EIILM UNIVERSITY
SIKKIM

AGRICULTURAL DEVELOPMENT IN INDIA

Subject: AGRICULTURAL DEVELOPMENT IN INDIA **Credits: 4**

SYLLABUS

Indian Agriculture: Institutional Perspectives

Agrarian Relations during British Rule in India, Land Reforms during 1947-70, Land Reforms: Programme and Performance after 1970, Land Relations in Pre-British India, Diversification Trends of India Agriculture

Forestry in India: Linkage with Agriculture Sector, Rural Industrialization Programme, Role and Importance of Agriculture in Indian Economy, Irrigation in India, Dry-land Farming and Agro-climatic Zoning Land Utilization and Cropping Pattern

Technological Change in Agriculture

New Technology and Distribution of Gains, Trends in Agricultural Productivity, Green Revolution: Nature and Extent, Agricultural Marketing in India, Cooperative Movement in Agriculture, Cooperative Legislations in India, Capital Formation in Indian Agriculture

Issues before Agricultural Development

Agricultural Taxation and Subsidies, Public Distribution System and food Security, Agriculture in the Context of Globalization of the Economy, Agricultural Pricing Policy in India

Suggested Readings:

M. Idris Siddiqi, Agricultural Development in India: An Analytical State-Wide Study, South Asia Books

Binoy Nath Verma, Flood Devastation and Agricultural Development in Eastern India, B.R. Pub. Corp.

Kalyani Bandyopadhyaya, Agricultural Development in China and India: A Comparative Study, John Wiley & Sons

Ramesh Chand, Agricultural Development, Price Policy and Marketed Surplus in India, Concept Pub. Co.

Lesson 1 – Indian Agriculture: Institutional Perspectives

Learning Objectives

- To define the Indian Agriculture.
- To explain the Agrarian Relations during British Rule in India.
- To explain the Land Reforms.
- To describe the Land Relations in Pre-British India.

1.1Introduction

India farming has abroad background which goes back to 10 thousand years. At present, in terms of farming production, the country holds the second place all over the world. In 2007, farming and other allied industries such as lumbering and forestry represented around 16.6% of the GDP of the country. In addition, the sector recruited about 52% of the entire work force.

Regardless of the fact that there has been a gradual slump in its contribution to the GDP of the country, India farming is currently the biggest trade in India. On the whole, it has a key role in the socioeconomic progress of the country.

The total arable land in India is 1,269,219 km^2, which represents about 56.78% of the overall land zone of the country. Arable land in India is diminishing because of continuous strain from an ever-increasing number of inhabitants and growing urbanization.

The overall water surface area of the country is 31440 km^2 and the country experiences a mean yearly precipitation of 1,100 mm. Irrigation represents 92% of the consumption of water and in 1974, it was 380 km^2. By 2025, the capability will probably increase to 1,050 km^2, with the equilibrium justifying both household and industrial usage.

India houses the biggest number of farm animals in the world and the count is 281 million. In 2008, the country housed the second biggest number of livestock in the world and the count was 175 million farm animals.

The population of India is increasing at a faster pace than its capacity to produce wheat and rice.

India holds the 2^{nd} position in production of wheat, rice, cotton, sugarcane, and groundnuts. It is also the second biggest producer of vegetables and fruit, representing 8.6% and 10.9% of the

overall vegetable and fruit production in the world correspondingly.

The country is the top producer of jute, milk, and pulses and holds the second rank in the production of silk and it is the biggest consumer of silk in the world. In 2005, the country produced 77,000 million tons of silk.

India enjoys the 2nd position all over the world in terms of farm production. During the period of 2009-10, agriculture and allied industries such as lumbering, forestry, and fishing represented approximately 15.7% of the GDP of the country. These industries also recruited 52.1% of the overall manpower of India.

Outputs on a unitary basis for every type of harvest have increased from 1950. This has been possible for the government has put particular focus on farm operations in the five-year plans (Panchabarshiki Parikalpana) and stable developments in the domains of engineering science, irrigation, implementation of contemporary farming operations, and supply of cultivation loans and grants after the Green Revolution took place in the country.

Nonetheless, worldwide evaluative studies disclose that the mean farm output in the country is typically 30%-50% of the maximum average output in the world.

