up food inflation and the overall inflation.

Overall corruption and malpractices may rise

- There may be many leakages and malpractices.
- Irregular supply of ration is a bigger issue that getting ration at subsidised rates. The accessibility and quantity wheat or rice made available to the poor is always at the discretion of the ration shopkeeper. The government must ensure to curb hoarding of food grain.
- Responsibility and accountability should be strictly enforced, without any leniency of any type.

Why Principle of self exclusion can be helpful in effective implementation?

The National Food Security Act has a novel concept of **conception to cremation lifecycle approach**. Besides putting a number of transparent criteria for excluding those from food security, self exclusion should be the guiding principle. The people who do not need food should not ask for it. Even if you include a man who should be excluded doesn't matter. But never should a deserving man be excluded. Freedom from hunger is freedom from corruption. The implementation of the act must be based on a culture of honesty.

General Knowledge Today

Agriculture-5: Irrigation, Government Schemes

Integrated IAS General Studies:2016-17
Last Updated: February 15, 2016
Published by: GKTODAY.IN

Contents

Model Questions

1. What do you understand by Command Area? Objectively differentiate between Gross Command Area and Culturable Command Area.
2. Differentiate between Minor, Medium and Major Irrigation Schemes. Bring out their relative importance.
3. "Despite of heavy public expenditure on canals, our governments have not been able to reduce the groundwater depletion." Critically examine the issue.
4. What do you understand by Command Area Development? Why successive governments have failed in Command Area Development?
5. "The soul of any government scheme lies in its implementation." With this reference, critically discuss the drawbacks of Command Area Development Programme and Accelerated Irrigation Benefit Programme (AIBP). In your view, how the recently launched Pradhan Mantri Krishi Sinchayi Yojana addresses these issues? Discuss.
6. Examine the different methods of irrigation practised in India and bring out their relative importance.
7. What is drip irrigation? Why is it considered the most efficient method of irrigation?
8. What do you understand by Microirrigation? Discuss its importance to a country like India.
9. "In the resource constrained and dry areas, the farming is a survival mechanism rather than a growth oriented activity." With this reference bring out various problems faced by farmers in Rainfed Areas.
10. Differentiate between Dryland Farming and Rainfed Farming. Discuss the relative importance of both for Indian agriculture.
11. "Both demand and supply of agriculture produce are inelastic." Explain throwing light on importance of agricultural marketing in India.
12. "Agricultural produce undergoes a series of exchanges from one hand to another before it finally reaches the consumer." With this reference discuss the facilities needed for efficient agricultural marketing?
13. Bring out the various problems of Agricultural Marketing System in India.
14. What do you understand by Contract Farming? Discuss the provisions made in APMC act for promotion of Contract Farming in India.
15. Centre had circulated the Model Agricultural Produce Marketing Committee (APMC) Act in 2003 and asked them to amend their APMC laws accordingly. However, many states are reluctant to do so. Examine the issue.

16. What do you understand by operational land holding? Discuss various types of Land Holdings in India.
17. Discuss the need and importance of Soil Health Card. Evaluate the progress done by government in Soil Health Card scheme so far.

Irrigation & Irrigation Systems

Irrigation refers to artificial application of water to crops. It is one of the most important critical inputs for enhancing the productivity that is required at different critical stages of plant growth of various crops for optimum production.

Our farmers have access to irrigation either from surface water or from groundwater. Surface irrigation is largely done via small and large dams and a network of canals, ponds or rivers. The irrigation from these can be either gravity-fed (water naturally flows in farms under gravity e.g. canals) or lift irrigation scheme (needs electrical / fuel power such as groundwater, river run off etc.)

Key Concepts

Gross Command Area and Cultivable / Cultural Command Area

These terms are mainly used in canal irrigation engineering. When a new canal is constructed, the engineers create its design maps etc. While doing so, they chalk out the entire area within an imaginary line that can be included in the irrigation project under development. This Gross Command Area (GCA) includes cultivable land as well as barren land, forests, houses, wasteland, roads etc.

Cultivable Command Area is that part of Gross Command Area, which is fit for cultivating crops. So, cultivable area excludes forest and barren land from the Gross Command Area. What is left is uncultivable area.

Gross Command Area=Cultivable Command Area + Uncultivable Area

The key feature of cultural command area is that it can be physically irrigated from a scheme and is fit for cultivation of crops.

Gross Irrigated Area and Net Irrigated Area

We can classify the irrigated area into gross and net irrigated area. The Net Irrigated Area is the actual land area on which irrigation was used for growing crops for as many times as many in an agricultural year {Agricultural Year is from 1st July to 30th June}. On the other hand, Gross irrigated area is the total irrigated area under various crops during the year counting the area irrigated under more than one crop during the same year as many times as the number of crops grown, crops sown mixed being taken as one crop. Thus, if a crop is grown for more than one time in an agricultural year, the Gross Irrigated Area will count the irrigated area for more than once. We note here that out of about 141 m. Ha of net area sown in the country, about 65 million hectare (or 45%) is presently covered under irrigation.

Irrigation Potential Created and Irrigation Potential Utilized

There is a huge difference between irrigation potential created and utilized. Irrigation potential

created is the total area which can be irrigated from a project on its full utilization. This implies that before an area is to be reported under "potential created", it is to be ensured that:

- Water is available for the area to be irrigated in each season during a complete irrigation year
- Conveyance system is available to carry water up to where it is needed
- The projected cropping pattern of the region is satisfactorily adhered to.

This implies that Irrigated Potential Created denotes full utilization. If the area actually irrigated is smaller than the potential created, it denotes under-utilization. Thus, irrigation utilization is percentage of actual irrigated area to potential created.

> We note here that the Irrigation potential 'created' figures are generally inflated figures and they are declared without paying attention to construction of proper construction network. Sometimes, even if water is available, it cannot be taken to the farm where it is actually needed; but potential created is shown in papers.

Thus, while the irrigated area created is merely a notional figure. The irrigation potential utilized is gross cultivable area actually irrigated during 1993-94 out of the gross proposed area to be irrigated by the scheme during the year.

Minor, Medium and Major Irrigation Schemes

A minor irrigation scheme has Cultural Command Area (CCA) up to 2000 Hectares. A medium Irrigation scheme has CCA from 2000 Hectares to 10000 Hectares. A major irrigation scheme has a CCA above 10,000 hectares.

Further, Micro-irrigation encompasses drip and sprinkler technologies which have helped in getting more crop per drop.

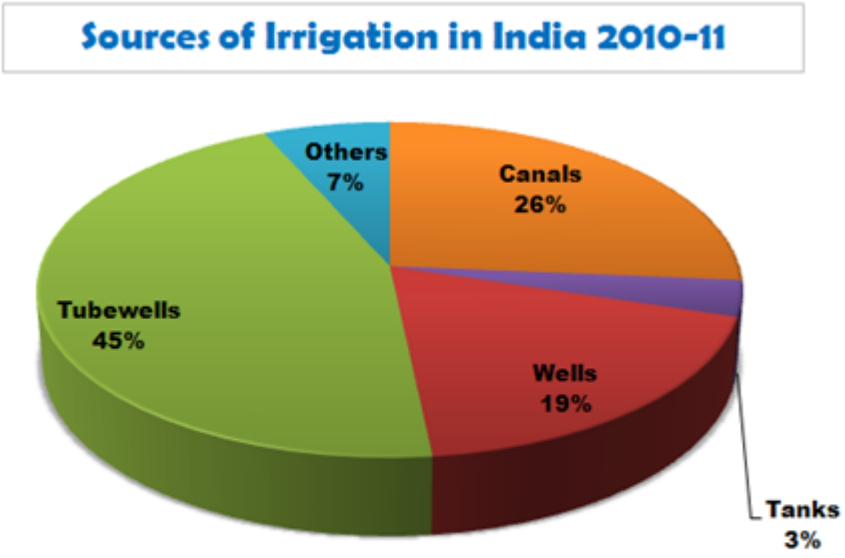
Sources of Irrigation

According to Agricultural Census 2010-11, India's total area under irrigation is 64.7 million hectares. Of this maximum 45% is shared by tube wells followed by Canals and wells.

Sources of Irrigation in India 2010-11

Canals	Tanks	Wells	Tubewells	Others	Total
17005.7	2249.48	11972	29108.2	4289.29	64624.7

Department of Agriculture and Cooperation (Agricultural Census 2010-11).



Department of Agriculture and Cooperation (Agricultural Census 2010-11).

We note here that since 1950-51, the government had given considerable importance to the development of command area under canals. In 1950-51, the Canal irrigated area was 8.3 million hectares and it currently stands at 17 million hectares. Despite that, the relative importance of Canals has come down from 40% in 1951 to 26% in 2010-11. On the other hand, the well and tube well accounted for 29% total irrigated area and now they share 64% of the total irrigated area.

This implies that "despite of heavy public expenditure on canals, our governments have not been able to reduce the groundwater depletion" done by the remarkable progress of the tube wells in last many decades. The key reason is widening gap between irrigation potential created and actually utilized.

States under Well Irrigation

- Well Irrigation is common in alluvial plains of the country except the deserts of Rajasthan. Plains of UP, Bihar, Gujarat, Karnataka & Tamil Nadu are the states which are more prominently under the well irrigation.

States under Canal irrigation

Canals are second most important source of irrigation in India after wells and tube wells. The Canals are irrigating those lands which have large plains, fertile soils and perennial rivers. The plains of

North India are mostly canal irrigated. Other parts are coastal low lands and some parts of Peninsular India. The states are: Andhra Pradesh, Assam, Haryana, Jammu & Kashmir, West Bengal, Punjab Rajasthan, Bihar, Karnataka, Tamilnadu and UP.

Major States under Tank irrigation:

The Tank irrigation is more in the rocky plateau area of the county, where the rainfall is uneven and highly seasonal. The Eastern Madhya Pradesh, Chhattisgarh, Orissa, Interiors of Tamil Nadu and some parts of Andhra Pradesh have more land under tank irrigation.

Command Area Development Programme

Command Area Development programme was launched to narrow the gap between irrigation potential created and actually utilized in major and medium irrigation schemes

In all five year plans, considerable importance was given to the creation of additional irrigation potential. However, the potential actually utilized was much below. The irrigation potential created over the years in major and medium works was not been fully utilised and the gap between the potential created and the actual utilisation was widening.

This non-utilization occurred mainly because there was a delay in construction of the field channels and drains. Lack of involvement of farmers is also an important constraint.

In 1974-75, the Government of India launched the Command Area Development programme to bridge / narrow the gap between irrigation potential created and actually utilized in major and medium irrigation schemes. This scheme was supposed to develop adequate delivery of the irrigation water up to the fields. A Command Area Development Authority was established to maximize the productivity in the irrigation command areas through an integrated approach with the following components:

- Construction of field channels and field drains
- Land shaping wherever necessary
- Introduction of rotational supply of water to ensure equitable and assured distribution to individual farm holdings.

But the CAD Programme was not particularly successful because of three constraints:

- The water supply at the outlet was unreliable
- The available technology was could not be adopted properly
- Farmers particularly did not participate in the scheme.

This programme was restructured and renamed as Command Area Development and Water

Management Programme (CADWMP) since April 1, 2004. The scheme was further restructured and was thrown to states to implement in 2008-09.

Currently, Command Area Development Programme has also been amalgamated with the AIBP to reduce the gap between irrigation potential that has been created and that is utilized.

Accelerated Irrigation Benefits Programme

The Central Government launched the Accelerated Irrigation Benefit Programme (AIBP) from 1996-97 for extending loan assistance to states for the completion of near complete irrigation scheme.

Rationale and Objectives

AIBP was specifically started because a large number of river valley projects – both major and medium – have spilled from plan to plan, mainly because of financial constraints of state govermnents. Some of these projects were in an advanced stage of construction and could provide irrigation benefits in four or five agricultural seasons. The completion of these projects, however, was beyond the resources capability of the State Govermnents.

Assistance Provided

The assistance provided was entirely in the form on loan in the beginning but later a grant component was also added in 2005. The central support was further relaxed in 2006 for special category states, DPAP (Drought Prone Area Programme) states, Tribal Areas, Flood Prone Areas and KBK(Koraput-Balangir-Kalahandi) area of Odisha. In these areas Central Government would provide 90% of the project cost only as grant.

Up to 31 December 2014, the Central Government has released a whopping Rs. 67195 Crore as central loan /grant on this scheme. According to papers, this has resulted in creation of 85 Lakh hectare potential.

Evaluation of AIBP Programme

Creating irrigation potential and making it actually deliver are two different things. If we look at the CAG and PAC reports, we find that this scheme has neither achieved desired results nor was saved from irregularities. In fact, a 2011 PAC report called it a big scam, bigger than many others.

Why these schemes fail?

Unless there is a strong monitoring system, such schemes easily fall prey to glaring deficiencies and irregularities resulting into time and cost over runs. The key reasons as to why both CAD and AIBP schemes failed to deliver is that the work is confined to construction of the main canal. Unless distributory network is properly in place, the main canal is useless. Poor planning and lack of proper

monitoring by Central Water resources ministry has been main reason for these under achievements.

Pradhan Mantri Krishi Sinchayi Yojana

The NDA government has launched the Pradhan Mantri Krishi Sinchayi Yojana, which heavily borrows from the Accelerated Irrigation Benefits Programme; but tries to replace the fragmented approach with an integrated approach aiming at convergence of investments in irrigation.

This scheme has amalgamated three ongoing programmes of three different ministries as follows:

- Accelerated Irrigation Benefit Programme of the Ministry of Water Resources
- Integrated Watershed Management Programme of the Ministry of Rural Development
- Farm water management component of the National Mission on Sustainable Agriculture.

Thus, with the launch of this scheme, it is believed that various ministries, departments, agencies, financial institutions engaged in creation, use and recycling of water will be brought under one platform to take into account the entire water-cycle and does proper water budgeting for all sectors such as households, agriculture and industries.

Allocation

This scheme has an allocation of Rs. 50,000 Crore for next five years. Rs 5,300 crore was allocated in budget for 2015-16.

Objectives

The broad objectives of PMKSY are as follows:

- Converge investments in irrigation at the farm level and provide end-to-end solution
- **Har Khet ko Pani:** Enhance the physical access of water on the farm and expand cultivable area under assured irrigation
- Integration of source, distribution, efficient use of water through appropriate technology and practice
- Enhance adoption of precision-irrigation and other water saving technologies under **More Crop Per Drop.**
- **Promotion of** micro-irrigation in the form of drips, sprinklers, pivots, rain-guns in the farm (**Jal Sinchan**)
- Enhance recharge of aquifers; promote sustainable water conservation
- Ensure integrated development of Rainfed areas
- Water harvesting, water management and crop alignment, explore feasibility of reusing treated municipal waste water for peri-urban agriculture and attarct greater private investments in irrigation.

Components

The PMKSY has following four components:

Accelerated Irrigation Benefit Programme (AIBP)

This focuses on faster completion of ongoing Major and Medium Irrigation including National Projects.

Har Khet ko Pani

This component mainly focuses on creation of new water sources through minor irrigation that includes both surface and groundwater. It also encompasses the repair, restoration and renovation of water bodies; strengthening carrying capacity of traditional water sources, construction rain water harvesting structures under its Jal Sanchay sub-component. Other things includes are

- Command area development with creation of distribution network from source to the farm
- Ground water development in the areas where it is abundant, so that sink is created to store runoff/ flood water during peak rainy season.
- At least 10% of the command area to be covered under micro/precision irrigation.
- Diversion of water from water abundant to nearby water scarce areas
- Creating and rejuvenating traditional water storage systems like Jal Mandir (Gujarat); Khatri, Kuhl (H.P.); Zabo (Nagaland); Eri, Ooranis (T.N.); Dongs (Assam); Katas, Bandhas (Odisha and M.P.) etc. at feasible locations.

Per Drop More Crop

This component promotes efficient water conveyance and precision water application devices like drips, sprinklers, pivots, rain-guns in the farm (Jal Sinchan). It also focuses on construction of micro-irrigation and storage systems.

Watershed Development

This component focuses on effective management of runoff water and improved soil & moisture conservation activities such as ridge area treatment, drainage linetreatment, rain water harvesting, in-situ moisture conservation and other allied activities on watershed basis.

Implementation

The PMSKY works on Project mode. The planning and execution is decentralized. The cornerstone of planning and implementation of PMKSY are District Irrigation Plans (DIPs). This DIP will identify the gaps in irrigation infrastructure of a district. A DIP can be prepared on two levels viz. Block and District. The DIPs will be vetted by the Governing body of Zila Panchayat and subsequently be incorporated in the State Irrigation Plan (SIP). Thus, an SIP is a consolidation of DIPs and it also takes into consideration the State Agricultural Plans created under the Rastriya Krishi Vikas Yojana. PMKSY projects would be scrutinised by the State Level Project Screening Committee (SLPSC) and sanctioned by the State Level Sanctioning Committee, which is already set

under Rashtriya Krishi Vikas Yojana. The state agriculture department would be the nodal agency for implementation of PMKSY projects with inter-ministerial National Steering Committee (NSC) for periodic review of the same. The funds under PMKSY will be allocated only if state government has prepared the district irrigation plans and state irrigation plans. PMKSY funds would be given to states as 75 per cent grant by the central government and the remaining 25 per cent share is to be borne by the state government. But, for the north-eastern region and hilly states, the funding pattern would be 90:10.

Critical Comment

The soul of any government scheme lies in its implementation. Most of our government schemes have failed so far in getting the maximum benefits out of our investment in irrigation in the sense that irrigated land has not contributed its maximum to agricultural output. Theoretically, irrigation should make double cropping possible, if not multiple cropping, but the bulk of the irrigated area in India still continues to be single crop area.

Although the AIBP remains as one of the components of the new scheme, it has many things obviously of launched by previous government; repackaged into once bundle. Since the scheme has been just launched, it will take some time to judge the output. The union Government has also decided to specially train IAS and IFoS officers in preparation and execution of district irrigation plans.

Methods of Irrigation

There are four methods of irrigation viz. Irrigation using buckets and water cans – this useful for small gardens and is out of our purview, Surface irrigation, Sprinkler Irrigation and Drip Irrigation

Surface irrigation

This refers to application of water by gravity flow to the surface of the field. This can be of three types depending on if the entire field is flooded (basin irrigation) or the water is fed into small channels (furrows) or strips of land (borders). The three types include Basin, Furrow and Border Irrigation.

Basin Irrigation

Basins are flat areas of land, surrounded by low bunds. The bunds prevent the water from flowing to the adjacent fields.

Basin irrigation is commonly used for rice grown on flat lands or in terraces on hillsides. Trees can also be grown in basins, where one tree is usually located in the middle of a small basin.

In general, the basin method is suitable for crops that are ***unaffected by standing in water*** for long periods such as 12-24 hours.

Furrow Irrigation

Furrows are small channels, which carry water down the land slope between the crop rows. Water infiltrates into the soil as it moves along the slope. The crop is usually grown on the ridges between the furrows.

This method is suitable for all row crops and for crops that **are affected** in water for long periods such as 12-24 hours.

Border Irrigation

Borders are long, sloping strips of land separated by bunds. They are sometimes called border strips. Irrigation water can be fed to the border in several ways: opening up the channel bank, using small outlets or gates or by means of siphons or spiles. A sheet of water flows down the slope of the border, guided by the bunds on either side.

Sprinkler Irrigation

It involves applying irrigation water which is similar to natural rainfall. Water is distributed through a system of pipes usually by pumping. It is then sprayed into the air through sprinklers so that it breaks up into small water drops which fall to the ground.

The pump supply system, sprinklers and operating conditions must be designed to enable a uniform application of water.

Sprinkler irrigation is suited for most row, field and tree crops and water can be sprayed over or under the crop canopy.

However, large sprinklers are not recommended for irrigation of delicate crops such as lettuce because the large water drops produced by the sprinklers may damage the crop.

Drip Irrigation

With drip irrigation, water is conveyed under pressure through a pipe system to the fields, where it drips slowly onto the soil through emitters or drippers which are located close to the plants. Only the immediate root zone of each plant is wetted. Therefore this can be a very efficient method of irrigation. Drip and Sprinkler Irrigation involves irrigating crops at the root zone as per the crop requirement. It greatly enhances water use efficiency and can also be used for fertilizer application. Drip irrigation is sometimes called trickle irrigation.

Rainguns: Rainguns are high performance impact sprinklers designed for a variety of uses and applications where relatively high flows and extended radius of throw are desired. Rainguns are available with operating pressure of 2.0 to 7.5 kg/cm2 and flows of 3 to 30lps usually with nozzle diameters ranging from 10 to 30 mm and with a wetting radius of 27 to 60 metre.

Micro Irrigation

Microirrigation refers to the slow application of water on localized volume of soil by surface drip, subsurface drip, bubbler, and microsprinkler systems. Water applies in such irrigation wets a part of

the soil so it is also called localized irrigation.

Importance of Micro-irrigation

Today, India is considered to be a water stressed country. We were highly water-surplus in 1950s. This change has come mainly due to two reasons. First – increasing population; and second – highly wasteful flood method of irrigation (FMI). Given that around 65% of irrigation and 85% if the drinking water comes from the groundwater resources, majority of the groundwater sources in the country are registering a fall in water levels. To arrest the decline in per capita water availability and per capita foodgrain availability, we need to increase production with judicious water use in farming. Its importance also increases given that 140 million hectares is owned millions of farmers with an average farm size of less than two hectares.

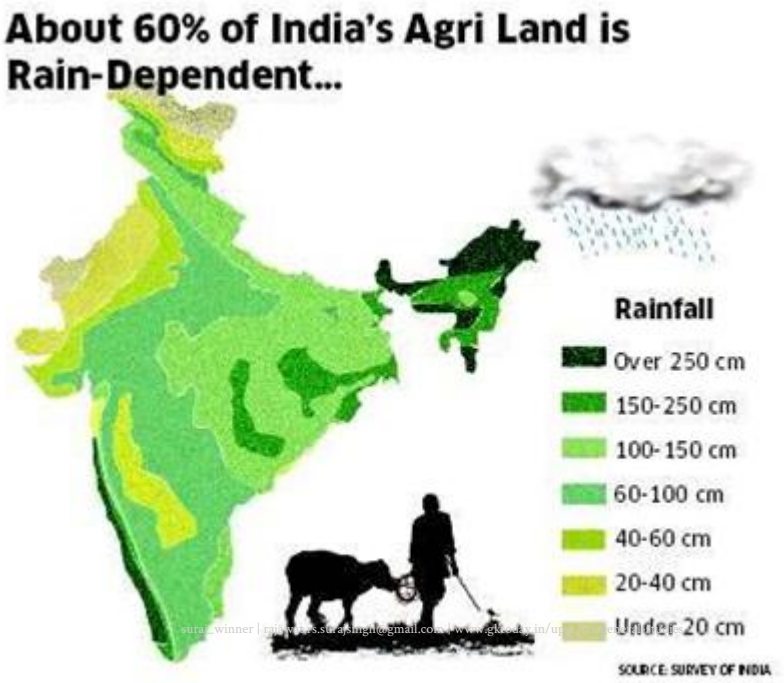
Micro irrigation systems (MIS) not only address the problem of water scarcity but also effectively save fertiliser consumption per unit of land. This is because in MIS, nutrients are released through the system, instead of their application on top of the soil leading to wastage during the periodic flooding of fields under FMI. More, water and nutrients floating in the fields let weeds flourish.