1.2 Agrarian Relations during British Rule in India

1.2.1 Agriculture and colonialism

Over 2500 years ago, Indian farmers had discovered and begun farming many spices and sugar cane. It was in India, between the sixth and fourth centuries BC, that the Persians, followed by the Greeks, discovered the famous “reeds that produce honey without bees” being grown. These were locally called saccharum. On their return journey, the Macedonian soldiers carried the "honey bearing reeds," thus spreading sugar and sugarcane agriculture. People in India had also invented, by about 500 BC, the process to produce sugar crystals. In the local language, these crystals were called *khanda* , which is the source of the word *candy*.

Prior to 18th century, farming of sugar cane was largely confined to India. A few trader began to trade in sugar - a luxury and acostly spice in Europe until the 18th century. Sugar became widely popular in 18th-century Europe, then graduated to becoming a human necessity in the 19th century all over the world. This evolution of taste and demand for sugar as an essential food ingredient unleashed major changes. Sugarcane does not grow in cold, frost-prone climate;

therefore, tropical and semitropical colonies were sought. Sugar cane plantations, just like cotton farms, became a major driver of large and forced human migrations in the 19th century and early 20th century - of people from Africa and from India, both in millions - influencing the ethnic mix, political conflicts and cultural evolution of various Caribbean, South American, Indian Ocean and Pacific island nations. The history and past accomplishments of Indian agriculture thus influenced, in part, colonialism, first slavery and then slavery-like indentured labor practices in the new world, Caribbean wars and the world history in 18th and 19th centuries.

1.2.2 Impact of Colonial Rule of British on Indian Agriculture

Farmingis the mainstay of Indian economy. Nearly eighty percent public adopted cultivation either as principal or as a secondary livelihood. About seventy percent of national earnings came from farm sector. Farm productions constituted mainly food-grains and such other harvests like oilseeds, fiber harvests, sugar cane required for domestic consumption. Moreover, agriculture had special importance in self-reliantrural economy. However, the British Rule altered the nature and structure of the Indian economy.

The land was heavily assessed for revenue; a new class of zamindars emerged; deindustrialization led to overcrowding of land; increasing rural indebtedness put the farmers in poverty; a large number of intermediaries caused low productivity and finally the impoverishment of the peasantry were accelerated.

Under these circumstances, Indian agriculture could not sustain the pressure from the growing dependence on the land, the increasing Government dues and the injustice of unscrupulous zamindars. The consequence was unavoidable . Farming became stagnant and personality acre yields declined.

There were various factors contributing to stagnation of farming. It began with the land revenue policy of the Company. Ownership of land was vested with non-farmers where as the actual farmers had no claim over land. The Government became the rent receiver; the Zamindars were rent-collectors; and the farmers were mere rent payers.

The Government did nothing for farm development. The rent-collecting Zamindars had no interest in farming. Finally, the farmers had no resources for investment to improve farming. Moreover, the farmers lost interest to bring about progress in the land which they did not possess.

The land cultivated by him was not his property and the benefit coming out of farmingprogress would be reaped by the absentee zamindars and financiers. To them, farm progress meant the payment of more rent and no cultivator came forward to invest in fear of extra payment. Thus, farming declined steadily.

India handiwork industries were closed down and local markets were no more beneficial to the Indian traders. Within short-time, farming was left as the lone source of employment and thus got overcrowded due to migration of working persons from non -farm sectors. Further, uncontrolled population growth added extra pressure on land.

Thus, people competed among themselves for a plot of land and were exploited by rack-renting of the zamindars. The method of subletting the right to collect revenue created a chain of intermediaries and led to the subdivision and the fragmentation of land into smallholdings. As a result per capita land was very low and earnings from land could not meet the livelihood of the farmers. All apart, everyone wanted to be a rent collector instead of being a cultivator for which subletting and subleases increased. Thus, fragmentation of land into small holdings and excessive overcrowding reduced yields per acre.

Indian farmers adopted primitive techniques in farm production. They hardly used better cattle and seeds, more manure and fertilizer and improved techniques of production. As discussed earlier, the farmers had no resource for progress of farming. The Government intentionally neglected farming.

Though the farmers shouldered the main burden of taxation, very small part of their taxes was paid for transformation of farming. The administration spent millions of rupees on the railways to promote the British trade interests. On the other hand, very little sum was spent on irrigation and that was the only field of Government investment.