Government Policy on Micro-irrigation

All governments support micro-irrigation because of its water use efficiency. The government of India had launched a subsidy scheme for micro-irrigation called National Mission on Micro Irrigation (NMMI) in 2006. This is a centrally sponsored scheme which promotes water-use efficiency by adopting drip and sprinkler irrigation. All States and Union Territories and all horticultural as well as agricultural crops are covered under the scheme.

Rainfed Agriculture

Rain-dependent areas can be broadly split into two: 'dry lands', which receive less than 750 mm of rain a year; and rainfed areas, which receive more than 750 mm. Comprising arid and semi-arid ecosystems, dry lands stretch from Gujarat in the west till Eastern Madhya Pradesh; and from Rajasthan till the southern tip of India.



Basic Facts- Extent of problem of Rainfed Agriculture

In India, about 60% of total net sown area comes under rainfed lands. Rainfed crops account for 48 percent area under food crops and 68 percent under non-food crops.

India ranks first among the rainfed agricultural countries of the world in terms of both extent and value of produce. Due to population pressure on agricultural lands, the *poverty is concentrated in rainfed regions.* The climate in India's rainfed regions is characterized by complex climatic deficiencies, manifested as water scarcity for rainfed crop production. The climate is largely semi-arid and dry sub-humid with a short (occasionally intense) wet season followed by long dry season. Rainfall is highly unreliable, both in time and space, with strong risks of dry spells at critical growth stages even during good rainfall years. The fluctuations are due to numerous factors affecting the monsoonal climate including the atmospheric circulation and strong links to ENSO phenomenon in the Pacific Ocean.

Characteristics and issues with Rainfed Agriculture

Rainfed areas in India are **highly diverse**, ranging from resource rich areas to resource-constrained areas. Some of the resource rich areas are highly productive and have experienced widespread adoption of technology. However, most of the areas are resource constrained and dry areas.

In the resource constrained and dry areas, the **farming is a survival mechanism** rather than a growth oriented activity.

Rainfed agriculture is practiced under a wide variety of soil type, agro-climatic and rainfall conditions ranging from 400 mm to 1600 mm per annum.

Rainfed Crops are prone to breaks in the monsoon during the crop growth due to water stress. This water stress may be due to variability of rainfall, delay in sowing, diversity in crop management practice and variability of the soil type. The prolonged breaks can result in partial o r complete failure of the crops.

Issues Related to Rainfed Farming

Farmer suicides in Rainfed areas

In past, the Rainfed farming system was mainly dependent upon the locally available inputs (seeds, manures, animal draft) and used to grow a number of crops, which were able to withstand drought-like situation. However, in recent times, the cropping systems have changed and currently the farmers in these rainfed areas have limited options. Many of the farmers in these regions started cultivating high value crops which requires intensive use of costly inputs (chemical fertilizers/ pesticides, hybrid seeds, life saving irrigation, farm energy etc.) and find it difficult to manage the resources on their own. This is the major reason of growing farm suicides in rainfed areas.

Green Revolution – Rainfed Areas – Groundwater Problem

Green Revolution bypassed the less-favored rainfed areas which were not the partners in this process of agricultural transformation. Green Revolution was designed around growing high-yielding varieties of wheat and rice, which needed plenty of water and chemical inputs. The entire agricultural research framework, incentive structure, price support, input subsidies, extension system were designed to 'flow' along with irrigation.

In the floodplains of the north, the farmers, realising rainfall risk was a thing of the past, switched to HYVs because canals were there for irrigation. However, the story was different in the drylands. Here, seeds and fertilizers reached but water did not reach. Those who wished to adapt to the new seeds and fertilizers, created the predictable water supply for themselves. When electricity came, these farmers invested in groundwater pumps. The result was tube wells became the mainstay of irrigation in India.

According to a Planning Commission report, titled 'Synopsis of Groundwater Resources in India', in 1960-61, canals and tanks accounted for 61% of non-rain water for irrigation, compared to 0.6% for tube wells. In 2002-03, the share of canals and tanks was down to 33%, while tube wells had increased to 39%.

Green Revolution – Rainfed areas – Change in the Cropping patterns

To reduce their vulnerability to rains, farmers in some areas grew crops such as jowar, bajra and pulses. These crops are low-yielding, but less affected by variations in rainfall. This saved the farmers from the risky nature of farming in rainfed and dry areas.

In the same field, they planted multiple crops. For instance, Jowar or pulses, both drought-resistant, would be planted alongside wheat, which gave high yields in normal rains. They also maintained livestock or, if forests were in the vicinity, gathered minor forest produce.

However, with the advent of green revolution and advent of electricity and groundwater tube wells, the cropping patterns also changed.

For example, the farmers of Malwa (MP) used to grow jowar during the rains and Malwi Ghehu , a local wheat variety, after that till the advent of Green revolution. However, once the pumps came in, farming became a year long activity. Cash crops like soya displaced jowar. HYVs of wheat displaced Malwi Ghehu. This is the story of almost all parts of India, and that is the reason that *cotton, maize and soya remain the major crops of the rainfed areas of India.*

Groundwater level

The too much exploitation of the groundwater by tube wells led to the depletion of this finite resource. For example, in some parts of Madhya Pradesh, the groundwater levels have plunged from 50 ft in the 1970s to 700 ft now. Today, it has taken a shape of acute crisis in six states of India.

Note: If the ratio of groundwater extraction to groundwater recharge is less than 70%, it is considered safe; 70-90 %, semi critical; 90-100 %, critical; and more than 100%, overexploited.

Between 1995 and 2004, the proportion of districts in semi-critical, critical and over-exploited has grown from 5% of the agricultural area and 7% of the population to 33% and 35% respectively.

The six states where the level of groundwater is unsustainable are Punjab, Rajasthan, Haryana, Tamil Nadu, Gujarat and Uttar Pradesh. Ironically, these six states accounted for half the food-grain production in 2008-09.

National Rainfed Area Authority (NRAA)

It was established in 2006 to give focussed attention to Rainfed areas of the country. This advisory body formulated some common guidelines for the Watershed Development Project and is in consultation with all the States for its implementation

Constituents	Dryland farming	Rainfed farming
Rainfall (mm)	< 750	>750
Moisture	Shortage	Enough / Sufficient

Constituents	Dryland farming	Rainfed farming
Growing regions	Arid and Semiarid & up lands of sub humid & humid regions.	Humid and slub humid regions.
Cropping system	Single crop or	Intercropping or double cropping.
	intercropping	
Constraints	Wind and water erosion	Water erosion.

Dry Land Farming

Dry farming or Dry Land Farming refers to an improved system of cultivation whereby maximum amount of water is conserved by soil and water management. It involves efficient system of soil and crop management in the regions of low land and uneven distributed rainfall.

Importance of Dry land Farming for India

Considering the present rate of development of irrigation facilities and also water potentiality of the country, it is estimated that at any point of time 50% of cropped area in India will remain under Rainfed farming system. Such vast areas as of now consume hardly 25% of total fertilizer consumption of the country. Due to poor level of management, crop productivity is also very low resulting in socio – economic backwardness of the people.

Dry land farming is different from Rainfed farming. The difference is given in below table:

Characteristics of Dryland Agriculture

Dry land areas may be characterized by the following features:

- *Uncertain, ill-.distributed and limited annual rainfall;*
- *Occurrence of extensive climatic hazards like drought, flood etc;*
- *Undulating soil surface;*
- *Occurrence of extensive and large holdings;*
- *Practice of extensive agriculture i.e. prevalence of mono cropping etc;*
- *Relatively large size of fields;*
- *Similarity in types of crops raised by almost all the farmers of a particular region;*
- *Very low crop yield;*
- *Poor market facility for the produce;*
- *Poor economy of the farmers; and*
- *Poor health of cattle as well as farmers.*

Key elements of effective combat with perils of Dryland agriculture

- Capturing and Conservation of Moisture
- Effective Use of Available Moisture
- Soil Conservation
- Control of Input Costs

Problems of Dry Farming in India

- Moisture stress and uncertain rainfall
- Effective storage of rain water
- Disposal or dry farming products
- Selection or limited crops
- Utilization of preserved moisture
- Quality or the produce

Principal Dry Farming Zones in India

- The Indo-Gangetic plains of North India
- The trapian plateau of peninsular India
- Plateau of granite formation

Marketing of Agricultural Produce

Marketing is an integral part of agriculture, it encourages the farmers to invest more and increase production.

The simplest form of agricultural marketing is the buying and selling of the farm produce. However, in modern sense, the agricultural produce undergoes a series of exchanges from one hand to another before it finally reaches the consumer.

Basics of Agriculture Marketing

What is agricultural marketing?

According to the **National Commission on Agriculture** – Agricultural marketing is a process which starts with a **decision to produce a saleable farm commodity**; involves **all aspects of market structure of system,** both functional and institutional, based on technical and economic considerations and includes **pre and post- harvest operations viz.** assembling, grading, storage, transportation and distribution.

Marketing is an integral part of agriculture, it encourages the farmers to invest more and increase production. The simplest form of agricultural marketing is the buying and selling of the farm produce. However, in modern sense, the agricultural produce undergoes a series of exchanges from one hand to another before it finally reaches the consumer.

Need for efficient agricultural marketing

Long ago, India agriculture was subsistence farming. With the development of means of transport and storage facilities, agriculture became commercial in character and the peasants grew those crops which fetch them better prices.

Thus, the cropping pattern is no longer dictated by what a farmer needs for his own personal consumption but what is responsive to the market in terms of prices received by him.

Further, the trade is organized but farmers are not conversant with the complexities of the marketing system. A farmer is handicapped by several disabilities as a seller and is forced to sells his produce at an unfavourable place, time and price. Due to all these there is a need of an efficient agricultural marketing system.

What should be the objectives of an efficient marketing system?

Agricultural products differ in nature and contents from industrial goods in the following respects. They are bulky and voluminous in comparison to industrial goods.

- They need special storage facilities because most of them are perishable goods.
- Many goods are seasonal, available in particular period only.
- The farm goods are produced on a large geographical area, their collection poses a serious challenge.
- Assorting and grading is difficult in case of farm produce.
- The farmers are generally cash stripped or debt burdened, so have to dispose off produce as early as possible.

> Both demand and supply of agriculture produce are inelastic. This means that if there is a bumper crop, it will spell disaster on farmer and if there is deficit crop, he is unable to take the advantage. The advantage passes on to middlemen.

Thus, the objectives of the efficient marketing system should be:

- To enable farmers to get the best possible returns,
- To provide facilities for selling the produce at an incentive price,
- To reduce the price difference between the primary producer and ultimate consumer.
- To make available all products of farm origin to consumers at reasonable price and within reasonable time.

What facilities are needed for efficient agricultural marketing?

The following basic facilities are required by a farmer.

- Proper storing facilities.
- Holding capacity – to wait till best prices are fetched.

- Adequate and cheap transport facilities so that he is able to reach *Mandi* rather than disposing it off at his village only.
- Clear and timely information about the market prices so that he is not cheated.
- Organized and regulated markets so that he is not ripped off by *Dalals* and *Adhtiyas*.
- As small as possible number of intermediaries.

Problems with Current Agricultural Marketing System

Various problems in the agricultural marketing system in India are discussed below.

Improper storage facilities

No proper warehousing facilities in villages. The farmers are forced to store the produce in mud-vessels or *katcha* storehouses. Result of this unscientific storage is either wastage or hastily disposing off the produce. Remedy for this problem is establishment of Rural Godowns and warehouses. To some extent, setting up of Central Warehousing Corporation and State Warehousing Corporation has improved the situation.

Lack of grading and standardization

There is no proper grading and standardization of farm produce. This leads to *Dhara* (heap) sales in which all qualities of produce are sold in one common lot. Farmer is unable to get better price for better produce and this implies that there are no incentives to use better farm inputs and produce better varieties. Thus the farmer producing better qualities is not assured of a better price. Hence there is no incentive to use better seeds and produce better varieties.

Inadequate transport facilities

There are highly inadequate transport facilities because only a small number of villages are joined by railways and pucca roads to mandies. The result is that farmers carry their produce to *Mandi* on either bullock carts or other such means. The produce, which is perishable, has to be dumped to nearby market at considerably low market prices.

Large chain of middlemen

There is a large chain of middlemen in the agricultural marketing which drastically reduces the share of cultivator. This chain includes village traders, Kutcha Adhtiyas, Pukka Adhtiyas, Brokers, wholesalers, retailers etc.

Market wrongdoings

The market of the farm produce is largely unregulated where the trading scene is dominated by the brokers and Adhtiyas. Many charges such as Adhat (pledging charge) and Tulai (weighting charge) have to be paid by the peasants. Even now the number of unregulated markets in the country is substantially large.

Inadequate market information

If the proper market information is not available to the farmers, they accept, whatever price the

traders offer to them. However, in recent times, this situation has changed drastically under the influence of information technology revolution.

Inadequate Farm Credit

The farmer needs to sell off the produce immediately after the crop is harvested though prices at that time are very low. He can be saved from this "forced sales" if credit facilities are available from the banks.

Current System of Agricultural Marketing

There are four major systems of agricultural marketing in India at present. They are as follows.

Direct sale to moneylenders and traders

Majority of the produce is sold by the farmers to the village traders and money lenders. The moneylenders then work as agent of the wholesalers.

Village Haats

A Haat is village market that covers an area of 5-10 miles. They are held weekly and here, the agents of wholesalers and different brokers visit to buy the produce. The Haats are poorly equipped and lack storage, drainage and other facilities. Smaller and marginal farmers generally sell in these haats.

Mandi

A *Mandi* is a wholesale market, which serves a number of villages and is generally located in a city.

The business here is carried out by the Adhtiyas. Adhtiyas buy from farmers via middlemen and then sell it to wholesalers who sell it to retailers. The system is different in case of sugar, paddy and cotton though. The Mandis are regulated by APMC acts of various states. There are various problems with them, about which you can read here.

Co-operative marketing

Such societies are **formed by farmers** to take advantage of collective bargaining. A marketing society collects surplus from it members and sell it in the *Mandi* collectively. This improves the bargaining power of the members and they are able to obtain a better price for the produce. In addition to the sale of produce, these societies also serve the members in a number of other ways.

Steps taken for Improvement of the Marketing System

A number of measures have been adopted to improve agricultural marketing. Some of the important ones are as follows:

- Establishment of regulated markets
- Construction of warehouses
- Provision for grading, and standardization of produce
- Standardisation of weight and measures
- Daily broadcasting of market prices of agricultural crops
- Improvement of transport facilities etc.

This further includes

AGMARK

- Under the **Agricultural Produce (Grading and Marketing) Act** the Government has set up grading stations for commodities like ghee, flour, eggs, etc. The graded goods are stamped with the seal of the Agricultural Marketing Department –AGMARK.
- Agmark goods have a wider market and command better prices.
- A **Central Quality Control Laboratory** has been set up at Nagpur and eight other regional laboratories in different parts of the country with the purpose of testing the quality and quality of agricultural products applying for the Government's "Agmark" have been created.

Regulated Markets

- Regulated markets have been organized with a view to protect the farmers from the malpractices of sellers and brokers.
- The management of such markets is done by a **market committee** which has nominees of the State Government, local bodies, Adhtiyas, brokers and farmers. Thus all interests are represented on the committee
- These committees are appointed by the Government for a specified period of time. Their major functions are as follows:

    - Fixation of charges for weighing, brokerages etc.,
    - Prevention of unauthorized deductions, underhand dealings, and wrong practices by the adhtiyas
    - Enforcing the use of standardized weights,
    - Providing up to date and reliable market information to the farmers, and
    - Settling of disputes among the parties arising out of market operations.
    - The committee is responsible for the licensing of brokers and weight men. It is nested with powers to punish anyone who is found guilty of dishonest and fraudulent practices.

Provision of warehousing facilities

- To prevent distress sale by the farmers, particularly the small and marginal farmers, due to prevailing low prices, rural godowns have been set up. Government is also implementing a Rural Godown Scheme.
- Central Warehousing Corporation was set up in 1957 with the purpose of constructing and running go downs and warehouses for the storage of agricultural produce.
- The states have also set-up the State Warehousing Corporations with the same purpose.
- At present the Food Corporation is constructing its own network of go downs in different

parts of the country. The total storage capacity in the country was 27 million tonnes at the end of the sixth plan.

- Government also encourages foreign direct investment in the godowns and Cold stores.

Directorate of marketing and inspection

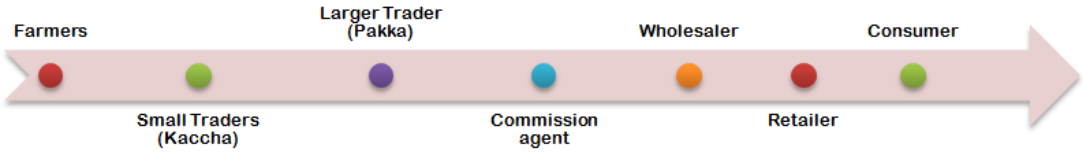
- The directorate was set up by the Government of India to co-ordinate the agricultural marketing of various agencies and to advise the Central and State Governments on the problems of agricultural marketing.
- Activities of this directorate include the following.
    - promotion of grading and standardization of agricultural and allied commodities;
    - statutory regulation of markets and market practices;
    - training of personnel;
    - market extension;
    - market research, survey and planning and
    - Administration of Cold Storage Order, 1980 and Meat Food Products Order, 1973.

Government Procurement

- Government also announces **Minimum Support Price** for various agricultural commodities from time to time in a bid to ensure fair returns to the farmers. These prices are fixed in accordance with the recommendations of the Agricultural, Price Commission.

The APMC Act & Other Issues

In India, the production of food products has been increasing in step with the rise in urban / rural population and export of food products is too insignificant to have any impact on prices. One of the real reasons for the runaway rise in food prices is the Inefficient Market mechanisms, manifested in the long supply chain as shown below:



The markets are generally far from most of the villages and therefore, the small and medium farmers find it economic to sell their produce to the local intermediaries.

Thus, intermediaries are the integral part of the supply chain of the agricultural produce. A typical supply chain has been shown by the above graphics.

One of the major reasons of such a long supply chain is the *poor infrastructural scenario*. The unreasonably long supply chain results in steep escalation in the total cost owing to procurement,

transit and other taxes and service charges levied at various layers.

Brokers and APMC

The role of broker in the market is to negotiate the deal between the buyer and the seller for which brokerage is charged at a stipulated rate fixed under bye-laws of the Agricultural Produce Marketing Committee under the APMC Act/Rules. There are other intermediaries like Commission Agents, wholesalers, retailers under different marketing channels through which the produce of farmers reaches to the consumers. The share of farmers in ultimate price of fruits and vegetables varies from 32% to 68% depending on the marketing channel adopted, the distance of the markets and the infrastructure facilities available.

APMC Act Background

- In India, agriculture is a "state subject". Thus, the wholesaling of agricultural produce is governed by the Agricultural Produce Marketing Acts of various State governments. The specific objective of market regulation is to ensure that farmers are offered fair prices in a transparent manner.
- The APMC Act empowers state governments to **notify the commodities**, and designate markets and market areas where the regulated trade takes place.
- The Act also provides for the formation of agricultural produce market committees (APMC) that are responsible for the operation of the markets. The entire State is divided and declared as a market area wherein the markets are managed by the Market Committees constituted by the State Governments. Currently there are around 7,500 regulated markets in the country.
- Once an area is declared a market area and falls under the jurisdiction of a Market Committee, *no person or agency is allowed freely to carry on wholesale marketing activities*. The issues with the monopolistic behaviour of these regulated wholesale markets result in:
    - No development in the competitive marketing system
    - No help to farmers in direct marketing and organizing retailing
    - No smooth raw material supply to agro-processing industries
    - No adoption of innovative marketing system and technologies.
- To tackle various issues, a report by a Government Task force suggested the following:
- New and competitive Agricultural Market in private and cooperative sectors should be promoted.
- Direct marketing and contract farming programmes should be promoted
- The industries and large trading companies should be facilitated to undertake procurement of

agricultural commodities directly from the farmer's fields

- Effective linkages between the farm production and retail chains should be established.

Thus, it was suggested that there is a necessity to integrate farm production with national and international markets to enable farmers to undertake market driven production plan and adoption of modern marketing practices. To make such changes effective, the current framework of APMC Acts in various states has to be amended.

Model APMC Act 2003

Union Government had prepared a Model APMC Act in 2003. As of 2014 some 16 states have adopted this Model Act. The salient features of this act are as follows:

Objectives of APMC Act

- To provide for development of efficient marketing system,
- Promotion of agri-processing and agricultural exports
- Lay down procedures and systems for putting in place an effective infrastructure for the marketing of agricultural produce.

Who can establish new markets?

- Under the existing acts, the markets are setup **only at the initiative of State Governments.** The 2003 act provides that Legal persons (such as individuals, organizations and companies), growers and local authorities are permitted to apply for the establishment of new markets for agricultural produce in any area.
- Further, in a market area, *more than one market can be established* by private persons, farmers and consumers.

Is a farmer forced to bring his farm produce to the APMC market area?

- There is no compulsion on the growers to sell their produce through existing markets administered by the Agricultural Produce Market Committee (APMC).
- However, agriculturist who does not bring his produce to the market area for sale will not be eligible for election to the APMC.

What are provisions for separate markets for some specific commodities?

- The act makes separate provision for notification of 'Special Markets' or 'Special Commodities Markets' in any market area for specified agricultural commodities to be operated in addition to existing markets.

What are responsibilities of the Market Committees under APMC Act?

- Ensuring complete transparency in pricing system and transactions taking place in market area;
- Providing market-led extension services to farmers;
- Ensuring payment for agricultural produce sold by farmers on the same day;

- Promoting agricultural processing including activities for value addition in agricultural produce; and
- Publicizing data on arrivals and rates of agricultural produce brought into the market area for sale.
- Setup and promote public private partnership in the management of agricultural markets.

What is the new chapter on contract farming?

Contract Farming may be defined as an agreement between processing and / or marketing firms for production support at production support at predetermined prices. Under the Model APMC Act 2003, a new chapter on 'Contract Farming' has been added to promote contract farming. The provisions include:

- **Compulsory registration** of all contract farming sponsors (such as companies)
- Recording of contract farming agreements
- Resolution of disputes, if any, arising out of such agreement
- Exemption from levy of market fee on produce covered by contract farming agreements
- Providing indemnity to producers' title/ possession over his land from any claim arising out of the agreement.

The provisions under this chapter enable direct sale of farm produce to contract farming sponsor from farmers' field without the necessity of routing it through notified markets.

How the act allows Direct Marketing?