The zamindars took no personal interest beyond the collection of tax. They exploited the farmers by rack-renting to enhance their earnings and were unwilling to make any investment to increase earnings by increasing output of land. Thus, farming continued to be neglected grossly and stagnation of farming was unavoidable .

No less were the effects of the natural calamities like floods, droughts and famines. The repeated occurrence of those calamities forced the farmers to give upon cultivation. There was no attempt to bring about any preventive measures against the natural calamities.

During the early years of the British Rule not anything was done to check or to regulate the flood water. No initiative was taken for providing irrigation that could have insured farm production against droughts or insufficient rainfall. Failure of harvests for two or more successive years took the dreadful shape of famine.

Neither the administration nor the zamindars paid any attention to prevent the devastation of the natural calamities. In India a good harvest depended on a good monsoon with adequate was uncertain, rainfall was irregular and natural calamities were inherent. The Government was apathetic, the zamindars were oppressive and the farmers were hopeless. Therefore, farming was left at the mercy of nature.

Similarly, no progress came in the farm technology. Farm implements were ordinary and old. Wooden ploughs were primarily used and cattle wastes constituted the manure. Use of iron ploughs was rare and an inorganic fertilizer was unknown.

There was very little effort for creating educational awareness among scientific advancement would have been an effective measure to increase productivity. But the scientific stagnation fastened the decline in farming and ultimately poverty was perpetuated for rural masses more specifically for the farmers.

1.3 Land Reforms during 1947-70

A huge disparity in land holding pattern continues to exist in the country even after four decades of independence. A series of farm land reform laws have been passed by the State and Central Governments. Though the laws are very rosy and catchy but their implementation is hope- less. However, people working with rural poor masses of India must have an elementary knowledge about the existing farmland reform measures, operating in 'the country.

1.3.1 Introduction

The stigma of Indian Farming is the highly defective structure of its farm land holdings. The measures of farm land reforms aim at correcting it. The term 'land reforms' involves procurement and redistribution of large holdings of farm land among the small farmers and landless farm labourers. It is an instrument to bring about progress in the institutional framework of farm land. The responsibility of land reforms is owned by the government with a view of benefiting those who either have petty holdings or have no farmland at all. As big farm land owners are quite unlikely to share their holdings with their landless counterparts, intervention by the government using force of law/legislation is necessary to secure social justice for the masses.

1.3.2 Land Tenure

Farmland tenure may be defined as the method in which an individual or the actual tiller of the land holds land; it determines his rights and responsibilities in connection with his holding. Obviously, the land tenure method refers to law/rules and regulations, which confer ownership rights upon an individual or actual tiller of the soil. It determines the status of the actual tiller of the farm land and his relations with the state. If the actual tiller is not the owner of the farmland it determines the relation between the owner and the actual tiller of the farm land. It points out under what circumstances; the actual owner of the farmland may lose his own right. It specifies rent to be realized from the tiller, its time and methods. It specifies the conditions under which the actual tiller can sell or transfer his holding. It specifies the conditions, whether a cultivator cannot- gage his farmland or not.

There were a large number of land tenure methods prevalent in India in the pre - independence period. But the following three were more prevalent in different parts of the country.

1.3.2.1. Raiyatwarimethod

Under this method, every registered holder is recognized as its owner. The owner cultivator or peasant proprietor is responsible directly to the government for the payment of farmland revenues and other dues. There is no intermediary between the government and the cultivator. This is perhaps the best method offarmland tenure. The peasant proprietor does not fear ejection by the government so long as he pays the farmland revenue. He can make permanent investments in his farmland as he is sure to reap its benefits. Thus, this method can ensure an increase in farm productivity.

1.3.2.2. Mahalwari method

Under this method,farm land is held (owned) jointly by a collective body of the village. This body collects farmland revenues from the owners or cultivator farmers and is responsible to the government. This method is found in some parts of U.P., Punjab and Haryana. This method facilitates cooperative farming to get maximum yield from the land. The smallholdings of peasant farmers can be combined for this purpose. The main drawback with this method is that it encourages absentee landlordism.

1.3.2.3. Zamindarimethod

In Zamindari method , there is a separation of ownership of farm land from its farmers. Under this method , one person known as zamindar owns a village and is responsible for the payment of farmland revenues to the government. This method existed in West Bengal, some parts of U.P., 1 Maharashtra and Tamil Nadu. Now this method has been abolished.