- Direct marketing helps the farmers to
  - Reach and fulfil specific demands of the wholesalers or traders
  - Dynamically take advantage of favorable prices
  - Reduce marketing cost
- Direct marketing also allows the farmer to undertake sorting, grading and quality marking at the farm gate itself. It helps him to obviate the regulated markets which are not necessarily equipped with all required services and facilities affecting the marketing efficiency adversely.
- The impact of direct marketing is that
  - The elongated chain of intermediaries is eliminated
  - There is a reduction of consumer prices
  - Producers receive better prices.
- In India, the direct marketing model This model has been experimented in Punjab and Haryana via the ***Apni Mandis*** , in Andhra Pradesh via the *Rythu Bazar* and in Tamil Nadu via the *Uzhavar Santhaigal* .
- The Model APMC Act 2003 makes provisions for establishment of consumers'/ farmers'

market to facilitate direct sale of agricultural produce to consumers.

Private Investments in market yards

The ultimate objective of this act is to attract private investment in constructing market yards and creating the post-harvest value chain comprising cold stores, warehouses and logistics infrastructure. Some of these measures are meant for high-value and perishable produce, such as fruit, vegetables and livestock products, which contribute substantially to food inflation.

Other important Provisions

- Imposition of single point levy of market fee
- Resolving of disputes, if any, arising between private market/ consumer market and Market Committee
- State Governments conferred power to exempt any agricultural produce brought for sale in market area, from payment of market fee.
- Market Committees permitted to use its funds to create infrastructure on its own or through public private partnership

Various Issues and need of amendment of APMC Act

In our country, the Agricultural marketing suffers from inefficiencies and infrastructural inadequacy. Needless curbs and controls, including movement restrictions, further constrain free and fair trade. Except for those who produce wheat and rice or the crops covered by the MSP regime, the gap between the prices received by producers and those paid by consumers is wide. Marketing operations lack transparency and are marked by high price volatility. The much-needed market intelligence, especially price information, is not readily available to most farmers. Various Issues with the APMC act are as follows:

- Centre had circulated the Model Agricultural Produce Marketing Committee (APMC) Act in 2003 and asked them to amend their APMC laws accordingly.
- The act provides for the setting up of private markets, direct deals between the growers and end-users of agro-commodities, including out of *Mandi* transactions, and legalisation of contract farming etc.
- While many states have altered their marketing laws on constant prodding from the Centre, *most of the amended laws do not conform strictly to the spirit of the Model statute.*
- Vested interests in retaining the present *Mandi* system along with virtual monopoly of the APMCs over the farm produce marketing are too strong to allow the needed legal changes.
- The state level statues have so far unable to address the key issues such as expansion and modernisation of marketing facilities, improvement in marketing information communication and linking small producers with efficient marketing channels.

- Further, task of establishing infrastructure needs massive investment, which the government alone cannot bear. So, Private participation is a must.
- But private investment of this magnitude is unlikely to come about in the absence of a favourable legal framework and policy environment.
- A planning commission working group report said that present model of marketing reforms, which seeks to create space for a new set of modern markets to operate along with the much less transparent APMC regulated markets, is unlikely to attract much private investment in modern marketing infrastructure.
- This report also maintained that private and APMC markets can coexist when some common standard operating procedure is introduced for all markets, including the existing ones.
- However, the existing APMC *Mandi*s will not adopt such measures if they are not legally bound to do so.

The above discussion leads us to conclude that one more round of amendment of state APMC laws is needed. But this is a lengthy process.

A faster alternative can be enacting a central law for agricultural marketing that overrides the state laws. Though the agriculture is a state subject, yet the parliament of India is empowered to enact a law on any of the state subject using the power conferred upon it by virtue of the Article 249 of the constitution of India. Such an approach has been adopted in some other sectors that fall in the states' jurisdiction under the Constitution.

Key Government Schemes in Agriculture

Agricultural Census

Every five years, an agricultural census is conducted in India. First such census was done in 1970s and the reference year for the first Agriculture Census was 1970-71. Under this scheme, centre provides funds to states and entire work is done by the states only.

Data in Census

The agricultural census is done in phases. Primary and Secondary data is collected on structure of **operational holdings** by different size classes and social groups. Operational Holding refers to all land which is used wholly or partly for agricultural production and is operated as one technical unit by one person alone or with others without regard to the title, legal form, size or location.

Three Categories of states on Land Use statistics

For the purpose of land use statistics; India has been divided broadly into three categories.

- In the first category are States where the village revenue agency collects statistics relating to

land holdings as a part of land records. This is done by village officials on the basis of actual inspection in the field at periodic intervals. Standard forms have been prescribed for this purpose. These data are then aggregated at the level of Revenue Inspector Circle, Tehsil, District and State by the officers of Revenue/Agriculture Departments.

- The second category consists of States of *West Bengal, Orissa, and Kerala*, where revenue agencies do not exists. In these states, information is collected on a sample area under principal crops and land utilisation. This is done by complete field to field enumeration of the sample villages.
- The third category consists of States and Union Territories mostly in the North-Eastern Region (except Assam) which are ***neither surveyed for land records nor the requisite revenue*** agencies for collection of data exist. In these areas the statistics of land records are collected on a sample basis on the basis of personal knowledge of Revenue Officer/Agricultural Officer.

Types of Landholdings in India

An operational land holding is a techno-economic land unit used wholly or partly for agricultural production and operated (directed/managed) by one person alone or with the assistance of others, without regard to title, size or location. A operation land holding may be consisted of either one or more than one parcels of land, provided they form the part of same unit. Operational Land Holdings include only those units which are used either in farm production or farm production + livestock and poultry products (primary) and/or pisciculture or for only livestock and poultry products (primary) and/or pisciculture.

There are five kinds of Land Holdings in India, depending on various sizes as follows:

- Marginal holdings: Size 1 hectare or less
- Small holdings: Size 1 to 2 hectares
- Semi-medium holdings : Size 2 to 4 hectares
- Medium holdings: Size 4 to 10 hectares
- Large holdings: Size above 10 hectare

Maximum number of operational land holdings in India is marginal holdings. According to Census 2011, 67 per cent of holdings were classified as marginal (less than one hectare) and 18 per cent were classified as small (one-two hectare). Large holdings were estimated to be only 0.7%.

Number of Holdings in India (in '000)						
Year	Marginal	Small	Semi-Medium	Medium	Large	All Sizes
1970-71	36200	13432	10681	7932	2766	71011
1976-77	44523	14728	11666	8212	2440	81569
1980-81	50122	16072	12455	8068	2166	88883
1985-86	56147	17922	13252	7916	1918	97155
1990-91	63389	20092	13923	7580	1654	106637
1995-96	71179	21643	14261	7092	1404	115580
2000-01	75408	22695	14021	6577	1230	119931
2005-06	83694	23930	14127	6375	1096	129222
2010-11	92826	24779	13896	5875	973	138348

Highlights from the latest agricultural Census

The below observations have been sourced from Agricultural Census 2010-11.

- There are 138.35 million (13.8 Crore) operational land holdings in India. In comparison to 2005-06, there was an increase of 7% in number of these holdings. Out of these 12.78% land holdings belong to women.
- The average size of operational holding in India is 1.15 ha. 85.01% operational land holdings in India are marginal holdings (below 2.00 ha). There are 14.29% semi-medium and 3.7% large holdings.
- Highest number of operational land holdings in India are in Uttar Pradesh, followed by Bihar, Maharashtra and Andhra Pradesh. Lowest land holdings in India are in Chandigarh. However, in terms of operated area, the largest contribution comes from Rajasthan followed by Maharashtra. Chandigarh constituted the lowest number of operational holdings as well as the operated area in the country in 2010-11.

Integrated Scheme for Agricultural Marketing (ISAM)

Six schemes of 11th plan period have been merged in a single integrated scheme from April 1, 2014.

The objective of this "Integrated Scheme for Agricultural Marketing (ISAM)", which has Rs. 4500 Crore outlay in 12th plan; are as follows:

- Promotion of agri-marketing through creation of marketing and agribusiness infrastructure including storage
- Incentivize agri-market reforms
- Provide market linkages to farmers
- Provide access to agri-market information
- Support quality certification of agriculture commodities.

This scheme has **five** components:

- **Agricultural Marketing Infrastructure (AMI):** This component is been created by merging Rural Godown Scheme / Grameen Bhandaran Yojana (GBY) and Development/ Strengthening of Agricultural Marketing Infrastructure, Grading and Standardization (AMIGS).
- The objective is to create *market infrastructure* including Storage Infrastructure and Integrated Value Chain Projects (IVC)
- **Marketing Research and Information Network (MRIN):** to collect and disseminate the price and market data for efficiently be used by producers
- Strengthening of Agmark Grading Facilities (SAGF)
- Agri-Business Development (ABD) through Venture Capital Assistance (VCA) Project Development Facility (PDF)
- Training, Research and Consultancy through Choudhary Charan Singh National Institute of Agriculture Marketing (NIAM).
- Developing Agricultural Marketing Infrastructure

The most important component of this scheme is **Agricultural Marketing Infrastructure (AMI).** By marketing infrastructure we mean developing infrastructure for *effectively managing marketable surplus of agriculture including horticulture and of allied sectors including dairy, poultry, fishery, livestock and minor forest produce.*

This scheme not only provides the basic infrastructure but also promotes innovative and latest technologies in agricultural marketing infrastructure, encouraging private and cooperative sector investments.

Since Rural Godown Scheme is now subsumed in this scheme, the AMI component will work towards development of storage, infrastructure facilities for grading, standardization and quality certification of agricultural produce. Along with this, the scheme also will ensure that price to the

farmers commensurate with the quality of the produce, promoting pledge financing and marketing credit, negotiable warehousing receipt system and promotion of forward and future markets to increase farmers' income.

Integrated Value Chain

One of the major objectives of the AMI component is to develop *Integrated Value Chain Projects (IVC).* Integrated value chain denotes a set of *inter-linked chain of activities* that bring *specific agricultural commodity / commodities from harvesting till retailing* and also those activities where *value is added to the produce without change in the form of the produce*. Development of IVC will also facilitate proper flow of subsidy to entrepreneurs.

Small Farmers' Agribusiness Consortium (SFAC)

Small Farmers' Agribusiness Consortium (SFAC) was established in 1994. Its fundamental objective is to link the small farmers to agricultural value chain, which includes investments, technology and markets in association with private, corporate or cooperative sector.

It also provides capital support in the form of Venture Capital Assistance and Project Development Facility. One of the mandates of SFAC is to promote the farmer producer organisations (FPOs) and their integration in agriculture value chain.

Over the period of time, the SFAC has emerged as a **Developmental Institution** which deals with agriculture in its wider connotation, including fisheries and horticulture.

The beneficiaries are agripreneurs (Individuals, farmers, producer groups, partnership, propriety firms, Self Help Groups, companies etc.) to set up agribusiness ventures in close association with banks.

National Crop Insurance Programme

Agricultural Insurance in India is covered by "National Crop Insurance Programme" which was launched by UPA government in 2013 by merging three schemes viz. Modified National Agricultural insurance Scheme (MNAIS), Weather Based Crop insurance Scheme (WBCIS) and Coconut Palm Insurance Scheme (CPIS). These three schemes now serve as components of the NCIP.

Unit area of insurance has been reduced to the village/village panchayat level in the restructured scheme of 'National Crop Insurance Programme' (NCIP).

Objectives

National Crop Insurance Programme provides financial support to farmers for losses in their crop yield, to help in maintaining flow of agricultural credit, to encourage farmers to adopt progressive farming practices and higher technology in Agriculture and thereby, to help in maintaining

production, employment & economic growth.

Components

The NCIP has three components viz.

Modified National Agricultural insurance Scheme (MNAIS)

MNAIS provides insurance coverage and financial support to the farmers in the event of failure of crops and subsequent *low crop yield*.

Weather Based Crop insurance Scheme (WBCIS)

In 2015-16, the Weather-based Crop Insurance Scheme (WBCIS) is being implemented as component of National Crop Insurance Programme (NCIP). This scheme provides insurance coverage and financial support to the farmers in the event of failure of crops due to *Adverse Weather Incidence* and subsequent *crop loss.*

Coconut Palm Insurance Scheme (CPIS)

There is a separate insurance component for Coconut palm growers.

Rashtriya Krishi Vikas Yojna

Rashtriya Krishi Vikas Yojana was launched in 2007 to achieve 4 per cent annual growth in the agricultural sector during the 11th plan. The scheme was launched to **incentivize the States** to provide additional resources in their State Plans over and above their baseline expenditure to bridge critical gaps. This scheme virtually covers all sectors such as Crop Cultivation, Horticulture, Animal Husbandry and Fisheries, Dairy Development, Agricultural Research and Education, Forestry and Wildlife, Plantation and Agricultural Marketing, Food Storage and Warehousing, Soil and Water Conservation, Agricultural Financial Institutions and other Agricultural Programmes and Cooperation.

The central government provides 100% grant to states and the amount of assistance is based on their agricultural budget and past performance. Currently, this scheme is a club of 10 different schemes called components. These are as follows:

- **Bringing Green Revolution to Eastern India (BGREI):** Targets improvement in the rice based cropping systems of Assam, West Bengal, Orissa, Bihar, Jharkhand, eastern Uttar Pradesh and Chhattisgarh.
- Integrated Development of 60,000 Pulses Villages in Rainfed Areas
- Promotion of Oil Palm
- Initiative on Vegetable Clusters
- **Nutri-cereals:** To promote balanced nutrition, higher production of bajra, jowar, ragi and other **millets** will be promoted.
- **National Mission for Protein Supplements:** To take up activities to promote animal based

protein production through livestock development, dairy farming, piggery, goat rearing and fisheries in selected blocks.

- **Accelerated Fodder Development Programme:** To accelerate the production of fodder through intensive promotion of technologies to ensure its availability throughout the year.
- **Rainfed Area Development Programme:** This programme aims at improving productivity of crops in rainfed areas.
- **National Saffron Mission:** This programme aims at revival of saffron cultivation in Jammu & Kashmir.
- **Vidarbha Intensified Irrigation Development Programme**

National Horticulture Mission

National Horticulture Mission is a centrally sponsored scheme launched in 2005-06, to enhance horticulture production and improve **nutritional security** and income support to farm households and others through area-based regionally differentiated strategies.

The scheme is not available in Andaman & Nicobar and Lakshadweep; Seven North East States and Sikkim, Jammu & Kashmir, Himachal Pradesh and Uttarakhand. **Rest all states and UTs are covered.** The North East States, HP, J&K and Uttarakhand are covered under the Technology Mission for Integrated Development of Horticulture in the North Eastern States (TMNE).

The scheme is not available to **coconut and medicinal plants, rest all horticultural crops** are covered. For Coconut, there is Coconut Development Board and for medicinal plants, there is National Medicinal Board along with **National Mission on Medicinal Plants**.

NHM is a Centrally Sponsored Scheme in which Government of India contributes 85%, and 15% is met by the State Governments.

The scheme *covers almost all sections of horticulture development from Nursery level to Marketing level.* Please note that it works on "**Cluster Basis**'. This means that the designated authority at the district level would choose a **cluster of minimum 100 hectares**, seek necessary approval & sanction and utilize the money under the programme -with the aim of achieving the desired goals. These goals are achieved by deploying modern and hi-tech interventions and duly ensuring backward and forward linkages. Support under this scheme includes financial support for:

- Setting up Nurseries, Tissue Culture labs
- Establishment of New Gardens
- Rejuvenation of Old and Senile Orchards
- Other horticulture activities.

Horticulture Mission for North East and Himalayan States (HMNEH)

This is a Centrally Sponsored Scheme being implemented in NE states, Sikkim, Himachal Pradesh and Jammu and Kashmir.

National Bamboo Mission

The National Bamboo Mission was launched in 2006-07 as a Centrally Sponsored Scheme to promote the growth of bamboo sector. The programmes supports Bamboo and Rattan in Research and Development; Plantation Development; Handicrafts Development and Marketing.

Bamboo Versus Rattan

Rattan and bamboo belong to two distant botanical families, have different properties, and are propagated and grown in dissimilar ways. Rattan is a palm, normally a climber and solid, while bamboo is a grass, and typically a hollow cylinder. Bamboo grows easily, and very quickly. Cane is a climber, requires a secluded environment, and has long gestation periods. All of the bamboo plant, from root to culm and leaves is utilised in diverse ways. Essentially only the stem of the rattan plant is used. This information was base of one of the questions in other mock tests and from this scheme; I believe it is the only good point to note.

Soil Health Card Scheme

This scheme was originally launched by UPA Government in 2007-08 under the integrated soil management initiative. But this scheme made little progress in the UPA regime. In 8 years (by March 2013) only around 50 Lakh Soil Health Cards were released to the farmers.

The new NDA government gave this scheme utmost importance and made it its Flagship programme, when it was relaunched as a new scheme from Suratgarh Rajasthan last year. The idea was to provide soil health card to 14 crore farmers. However, currently, the scheme is struggling to meet its targets due to severe shortage in the field staff. By 2015-16, the scheme was to deliver 3.14 SHCs to farmers. So far 18 Lakh cards have been released.

Since the scheme is being implemented by the State Governments; it indicates that states need to increase their manpower requirement and funding. The issue is that the soil testing labs are poorly managed and it takes lots of time for a farmer to get a soil health card after the sample was collected from his / her farm.

Need of Soil Health Card

The main reason is soil deterioration. Soil has not only deteriorated in many parts of the country but also has been tendered useless for irrigation. The main reasons for soil deterioration include midless use of chemical fertilizers, low use of organic matter and non-replacement of depleted micro and

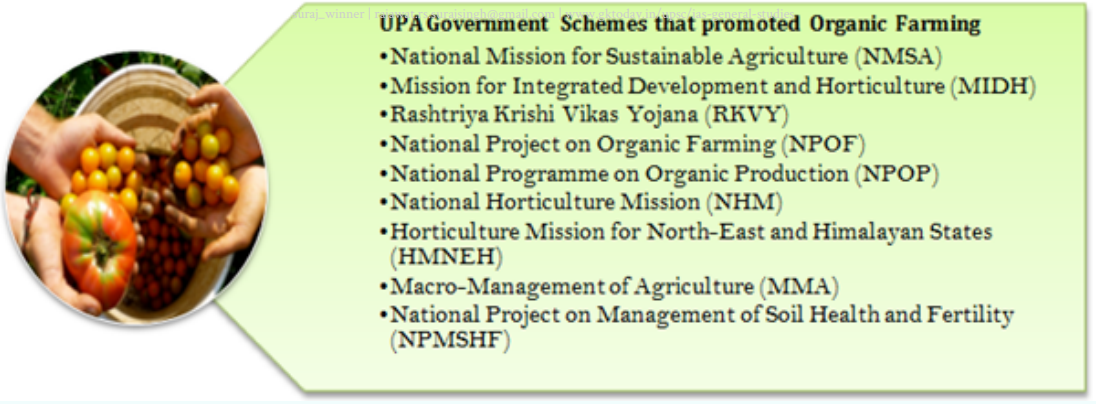
secondary nutrients in the soil. Due to all these, the nutrient deficiencies and decrease in soil fertility made farming unproductive.

For example, green revolution demanded use of chemical fertilizers for increasing production. However, mindless use of fertilizers led the soil in many regions useless for farming. This is mainly because of unwise distortion of the ideal NPK (nitrogen, phosphorous, potassium) proportion (4:2:1). For example, in 2011, the ratio was 19.2:5.5:1 and 20.6:6:1 respectively in Punjab and Haryana. The over-use of Urea is mainly because it comes with a government subsidy. Excessive use of Nitrogen reduces the health of crop and productivity goes down year after year.

Paramparagat Krishi Vikas Yojna

The Paramparagat Krishi Vikas Yojana of the NDA government is basically a scheme of supporting organic farming via cluster approach. This scheme is also a repackaged version of various old UPA government schemes but none of the schemes of UPA were totally focussed on organic farming except NPOP. But this scheme also mostly ran into papers and was marred with various data frauds and faulty / scandalous implementation. [Read this article to know how]

The schemes which promoted organic farming under UPA regime are listed in below graphic:



The PKVY and Cluster Approach

The new scheme launched by the NDA Government, follows cluster approach. Fifty or more farmers form a cluster having 50 acre land to take organic farming. Each farmer will be provided Rs. 20000 per acre in three years for seed to harvesting crops and to transport them to market. The government plans to form around 10 thousand clusters in three years and cover an area of 5 Lakh hectares under organic farming. Government also plans to bring certification of organic produce. We note here that the certification of organic products was so far limited to export products only. It might change now.

General Knowledge Today

Indian Agriculture-6: Seeds, Fertilizers, Technology

Integrated IAS General Studies:2016-17
Last Updated: February 15, 2016
Published by: GKTODAY.IN

Contents

Model Questions

1. What are Foundation Seeds, Breeders Seeds and Certified Seeds? Examine the importance of Breeder's seeds in seed development and multiplication.
2. What do you understand by Seed Replacement Rate? Despite of a plethora of Government and Private agencies developing certified seeds in the country, why India suffers from dismal Seed Replacement Ratio? Examine.
3. In India, the seed development in case of staple crops is confined to public sector. Discuss the reasons why the private companies avoided staple crops such as wheat despite they are high volume crops.
4. Discuss the key thrust areas of National Seed Policy in India.
5. What is Plant variety Protection? Examine the role of Pressure Groups and NGOs in ensuring the Farmer's Rights in the legislation of Protection of Plant Varieties and Farmer's Rights Act 2001.
6. "The Protection of Plant Varieties and Farmers' Rights Act 2001 not only gives intellectual property protection to the plant breeders, but also upholds the legal space for farmers to save, use, exchange and sell the farm saved seeds." Discuss citing salient features of the act.
7. Differentiate between Straight, Complex and Mixed Fertilizers. Briefly explain the use of various chemical fertilizers in Indian agriculture.
8. Critically examine the implications of indiscriminate use of Fertilizers on soil, farm productivity and environment.
9. "The skewed utilization of fertilizers is mainly due to pricing of subsidized fertilisers." Examine the issue throwing light on current policy framework.
10. "Although Fertiliser industry has made rapid progress; India's indegenous Fertilizer production is still not able to keep pace with the growth in consumption." Discuss.
11. Rather than import parity price (IMPP); the Gas Price Pooling Policy seems to be a better deal for Urea Manufacturers. Do you agree with this view? Discuss.
12. To what extent New Urea Policy 2015 is able to address the skewed use of fertilizers in the country. Discuss citing key features of this policy.
13. Government has mandated all indigenous producers of Urea to produce 100% of urea as Neem coated urea only. What are advantages of Neem Coated Urea? Examine.
14. What do you understand by Precision Farming. Discuss the key challenges to Precision Farming in India.
15. Discuss the major applications of remote sensing in Agriculture throwing light on India's

achievements in this direction.

16. "ICT has many potential applications in delivering agricultural extension and can bring new information services to rural areas." Discuss.
17. Discuss the role played by Fisher Friend Project, mKrishi and other Mobile based initiatives towards Indian Agriculture.

Seeds and Seeds Related Issues

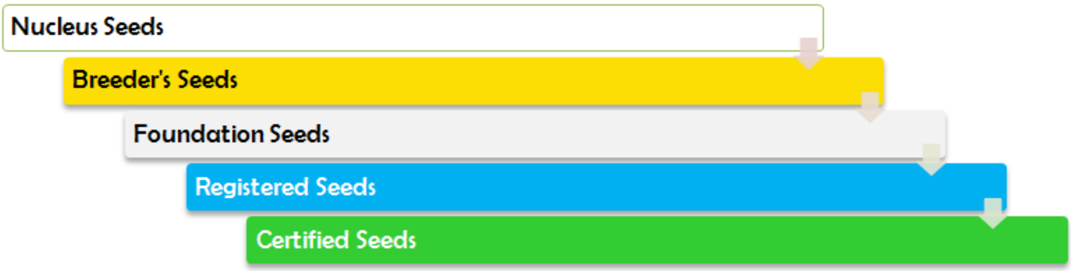
Classes of Seeds

Seeds are basic and critical input for enhancing agricultural production and productivity.

The seeds which seeds companies sell in the market and our farmers grow are commonly "certified seeds". The certification of seeds is a legally sanctioned system for quality control of seeds that are used to cultivate crops. The certified seeds are grown under stringent production requirements and they have improved traits such as better yield, pest resistance, drought tolerance, herbicide tolerance etc. The certified seeds are outcome of few years of research and development to get these improved traits. This R&D is done on their parent plants.

On this basis, there are five different categories viz. Nucleus Seeds, Breeder's Seeds, Foundation Seeds, Registered Seeds and finally certified seeds. The Offspring of breeder seeds is foundation seeds to registered seeds to certified seeds.

Further, each of the breeders, foundation, registered and certified seeds are certified and labelled with a different colour tag as per Section 5 of the Seeds Act, 1966. Thus, they are also called as Labelled Seed. The Breeder seeds have golden yellow tag, Foundation seeds have white tag, registered seeds have opal blue tag and certified seeds have green tag. This is shown by below graphics.



Nucleus Seed

The process of development of certified seeds begins from its distant parent called Nucleus Seed. The nucleus seed is a genetically pure seed without any impurity. They are obtained from a handful of healthy plants growing in a plot and then grown strictly in isolation. All physical observations such as plant size, growth features, colour and shape of various parts, days taken in maturity etc. are taken into account and recorded. This stage is the most important phase in the seed development because any erroneous selection of the nuclear seed plants would adversely affect the further generations. Once these plants are selected; their seeds are obtained and threshed separately. If it is an oilseed crop; the quality of seeds, yield etc. is observed and recorded and those with undesired yield are

removed. These seeds are properly packed and regrown to get the breeder seeds.

Breeder Seeds

A breeder's seed is an offspring of nucleus seed. A breeder is a person (qualified plant breeder) or organization who raises plant primary for breeding purpose. While nucleus seed is genetically pure; the Breeder seeds are produced by mutual multiplication of three different lines which are denoted by A line, B line and R line. A line is female, while B and R line are male sterile. The seeds from off springs with best and desired quality are selected and certified as Breeder seeds. Such seeds are protected by legal rights called as Breeder's rights.

The Breeder seed is further multiplied into the foundation and certified seeds. In our country, Breeder seeds are produced Indian Council of **Agricultural Research,** National Seeds Corporation, States Farms Corporation and agricultural universities in India.

Foundation Seeds

Offspring's of the Breeder seed which can be clearly traced to Breeder seed are called Foundation Seeds. They are further breaded to give rise to certified seeds. The production of the foundation seeds must be acceptable to a certification agency. A person or company who grows and distributes the certified seeds in accordance with the procedure and specifications of the certification agency is called Certified Seed Producer. The national Seeds Corporation, State farms Corporation of India (SFCI) have the responsibility to produce foundation seeds which suit to demand of national varieties. The State Seed Corporations produce the foundation seeds to suit to local demands.

Registered Seeds

The progeny of the foundation seed approved and certified by a certifying agency and is suitable to produce certified seeds is called Registered seed.

Certified Seeds

This is the last stage, which actually reaches to a farmer. Certified seed is the progeny of foundation seed and must meet the standards of seed certification prescribed in the Indian Minimum Seeds Certification Standards, 1988.

Seed Replacement Rate

Whether a farmer grows certified seeds or farm saved seeds – is at his discretion. Seed Replacement Rate (SSR) or Seed Replacement Ratio is a measure of how much of the total cropped area was sown with certified seeds in comparison to farm saved seeds. However, since every farmer is aware of the benefits of certified seeds; he would want to sow certified seeds, provided he is supplied with required quantity of certified seeds. Thus, Seed Replacement Ratio also denotes actual quality seed distributed to farmers vis-a-vis actual seed required for cultivation of crops.

What does Seed Replacement Rate denote?

A better seed replacement rate shows a better utilization of the Certified / Quality Seeds. Since certified seeds are better in productivity, the Seed Replacement Rate is directly proportional to productivity. Thus, higher the Seed Replacement Ratio, higher is production as well as productivity and higher are chances of achieving nutritional security, food security and containing food price inflation.

India's Seed Replacement Rate

Supply of quality seeds is not a onetime affair; they need to be produced every new season continuously. The hybrid seeds (those produced by cross pollinating of plants) can be sown only once because the seed from their first generation does not reliably produce the same copies of their parents. Thus, every new crop season requires purchase of new seeds. Producing certified seeds from breeder seeds takes at least three years efforts.

Due to huge demand supply gap, India suffers from a dismal seed Replacement Ratio. Currently, only around 15 per cent of India's total cropped area is planted with freshly obtained quality seeds every year. A huge 85 per cent area is sown with farm saved seeds. This ratio varies from crop to crop between 7% in staple crops to maximum 70% in some vegetables and fruits. For wheat and rice, it is between 9 to 18%.

We note here that enough seeds are available for fruits, vegetables, flowers and high value / costly seed crops but not enough seeds are supplied in case of low value and high volume crops such as rice, wheat. For crops such as wheat; this ratio must be between 20-30%. For oilseeds and pulses; this ratio must be between 20-100% and for some crops such as Hybrid cotton, it must be 100%.

Without achieving the optimal seed replacement ration, any efforts to get expected yields will be futile.

Reasons of Demand Supply Gap in Quality Seeds

The foundation of green revolution in the country was hybrid, high yielding seeds. The Government established National Seeds Corporation (NSC) in 1963 to undertake production of foundation and certified seeds. NSC and the state seed corporations did commendable job in production of high yield variety seeds of crops such as wheat, rice, maize, bajra etc. But these public sector companies could not go beyond the production of seeds for cereals. Gradually, their work went on decline. Since, the private sector was not opened for this activity, quality seed production segment remained neglected.

After the 1991 LPG reforms, the private multinational corporations were allowed to enter into India's seed market. But these companies preferred to deal in the non-food, high value and low volume crops, because of higher profit margins. This led to significant increase in fruits, vegetables and other non food crops such as Cotton. Cotton is one non-food crop whose bumper production is

due to availability of hybrid and Bt seeds from private sector.

However, the production of quality seeds for wheat, rice and other staples remained largely in the public sector. The implication of this imbalance was that –

- On one hand, there was inadequate availability of quality seeds for low value high volume crops such as staples
- On the other hand, there was a rise in the productivity of some high value crops, such as vegetables and fruit due to availability of quality seeds.

The private sector players did not deal in wheat and other such crops due to their peculiar reproductive biology also. We note here that Wheat and Rice, both are self pollinating crops. This implies that these plants use their own pollens to bear a fruit (called ear). Thus, the harvested grains from one season can be saved and used in subsequent seasons without much deterioration in yield for at least two or three seasons. This is a problem in economics of seed – because all research efforts would reach to the farmer embodied in that seed only. These efforts can be almost fully appropriated by the farmers without paying anything to the researcher. This discourages private investment and necessitates public investment in improving the crop varieties in such self pollinating crops.

However, hybrid crops encourage them private investment because of their peculiar ability called heterosis (refers to increase yield in hybrid). But, the yield gain obtained due to heterosis would suffer dramatically in the next generation. Thus, hybridisation was a lucrative business that private sector produced almost every seed as a hybrid seed – to keep profit as main focus – because these seeds are needed to be purchased freshly for each sowing.

Further, private sector players sold only those seeds which were developed via their own in-house research. It was also unfortunate that despite of more number of varieties developed by public sector in India in comparison to private sector, the quality seed could not reach to the farmers.

Seeds Act 1966

The parliament had passed to Seeds Act 1966 to provide legal framework around seed certification and make good quality seeds available to the cultivators. Under this act Seed rules were framed and notified in1968 and systematic Seed Certification started in India in 1969. This act provided for establishment of a Central Seed Committee to advise the states in seed related matters. It also provided for establishment of Seed Certification Agencies in the states; Seed certification Boards and State Seed Testing Laboratories. To meet with the current requirements, the bill needed to be amended. A new bill was introduced in 2004 (Seed Bill 2004) but so far that bill has not seen the light of the day. The NDA Government is now proposing to introduce a fresh seed act amendment bill.[currentuser_id]

1. This act applies to whole of India including Jammu & Kashmir.
2. It covers seeds of food crops, oil crops, cotton seeds, seeds of cattle fodder and all types of vegetative propagating material.
3. It provides for establishment of a Central Seed Committee (comprising eight members) to advise the Central and State Governments on matters arising out of the administration of this act and carry out other functions assigned to it by the Act
4. It provides establishing a Central Seed Laboratory as well as State Seed Laboratory to carry out seed analysis of notified variety
5. It empowers the Central Seed Committee to notify any variety found suitable as per the Act after notification in the Official Gazette
6. It empowers the committee to fix the minimum limits of germination and purity of seed for a variety to be notified as well as for marking or labelling a seed lot to be sold commercially
7. Regulation of sale of seeds of notified varieties by compulsory truthful labeling revealing the true identity of the variety, germination as well as purity
8. Constituting a certification agency for undertaking the process of certification
9. Power of certification agency to recommend notification of suitable variety and grant of notification certificate provided the seed meets minimum limits of germination and purity.
10. Empowerment to the agency for revocation of certificate if the agency is convinced that holder has obtained certificate by misrepresentation or not complied with the conditions
11. Provision for an appeal by the holder on payment basis to express before an appellate in India authority, his limitations for not complying with the conditions
12. Appointment of a seed analyst to undertake seed testing.
13. Appointment of seed inspector who is deemed to be a public servant within the meaning or section 21 of the Indian Penal Code (45 of 1860)
14. Empowerment of seed inspector to draw samples from any seller or a purchaser and verify the quality by sending samples to a seed analyst in the seed testing laboratory
15. Laying-out of procedure for seed sample collection and other rules. The clause also entrust inspector with the power to break open any seed container or door of any premises where such seed may be kept for sale, under those circumstances when owner refuses to cooperate. The whole operation has to be done in presence of two witnesses with their signatures on a memorandum
16. Responsibility of Seed analyst to report the results in a specified format after analysis of the seed samples to Seed Inspector as well as the seller/ purchaser. Complainant if dissatisfied

with the result can apply to the court for sending samples to Central Seed Testing Laboratory. Central seed laboratory shall thereupon send its report to the court in the prescribed format within one month from the date of receipt of the sample.

17. Restriction on import and export of seeds of notified varieties. Any variety imported or exported should meet the minimum limits of seed germination and purity marked or labeled on the container truly
18. Recognition of seed certification agencies of foreign countries for the purpose of this act.
19. Penalty or punishment or both for those who do not comply with the provisions of the act and also prevent seed inspectors from executing his power
20. Forfeiture of property (seeds) belonging to any person convicted under this act due to contravention of the procedures under this act
21. Punishment for offences committed by companies or anybody corporate. All who was incharge of, when the time the offence was committed and was responsible to the company shall be deemed to be guilty of the offence and punished accordingly
22. Protection of Government action taken in good faith that is no prosecution or legal proceeding will lie against Government or any Government Officer for anything that is done in good faith
23. Power for Government to give directions for smooth conduct of the act 24. Non-application of the act to the seed exchange by the farmers without any brand name
24. Power of Government to make rules to carry out various functions of Central Seed Committee, Central Seed Laboratory, Certification Agency and Seed Inspectors

National Seed Policy

Prior to the National Seed Policy 2002, the Government of India had adopted a "New Policy on Seed Development" in 1988 to remove the roadblocks in import of horticultural seeds and to allow import of limited quantity of seeds of course cereals, pulses and oilseeds. However, this policy was flawed due to nonexistence of IPR laws and several restrictions on import and exports.

Thus, the National Seed Policy 2002 was launched to – provide intellectual property protection to new varieties; usher this sector into planned development; protect the interest of farmers and encourage conservation of agro-biodiversity. This policy had 10 thrust areas as follows:

1. Varietal Development and Plant Varieties Protection
2. Seed Production
3. Quality Assurance
4. Seed Distribution and Marketing.

5. Infrastructure facilities
6. Transgenic Plant Varieties
7. Import of seeds and planting material
8. Export of seeds
9. Promotion of Domestic Seed
10. Strengthening of monitoring system

These initiatives will encourage investment in research and development, thereby ensuring availability of high yielding varieties of seeds which will lead to higher production and improving the economic condition of the farmers in the country. The key initiatives announced in this policy are as follows:

- A *Plant Varieties & Farmers' Rights Protection (PVP)* Authority will be established which will undertake registration of extant and new plant varieties through the Plant Varieties. Registry on the basis of varietal characteristics.
- A *National Gene Fund* will be established for implementation ofthe benefit sharing arrangement, and payment of compensation to village communities for their contribution to the development and conservation of plant genetic resources and also to promote conservation and sustainable use of genetic resources. Suitable systems will be worked out to identify the contributions from traditional knowledge and heritage.
- Plant Genetic Resources for Food and Agriculture Crops will be permitted to be accessed by Research Organisations and Seed Companies from public collections as per the provisions of the 'Material Transfer Agreement' of the International Treaty on Plant Genetic Resources and the Biological Diversity Bill.
- The *National Seeds Board (NSB)* will be established in place of existing Central Seed Committee and Central Seed Certification Board. The NSB will have permanent existence with the responsibility of executing and implementing the provisions of the Seeds Act and advising the Government on all matters relating to seed planning and development. The NSB will function as the apex body in the seed sector.

Seeds (Control) Order, 1983

Under the Seed Control Order 1983, seeds were included as an essential commodity item under the Essential Commodity Act, 1955. A person carrying on the business of selling, exporting and importing of seeds needs to obtain a license. [Currentuser_id]

Protection of Plant Variety Act

The parliament of India had passed the PPVFR (Protection of Plant Varieties and Farmer's Rights)

Act 2001 to establish an effective system for the protection of plant varieties, farmer's & breeder's rights and to encourage the development of new plant varieties.

Background

Prior to enactment of this act; agriculture was not included in the system of intellectual property rights in India; and thus there was no concept of plant variety protection in the country. There was one principle of 'common heritage' whereby the crop genetic resources were considered as a part of the common human heritage, not owned by anyone. Thus, farmers were free to use, share and exchange the seeds.

This system was fine until there were no private players in seed sector in the country. But the New Seed Policy of 1988 allowed the private sector to enter into Indian seed segment. This was the time when for the first time, the plant breeder's rights were voiced. One of the first organizations to promote breeder's rights in the country was Seed Association of India, formed in 1985.

In 1995, India became a member of the World Trade Organization. The obligations under the TRIPS agreement required plant protection law in the member countries. The member countries could provide protection to plan varieties either by system of patents or by any other *sui generis* (of its own kind) system.

Protests and Including the Farmer's rights

Initially the Public sector opposed to the plant variety protection, mainly due to the fear that the private companies would take an unfair advantage of breeding material developed by them. Moreover, the NGOs and farmer's organizations also protested against such law arguing that such a law would recognize the rights of only companies and would sideline the farmers and local communities.

In this background, the government created draft of the plant breeder's rights bill. After substantial debates and a number of revisions, the PPVFR Act was passed in the parliament with a separate chapter on Farmers' Rights and a system for registration of farmers' varieties. This bill thus must be noted for role of NGOs and Pressure Groups under whose pressure, it underwent a sequence of amendments resulting into provisions for registration of farmer's varieties.

Salient Features of the PPVFR Act 2001

The basic objective of the Protection of Plant Varieties and Farmers' Rights (PPVFR) Act 2001 us to recognize and protect the rights of the breeders including farmers and stimulate investment for research and development in the public and private sector for the development of new plant varieties. This act has nine specific rights; of which the most important are summarized as follows:

Right to Seed

The PPVFR act gives farmers the right to save, use, exchange or sell seed in the same manner as they

were entitled to before the Act. However, farmers may not sell the seeds of protected plant varieties in branded packages.

Right to Register Varieties

Any farmer or a commercial organization can apply for intellectual property rights over the varities they breed. If any farmer or commercial organization has develop a plant variety which is distinct in terms of genetic uniqueness, uniformity and stability; it has right to register it for intellectual property protection. Here, the law has included Farmer's variety as a variety which has been developed by farmers in their fields.

National Gene Fund

The PPVFR act makes provisions to establish a National Gene Fund through which the conservation of varieties developed can be done, recognized and rewarded. This fund is made of the money as fees collected from plant breeders who are required to pay for benefit sharing. This money is used to support and reward the farmers who are engaged in plant verities conservation.

Protection of Plant Varieties and Farmers' Rights Authority

The act makes provisions to establish Protection of Plant Varieties and Farmers' Rights Authority which oversees the implementation of this act. This authority publishes the list of registered varieties and invites claims for benefit sharing. Any person, firm, governmental organization or NGO can submit claim to benefit sharing.

The Authority is to consist of a Chairperson and 15 members. One member is to be a representative from a national or state level farmers' organisation, while one member is to be a representative from a national or state level women's organisation working on agricultural issues. The seed industry and various government institutions are also to be represented. On the other hand, the farmers' representative as well as the seed industry representative and the women's organisation representative are to be nominated by the central government

Right to Information and Compensation for Crop Failure

The act makes provisions that the breeder must give information about expected performance of the registered variety. If such material fails to perform, farmers may claim compensation under the Act. This provision curbs the exaggerated claims of the seed companies and enables farmers to apply to the Authority for compensation if they suffer losses due to the failure of the variety [currentuser_id].

Curb on Undisclosed use of Traditional Varieties

If a breeder fails to disclose that the source of a variety belongs to a particular community; that community will get compensation from the National Gene Fund. Such claims can be filed by any individual, government organization or NGO on behalf of farmers. This provision is to compel the breeder to acknowledge the use of traditional knowledge or resources of the community.

Apart from the above, the act mandates the breeders to ensure adequate supply of seeds of his variety

to public at reasonable price. The farmers are exempted from paying fees for registration of variety. Further, recognising the low literacy levels in India, the Act provides safeguards against innocent infringement on the part of farmers. Farmers who unknowingly violate the rights of a breeder shall not be punished if they can prove that they were not aware of the existence of breeder's rights.

Analysis of the PPVFR Act

The Protection of Plant Varieties and Farmers' Rights Act 2001 not only gives intellectual property protection to the plant breeders, but also upholds the legal space for farmers to save, use, exchange and sell the farm saved seeds.

However, the way this act was passed; it was able to attract wide attention and hot debates on rights of farmers for the first time in India. There was a lot of difference between the initially drafted act and the finally passed act; as the final act had not only included 'Farmer's Rights' phrase in its title but also dedicated a whole chapter on this. The role of NGOs and other organization must be lauded here which forced the government to initiate wide-ranging dialogue with various stakeholders.

Factbox: What is Plant variety Protection?

The breeding activities and exploitation of new varieties are the decisive factors for improving rural income and their overall economic development. Since the process of plant breeding is long and expensive, it is important to provide an effective system of plant variety protection with an aim to encourage the development of new varieties of plants for the benefit of society. A Farmer who has bred or developed a new variety is entitled for registration and other protection under PPV&FR Act, 2001 in the same manner as a breeder of a variety. This protection is provided for 18 years in respect to trees and vines, 15 years for other crops. Any traditionally cultivated plant variety which has undergone the process of domestication / improvement through human interventions can be registered and protected subjected to fulfilment of the eligible criteria.

FactBox: What is DUS test?

DUS stands for distinctness, uniformity and stability (DUS) of new varieties of plants for the purpose of granting the Breeders' Right. The new variety should be distinct from the other varieties for at least one characteristic to pass in the DUS test. The authority has DUS monitoring centers. The breeder is required to deposit the seed or propagating material including parental line seeds of registered variety to the Authority. The DUS test is done for a fee of Rs. 20,000/- and other applicable fees. The person after getting the right can sell the seeds / propagating material in his / her name.

Seeds Bill 2004

To deal with several issues of the seed sector and repeal the old 1966 act, Seed Bill 2004 was introduced in parliament in December 2004. However, this bill has not been passed as of now. Apart from putting a proper production and supply regime which protects the farmers from monopolistic activities of commercial seed producers. The NDA Government is to soon redraft a new seed bill. This topic will be covered in CGS documents.

Chemical Fertilizers

Plants get three elements viz. Carbon(C), Hydrogen (H) and Oxygen (O) from air and water. During the process of Photosynthesis, these three elements are combined to make carbohydrates, with subsequent releasing of Oxygen. While roots absorb water, CO2 enters the plants via stomata (the small leaf openings).

Apart from air, 15 of the essential nutrients are supplied by the soil to plants. Out of them, Nitrogen, Phosphorus and Potassium are called primary nutrients or macronutrients. They are called primary nutrients because they are required by plants in large amount relative to other nutrients and deficiency of them is most likely to limit the plant growth and healthy development.

Three more elements viz. Calcium, Magnesium and Sulphur are known as secondary nutrients because the deficiency of them is less likely to be a growth limiting factor. Calcium and Magnesium are generally added to soil to adjust soil pH. Sulphur generally gets added to soil via rain and release from organic matter in soil.

Further, nine more elements viz. Zinc, Chlorine, Boron, Molybdenum, Copper, Iron, Manganese, Cobalt and Nickel are called micro-nutrients. They are called so because they are found and needed by plants in very small amount relative to other nutrients and are least likely to be limiting plant growth and healthy development.