1.3.3. The Need for Land Reforms

As discussed earlier, the defects existing with the Indian agrarian structure pointed out by the Planning Commission, highlighted the need for land reforms. The existing method during the beginning of Planned Growth, allowed the landlord and intermediaries to grow richer and they continued to flourish at the cost of the actual tillers. The cultivator tenants had to live a very tough life. Tenant got little incentive to increase his output for a large share went to the landowner. Very small margin was left for the actual cultivator and this amount was quite insufficient to provide for a capital investment in the farmland. The zamindars grew richer, the intermediaries continued to flourish, the state was deprived of its share of legitimate increase in revenue and the cultivator tenants were in hand to mouth existence.

In order to remove the defects with existing agrarian structure, there was need of institutional changes in holdings. A high powered committee in 1948 with J. L. Nehru as its Chairman recommended that “all intermediaries between the tiller and the state should be eliminated and all middlemen should be replaced by non-profit making agencies like cooperatives. The maximum size of holdings should be fixed and the surplus farmland should be acquired and placed at the disposal of the village cooperatives. Small holdings should be consolidated and steps should be taken to prevent further fragmentation".

1.3.4. Purpose of Land Reforms

The basic purpose of farmland reforms in India has been the creation of a method of peasant proprietorship. 'Land to the tiller' has been the motto. Through the redistribution of farmland by applying ceiling on farmland holdings, the idea has been to build up a vigorous independent peasantry consisting of small farmers and to help these farmers class with extension of credit and distribution facilities, largely through a network of cooperative service organization.

The planners set out the objectives of the land reform policy as "the removal of such institutional and motivational impediments to the transformation of farming as were innate in the agrarian

structure inherited from the past and the reduction of gross inequalities in the agrarian economy and rural society which stemmed from unequal rights in land".

The Planning Commission gave two basic objectives of land reforms, namely.

1.3.4.1. Economic efficiency

The agrarian reforms should help in removing all obstacles to achieve higherfarm productivity. They should help in creating conditions for evolving as speedy as possible , afarm economy with a high level of efficiency.

1.3.4.2. Social justice

The agrarian reforms should help to eliminate all elements of injustice and ensure social justice within the agrarian method to provide security for the tiller of the soil and assure equality of status and opportunity to all the sections of the rural population. In order to achieve these objectives, the following policy measures were envisaged:

-Abolition of the prevalent intermediary method between the state and the actual tillers;
-Tenancy reforms such as conferring of ownership rights on the cultivating tenants in the farmland held under their possession;
-Imposition of a ceiling on farmfarmland holdings as a measure contributing to the transformation of farming and to eliminate parasitic absentee farmlandlords;
-Rationalization of the record of rights in farmland so as to make the rights of tenants, share harvesters and other categories of insecure zamindars;
-Consolidation of holdings with a view to making easier the application of modern techniques of farming; and Development of co-operative farming and co- operative village management.

1.3.5. Progress of Land Reform Measures

The farmland tenure method which the British imposed in India, regardless of the different juridical forms they assumed in different regions, where only variants of feudal and semi-feudal farmland ownership. The British administrators altered these methods in a manner as to facilitate the extraction of more rants from the farmers by making the landlord, who was earlier a rent collector, the absolute owner of farmland and by depriving the actual farmers of all their traditional rights. This was done in a forthright manner under the zamindarimethod and in yield and indirect manner in the Raiyatwari method . Although juridical no landlord or intermediaries

were created and the settlements were made directly with the raiyat, yet the fact was that, due to prevailing inequalities in farmland holdings, the bigger raiyat zamindars came to dominate the agrarian set up in many respects and became the counter- parts of the zamindars in zamindari areas. Like the latter, they indulged in many semi-feudal forms of injustice such as share harvesting, rack renting, ejects, forced labor, usury, etc.

Under British rule, farmland reforms had a very limited scope and content. These farmland reforms were motivated not by consideration of improving production, nor did they have any sense of social justice. They were meant to safeguard British political influence in the rural areas and save the rural market from being completely pauperized.

Thus, the structure of agrarian society evolved under British rule, created a socioeconomic set up in which parasitism flourished, farmlandconcentrating in the hands of a few rural rich continued to grow, and landlessness and land hunger of the farmers mounted at an ever increasing pace. Evictions and insecurity of tenancy and rack- renting became a general phenomenon and the farmers were ground down by a colossal burden of indebtedness.