Essential plant nutrients			
Supplied by Air & Water	Supplied by Soil		
Non-Mineral	Primary or Macronutrients	Secondary Nutrients	Micronutrients
Carbon – C	Nitrogen – N	Calcium – Ca	Zinc – Zn
Hydrogen – H	Phosphorus – P	Magnesium – Mg	Chlorine – Cl
Oxygen – O	Potassium – K	Sulfur – S	Boron – B

Essential plant nutrients			
			Molybdenum – Mo
			Copper – Cu
			Iron – Fe
			Manganese – Mn
			Cobalt – Co
			Nickel – Ni

- Nitrogen: Promotes rapid growth, chlorophyll formation and protein synthesis.
- Phosphorus: Stimulates early root growth. Hastens maturity. Stimulates blooming and aids seed formation.
- Potassium: Increases resistance to drought and disease. Increases stalk and straw strength. Increases quality of grain and seed.
- Calcium: Improves root formation, stiffness of straw and vigor. Increases resistance to seedling diseases.
- Magnesium: Aids chlorophyll formation and phosphorus metabolism. Helps regulate uptake of other nutrients.
- Sulfur: Amino acids, vitamins. Imparts dark green color. Stimulates seed production.
- Boron: Aids carbohydrate transport and cell division.
- Copper: Enzymes, light reactions.
- Iron: Chlorophyll formation.
- Manganese: Oxidation-reduction reactions. Hastens germination and maturation.
- Zinc: Auxins, enzymes.
- Molybdenum: Aids nitrogen fixation and nitrate assimilation.
- Cobalt: Essential for nitrogen fixation.
- Nickel: Grain filling, seed viability
- Chlorine: Water use.
- Oxygen: Component of most plant compounds.
- Hydrogen: Component of most plant compounds.
- Carbon: Component of most plant compounds.

Basic Knowledge about Fertilizers

Any natural or synthetic material added to soil to provide plant nutrients is called Fertilizer. Fertilizers are available in the market in liquid, solid as well as gaseous form (e.g. anhydrous ammonia).

All chemical fertilizers available in the market are labelled with three numbers, which represent the weight of total nitrogen (N), citrate-soluble phosphorus (expressed as P2O5) and water-soluble potassium (expressed as K2O), respectively. These numbers represent nitrogen, phosphorus and potassium or NPK respectively.

We note here that these numbers are not N-P-K but are actually N-P_2O_5-K_2O. To get the actual elemental proportion of these three elements, we need to multiply fraction of P_2O_5 with 0.44 and fraction of K_2O by 0.83. Nitrogen number represents actual Nitrogen present. Thus, if a fertilizer bag is labelled as 18–51–20, this implies that it has:

- 18% Elemental Nitrogen
- 44= 22% elemental Phosphorous
- 83= 17% of elemental Potassium

Apart from the above, fertilizer bags also come with filler material such as pelleted bio solids, vermiculite, fuller's earth, diatomaceous earth etc. These filler items help to spread the fertilizer avoid the so called "Fertilizer burn" in plants.

The below table represents the labels found on common fertilizers available in the markets:

Fertilizer	NPK Ratio
Calcium nitrate	15-00-00
Ammonium sulphate	21-00-00
Ammonium nitrate	33-00-00 to 34-00-00
Urea (U-46)	46-00-00
Anhydrous ammonia	82-00-00
Potassium nitrate	13-00-44
Potassium chloride	00-00-60

Kindly note that Urea has the highest nitrogen content of all solid nitrogenous fertilizers in common use in India.

Straight, Complex and Mixed Fertilizers

The straight fertilizers are those fertilizers which supply only one primary plant nutrient, either N or P or K. On this basis, the fertilizers can be straight nitrogenous, straight Phosphatic or straight Potash fertilizers. For example, Urea provides only N while Potassium Chloride provides only K.

- Examples of straight nitrogenous fertilisers include Ammonium Sulphate (AS), Calcium Ammonium Nitrate (CAN), Ammonium Chloride and Urea.
- Examples of straight Phosphatic fertilizers include Single Super Phosphate (SSP) and Triple

Super Phosphate (TSP)

- Example of straight Potash fertilizer is Potassium Chloride

Complex fertilizers on the other hand provide two or three primary nutrients in which nutrients of at least two are in chemical combination. For example, Diaammonium Phosphate provides both N and P. Further, Mixed fertilizers are physical mixtures of the straight fertilizers. We note here that complex and mixed fertilizers are considered agronomically better.

Implications of Indiscriminate use of Fertilizers

Indiscriminate use of synthetic fertilizers can result in soil contamination by heavy metals; reduction in the nutritional value of crops, reduction in soil fertility etc. Fertilizers contaminate the soil with impurities, which come from the raw materials used for their manufacture. Mixed fertilizers often contain ammonium nitrate (NH4NO3), phosphorus as P2O5, and potassium as K2O. The Arsenic , Lead and Cadmium present in traces in rock phosphate mineral get transferred to super phosphate fertilizer. Since the metals are not degradable, their accumulation in the soil above their toxic levels due to excessive use of phosphate fertilizers becomes an indestructible poison for crops. Further, over use of NPK fertilizers reduce quantity of vegetables and crops grown on soil over the years. It also reduces the protein content of wheat, maize, grams, etc., grown on that soil. The carbohydrate quality of such crops also gets degraded. Excess potassium content in soil decreases Vitamin C and carotene content in vegetables and fruits. The vegetables and fruits grown on overfertilized soil are more prone to attacks by insects and disease.

India's Chemical Fertilizer Scenario

Although India has diverse types of soil but most of them are deficient in nitrogen and phosphorus. Over the years, the increased usage of chemical fertilizers has played a significant role in increasing the farm productivity. However, the current trends show that the marginal productivity of soil in relation to the application of fertilizers is declining. The key reason to this is a comparatively higher usage of the straight fertilizers (Urea, DAP & MOP) in comparison to complex fertilizers (NPKs); and either low or non usage of secondary and micro nutrients. The skewed utilization of fertilizers is mainly due to pricing of subsidized fertilisers.

Production, Consumption and Import dependency of Fertilizers

In 1950-51, consumption of chemical fertilizers in India was negligible. In 2010-11, per hectare chemical fertilizer consumption was 144 Kilograms. This value is still low in comparison to some of the developed countries such as South Korea (400 kgs), Netherlands (275 kgs), Belgium (225 kgs), Japan (340 kgs). The main reason of low per hectare consumption of chemical fertilizers is absence of assured water supply. Assured water supply is precondition for the usage of chemical fertilizers.

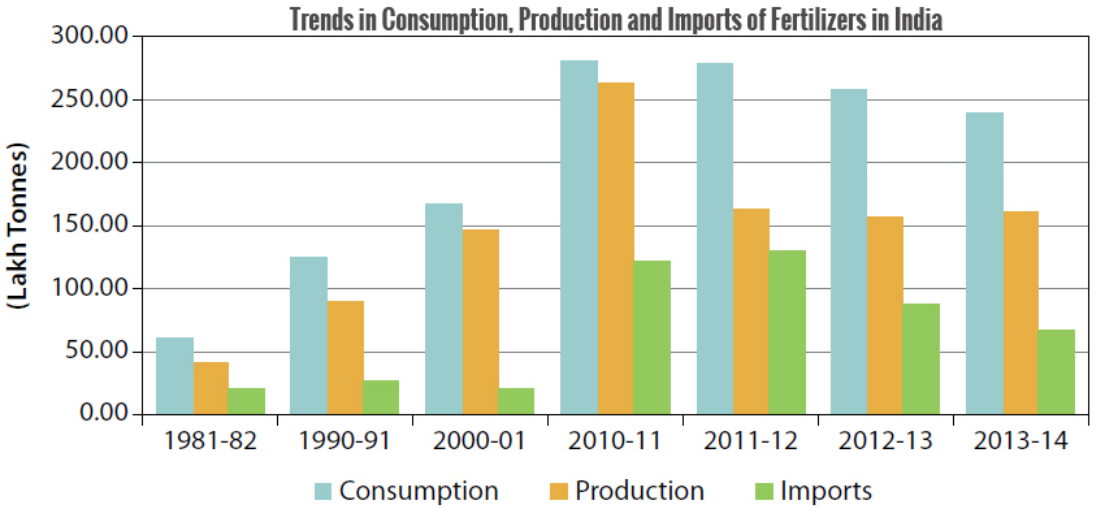
Since most of the cultivated areas in India are rainfed; they consume only 20% of the total fertilizers. However, despite low per hectare consumption fertilizers, India needs to import fertilizers to fulfil the demand. Production, consumption and import figures of fertilizers in India are shown in below table:

Consumption, Production and Import of Fertilisers (Lakh Tonnes)

Year	Consumption				Production			Imports				C &.F Value of Imports (₹ Crore)
	N	P	K	TOTAL	N	P	TOTAL	N	P	K	TOTAL	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1981-82	40.69	13.22	6.73	60.64	31.44	9.49	40.93	10.54	3.43	6.44	20.41	716.62
1990-91	79.97	32.21	13.28	125.46	69.93	20.52	90.45	4.14	10.16	13.28	27.58	1335.82
2000-01	109.20	42.15	15.67	167.02	109.61	37.43	147.04	1.54	3.96	15.41	20.91	#
2010-11	165.58	80.50	35.14	281.22	221.56	42.22	263.78	45.64	37.38	38.81	121.83	8348.89
2011-12	173.00	79.14	25.76	277.90	122.59	41.01	163.60	52.40	44.27	33.35	130.02	15442.02
2012-13	180.36	59.55	18.13	258.04	121.94	35.41	157.35	46.90	27.78	12.30	86.98	15980.22
2013-14	165.25	54.58	19.76	239.59	123.78	37.14	160.92	38.08	15.9	13.33	67.31	-

There was no import of Urea in 2000-01, 2002-03 and 2003-04 in Government account.

The above table shows that in all kinds of fertilizers, India need to import to fulfil the domestic demand. Although Fertiliser industry has made rapid progress and there has been considerable increase in the domestic production of fertilisers over the years but it is not enough to keep pace with the growth in consumption. India is deficient in primary sources of fertilizer inputs (such as natural gas, rock phosphate, potash); it has sizeable import dependence for the intermediates like phosphoric acid and ammonia. The below graphics shows the production-consumption imbalance in the fertilizer sector:



The key reasons as to why India was not able to increase the fertilizer production are as follows:

- Firstly, setting up a fertilizer plant in India is a long process which generally takes five to eight years from time of issue of letter of intent to start of production. There was an absence of clear policy of setting up fertilizer plant in the country.
- Secondly, the government policy towards private sector players in fertilizers has never been clear. The business environment for fertilizer companies has been hostile due to urea subsidy and erratic supply of natural gas, which is raw material.

Further, India could not attract foreign companies to produce fertilizers here because they earn huge profits in exports to India. Thus, since local production is low, India is dependent on fertilizer imports.

Fertilizer Subsidy Issue

Fertilizer subsidy is the difference between the retention price of fertilizers and the price at which fertilizers are made available to consumers. The difference is paid to industry as subsidy. Fertilisers, after oil and food, account for the third-biggest share of India's total subsidy bill, which is estimated at Rs 2.46 crore for 2014-15. The total fertiliser subsidy in 2014-15 has been pegged at Rs. 67,970 crore. Out of this, subsidy for imported urea is pegged at Rs 12,300 crore, domestic urea is Rs 31,000 crore and sale of de-controlled fertilisers (like phosphatic & potassic fertilisers) is Rs 24,670 crore.

What are the major issues of Fertilizer Subsidies?

Application of fertilisers was popularised in our country during the Green Revolution of the 1960s and the 1970s. Incremental use of fertilizers in synergy with high yield seeds proved to be of tremendous contribution to the success of Green Revolution. However, the prices of fertilizers kept

increasing. Since the Government wanted to encourage use of mineral based fertilizers; it started providing reimbursements to companies to compensate for high cost of production for the mineral-based fertilisers and for selling it at low costs to the farmers. This is all what we call fertilizer subsidy. However, this has been a major contentious issue today. The major problems are as follows:

- The objective of the government is to support the farmers but the question is exactly how much of that really goes to the pocket of the farmers and how much is siphoned by the companies.
- It has been debated that the beneficiaries have been the large farmers and not small & marginal farmers.
- While deciding on the subsidy regime, it has to be kept in mind that Urea accounts for almost 50 per cent of fertiliser application and India is NOT self sufficient in Urea production. At the same time, distorted subsidy regime may deplete the NPK use ratio. The normally accepted ratio is 4:2:1.

Backgrounder on Fertilizer Subsidy Policy

Till 2003, the subsidy to urea was under the provisions of the **Retention Price Scheme** (RPS). Under RPS, the difference between retention price (cost of production as assessed by the Government plus 12% post tax return on net worth) and the statutorily notified sale price was paid as subsidy to each urea unit. Later the RPS regime was dismantled and a **Concession Scheme** for urea units based on the prices of feedstock used and the vintage of plants was introduced in 2003. This was called **New Pricing Scheme** or NPS. It had various phases like NPS-I (2003-2004), NPS-II (2004-2006) and NPS-III (2006 onwards). The difference between the cost of production and the selling price/MRP is paid as subsidy/concession to manufacturers.

Urea is the only controlled fertilizer, which is sold at statutory notified uniform sale price. The Phosphatic and Potassic fertilizes are under a decontrolled regime and are sold at indicative maximum retail prices (MRPs).

However, the New Pricing Scheme resulted in distortion of the market. The fertilizer companies started bleeding due to fixed Urea prices and rising cost of Inputs such as Natural Gas and Naptha as 80% of the production of urea in India is gas-based. The government increased the prices of Urea but still the prices have been skewed.

At present, the urea-based fertilizers cost Rs. 5,360 per tonne, while the potash and phosphate fertilizers cost Rs. 24,000 per tonne.

Since, Urea is available at such a cheap price that people not only started unbalanced use of this fertilizer but also misused it by illegally exporting, preparation of adulterated milk etc.

Urea Decontrol

There has been a long pending demand of decontrol of Urea but decontrolling urea is a politically sensitive issue. The Planning Commission's Soumitra Choudhary panel had recommended that the NBS policy, which is applicable only on P and K fertilisers needs to be extended for urea also. This has become all the more desirable to maintain the ratio between MRP of urea vis-a-vis P and K fertilisers, which is essential for balanced fertilisation.

Nutrient Based Subsidy (NBS) scheme

To foster the balance use of fertilizers; government is implementing Nutrient Based Subsidy (NBS) policy w.e.f. 1st April 2010 for fertilizers other than Urea. The fertilizers included in this scheme include 22 grades of decontrolled fertilizers namely DAP, MAP, TSP, DAP Lite, MOP, SSP, Ammonium Sulphate and 15 grades of complex fertilizers. These fertilizers are provided to the farmers at the subsidized rates based on the nutrients (N, P, K & S) contained in these fertilizers. Additional subsidy is also provided on the fertilizers fortified with secondary and micronutrients as per the Fertilizer Control Order such as Boron and Zinc.

This subsidy given to the companies is fixed annually on the basis of its nutrients content (i.e. Nitrogen, Phosphate, Potash and Sulphur).

Under this scheme, Maximum Retail Price (MRP) of fertilizers has been left open and manufacturers/marketers are allowed to fix the MRP at reasonable level. However, this scheme failed to produce any result mainly due to huge difference in prices of Urea and other fertilizers.

Efforts to Increase Urea Production

In 2010-11, India consumed around 31 Million tonnes of Urea, out of which 22 million tonnes was produced at home and rest 8 million tonnes was imported. Urea demand during 2017-18 is projected to be about 34 million tonnes and by 2024-25, it is expected to be 38 million tonnes.

Ironically, urea is the only chemical fertilizer that can be produced wholly indigenously. For manufacturing phosphatic and potassic fertilisers, either whole or a part of the raw material needs to be imported. The government controls the urea sector and has fixed the maximum retail price (MRP) at Rs.5,360 a tonne. The difference between the MRP and the cost of production is given as subsidy to manufacturers.

The growth in indigenous production of Urea has been stagnant vis-à-vis the entire fertilizer industry. The reason of stagnancy in Urea production is lack of capacity addition because of numerous policy hurdles and limited / uncertain availability of raw materials.

Government Efforts to increase Urea Production

On the basis of recommendations of Planning Commission panel led by Abhijit Sen, the UPA Government had notified a new Investment Policy for Urea Sector. This policy was based on import

parity price (IMPP) (this actually means – I will pay you what I pay when I import) with some provisions of floor and ceiling for determining the producer's price of urea produced from new investments. But this policy did not attract expansion in the Greenfield or Brownfield Projects because government could not come up with assured supply and transparent price mechanism for natural gas.

In 2011, one more "New Investment Policy" was launched by Manmohan Singh Government on the basis of an EGoM (Empowered Group of Ministers), such EGoMs and GoMs were in vogue during UPA regime. This new investment policy offered huge incentives to companies that decide to set up new Urea plants or expand the capacity of the existing plants. In summary, this policy **ensured** a 12-20% post tax return on fresh capital infused by the manufacturers. This assured return was possible because the Manmohan Government linked the Urea price to price of the Natural Gas. [Urea price=$305-335 per tonne @Natural Gas Price=6.50 per mmBTU]. It was also decided that for $1 increase in the Natural Gas prices; the price of Urea will be increased to $20 per tonne. This was a lucrative idea but on ground it did not materialize. It was reported that the businessmen are lining up to put in place new Urea plants; however on ground, we did not see any substantial increase in Urea production.

Why this scheme did not work?
All business work on the basis of some future projects costs and benefits. The current MRP of Urea is Rs. 5310 per tonne. It was assured that at 1 dollar increase of the cost of natural gas, the government would pay additional $20 per tonne of Urea. This would imply that if Natural gas goes up from 6.50/mmBTU to 14.50 /mmBTU; this would translate into $335+160=$495 per tonne. This translates into approximately Rs. 30000/- per tonne price of Urea {taking USD near Rs. 60}. That figure is six times of its MRP. Thus, the viability of such business in which their investment would need five times of support from government was not digestible to investors. We note here that imported Urea from countries like Oman costs around Rs. 10000/- per tonne. Thus, keeping MRP artificially low has been the root cause of policy paralysis in fertilisers. [currentuser_id]

NDA Government Policy in Fertilizer Sector

Several new things have come up in NDA regime in fertilizer sector. These include a Gas Price pooling Policy; comprehensive New Urea Policy 2015 and removing restrictions on production of 'Neem Coated Urea'. We examine each of them for our study purpose.

Gas Price Pooling Policy

From July 1, 2015; there is a 'Gas price pooling' mechanism in place in India. Under this scheme; the price of domestic natural gas is averaged or pooled with the cost of imported LNG to create a uniform rate for fertilizer plants. All fertilizer plants in the country get the feedstock natural gas to make urea at this uniform price.

The Gas Price Pooling seeks to change the industry dynamics in Urea sector by levelling gas costs for all players. Earlier, the situation was that every plant needed make its own arrangement / contracts individually on varied costs from different suppliers. This situation was particularly disadvantageous for the plants which had no access to cheap domestic gas. By pooling domestic gas with imported gas, the delivered gas cost for all units will be uniform for all players who are connected to the natural gas grid.

Implications of this policy

- Under the 2012 policy, the onus of contracting gas supply for new units was on the individual players. This has been done away with now.
- Since price is same for input gas for all plants, and the subsidy is also same provided by the Government (Cost -Rs. 5310 per tonne); this policy would incentivise the competition among the various fertilizers makers and this competition would be on energy efficiency and production volume mainly (not on price of natural gas input).
- This policy allows the industry to focus on its core business of increasing urea production at healthy energy efficiency. Their problem of dealing with the gas supply has been now left to LNG suppliers and gas pool operator GAIL (India) Ltd.

We note here that the price of domestic gas is almost half of the imported gas. Fertiliser plants consume about 42.25 million standard cubic meters per day of gas for manufacture of subsidised urea. Out of this, 26.50 mmscmd comes from domestic fields and the rest 15.75 mmscmd is imported liquefied natural gas (LNG).

New Urea Policy 2015

In May 2015, the Union Cabinet gave its approval to a comprehensive New Urea Policy 2015 for the next four financial years (June 2015 to March 2019).

Objectives

The key objectives of the New Urea Policy 2015 are as follows:

- Maximise indigenous Urea Production to reduce import dependency and reduce subsidy burden on the government
- Promote energy efficiency to reduce Carbon-footprint (via energy efficiency) to make Urea

production environment friendly. [This will be done via revised specific energy consumption norms]

- Make Urea production plant to adopt best technology available and become globally competitive.
- Timely supply of Urea to farmers at the same MRP.

Proposed Outcome

- According to the government, the new Urea policy will result in direct saving of Rs. 2618 Crore and Indirect saving of Rs. 4829 Crore. It also expects to output additional 20 Lakh tonnes of Urea every year.

Promotion of Energy Efficiency

Currently, the subsidy for Urea plants varies as per their actual energy consumption vis-a-vis the predefined norms of the government for different plants depending on their vintage. Higher is the energy efficiency of a unit, higher is its profitability. Via the 2015 New Urea Policy, the government has tightened these norms for next four years. The overall idea is to make these units go for maximum saving of power to get maximum incentives. This is good for the government but is marginally negative for the industry because the new norms will not allow them to get the same quantum of incentives as they were getting earlier. The companies will have to improve their energy consumption levels and adopt best technology available to produce urea efficiently.

Cost of Urea for Farmers

Interestingly, the new Urea Policy has the old rates of Urea for farmers. MRP of urea for the farmers is same @ Rs. 268/- per bag of 50 kgs. excluding local taxes. Farmers have to pay an additional price of only Rs.14/- per bag of neem coated urea.

Comment / Analysis

The above discussion makes it very clear that the new Urea Policy is mostly about making energy efficiency norms more tight for fertilizer units. What the government has done is to link their incentives with the annual energy consumption and prompted them go for most energy-efficient technologies to raise actual production. The units that fail to do so would lose their profit margins. If we look at it with Gas Pricing Pooling mechanism; we find that government has tried to make the urea production a level playing field.

However, the new Urea Policy does not seek to trim Urea subsidy substantially. It keeps the Urea prices same as before, otherwise that move could be tagged as anti-farmer. Not only this, the subsidy rates for decontrolled P and K fertilizers has also been kept at same level. In summary, we cannot call this a big reform. The real problem of huge price differential between N and P/K is not going to be alleviated. To check the misuse of Urea, government has gone to remove restrictions on Neem

Coated Urea instead.

Neem Coated Urea

Before we move to the government policy on Neem Coated Urea, we need to understand what is Neem coated Urea and what are its advantages vis-a-vis uncoated urea.

Understanding Nitrogen Efficiency

With 46% N content, Urea is the most popular Nitrogenous fertilizer around the world. When Urea is applied to soil, it is first hydrolysed (i.e. broken by water) into Ammonical form (Ammonium Ion i.e. NH_4^+) and then to nitrite (NO_2^-), followed by to nitrate (NO_3^-) forms by the process called nitrification. Here, we note that most crops use nitrate as source of nitrogen (A few crops such as **Paddy prefer Ammonical form over nitrate**.).

Thus nitrification process is necessary for making nitrogen available to plants. However, if the process of nitrification is too rapid; nitrogen will escape to atmosphere and plants will not be able to recover it from Urea efficiently. Generally, the plants are able to recover a fraction of all Urea N and this fraction is known as Nitrogen Use Efficiency (NUE). This NUE stands anywhere between 30 to 50%. Thus, two third of Urea Nitrogen escapes from the soil and is not used by the plants. Further, faster conversion of nitrate into Urea also results in accumulation of nitrates in soil / underground water. Once nitrate reaches underground water, it is most difficult to remove; and causes diseases such as blue baby syndrome.

This implies that there is a need to regulate the urea hydrolysis and nitrification. This is done by some chemical / natural agents which are called Nitrification inhibitors. However, most of the nitrification inhibitors are costly chemicals (examples nitrapyrin, dicyandiamide and ammonium thiosulphate) beyond reach of Indian farmers. Coating Urea with Neem oil or Neem cake has been proved to be an effective natural alternative to these chemicals. It has been scientifically established that Neem oil serves as an effective inhibitor if coated on Urea. Thus, the benefits are as follows:

- Neem coating leads to more gradual release of urea, helping plants gain more nutrient and resulting in higher yields.
- Lower underground water contamination due to leaching of urea.
- Neem serves as a natural insecticide
- Collection of neem seeds is needed for manufacturing of neem coated urea. This would generate employments in rural areas.
- Neem-coating will help check heavily subsidized urea's pilferage to chemical industry and other uses such as making of adulterated milk.

Government Policy on Neem Coated Urea

In January 2015, the government allowed the urea producers to produce up to 100% of production as Neem coated urea. Further, the government made it mandatory to produce at least 75% of domestic Urea as Neem coated. The current policy is that Government has mandated all indigenous producers of Urea to produce 100% of urea as Neem coated urea only.

Technology in Agriculture

Precision Farming

Precision Farming refers to precise application of agricultural inputs based on soil, weather and crop requirement to maximize sustainable productivity, quality and profitability. It includes the use of latest technologies such as remote sensing (RS), GPS, and geographical information system (GIS) with an objective to improve profitability and productivity. Precision Farming gives farmers the ability to use crop inputs more effectively including fertilizers, pesticides, and tillage and irrigation water. More effective use of inputs means greater crop yield and/or quality, without much polluting the environment.

Potential of Precision Farming

The potential of precision farming lies in the precise use of farm inputs such as water, fertilizers, herbicides and pesticides and the farm equipments. This implies that rather than managing an entire field based upon some hypothetical average condition, precision farming recognizes site-specific requirements within fields and adjusts management actions accordingly. Thus, Precision farming allows taking decisions quickly for small areas within larger fields.

How it is done?

A filed is divided into management zones called **grids** on the basis of soil pH, nutritional status, pest infestation, yield rates, and other factors that may affect crop production. The management decisions are based on the requirements of each zone. The tools such as GIS, GPS, etc. are used to control zone inputs. With the use of GPS, exact location for a particular management decision can be found. For example a farmer mounts a GPS device on the tractor while applying the fertilizers or pesticides. Crop yield can also be monitored to create maps that show the high and low production areas of a field for improved management decisions.

Technologies used in Precision Agriculture

Mapping & Data Collection

- Maps generation is the first step in Precision Farming. The maps measure spatial variability and provide the basis for controlling spatial variability.
- Mapping is done with data collection in the filed related to various spatial variables such as soil type, soil nutrition status, crop density, infestations etc.
- The data is collected using soil probes and other such tools. Mapping and data collection can

be done using the RS, GIS and manual inputs.

Global Positioning System (GPS) receivers

- The GPS satellites broadcast the signals that allow the GPS receivers to compute their location. The information is provided while in motion.
- Having precise location information at any time allows soil and crop measurements to be mapped.

Yield monitoring

- The grain yield monitors measure and record the yield of the crop, which is essential for making sound management decisions.
- If the yield maps are used properly, they would provide important feedback in determining the inputs such as fertilizer amendments, seed, pesticides and cultural practices including tillage and irrigation.

Remote sensing

- Remote sensing refers to collection of data from a distance. The data sensors can simply be hand-held devices, mounted on aircraft or satellite-based. The remote sensing provides information about the crop health, moisture, nutrients, compaction, crop diseases etc.
- For example, the near infrared images that are highly correlated with healthy plant tissue can be recorded in the cameras.
- RS also provides information about the in-season variability that affects crop yield and extent of crop stress.

Geographic information systems (GIS)

- Geographic information systems (GIS) use feature attributes and location data to produce maps.

Key Challenges to Precision Farming in India

Though widely adopted in developed countries, the adoption of precision farming in India is yet in infancy primarily due to its unique pattern of land holdings, poor infrastructure, lack of farmers' inclination to take risk, socio-economic and demographic conditions. The small size of farms and fields in most of Indian agriculture limits economic gains from currently available precision farming technology, while the population density, and public concerns for the environment, food safety and animal welfare means that those potential benefits are being given more attention.

Remote Sensing Applications

Remote sensing techniques play an important role in Crop identification; Acreage and production estimation; Disease and stress detection; Soil and water resources etc. Remote sensing applications have become very important for making macroeconomic decisions related to food security, poverty

alleviation and sustainable development in the country.

Historical Bits

The use of remote sensing for national development started in India comparatively earlier than other developing countries. The first experiment that used remote sensing was on coconut root–wilt disease in Kerala using colour-infrared aerial photography in late 1960s. Another early programme was Agriculture Resources Inventory & Survey Experiment (ARISE) in 1975. After that many other programmes were started such as Experimental Studies on Crop Discrimination in 1970s; Estimation of area & production of major crops at State level in 1980s, Launch of FASAL in 1990s etc.

For your preliminary examination, please note the below facts:

- National Remote Sensing Agencies (NRSA) was established in 1975 primarily for providing operational aerial survey services.
- Launch of two experimental earth observation satellites Bhaskara I and II (1979, 1981) provided the necessary experience in handling a total remote sensing system on an experimental level. These satellites carried cameras and SAMIR (Satellite Microwave Radiometer).
- India received a tremendous boost with the launch of Indian Remote Sensing Satellite-1A (IRS 1A) in March 1988. This carried two cameras LISS-I and LISS-II. A series of IRS satellites were launched in 1990s. Today, IRS system is the largest constellation of remote sensing satellites for civilian use in operation today in the world, with 12 operational satellites.
- In 1990s, concept of Forecasting Agricultural output using Space, Agro-meteorology and Land based observation (FASAL) developed. Its main objective was to collect Monsoon data through remote sensing, economic data and monitoring of crops when growing.
- To provide real-time information about the prevalence and severity of droughts at district and sub-district level in 13 key agricultural states, the ISRO's National Remote Sensing Centre, Hyderabad launched a National Agricultural Drought Assessment and Monitoring System (NADAMS). It prepared fortnightly reports on droughts by using advanced wide-field sensors of satellites like Resourcesat-1, IRS 1C and IRS 1D.

At present, the NDA government is preparing to deploy satellites to digitally map each farmland in the country, data from which will be used to provide tailor-made crop insurance cover to farmers. The idea is to digitally map all of India's farming plots using GPS readings and offer farmers yield-based insurance products, which will cover their individual risks. At present, crop insurance mainly covers the loans taken by a farmer and not his farming activities.

Autonomous farming

Autonomous Farming refers to the use of machine for seeding, crop sensing, harvesting, weeding and other follow-up operations by using remote sensing and GIS. Seeding is done by an attached seeding drill controlled by GPS. Crop growth, soil moisture and weeds are continuously noted via the remote sensing appliances. Autonomous & coordinated harvesting and grain collection machinery. The automation of agriculture is still in research level in many developed countries (US, Australia).

Major Applications of Remote sensing in Agriculture

Some of the specific applications are as follows:

- **Soil Properties Sensing**: Soil Texture, Structure, and Physical Condition Soil Moisture; Soil Nutrients.
- **Crop Sensing:** Plant Population; Crop Stress and Nutrient Status.
- **Yield Monitoring Systems:** Crop Yield; Harvest Swath Width; Crop Moisture:
- **Variable Rate Technology Systems:** Fertilizer flow; Weed detection, pressure sensors

Mahalanobis National Crop Forecast Centre (MNCFC)

Indian Government had launched two programmes viz. FASAL and NADAMS in 1990s and early 2000s. In 2012, both of these were merged and were put in control of Mahalanobis National Crop Forecast Centre (NCFC) in New Delhi. This works as an integrated centre to provide estimates of crop output and assess the drought situation in the country through latest technologies. MNCFC prepares in-season forecasts for major crops such as rice, wheat, sugarcane and maize.

ICT in Agriculture

In the context of agriculture, the potential of information & communication technology (IT) can be studied under broadly two outcomes viz. direct contribution to farm productivity and indirect contribution. The **Precision farming** is the result of direct contribution of agriculture technology for farm productivity.

The indirect tools help farmers to take informed and quality decisions which will have positive impact on the way agriculture and allied activities are conducted. Indian farmer urgently requires timely and reliable sources of information inputs for taking decisions. At present, the farmer depends on trickling down of decision inputs from conventional sources which are slow and unreliable. The changing environment faced by Indian farmers makes information not merely useful, but necessary to remain competitive.

The major ICT tools for agricultural sector include personal computers, mobile telephones and other

telecommunication devices. ICT has many potential applications in delivering agricultural extension and can bring new information services to rural areas. ICT tools can help in meeting the challenges in agricultural development in the following ways:

- Agriculture Information, Awareness and Education using ICT.
- Advanced information about adverse weather condition, so that farmers can take precautionary measures.
- Real time and near real times pricing and market information.
- Information dissemination about various government schemes.
- Information regarding agrifinance, agriclinicls and agribusiness.
- Online Farmer Communities

Government Initiatives on ICT in agriculture

Key Government initiatives to promote use of ICT in agriculture include National e-Governance Plan in Agriculture (NeGP-A), various Touch Screen Kiosks, Krishi Vigyan Kendras, Kisan Call Centres, Agri-Clinics, Common Service Centers, mKisan, Kisan TV and various other applications.

Use of Mobile Technology for Small Farmers

Indian Landscape is dominated by small and marginal farmers (80%) and it has been established that small holdings have higher productivity than medium and large farms in India. Mobile telephony has made it possible to reach every farmer of the country. Mobile is being used to bridge the information gap. One such early mobile based initiatives was Fisher Friend Project by MS Swaminathan foundation. It used mobiles to provide vital livelihood information to fisher folks of Tamil Nadu and Pondicherry. Later, **mKrishi** was launched by the Tata Consultancy Services (TCS) Mobile Agro Advisory System which connects farmers with an ecosystem that empowers them to make efficient decisions about agriculture, drive profits, and conserve the environment.

The key current mobile applications helpful for farmers are as follows:

MyRML

MyRML is a mobile application developed by Reuters Market Light, a PPP project running across several states in India. Reuters Market Light is a pioneering mobile phone-based highly-personalised professional information service specially designed to support the farmer community. Its myRML is available for android phones.

MKisan Application

This app has been designed and developed by inhouse IT team of DAC with the help of C-DAC Pune under project mKisan. It enables farmers and all other stakeholders to obtain advisories and information being sent by experts and government officials at different levels through mkisan portal without registering on the portal.

Farm-o-pedia

Developed by CDAC, Mumbai, this is an android app targeted for rural Gujarat. The app is useful for farmers or anyone related to agriculture. It is available in English and Gujarati languages.

Bhuvan Hailstorm App

This app collects data about hailstorms in real time along with photographs and geographical coordinates.

General Knowledge Today

Land Reforms in India

Integrated IAS General Studies:2016-17
Last Updated: February 15, 2016
Published by: GKTODAY.IN

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Bali and Shadbhaga, Meaning of Land Grants, Earliest Land Grants, Iqta System, Khuts and Muqaddams, Mustkharaj, Mustkharaj, Revenue systems of Alauddin Khilji and Shershah, Patta and Kabuliyat, Polaj and Paruti, Dahsala system, Galla-bakhshi, Kankut, Nasaq, new land ownership policy of the British, Izaredar System, Features of Permanent Settlement, Ryotwari System, Mahalwari System, Commercialization of Agriculture during British Era, Constitutional Provisions Towards Land.

1. Critically examine the implications of the Indian Feudalism on polity of early medieval India.
2. "Shershah Suri had laid the foundation of administration on which Akbar raised the superstructure." Explain.
3. What improvement were done by Todarmal / Akbar in the existing land revenue system created by Sher Shah Suri? Discuss their impact on peasants.
4. Write a critical note on Akbar's land revenue system. To what extent a shift from annual system of assessment to Dahsala system helped the royal exchequer or the peasants. Discuss.

5. "The position of Zamindars had undergone a paradigm change from Mughal era to British Era.". Amplify.
6. "In the 18th and 19th centuries free countries of Europe and America, more and more people shifted from agriculture to industry and service. Ironically, exactly reverse happened in India." Discuss critically.
7. Discuss the salient features of Permanent Settlement. Why some historians call it a bold step and a wise measure adopted by company while some others called it a sad blunder? Substantiate.
8. Critically examine the social, economical and political outcome of Permanent Settlement of Bengal, Bihar and Odisha.
9. Make a comparative account of Zamindari, Mahalwari and Ryotwari system.
10. Critically examine the impact of the commercialization of agriculture on the peasant classes during 18th and 19th century India.
11. Critically examine the circumstances in which Zamindari Abolition Acts were passed in newly independent India throwing light on the outcomes of the enactments.
12. Discuss the tenancy reforms in independent India throwing light on their achievements.
13. "The Bhoodan and Gramdan movements led by Vinoba Bhave attempted to bring about a "nonviolent revolution" in India's land reforms programme." Discuss.

14. Critically examine the performance of Land Ceiling acts / reforms in Independent India.

Land Revenue in Ancient India

Land Revenue in Ancient India

Land revenue system in ancient India was based upon income from land, thus rated according to the productivity and kind of soil. Manu fixed it between 1/6, 1/8 or 1/12 according to the quality of the soil. Gautama raises the lower limit to 1/10. Sukra's schedule gives 1/6, 1/4, 1/3 and 1/2 according to the nature of soil, rainfall and irrigation facilities .

The Arthashstra mentions that the upland or *Sthala* and lowland i.e. *Kedara* should be entered differently in the land revenue books. The tax rate is 1/10 as per Arthashashtra initially, but later Kautilya mentioned about two taxes viz. **Bali** and ***Shadbhaga or Sadbhaga*** which is 1/6th.

In summary, the assessment of land varied as per the quality of the land and nature of the crop in ancient India. The King's share did not necessarily mean a fixed share. It was determined by consideration of fertility of the soil and by the needs of the State or of the cultivator. The system of measurement and survey and differentiation of soil according to productivity also indicate that land revenue assessment was not permanent but revised at intervals although a constant revision was not necessary.

Megasthenes states that Maurya officers were most likely concerned with the measurement and supervision of alluvial deposits for revenue purposes.

Indian Feudalism and Land Grants

From the post-Maurya period, and especially from Gupta times, India's political and administrative developments tended to feudalise the state apparatus.

What is feudalism?

In Europeans sense, feudalism describes a set of reciprocal legal and military obligations among the warrior nobility, revolving around the three key concepts of lords, vassals, and fiefs. However, in context with ancient India, the system gradually **developed from the beginning of the land grants**.

The practice of making land grants to the Brahmanas was a custom, sanctified by the injunctions laid down in the Dharmashashtras, Epics and Puranas. The **Anusasana Parva** of the Mahabharata devotes a whole chapter to the praise of making gifts of land (*Bhumidanaprasamsa*).

The Land Grants & Administrative Rights

The early Pali texts of the pre-Maurya period refer to the villages granted to the Brahmanas by the rulers of Kosala and Magadha. A term used for such grants was "**Brahamdeyya**".

Earliest Land Grants

The earliest land grants belonging to the first century BC were given to the Buddhist priests and

Brahmanas and other religious establishments. However, in the post-Guptas period even administrative officials were granted land. The landed beneficiaries were given both powers of taxation and coercion, leading to the disintegration of the central authority. The secular recipients of the grants and the autonomous holders of land are generally termed as fief holders and free holders. The major outcome was decentralization.

However, the Earliest epigraphic record of a land grants in India is a Saatavahana inscription of the first century BC, which refers to the grant of a village as a gift in the *Ashvamedha Sacrifice*. However, it is not clear, whether the administrative or revenue rights of these lands were also given to those priests or not. It has been guessed that the administrative rights were perhaps given up for the first time in the grants made to Buddhist monks by the Satavahana ruler – Gautamiputra Satakarni in the second century AD. Such a land grant included the rights that :

- The royal troops could not enter such land granted
- The government officials and district police was not supposed to disturb such lands.

Changes in Land Grants

From the period of later Mauryas, the land grants included the transfer of all sources of revenue, and the surrender of police and administrative functions. The grants of the second century AD mention that the *transfer of the king's control only over salt,* which implies that he retained certain other sources of revenue. But in some other grants, it was recorded that the donor (King) **gave up his control over almost all sources of revenue**, including pastures**, mines including hidden treasures and deposits.**

Then, the donor not only abandoned his revenues but also the right to govern the inhabitants of the villages that were granted. This practice became more prevalent in the Gupta period. There are many instances of grants of apparently settled villages made to the Brahmanas during the Gupta era. In such grants, the residents, including the cultivators and artisans, were expressly asked by their respective rulers not only to pay the customary taxes to the donees, but also to obey their commands. All this **provides clear evidence of the surrender of the administrative power of the state**.

One of the important aspect of the Kings sovereignty was that he used to retain the rights of the punishing the culprits. In the Post-Gupta times, the king made over to the Brahmanas not only this right, but also his right to punish all offences against family, property, person, etc.

Implications of Land Grants

We see that, by giving such privileges, the state was bound to disintegrate. Out of the seven organs of the state power mentioned in literary and epigraphic sources, taxation system and coercive power based on the army are rightly regarded as two vital elements. If they are abandoned, the state power

disintegrates. This was the system created by the grants made to the Brahmins. The land was granted for as long as the existence of the sun and the moon, which implies the permanent break-up of the integrity of the state.

The above discussion makes it clear that in the Post-Gupta period, the Brahamdeyya carried **freedom from taxes** , Administrative freedom and also the freedom from punishments (**Abhayantarasiddhi**). The widespread practice of making land grants in the Gupta period paved the way for the rise of Brahmin feudatories, who performed administrative functions not under the authority of the royal officers but almost independently. What was implicit in earlier grants became explicit in grants from about 1000AD; and well recognised in the administrative systems of the Turks.

The implications were many but the major implication was the creation of powerful intermediatories wielding considerable economic and political power. As the number of the land-owning Brahmins went up, some of them gradually shed their priestly functions and turned their chief attention to the management of land. Thus, their case secular functions became more important than religious functions. The comprehensive competence based on centralised control', which was the hallmark of the Maurya state gave way to **decentralisation in the post-Maurya and Gupta periods**. The functions of the collection of taxes, levy of forced labour, regulation of mines, agriculture, etc., together with those of the maintenance of law and order, and defence which w re hitherto performed by the state officials, were now systematically abandoned, first to the priestly class and later to the warrior class.

Thus, the main implications of the Indian Feudalism in early medieval period are as follows:

- **Political decentralization:** The seed of decentralization that was sown in the form of Land grants turned into a vividly branched political organization made up semi-autonomous rulers, Samantas, Mahasamantas and others such as Rajpurushas.
- **Emergence of new landed intermediatories:** The emergence of landed intermediaries- a dominant landholding social group absent in the early historical period- is linked to the practice of land grants which began with the Saatavahana.
- **Changes in agrarian relations:** Free vaishya peasants dominated the agrarian structure in early historical India and labour services provided by the Shudra. But, from the sixth century AD onwards the peasants stuck to the land granted to the beneficiaries because they were asked not to leave the village granted to the beneficiaries or migrate to tax-free village. This resulted in the immobility of the population and isolation from the rest of the world. Its implication was very profound such as development of localized customs, languages and

rituals.

Land Revenue in Medieval India

Sultanate Era

The conquest of Mohammad Ghori and establishment of the Sultanate brought major changes in the land revenue system in India. The Governments in those times made all attempts to increase the revenue by collecting taxes as per those in Islamic nations. The new taxes were imposed upon people and government's share in produce increased. However, till that time, the original form of Hindu system of Land tenure as per ancient Manu's laws survived with some modifications done by some of the greedy sultans and their officials.

The agricultural and land revenue system of the early Turkish Sultans rested on two foundations viz. the **Iqta** (assignment of land revenue) and **Kharaj** (Land Revenue).

The Iqta system provided an agrarian system to the country while the members of the ruling class attained income without any permanent attachment to any territory. The Iqta system was provided institutional status by Iltutmish and later this system became the mainstay of the sultanate administration under slave dynasty.

Iqta System

Under Iqta System, the land of the empire was divided into several large and small tracts called Iqta and assigned these Iqtas to his soldiers, officers and nobles. In the beginning, an Iqta was based upon salary. Later, under Firoz Shah Tughlaq it became hereditary.

Literally, Iqta means land or land revenue assigned to an individual *on certain conditions.* The holders of these Iqtas were the trustful agents of the Sultan. There were two kinds of Iqtas viz. **Large Iqtas** and **Small Iqtas**. The holders of large Iqta were the provincial governors, who had some administrative responsibilities also. On the other hand, the holders of the small Iqtas were the small troops holders who had no administrative responsibilities.

The small Iqta holders held and appropriated all the income obtained from the cultivators but as a *quid pro quid*, they were bound to present themselves with horses and arms whenever called upon by the Central Government. These small Iqta holders were called *Khuts* and *Muqaddams*. Amir Khusarau, for the first time, referred to Khuts as Zamindars.

The Khuts and Muqaddams became fond of luxurious living over the period of time, later, Alauddin Khilji suddenly abolished the system of small Iqtas with a stroke of pen and brought them under the central Government (thus called Khalsa land). This was regarded as one of the most important agrarian reforms of Alauddin Khilji.

Alauddin Khilji

Under Alauddin Khilji, India saw one of the most harsh land revenue system in India. His land and revenue reforms are notable for two measures viz. abolition of small Iqtas and Land Measurement (Paimaish)

Abolition of small Iqtas

With a stroke of pen, Alauddin abolished almost all small Iqtas and brought these lands under Khalsa or Crown lands. Almost entire land of Doab was brought under Khalsa. *In the Khalsa lands, the revenue was collected directly by the state.* The Sultan deprived the Khuts, Maqaddams and Chaudhuris of their privileges. They were forced to pay arrears of land revenue in a newly established department of arrears called *Mustkharaj*. This Mustkharaj reduced these Khuts and Muqaddams to beggars literally.

Land Measurement and Tax rates

Alauddin Khilji made several sweeping reforms in the field of revenue system. He was the *first Sultan who paid attention to measurement* (paimaish) of the cultivable land, which he called *zabita*, and estimated *yield per Biswa was fixed as unit of revenue collection* (currently, Biswa is 20th part of Bigha).

The ancient Hindu terminology of taxes viz. Bhaga, Bhoga and Kara were still in operation in those times but their meaning and demand had changed. Bhaga now meant Land revenue, Bhoga meant cess and Kar meant other taxes. These three were basis of assignment of land to nobles under Khilji.

As far as state demand is concerned, Alauddin made the harshest possible hike in tax demand till that time. He fixed state demand to be *half of the produce per Biswa yield*. This scale of agrarian tax at 50% was the highest under Khilji among all other sultans and kings so far in India. Not only this, he also imposed house tax (Ghari) and pasture tax (Charai or Chari) on the agrarian population.

But these harsh measures were not sustainable. As soon as Alauddin died, the system lost into oblivion. Later, Mohammad Tughlaq somehow tried to return to the Khilji's system and he tried to implement such a pilot project in a local area in Doab, but this pilot project failed like many of his other adventures.