Farmland reforms have been on the agenda of rural reconstruction since independence. The state and central government have made the number of farmland reform laws after independence. The reforms have been undertaken along the following lines:

-Abolition of zamindars and other intermediaries (jagirdars, inamdars, malgujars, etc.) Between the/state and the cultivator;
- Tenancy reforms and the reconstruction of the farmland ownership method ;
-Fixation of ceiling on holdings and distribution of surplus farmland among the landless;
-Reorganization of farming through consolidation of holding and prevention of further fragmentation; and
-Development of co-operative farming and co-operative village management methods.

1.3.5.1 . Abolition of zamindarimethod

Intermediary tenures like zamindaris, joggers, imams, etc. Which prevailed over nearly 40 % of the cultivated farmland have been abolished. These intermediaries were responsible for the payment of farmland revenues to the government. The zamindars and other intermediaries were merely rent receivers and were not bothered about the progresss .

1.3.5.1.1. Reasons for abolition

The general compulsion underlying the abolition of the intermediaries was the concentration of farmland ownership in the hands of a parasitic class who played no positive role in production while the vast mass of small farmers, who were the actual farmers, were divorced from the ownership of farmland. This discrepancy became the root cause of the state of chronic crises in which the Indian farm economy was enmeshed for several decades before the attainment of independence. It remained a completely stagnant economy. The rate of growth was less than half per cent. It was not expected that an utterly weak and unsuitablefarming of this nature would meet the growing demands of food and raw material of a new developing independent nation's economy. Thus the abolition of feudal and semi-feudal vested interests became an essential step for facilitating the growth of productive forces in the country. Besides, the intermediary method was subject to high rent and rack-renting, share-cropping, injustice and demoralization of the actual tiller of the soil.

Thus, immediately after independence a strong voice was raised against the vested interests in farmland. As a result, top priority was given to the abolition of zamindari method or the intermediary method as a whole. Accordingly, every state enacted its own legislations for the abolition of intermediary interests.

Legislative measures for the abolition of intermediaries were initiated soon after the independence, starting with Uttar Pradesh and being followed up in other states. The whole process of legal enactments on this issue was completed in the country within a decade, i.e. From 1950 to 1960. Since farmland reform was a state subject, actual enactments abolishing intermediaries were marked by certain variations from state to state though the salient features of most of those enactments were common.

1.3.5.1.2. Economic and social effect

Though the abolition of intermediaries was associated with many advantages, it had the following economic and social undesired consequences.

1.3.5.1.2.1. Heavy burden of compensation

The compensation to be paid to the intermediaries amounted to Rs 670 crores as compared to additional farmland revenues of only Rs 29.52 crores. This was a heavy burden on state governments. The compensation received by the zamindars was a waste of capital resources by

the state governments. This amount was not invested in farming but in urban property or was spent in buying consumer durables.

1.3.5.1.2.2**. Increase in the number of feudal zamindars ,**

The acts abolishing intermediaries did not divest the feudal zamindars of their holdings. This is because owners were allowed to retain as much farmland as they themselves can cultivate. Big farmland owners started cultivating farmlands by employing hired labour in any form. Thus, the "feudal landlord" was permitted or rather encouraged to shift! Their position from rent receivers ofself-farmers. It also encouraged "absentee landlordism" in which many intermediaries and non-farmers of soil became owners of farmland. They retained as many areas as they could show under their personal cultivation. Before the implementation of the act, the zamindars got the records manipulated into their favour in connivance with the local bureaucrats.

1.3.5.1.2.3**. Eviction on a large scale**

Since the intermediaries wanted to become owners of farmland under the garb of self-farmers, they evicted tenant farmers before the implementation of the legislation. The poor evicted tenants did not approach the court or the government because of poverty, fear and lack of organization.

1.3.5.1.2.4**. Faulty records**

The revenue records were faulty because of which many farmers could not get the benefit under the legislation of abolition of intermediaries.

1.3.5.1.3. Tenancy reforms

The first phase of land reforms (1948-55) was mainly concerned with the abolition of intermediaries. The tenancy reform, which is the integral part of the land reform policy,favoured neither wholesale removal of landlordism nor the wholesale abolition of tenant farmers. Hence, the middle course was adopted. Thus, certain amendments to the existing tenancy laws were carried out along with the legislations for the abolition of intermediaries. This extended the scope of protection to the tenants of intermediaries particularly in areas of statutory landlord- deism.