Shershah Suri

Shershah Suri had laid the foundation of administration on which Akbar raised the superstructure. Todarmal, who later carried out most reforms under Akbar had gained considerable experience under former master Shershah Suri.

Shershah is known to have made *a systematic survey and measurement of the entire cultivable land* of his empire using a unit called *Sikandari Gaj*. {Sikandari Gaj was introduced by Sikandar Lodi and it was equivalent to 39 inches). He introduced the so called *Patta and Kabuliyat* (or Qabuliyat) system of land

deeds.

> Under Patta system, the area sown, types of crops cultivated and revenue share was duly written on paper. The Qabuliyat system involved a deed agreement between the peasant and the government. Qabuliyat system aimed at discouraging the Jagir system.

Shershah had also established the per Bigha land (Rai) for the lands under continuous cultivation (Polaj) and the lands which kept out of cultivation temporarily (Parauti). Rai was average of three rates representing good, middle and low yields. This rai system was later adopted by Akbar.

Shershah also introduced direct remittances of the taxes to the government so that the taxpayers are saved from any exploitation by the middle officers. He also placed a survey charge of 2.5% called *Jaribana* and collection charge of 5% called *Muhasilans.*

But Shershah died soon and much of his work was destroyed by the anarchy that followed his death.

Land Revenue System of Akbar

There was no Mughal land revenue system before Akbar. His father Humayun and grandfather Babur did not introduce any changes because they were the first conquerors of their dynasty and remained pre-occupied with subduing rebellions, consolidating empires and maintaining order.

A proper land revenue system was founded by Akbar. However, the system of Akbar was itself based on what Shershah Suri implemented during his short tenure. Thus, the land revenue system of Akbar was neither an innovation nor an invention. His indebtedness to the earlier rulers is immense but this has not diminished his fame as far as land revenue system is concerned. He followed the policy of Shershah with greater precision and correctness and then extended it to various *subah* or provinces of his empire. But this correction or precision did not came overnight. Initially was tortuous enough to turn peasants into beggars, and forcing them to sell their wives and children. But it was revised several times.

The first question is – what were the corrections and precisions Akbar did in the existing system created by Shershah? The corrections done by Akbar in land revenue system can be mainly divided into three heads as follows:

- Standardization of measurement of land
- Ascertaining the produce per Bigha of Land
- Fixation of state's share in that produce

Standardization of measurement of the land

In Akbar's administration, we find so many territorial divisions and sub-divisions for the first time in medieval history. For political as well as fiscal purposes Akbar had divided his empire into 15 *Subahs*

(originally there were 12 Subahs, but by the time Akbar died, the number stood at 15), 187 Sarkars and 3367 Mahals. He ordered a standardization of measurement unit and the so called *Ilahi Gaj* was made the definite unit of land measurement. This *Ilahi Gaj* was equivalent to some 41 fingers (29-32 inches), and was shorter than the Sikandari Gaj (approx 39 inches) used by Shershah. The Gaj as measurement of land finds its origin during Sikandar Lodi's times.

Standardization of land measurement was adopted to brush aside all kinds of vagueness in defining extent of land and to reduce extortion / corruption by officials.

For land measurement (*Paimaish*), a rope called *Tenab* was used in those days. Since, this rope was subject to variation in its length due to seasonal dryness or humidity, Akbar made reforms in Tenab also. Instead of an ordinary rope, Akbar ordered the Tenab to be made of pieces of Bamboo joined together with iron rings. This made sure that the length of Tenab varies little during different seasons of a year.

A further change done by Akbar was to fix definite measurement to *Bigha* of land. A Bigha was made of 3600 Ilahi Gaj, which is roughly half of modern acre. Several Bighas made a *Mahal*. Several *Mahals* were grouped into *Dasturs*.

Ascertainment of produce per Bigha

After the standardization of land measurement, Akbar turned towards ascertainment of the amount of produce per Bigha and the state's share in it. Shershah Suri had already divided land into four different categories. Akbar followed the system and to make a comparative estimate of the produce of lands and fixed different revenues for each of them. These four types were as follows:

Polaj

Polaj was the ideal and best type of land throughout the empire. This land was cultivated always and was never allowed to lie fallow.

Parati or Parauti

This was the land kept out of cultivation temporarily in order to recoup its lost fertility.

Chachar

Chachar was a kind of land allowed to lie fallow for three or four years and then resumed under cultivation.

Banjar

Banjar was the worst kind of land that was left out of cultivation for five years or upwards.

Fixation of state's share in produce

The best lands viz. Polaj and Parauti were subdivided into three categories viz. good, middle and bad. Average produce of these three categories, called *Mahsul* was taken as a normal produce per Bigha. One third of this *Mahsul* (average produce) was fixed as state's share. The Parauti land also was liable

to pay the Polaj rate (one third of *Mahsul*) when cultivated. Chachar land was allowed to pay a concessional rate until it was cultivated again to be liable to pay the Polaj rate. Banjar lands were also not totally neglected.

Further, the peasants were given option to pay either in cash or kind, whichever was convenient to them.

It's worth note here that during British Era, the land was divided on the basis of natural or artificial qualities of soil in clay, loam, irrigated, unirrigated and so on. However, the basis of land classification by Akbar was on the continuity or discontinuity of the cultivation. Akbar's vazirs had not taken account the soil qualities for ascertaining the produce.

Fixing Rate of Assessment

Once the land was measured and state's share in produce was fixed per Bigha of land, Akbar next proceeded to fix the rate of assessment. This was the *most contentious part* and in fact several changes were done in the system till 1585. Firstly, Akbar adopted Shershah's Rai system in which cultivated area was measured, and a central schedule was created fixing the dues of peasants crop wise on the basis of the productivity of the land. The state's share was fixed one-third of the produce under the schedule (*Dastur-i-amal*) to be paid in cash. The peasant's tax was based on annual system of collecting prices and settlements of revenues for the previous years. But there were several problems with this arrangement. Firstly, the prices of crops could not reasonably be applied to the whole empire. Prices were lower in rural areas which were far away from the urban centres. Secondly, the cultivators found it difficult to pay in cash at the official rate. Thirdly, this system was affected by corruption of the revenue collectors, particularly the ***Karoris*** appointed in 1573-74. Fourthly, fixing prices every year and doing settlements of revenues of previous years was a cumbersome practice. Akbar ordered that the settlement should be concluded for past 10 years. An aggregate of the rate of revenues from 1570 to 1579 was made and a decennial average was fixed as demand of the revenue. This brought certainty to collections and alleviated the problem of peasants to great extent. This was the so called **Dahsala system** or **Zabti System**, that was implemented by Raja Todarmal. This remained a standard system of revenue assessment during the greater part of the Mughal empire. During Shahjahan's era, it was introduced in the Deccan by Murshid Quli khan.

Assessment of Karori / Crori System

The determination of current prices and rates of collection was one of the most arduous task for Akbar because the extent of empire was big and administrative machinery was new. However despite the difficulties, entire land – whether dry or irrigated; whether in towns or hills or deserts or jungle;

was measured in all the Parganas. {Pargana: Fiscal Union of Akbar's administration}

To make the collection of revenue efficient, every piece of land large enough to give revenue of Once Crore *Tanka* was divided off and put under an special officer called Karori / Crori.

Tanka & Tanki

Kindly note that in Sultanate era *Tanka* referred to a Silver coin. In Shershah's time, the place of the silver *Tanka* was taken by Rupiah, which was as it is adopted by Akbar and remained India's currency unit till date. However, Akbar had transferred the names of *Tanka* to copper coins coined during his rule. One *Tanka* was equal to 2 Dams. Akbar also struck a coin called Tanki that was equal to 1/10th of *Tanka*)

The Crori was selected for his trustworthiness and not acquaintance with the revenue matters. The measurement of the land was started at Fatehpur Sikri and first Crore was named Adampur, next as Sethpur and so on after the patriarchs of those areas or names of prophets etc.

Critical Assessment of Akbar's Land Revenue System

The assessment of Akbar's land revenue system must be done on two accounts viz. annual system and Dahsala system.

Annual System

The annual system was another name of uncertainty in assessment and appointment of Karoris was disastrous for the peasants. The Karoris turned rapacious and system of paying previous years taxes in current years led the peasants to sell their wives and children. Badauni writes that by the time Karoris were made accountable to Raja Todarmal, lots of damage to life of people had been already done. The uncertainty and confusion regarding taxation rendered cultivation without any incentives.

Dahsala System

Under the Dahsala system, the peasants were relieved from the uncertainty of the taxes they would be paying. Since amount due from the peasant to government treasury was fixed, the farmers had hope to enjoy some greater profits if they improve or extend their cultivation.

Apart from this, we can also examine Akbar's land revenue system vis-a-vis ancient system. In ancient India, the share of the government was 1/6th, however, by the time of Akbar, this share had gone up to 1/3rd. This was an excessive demand because even in Akbar's times, the other Hindu sovereigns were taking 1/6th of the produce. Various historians justify this 1/3rd share arguing that Akbar reduced or abolished as many as 29 taxes including Jehat (Manufacturing tax).

Other Systems of Mughal Era

During the reign of Akbar and his successors three more systems of revenue assessment were prevalent viz. Batai or Gallabakshi System, Kankut System and Nasaq System.

Batai or Galla-bakhshi

Batai or Galla-bakhshi was a very old system which continued during the Mughal period. This was a simple method of crop-sharing in which the produce was arranged into heaps and divided into three shares, one of which was taken by the state. Under this system the peasant had the choice to pay in cash or kind.

Kankut System

Kankut system was also an old prevalent method in which, instead of actually dividing the grain (kan), an estimate (kut) was made on the basis of an actual inspection on the spot and one-third of the estimated produce was fixed as the state demand. *So, it was a rough estimate of produce on the basis of actual inspection and past experience.*

Nasaq System

Nasaq System was widely prevalent in the Mughal Empire, particularly in Bengal. In this system a rough calculation was made on the basis of the past revenue receipts of the peasants. It required no actual measurement, but the area was ascertained from the records.

Position of Zamindars during Mughal Era

Zamindars during the Mughal era were petty landholders in the villages, descendants of old ruling families who retained small portions of their ancestral lands. These also include the rajput and other chiefs who exercised autonomous administrative authority in their principalities. They had hereditary rights of collecting land revenues which could go up to 25 percent of the revenue. They generally made collection from the individual peasants at rates fixed by custom or by themselves and paid a fixed tax to the Government. The difference between his collections and the amount he paid to the state was his personal income.

If the state demand reached the maximum that the peasant could pay, a deduction of 10 percent was made from the total amount of revenue and paid to the Zamindars as *malikana* .

> Please note that in Mughal Era, the Zamindar was not the owner of the land and the peasants could not be dispossessed of land as long as they paid land revenue. Only later Zamidars became prominent and some of them had militaries and forces. Sometimes the state had to use military force against recalcitrant Zamindars for the realization of revenue.

In some respects of Zamindars and the peasants were natural allies in any struggle against the Mughal government. Hereditary succession to Zamindari was the general rule. Zamindari was divisible among legal heirs and could also be freely bought and sold. Normally in the Mughal empire villages were divided into zamindari and raiyati (non-zamindari) areas.

Land Revenue During British Era

India's land revenue system was radically changed under British due to several factors such as agricuituralisation and de-industrialization; change in land ownership; methods of assessment; and collection of land revenue.

In the 18th and 19th centuries free countries of Europe and America, more and more people shifted from agriculture to industry and service. Ironically, exactly reverse happened in India. When England was undergoing Industrial Revolution, India was undergoing increased *agricuituralisation and de-industrialization.* The coordination between Indian Industry and Indian Agriculture was destroyed and a new bond of Indian agriculture and Britain's industry was developed which shifted the entire wealth of India to that European country.

Destruction of rural and cottage industries, allied trades and commerce ruined all supportive vocations of the bulk of population and the people thus thrown out from their vocations crowded in the agriculture sector.

Coupled with new land ownership policy of the British, even the peasants started getting uprooted from land ownership. *Land was never a mortgagable commodity in India earlier to British. It was rarely transferable as a matter of right. The laws enacted around 1835 A.D. and in the following years by the British conferred unrestricted rights of transfer of land on occupants of all classes.* It could be mortgaged now and could be recovered through the British court of law.

In the pre-British India, land had no exchange value and labour was costly. During British rule all those who were deprived of their vocations and trade, flocked to agricultural land and labour became cheap. These things are evident by the repeated famines during the early British rule in India. This has been endorsed by the famine commission appointed in 1878.

Another blow to the whole system of agriculture was given by introducing Zamindari in India in the British style. These changes in land policy and revenue system literally shattered the whole system of agriculture and trade in the country.

In conclusion, within 50 years of British Rule, the pattern of ownership, the method of assessment and the collection of land revenue introduced by the British in India had destroyed the self sufficiency of the Indian economy.

Post Plassey changes in Land Revenue System

Izaredar System

After the battle of Plassey, the British secured the Diwani rights (rights to collect revenue). When Robert Clive obtained the Diwani of Bengal, there used to be annual settlements of the Land revenue. Izaredari system was introduced in 1773 by Warren Hastings in Bengal whereby he

assumed that all land belongs to State. This was the first land tenure system implemented in India by British. Under this system, right of collecting revenue of a particular area was auctioned to the highest bidder. The Peasants, shopkeepers and merchants had to pay their taxes to the **Izaredar** who eventually was also the highest bidder to the company. Hastings first made the assessment from annual to 5 years and then back to annual.

Implications of Izaredar System

So far, the Zamindars had the customary hereditary rights of revenue collection and formed two way links to the Government and the peasants. But the auctioning of Land made many of those old settled Zamindars lose their job and thus the two way links were broken. The **Izaredar** was essentially a contractor who squeezed the poor peasants and then paid to the company saving his profit. They had no interest in the welfare of the peasants.

From Company's point of view also, the Izaredari system was no good because there was a frequent change in the assessment period and no fix revenue generation. The Ijaredar system ended when Lord Cornwallis introduced the Permanent Settlement in Bengal, Bihar, Odisha and some parts of Carnatic (parts of northern Karnataka).

Permanent Settlement : Zamindari System

Permanent settlement was introduced in 1793 by Lord Cornwallis and covered around one fifth of British territory in India, including Bengal, Bihar, Orissa, parts of Northern Karnataka, Varanasi and some other areas. With the permanent settlement, the auctioning of land (Izaredar system in Bengal) came to at an end.

Salient Features of Permanent Settlement

- The previous experiment of Izaredar system was based on annual assessment of revenue. To streamline the revenues of the company, Cornwallis changed the settlement schedule from annual to decennial (10 years).
- Zamindars were hitherto only collectors of revenue and had no ownership rights over land. In the permanent settlement, the company recognized them as owners of soil. They were given permanent hereditary rights to collect revenue.
- The Zamindars needed to pay a fixed amount of land revenue on a fixed date every year. This amount could not be increased later, however, if the Zamindar failed to pay the amount on fixed date, the Company could sell their land via public auction. This made sure that Zamindars were strict enough to collect revenues from peasants and pay it to company at fixed time.
- Zamindars were allowed to keep force and maintain order in their districts. They were

expected to improve the conditions of the tenants but the company would not interfere in their internal dealings with the tenants so long they paid the fixed land revenue.

Assessment of Permanent Settlement

Some historians called permanent settlement a bold step and a wise measure adopted by company while some others called it a sad blunder.

The assessment of the Permanent Settlement of Bengal, Bihar and Odisha should be done in the light of following points.

Position of Zamindars

The permanent settlement was mainly done to make the amount of land revenue permanent, certain and fixed. The ownership of land had undergone paradigm shift. In Mughal era, Zamindar was not owner of the land but only a collector of revenue. With permanent settlement vesting ownership rights in Zamindar, he assumed a position that never been his before. The Zamindars became wealthier.

Further, Zamindars were not the same old hereditary landholders, but anyone could become a Zamindar provided he had good connection in East India Company or some other hack. Many servants of old Zamindars, petty clerks, agents, traders and merchants became the so called new Zamindars. They all became petty capitalists and they invested in trade, commerce thus some positive impact on other segments of economy was seen. This class of new capitalists was called "*Mushroom gentlemen*".

For East India Company, this system secured the British Dominion in India. In Zamindars, it created a faithful class of Indians who proved to be a great instrument for the security of the British interests in India. This settlement was the reason that during the 1857 mutiny, the Zamindars remained loyal to the company and did not provide any help to the rebels.

However at the same time, company retained the ultimate ownership and was able to sell the land via public auction if the fixed rent was not paid on due date by Zamindar. The Zamindar had to deposit the collected revenue on a day fixed before sunset, if not done, he would lost part or full of estate and then the estate would be sold in open auction. No excuses were entertained.

This so called "sunset law" on rigidity of the sale later became a prestige issue and its brunt was borne was the peasants. The land revenue was fixed high and it was not very convenient to pay it on time. Many Zamindars turned defaulters and it created problems.

Revenues of Company

By this settlement, the company was sure of getting fixed revenues. It also facilitated the easier method of collection of revenue through Zamindars. Before this settlement, the company needed

large establishment / officials to make annual / five yearly assessments. The permanent settlement saved the company from these expenses. The officials could be engaged in judicial or other works. However, the permanent settlement could not enhance the amount of land revenue because *it was inherent in the settlement that it was permanent in terms of revenue* also and company could not increase a single pie even if there was rise in the produce or prices of the produce. This was one of the reason that some British authors called the settlement a blunder as it resulted in loss of enhanced land revenue in times to come.

Impact on Peasants and Productivity

Since the permanent settlement made Zamindars owners of land, peasants were left at their mercy. The Peasants had no right over land and could be kicked out any time.

In 1799, the East India Company passed some notorious regulations which gave arbitrary powers to the Zamindars to eject the cultivator and forfeit the agriculture stock for non-payment. This was probably the lowest point in Indian Peasantry.

Since any increase land productivity was not subject to increase taxes, it was expected that Zamindars would make efforts to improve the conditions of the tenants. This system was that what company would levy from the Zamindars was fixed as 10 parts out of 11 parts. The 11th part was the remuneration of the Zamindar. However, what the Zamindar would levy from the Peasants was left unsettled. This implies that more the value of 11 parts, more is the remuneration of Zamindar's 11th part. Thus, it was clear that if the productivity of land is improved, company will have no right to demand anything in excess of what was already settled. But this belief of Cornwallis was belied later because unfortunately, the increased earnings were not spent on peasants. Instead this led to increased luxuries and pleasures of the Zamindars.

Pressure on land and Absentee Landlords

The same time was of increasing pressure on lands due to many reasons. Since work of Zamindars was to collect and pay revenues at time, they started doing sub-feudalization of their estate to some unofficial middlemen. Thus, a new crop of unofficial middlemen also grew between the Zamindars and Peasants. A Zamindar would sublet the land to a middlemen and would relocate to big cities like Calcutta to live a luxurious life. Zamindars thus turned into Absentee landlords due to permanent settlement. This was exact opposite to the hitherto Zamindari system prevailing since Mughal era. old rural based zamindars were replaced by many new urban landlords, who obtained Zamindari by hook or by crook to earn money as well as social distinction. The urban Zamindars left their servants and agents to collect revenue from peasants. This furthered the exploitation of the peasantry because agents / middlemen would extort almost all a peasant produced.

Impact on rural society of Bengal.

The social outcome of permanent settlement in Bengal was that the society was divided into two mutually hostile classes of Zamindars and Tenants. While Zamindars were favourite children of British Imperialism, they were few in numbers in comparison to the other class of tenants. British won loyalty of a few at cost of many.

Assessment : Changes in Zamindari System from Mughal to British Era

During reigns of Shershah Suri and Akbar, the system was that land revenue was collected directly by the officers of the state and could be paid either in cash or in kind, though cash payments were encouraged. Thus, the peasant called *ryot* held his land directly from the crown. But in the eighteenth century, with the growing clout of British, the tax collectors tended to be hereditary and the right of collection of revenue from the cultivator (which was hitherto a duty) came to be considered as a right and a possession. Via the permanent settlement in Bengal, Bihar and Odisha, the Zamindars were recognized as proprietors of the land on condition that they would pay the government rent on a fix date. The peasants had no proprietary rights and were subject to ejection from the land unless they purchased it by paying the zamindar a special additional fee and price. This system continued till India became independent.

Ryotwari System

Ryotwari System was initially introduced by Shershah Suri. He had surveyed the entire land under cultivation of his territory and fixed per bigha due on the basis of average of three rates representing good, middle and low soils under continuous cultivation (Polaj) and temporary out of cultivation (Parauti). This average rate was called "Rai" and the cultivator was called Ryot. The Rai system was initially adopted by Akbar.

In the East India Company territories, the Ryotwari system was introduced by Thomas Munroe and Captain Reed first in Madras presidency. It was later extended to Bombay, Parts of Bengal, Assam, Coorg etc. This system was exactly opposite to the Zamindari system. In this system, peasants were given the ownership and proprietorship and they would make direct payment to state as 55% of produce. But the system was such that whatever government calculated was faulty and exploitive. Thus, excessive rate of revenue made the agriculture unprofitable. Then, the ways of collecting revenue were so harsh and rigid that the peasants would like to handover their ryots to some money lenders.

It is not that uniformly all the tillers were recognized as proprietors. Under the Ryotwari settlement system, the company recognized *mirasidars* as the sole proprietors of land, dismissing tenants' rights completely. Only in villages where no mirasidars system existed, were the villagers holding

permanent occupancy rights recognized as landholders responsible for the payment of land revenue. The impacts were more visible such as

- the supply side of land increased and land prices fell
- Interest rates increased. The rates were so high that the cultivator was at best could pay only interest.

Assessment of Ryotwari System

Ryotwari system of land tenure was introduced early in the nineteenth century in Presidencies of Bombay and Madras. Under this system the settlement was made by the government directly with the cultivator (ryot) who thus was the proprietor, but only for a period of time. This time was fixed for thirty years after which it was subject to re-assessment and re-settlement on new terms. The government share was fixed at 55% of the produce, which was highest ever share. Though the cultivator got security of tenure but was subject to a very heavy duty, thus leaving no motivation for cultivation.

Mahalwari System

The Zamindari as well as the Ryotwari System could not fulfil the expectations of the policymakers. A third type of system called Mahalwari system was introduced in Agra, Awadh (Oudh), Central parts of India, Punjab, parts of Gangetic valley etc during regime of Lord Hastings.

Mahal refers to an estate with many cultivators. The term Mahal referred to the fiscal unit / revenue division into which the whole land was divided by Akbar. In Mahalwari system, all the proprieties of a Mahal were jointly and severally responsible, in their persons and property, for the sum assessed by the government on that Mahal. If the number of the proprietors was large, some of them were made representatives of all. The ownership and occupancy right was reserved for individual peasants. Even cultivation was to be dome individually. But for the payment of the land revenue, the peasants were jointly responsible. Usually the village as a whole would be designated a Mahal and it paid the revenue via its headman called Lambardar. Thus, Lambardars worked as a link between the individual tillers and the government, but they were not given rights like those of Zamindars. The issues with the Mahalwari system were as follows:

- In actual practice, only some big families could take the land rights not all villagers.
- The stable revenue dream of the government could not be fulfilled.
- Mahalwari was a limited reform in area as well as duration. It was a temporary settlement.

Talukdar System

Side by side with the Mahalwari system there existed Talukdar system which recognised the Talukdar as the proprietor and gave him full control over the ryot. It differed from the zamindari or permanent system of Bengal only in as much as it was not permanent. This system prevailed in

some parts of current states of Uttar Pradesh, Madhya Pradesh and Punjab.

Commercialization of Agriculture during British Era

The British Era is also known as a period of commercial revolution in the agricultural sector. Commercialization of agriculture was coincident with Industrial revolution and became prominent around 1860 A.D. This brought about a change from cultivation for home consumption to cultivation for the market. Cash transactions become the basis of exchange and largely replaced the barter system. The major reason of commercialization of agriculture was that India was now reduced to the supplier of raw materials and food grains to Britain and importer of British manufactured goods. This era saw the introduction and proliferation of many crops as cash crops such as Indigo, cotton, jute, tea, tobacco. The Land revenue payments were also monetized and India saw emergence of grain merchants. The increasing demand for some of the commercial crops in other foreign countries gave impetus to commercialization of agriculture.

Impact of Commercialization

- The commercialization of agriculture should have increased productivity but in reality it did not happen because of poor agricultural organization, obsolete technology, and lack of resources among most peasants. Rich farmers benefited and this accelerated the inequalities of income in the rural society.
- The commercial non-food crops substituted the food grains. This had a devastating effect on the rural economy and showed its impact in famines.
- one more outcome of the commercialization of agriculture was the crop production got regional specialization based upon the climatic conditions. This was the outcome of the commercial revolution in agriculture. The peasants of Bombay presidency grew cotton, Bengal grew jute and Indigo, Bihar grew opium, Assam grew tea, Punjab grew wheat.
- The agriculture sector of India was linked to the world market. Price movements and business fluctuations in the world markets began to affect the fortunes of the Indian farmer to a greater degree. The crop selection became dependent upon the market demand and price.

Thus we can conclude that the commercialization of agriculture assisted the industrial revolution in Britain, it broke the economic self-sufficiency of villages in India.

Increased population of Landless Labourers

In ancient India there were no wage earners in agriculture. The situation in British Era was reverse with an ever high population of the landless labours. Landless agricultural labourers were as high as 20 percent of the agricultural population in Dinajpur in 1808. Those who either owned land or had customary rights to cultivate it were not homogeneous in the early decades of the nineteenth

century.

Further, the impact of the commercialization of agriculture on the peasant classes was complex. It sometimes strengthened small peasants by providing a higher income, but often the growing fluctuation in prices led them to disintegrate into a group of richer peasants, who benefited from the fluctuation, and others who came under the grip of moneylenders and merchants. In general, it contributed to the expansion of landed property by the non-agricultural population, though the extent of such transfer differed by region.

Land Reforms In India

Before discussing about current and recent past issues in land reforms, we should understand the three different terms that are used frequently while discussing about land reforms. These three terms are land reform, agrarian reform and land rights.

Land Reforms

Land reforms refers to a wide variety of specific programmes and measures to bring about more effective control and use of land for the benefit of the community as a whole. *Land reforms generally comprise the takeover of land by state from big land lords with partial compensation and transfer it to small farmers and landless workers.*

Land reforms are aimed at changing the agrarian structure to *bring equity and to increase productivity.* The structure includes both the man-land relationship and man-man relationship (tenant and landlord). In India, the land reforms aim to follow the ideal of socialistic and democratic society. The land reforms in India are envisaged to bring reforms through abolition of intermediaries, tenancy reforms, ceiling on land holdings, and consolidation and encouragement of co-operatives.

Agrarian Reforms

Agrarian reform is a broader term. Along with land reforms it also includes measures to modernize the agricultural practices and improving the living conditions of entire agrarian population. It also covers the establishment of co-operatives; development of institutions to provide agricultural credit and other inputs; processing and marketing of agricultural produce; and establishment of ago-based industries etc.

Land Right

Land right is defined as legally and socially recognized claims on land enforceable by a legitimized authority like state government. Land rights can be in the form of ownership, different degrees of freedom to lease out, mortgage, or sell.

Constitutional Provisions Towards Land and Land Reforms in India

The constitution of India has included the Land reform in State subjects. The Entry 18 of the State List is related to land and rights over the land. The state governments are given the power to enact

laws over matters related to land.

Part IV of the Directive Principles of State Policy also indirectly mandates the government to take measures for land reforms to achieve an egalitarian society.

The Entry 20 in the concurrent list also mandates the Central Government to fulfil its role in Social and Economic Planning. The Planning Commission was established for suggestion of measures for land reforms in the country. The specific articles of the constitution that pertain to land reforms are as follows:

- Article 23 under fundamental rights abolished Begar or forced unpaid labour in India.
- Article 38 under Directive principles directed the state to minimize inequality of income, status and opportunities.
- Article 39 under the Directive Principles directed the state to work for equitable distribution of the material resources of the community for common good.
- Article 48 directed the state to organize agriculture and animal husbandry on modern-scientific lines.

Further, immediately after the independence, the state government enacted laws to abolish the Zamindari, Jotedari, Ryotwari etc. systems. But soon, these laws were dragged into the court on the basis that they violated the fundamental rights to property of the Zamindars under article 19 and 31. Consequently, the first amendment of the constitution was passed that amended the constitution and secured the constitutional validity of zamindari abolition laws passed by states.

Objectives of land reforms

The main objective of the land reforms programme is to *do away with the existing inequalities in the system of landholding* and *to increase the agricultural productivity.* The Five Year Plans aimed to remove the impediments for increase in agricultural production and elimination of exploitation and social injustice within the agrarian system so as to achieve equality and providing opportunities for all sections of the rural society.

The other objectives of land reforms are *abolition of intermediaries* and their exploitative practices on real tillers of the land. The measures sought to enable the *redistribution of lands from the hands of middlemen to the tillers themselves.* Ceiling on agricultural holdings aimed to ensure that ownership of land does not get concentrated in a few hands. Tenancy reforms seek to give rights to tenants or *complete abolition of tenancy.*

Efforts in Land Reforms

Changing the man-land relations and the man-man relations on land has been a concern for decision-makers and people of a country. Whenever there is exploitation of landlords or the

government's failure to frame the policies, peasants and people's movements targeted the oppressors and policy makers. The efforts in land reforms can be categorised under four heads.

- Governmental action (top-down): This is related to enactment of various laws related to land.
- Peasants or people's movements (Bottom-up): Protest movements from disadvantaged sections. These movements have often turned militant.
- Initiatives by individuals, charismatic leaders or non-governmental organizations. Such voluntary efforts aims to bring the change through non-violent and consensus based decisions. Bhoodan and Gramdan movements are glaring examples of this.
- Based on efforts of two or more of the above three categories above.

Government Action Towards Land Reforms

In India, governmental efforts in land reform are basically centred around the following five measures:

- Abolition of intermediaries;
- Tenancy reforms;
- Ceiling on land holdings;
- Consolidation of land holdings;
- Legislations and their Implementation.

Abolition of Zamindari and other such systems

The major objective of land reforms in free India was to abolish intermediaries and to bring changes in the revenue system that would be favourable to cultivators. The process of abolition of Zamindari, Jagirdari, Ryotwari etc. system had started even before the constitution of India came into effect.

Position of the intermediaries at the time of independence

On the eve of the independence, there were two extremes in India. On one extreme, there were landless labourers and tenants-at-will while on the other end, there were big landlords having huge estates. However, various tenancy systems had undergone vast transformation in 150 years of their practice. The coexistence of Zamindari, Mahalwari and Ryotwari led to intermixing of their characteristics, which led to drastic problems at the time of enactment of Zamindari abolition laws. The intermixing of the various systems made it difficult to know who was the rentier. This problem was made further complex due to land sub-letting, absentee landlords, absence of proper records etc. The most harassing feature was absence of proper revenue records which made the task of abolition of intermediaries very difficult. Thus, there was a need felt for complete census of land holdings.

Zamindari Abolition Acts

The first important agrarian reform after independence was the abolition of the Zamindari system.

The process of passing Zamindari abolition bills had started even when the constitution of India was not enacted. A number of provinces such as United Provinces (UP), Central Provinces, Bihar, Madras, Assam, Bombay had introduced such bills on the basis of a Zamindari Abolition committee, chaired by G.B. Pant. However, there was a widespread concern that he Zamindars would make every effort to cause delay in acquisition of their lands. When constitution was passed, right to property was enshrined as fundamental right under article 19 and 31. The provinces passed the Zamindari Abolition Acts but all these acts were challenged in the court on account of their constitutional validity. The supreme court upheld the rights of Zamindars. To secure the constitutional validity of these state acts, the parliament passed first amendment (1951) within 15 months of enactment of the constitution and second amendment in 1955. By 1956, Zamindari abolition act was passed in many provinces. Due to conferment of land rights, around 30 lakh tenants and share-croppers were able to acquire the ownership rights over a total cultivated area of 62 lakh acres throughout the country due to these acts. On the other hand, the compensation paid to Zamindars was generally small and varied from state to states.

Tenancy Reforms

After passing the Zamindari Abolition Acts, the next major problem was of tenancy regulation. Tenancy reforms aim to regulation of rent, provide security of tenure and conferring ownership to tenants. The tenancy reforms laws provide the provisions for registration of tenants, or giving ownership rights to the former tenants to bring them directly under the state.

Regulation of Rent

The rent paid by the tenants during the pre-independence period was exorbitant. It was anything between the 35 and 75 percent of gross produce throughout India. With the enactment of legislation for regulating the rent payable by the cultivators in the early 1950s, fair rent was fixed at 20 to 25 percent of the gross produce level in all the states except Punjab, Haryana, Jammu and Kashmir, Tamil Nadu, and some parts of Andhra Pradesh. In these states, the rent payable by the tenants varied between 25 percent and 40 percent, depending on the available irrigation facilities.

Security of tenure

Providing security of tenure was the second important reforms brought about during the first three five-year plans via tenancy acts. Legislation for security of tenure had three essential elements:

- Ejection could not take place except in accordance with the provision of the law;
- Land could be resumed by an owner, but only for personal cultivation;
- and in the event of resumption, the tenant was assured of a prescribed minimum area.

Tenancy laws were enacted in all states though their implementation varied widely across the states.

Conferment of ownership rights to tenants

The third important component of tenancy legislations was the conferment of ownership rights to tenants.

At national level, a tenancy regulation policy was announced. As per this policy, large landowners were allowed to evict their tenants and to bring the land under personal cultivation up to a ceiling limit to be prescribed by each state. At that time, the term "personal cultivation" was defined as cultivation by the owner of the land and other members of his family.

The tenants of those lands which were not resumable (i.e. without landowners) were given occupancy rights on payment of a price to be fixed as a multiple of the rental value of the land.

The owners of land not exceeding a family holding were defined as small owners. Land belonging to small and middle owners was divided into two categories viz. land under personal cultivation, and land leased to tenants at will. If the land posses was below a ceiling restriction, tenants of such land owners were given limited protection, provided that it should be renewed for five to ten years and should be renewable, and that the maximum rent payable should not exceed 20 to 25 percent of the gross produce. However, in second five year plan, the definition of "personal cultivation" was amended with three elements viz. risk of cultivation, personal supervision, and personal labor. This further narrowed down to define who was eligible for the ownership rights on land. In the third five year plan, the final goal was fixed to confer rights of ownership to as many tenants as possible. The policy suggested that the states should study the problem and determine the suitable action in light of prevailing conditions. In the fourth plan, the tenancies were suggested to be declared non-resumable and permanent except in the case of landowners working in defence services or with any disability." Thus, the lands where cultivators, agricultural labourers, and artisans had constructed their houses, was now to be their own land.

All these efforts were partially successful in reversing the conditions of the British Era. But still, there were issues of tenants being forced to sell the lands due to poverty. The government was suggested to make efforts to bring them within the institutional credit regime.

In the sixth five year plan, a time bound schedule was given to the states to implement the measures of land reforms. It further recommended that the states in which legislative provisions for conferment of ownership rights on all tenants did not exist should immediately introduce appropriate legislative measures within one year (by 1981–1982). However, it was not achieved in all states.

Critical Assessment of Tenancy Reforms in Independent India

Despite repeated emphasis in the plan documents, some states could not pass legislation to confer rights of ownership to tenants. Few states in India have completely abolished tenancy while others

states have given clearly spelt out rights to recognized tenants and sharecroppers. The tenancy reforms led to only a small percentage of tenants acquiring ownership rights, but undoubtedly it has reduced the area under tenancy.

Impact of Tenancy reforms on productivity

Further, since the tenancy reforms coincided with green revolution, it was difficult to define, how exactly it helped in productivity. However, some studies attempted to separate all the other effects and concluded that: –

- There was a positive correlation between the growth in production and the progress of tenancy.
- It led to changes such as greater social equity and self-confidence among the poor tenants.
- However, some studies criticise it and say that due to poor resource base, tenancy reforms could not led to growth in productivity.

The proportion of landless agricultural households in the rural area had stabilized. However, at the same time, there has been an increase in the marginal and small holdings. However, the increase in smaller holdings is also due to increase in population and lack of alternative employment in rural areas.

Land Ceiling & Consolidation of Landholdings

The land ceiling acts define the size of land that an individual/family can own. In India, by 1961-62, all the state governments have passed the land ceiling acts. But the ceiling limits varied from state to state. To bring uniformity across states, a new land ceiling policy was evolved in 1971. In 1972, national guidelines were issued with ceiling limits as 10-18 acres for best land, 18-27 acres for second class land and for the rest with 27-54 acres with a slightly higher limit in the hill and desert areas. Before 1972, the basis of land ceiling was an individual as a unit instead of family. Since 1972, family is considered as the unit of application for land ceilings. And also certain exemptions were allowed for plantations of crops like tea and coffee, Bhoodan Yagya Committees, registered cooperatives, and other bodies.

The land ceiling also deals with the acquisition of surplus land and its redistribution among the small farmers and landless workers. But the progress of redistribution of surplus land has been unsatisfactory.

A number of factors such as separate ceilings for major sons, exemptions for religious and charitable institutions, benami transfers, falsification of land deeds, judicial interventions, loopholes in ceiling laws, non-availability of land records, inefficient administration and lack of political-will etc. account for the failure of the land ceiling. Other reasons include the generally poor quality of surplus lands and lack of financial

and institutional support to bring these lands under cultivation.

Consolidation of Landholdings

The fragmentation of land implies a single farm consists of numerous discrete parcels, often scattered over a large area. It results in inefficient use of soil, capital, and labour in the form of boundary lands and boundary disputes and litigation costs. Efficiency of cultivation is considerably reduced and also prevents land improvement. Consolidation refers to reorganization of fragmented holdings into one plot. Of all the land reform measures, this has received the least critical appreciation. The land consolidation was resisted by the small and marginal landowners because of the fear of displacement among tenants and sharecroppers and lack of updated land records; the perceived advantage of having land in fragmented parcels in the event of floods and other natural calamities or acquisition for public purposes.

Conclusion

After independence, most of the major legislations with far-reaching consequences to land reforms have been passed. The main features of the laws relating to land reforms are:

1. All states passed the laws to abolish intermediaries, with varying provisions for resumption for self-cultivation.
2. Ceiling laws showed wide variations in their actual ceilings.
3. All laws provided heritable rights to the tenants. Eviction is possible only if tenants violates the conditions of the agreement or if the landowner wants the land back for self-cultivation.
4. In all states the provisions for redistribution gave preference to SC caste for allocation of surplus land.
5. Provisions with respect to tribal lands were made in every state with sizeable tribal populations.

Implementing these laws has been an uneven process in all the States. These differences were both in the timing of the laws as well as in their implementation.

Peasant Movements and Land Reforms

The peasant movements for agrarian reforms in India have always been centred on the issue of land ownership and land distribution. The term 'peasant' includes tenant, sharecropper, small farmer not regularly employed, hired labour, and landless labourers. Several peasant movements rose over economic questions all through the British period but with limited results. The 20th century saw some of the most violent and widespread peasant movements with far-reaching consequences. The main demands of these movements centred on reduction of excessive rent or revenue on produce and land redistribution from the rich to the poor. Many of these movements have provided the

stimulus necessary for land legislation in India.

Some of the major movements of 20th century are discussed below:

Peasant Movements in Bihar

After the Champaran Satyagraha in 1917, Bihar became an important centre for peasant movements. These activities had addressed the problems of share croppers such as abolition of customary non-rent payments, regulation of eviction, and fixation of fair rent. The main centre of the movements was north Bihar. The Bihar Kisan Sabha, started in 1927, developed as an extensive organization under the leadership of Swami Sahajanand Saraswati. It was the strongest section of the All-India Kisan Sabha. With passage of Zamindari Abolition Act,1949, the movements disappeared. In 1978, the peasants in Bihar, under the leadership of the Yuva Chhatra Sangharsh Samity, organized a long drawn out struggle in Bodhgaya to secure land rights from the Shankar Math. The mahants (religious heads) of the Buddhist monasteries in the area had amassed huge tracts of land under the exemption given to religious and charitable institutions in the ceiling laws of the state. The situation erupted in violence. After the Supreme Court's directive to the effect that the land is handed over to the tillers, the struggle was considered to be successful.

Kisan Sabha and Khet Mazdoor Sabha in Uttar Pradesh

Kisan sabhas were started in U.P. in 1926-27. Their main demands centred on problems of tenants, such as giving tenants occupancy rights, abolishing non-rent extraction and forced labour, cancelling all rent arrears, reducing rent and water rates. These movements did not show much interest in problems of agricultural labourers. This led to the establishment of the Khet Mazdoor Sabha in 1959.

Tebhaga Movement in Bengal

Despite repeated famines in the Bengal region, the tenants were forced to surrender half of their produce to the landlords. The famine was worsened when the jotedar (landlord) class were indulged in hoarding and black marketing of food grains. In 1946, the *All India Kisan Sabha* started the Tebhaga movement, demanding that tenants be allowed to keep two-thirds of the produce. The movement received the massive support from agricultural labourers. The movement declined in 1947 due to crackdowns by the police, and the divisions that developed within the movement along religious lines.

Telangana Movement

One of the most politically effective peasant movements was seen in the erstwhile State of Hyderabad. In Telangana region, the land ownership was in the hands of very few ruling class people. The actual cultivators of the land were subjected to high rent, increasing indebtedness and a system of free labour (also known as the *vetti system*). The Communist Party of India took up these issues as the basis for a peasant's struggle against feudalism in the period 1946-48. The objectives of

this armed struggle were land grabbing and redistribution, abolition of compulsory levy to the government, and stopping eviction of tenants under any pretext. The struggle turned in to violent with police retaliation against the Gram Raj Committees that were set up by the peasant groups to work as defence squads and institutions for self-governance. Laterthe A.P. (Telangana Area) Tenancy and Agricultural Lands Act, 1950, was passed when the Indian Government took over from the Nizam's rule.

Naxalbari Movement in West Bengal

In 1967, the Communist Party of India (Marxist-Leninist) had started a liberation movement by imitating Chinese Model, in the village of Naxalbari, Darjeeling district in north Bengal. The main issue of the movement was to secure rights for the marginalized sections of the agricultural community. In the course of the movement, several peasant committees were set up and land was redistributed. Several landlords were put on trial and executed. Village defence squads were established with agricultural labourers as its leaders. Later the revolution was quickly liquidated. The Naxalbari movement is one of the most widespread movements of the present times. Now, it no longer confines its issues to land reforms, but also on larger issues of corruption, exploitation, maladministration.

Voluntary Efforts Towards Land Reforms

Traditionally, voluntary efforts in India were confined to educational and welfare-related activities to benefit the disadvantaged sections of society. Gandhiji had introduced the voluntary efforts initially in promotion of village and cottage industries, animal husbandry and agriculture. It is only after independence, the voluntary efforts started focusing on economic issues. Since then the voluntary organisations focussed on larger issues of poverty alleviation, income generation, watershed management, etc.

Voluntary efforts can be initiated either by individuals or by organizations, both formal and informal.

Individual Efforts : Bhoodan and Gramdan

The Bhoodan and Gramdan movements led by Vinoba Bhave attempted to bring about a "non-violent revolution" in India's land reforms programme. These integrated movements were an attempted to implement land reforms by urging the landed classes to voluntarily surrender a part of their land to the landless. The Bhoodan was started in 1951. The problems faced by the landless harijans were presented to Vinoba Bhave in Pochampalli, Telangana.

In response to appeal by Vinoba Bhave, some land owing class agreed to voluntary donation of their some part of land. This led to the birth of Bhoodan Movement. Central and State governments had

provided the necessary assistance to Vinoba Bhave. Later, Bhoodan gave way to the Gramdan movement which began in 1952. The objective of the Gramdan movement was to persuade landowners and leaseholders in each village to renounce their land rights and all the lands would become the property of a village association for egalitarian redistribution and joint cultivation. A village is declared as Gramdan when at least 75 per cent of its residents with 51 per cent of the land signify their approval in writing for Gramdan. The first village to come under Gramdan, was Magroth, Haripur, Uttar Pradesh.

The movement received widespread political patronage. Several state government passed laws by aimed at Gramdan and Bhoodan. The movement reached their peak around 1969. After 1969 Gramdan and Bhoodan lost its importance due to the shift from being a purely voluntary movement to a government supported programme. In 1967, after the withdrawal of Vinoba Bhave from the movement, it lost its mass base. In the later period, landlords had mostly donated land under dispute or unfit for cultivation. The whole movement was treated as something different from the general scheme of development rather than combining with the existing institutional means. This separation from the mainstream scheme seriously affected its continuation as a policy.

Organizational Efforts

Voluntary efforts by organisations were initially focussed on poverty alleviation. After the Bhoodan and Gramdan movements, voluntary organisations took up the issue of land reforms. They started working for the voluntary donation of land and its redistribution to the landless. The voluntary organisations have realized that land reforms core around which the whole issue of poverty removal and equality should revolve. This realization was confined to a minority, and did not gain general acceptance. After the passage of ceiling acts, acquiring land for redistribution was removed from the agenda issue for voluntary organisations. Instead, the focus shifted to securing rights to the tenants and landless by promoting the causes of land consolidation, identifying the beneficiaries for the programmes.

Other activities of the voluntary agencies are:

- Awareness generation among the peasants about the importance of the land reform and motivating them to initiate action against the violators of the laws.
- Distribution of pattas among the landless workers, who have not been covered under formal ownership rights.
- Providing legal assistance to the rural poor to deal with the legalities of land rights.
- Identification of the landless for purposes of redistribution of surplus land.
- Provision of training in agriculture and supplying of inputs like seeds, fertilizers and

technology.

Combined Efforts

Whenever the government tries to initiate and implement a programme with the active cooperation of the peasants and voluntary organisations, such efforts be largely successful.