But the owners were allowed to resume farmland for their personal cultivation. This led to the mass eviction of tenants, sub-tenants and share-croppers through various legal and extra-legal actions. In fact, a big drive to clear farmland of tenant occupants was started by zamindars in order to obtain maximum areas. Innumerable evictions were effected III the process of

resumption of farmland by landowners. However, such evictions could not take place in the U.P. and Union Land of Delhi. In fact, U.P. has the credit of having the best land reforms in India.

To counteract this, the lawmakers in most of the states tried to enact or amend tenancy laws in the following decade (1955-65) and friends plug certain glaring loopholes in the existing laws. The major aspects incorporated in tenancy legislation in different states to protect the tenants can be identified as follows.

1.3.5.1.3.1**. Fixation of rents**

Before the initiation of farmlandreform measures, the tenants were required to pay one half of their produce or more as rent to the zamindars. During the first five-yearplan period, it was suggested that the rent should not exceed 1/4th or 1/5 of the produce in any case. During the second and third plans also this suggestion was repeated and it was suggested that the rent should be made payable in cash. Legislation along these lines has been enacted in all the states. However; different states have prescribed different rates of rents. For instance in Gujarat and Maharashtra the maximum rent stands at one-sixth of the produce. In Assam, Manipur and Tripura maxi: mum rents vary between 1/4 to 1/5th of the gross produce. In Orissa and Bihar, 1/4th of the gross produce has been fixed as rent. In Rajasthan, fair rent is fixed at 1/6th of the gross produce but in case of cash rents, at twice the ' land revenue assessment.

1.3.5.1.3.2**. Security of tenants**

It was emphasized in the first, second and third five year plans that the tenants. Should be accorded permanent rights In the farmlands leased In by them subject to a limited right of resumption to be granted to landowners. In accordance with this legislation, providing for security of tenure has been enacted in all states. This legislation has three aims:

-The ejectment of the tenant should not take place except in accordance with the provision of law;
-The land may be resumed by the owner only for personal cultivation; and
-In the event of resumption, the tenant is to be assured of a minimum tenanted area in his possession.

The legislation provided that the ejectment of tenant can take place only through order of a revenue court. The grounds on which ejectment may be allowed include: (a) non-payment of rent, (b) performance of an act which is destructive or permanently injurious to the land, (c) sub-letting the land, and (d) resumption of land for personal cultivation by the landlord.

Legislations have been passed for granting security of tenure in different states on the following patterns.

-All tenants in possession of cultivated farmland have been given full security of tenure. The landowners have no right to resume farmland for personal cultivation as in V.P. and Delhi.
-In Assam, Maharashtra, Gujarat, Punjab, Rajasthan and Himachal Pradesh landowners are permitted to resume a limited area for personal cultivation subject to the condition that a minimum area or portion of the holding is left with the tenants.
-In West Bengal and Jammu & Kashmir, a limit has been placed on the extent of farmland, which a landowner may resume. But the tenant is not entitled to retain a minimum area or portion of this holding in all cases.

1.3.5.1.3.3**. Right of ownership**

Regulation of rents and security of tenure is treated as the first stage in the tenancy reforms. The ultimate goal is to confer rights of ownership on as many tenants as possible and bring them in direct contact with the state. Legislations passed along these lines provide for bringing tenants of non-resumable farmlands into direct relationship with the state in the following three ways.

-By declaring tenants as owners; the tenants were required to pay compensation to owners in suitable instalments;
-Through the acquisition of right of ownership by the state on payment of compensation and transfer of ownership to tenants; and
-By protecting the interests of sub-tenants under the tenancy laws and bringing them into a direct relation - ship with the state.

The impact of these measures can be seen from the pattern of holding that has now emerged in the country. The farm census report pointed out that out of the 70 million holdings in the country 64 million or 92 % holdings are wholly owned or self-operated, 3 million holdings are partly owned and partly rented and another 3 million holdings are wholly leased accounting for 4 % each. Out of 162 million hectares under the holdings, 148 million hectares (91 %) are wholly owned and self operated; 10 million hectares (6 %) are partly owned and partly rented and the balance 4 million (3 %) hectares are wholly leased. It is now obvious that the most of the holdings are now under self-cultivation and the evil of share-croppers has been reduced to a great extent. It is because of high re- turns into self-cultivation and the owner cultivator do not

find it beneficial to lease out farmland on share harvesting. In view of the increasing pressure of population on farmland and unemployment the leasing out of farmland is expected to be a rare phenomenon in future.

Those farmers' who do not possess the required amount of labour and capitals adopt the practice of leasing out of farmland. Otherwise, in view of high returns from farmland, leasing out and share-cropping are considered unbeneficial by owner farmers.

1.3.5.1.3.4**. Evaluation of tenancy reforms**

Because of tenancy legislations in many states the tenants and sub-tenants have been brought into direct relationship with the state. But the progress was very slow in some states due to the following reasons.

-The legislation has not been able to meet the objects laid down by the Planning Commission. The fixation of statutory rent was very high in some states.
-The term personal cultivation was defined in a loose manner. Because of this, the farmlands ostensibly resumed by the landlords on the pretext of personal cultivation are cultivated through harvest -sharing arrangements where the sharers are treated as labourers.
-The definition of the term 'tenant' excluded the share-croppers who form a vast majority of the tenant farmers. Thus share-croppers did not get any benefit.
-The non-availability of correct and up-to-date farmland '. Records have not allowed to carry out the tenancy reforms properly.
-The tenants can be evicted from their holdings on many grounds. This has been termed as a continuing hang over of the feudal method.

1.3.5.1.3.1**. Suggestions for progress**

The following suggestions can be considered useful in achieving the aims of tenancy reforms.

1. The resumption of farmland by the owner should be legal in cases where the owner cultivates the farmland himself.
2. The ex-zamindars who have retained excess holdings under the pretext of personal cultivation should be brought under a ceiling limit.
3. Correct farmland records should be compiled and maintained so as to facilitate effective application of tenancy farmland reforms.

4. There should be a complete ban on letting and subletting of farm lands. An Exception should be allowed in cases where the owner is a widow, minor or handicapped. The real purpose of land reforms can be served only if the farmers get financial support from the financial institutions for the permanent progress of their holdings.

1.3.5.1.4. Ceiling on land holdings

Ceiling on farmland holdings refers to the fixation of maximum size of a holding that an individual cultivator or a household may possess. Beyond this maximum limit, all farmland belonging to the zamindars is taken away by the government to be redistributed among the landless labourers. Thus the imposition of a ceiling on farm holdings is mainly a redistribution measure. The idea basically is to ration the farmland in such a way that, above a certain level, the surplus farmland is taken away from the pre- sent holders and is distributed to the landless or to the small farmers. This will reduce the wide disparities of earnings and wealth found in the agrarian structure.

The ceiling question gave rise to more debate and arguments than any other reform issue. Legislations for ceiling on existing holding and future acquisition were enacted in most of the states during the second plan period.

The ceiling on farm holdings was intended to:

-Meet the hunger of the landless;
-Reduce the glaring inequalities in farmland ownership so as to pave the way for development of co-operative rural economy; and
-Increase self-employment in owned farmland.

The ceiling laws were enacted and enforced actually in two phases: the earlier phase covering the period from 1960-1972, before the national guidelines were laid down, and the latter since 1972 after the adoption of the guidelines. However, provisions related to ceiling laws can be analyzed under the following heads.

1.3.5.1.4.1**. Unit of application**

In the beginning some states took 'individual' as the unit of the ceiling, while some others regarded 'family' as the unit. This led to widespread irregularities and big farmland owners started transferring their farmland into pieces to their fake kiths and kins and managed to keep unduly

large holdings. However, since 1972, after suitable corrections, the unit of farmland ceiling universally adopted by all the states is a family having a father, a mother and children. Parents having more than 5 children can be given a little exemption but in no way the amount of exemption will exceed twice the prescribed limits.

1.3.5.1.4.2**. Level of ceiling or maximum limit**

Under the old acts (prior to 1972) there were wide variations in the fixation of ceiling on farmland holdings since the ceiling was a state subject and each state enacted its own ceiling laws. For instance the limit of ceiling prior to 1972 in Andhra Pradesh varied from 27 to 234 acres, in Assam it was fixed at 50 acres, in Gujarat it varied between 10 to 132 acres, Haryana 30-60 standard acres, Kerala 15 acres, M.P. 25 acres, Orissa 20-80 acres, Punjab 30-40, acres, U.P. 40-80 acres, Tamil Nadu 30 acres to 120 ordinary acres, and West Bengal 25 acres. Thus, there was a large gap between minimum and maximum and from state to state permissible limits of farmland holdings. As such, much farmland could not be achieved for redistribution. Since 1972 these limits have been rationalized. Thus under the new policy, the upper limit of the ceiling has been lowered and the range between the lowest and the highest has been considerably narrowed. For irrigated farmland where at least two harvests are raised, the ceiling, depending on the productivity of farmland and other factors, has been fixed at 10-18 acres. In places where irrigation is done by private sources, for the purpose of fixation of ceiling, 1.25 acres is deemed to be equivalent to one acre of farmland irrigated by public sources. However, in both cases, the upper, limit does not exceed 18 acres. In areas where there is a provision for irrigation for the raising of only one harvest, the upper limit of the ceiling has been fixed at 27 acres. For, remaining types of farmland which are not so productive, the I~ upper limit. Is 54 acres.

1.3.5.1.4.3**. Exemptions**

There was a long list of other kinds of farmlands whichwas exempted from the purview of ceiling legislation before 1972. For instance, tea, coffee, and rubber plantations, orchards, specialized farms engaged in cattle breeding, dairying, wood raising etc., Sugar cane farms, factories and efficiently managed farms which consist of compact blocks on which heavy investment or permanent structural progress have been made were exempted. In those parts where cultivable wastes are available and sufficientnumber of farmers is not forthcoming, the ceiling may not be imposed or may be placed at a higher level.

The farmland ceiling measures have been disappointing in the country except in the states of J & K and West Bengal. By the end of 1970 about 11 lakh hectares of farmland could really be taken

over and again only a half of the taken- over farmland could actually be distributed among the landless labourers. In some states such as Bihar, Karnataka, Orissa and Rajasthan, no farmlandwere declared surplus. The situation did not improve even after 1970.

1.3.5.1.4.4. Recommendations of the chief minister's conference

In 1972, a new national policy on the land ceiling was evolved on the recommendations of the chief minister's conference. The following guidelines were laid down.

-Taking into account the fertility of soil and other conditions, the best category of land in the state with assured irrigation and capable of yielding at least two harvests a year the ceiling should be fixed 10-18 acres.
-In the case of land with assured irrigation for only one harvest in a year, the ceiling shall not exceed 27 acres.
-In case of owners with different types of holdings, after converting the better categories of land into lowest categories, the ceiling should not exceed 54 acres.
-The unit of application should be a family of 5 members. Where the members of the family exceed additional land may be allowed for each member in excess of 5 in such a manner that the total area admissible to the family does not exceed twice the ceiling limit for a family of 5 members. Where both husband and wife hold land in their own names the two will have rights in the properties within the ceiling in proportion to the value of land held by each before the application of the ceiling. Each major child is to be f treated as a separate unit for the purpose of application of the ceiling.

1.3.5.1.4.5. Consolidation of holding

India is a land of very small, fragmented and uneconomical holdings. That is why the need of consolidating these fragmented holdings was felt in order to improve their productivity and viability of investments. Various state governments, on these lines, have introduced legislations. Consolidation of farmland is a process of rearrangement of farmland on the basis of existing rights. Most states have not shown any enthusiasm for implementing such legislations. Only in Punjab, Haryana and parts of UP. Thisprogram has made desired progress. Orissa, Bihar, H.P. etc. Have also taken up consolidation in a big way. An area of 584.72 lath hectares has so far been consolidated all over India.

1.3.6. Impact of Land Reforms

The impact of farmland reform measures on the agrarian structure of the country can be discussed under the following heads.

1.3.6.1. Changing over to market oriented farming

The analysis of pre-independence patterns of farmlandmethod reveal that the agrarian and social structure which developed under the British tended to perpetuate a back- ward and medieval economy in a state of stagnation for decades. The forces to impede the production and development were very active.

In contrast to this, National Commission on Agriculture (NCA) pointed out that the essence of the present situation is that Indian farming is in a stage of transition from predominantly semi-feudal type of farming characterized by large scale leasing of farmland and subsistence farming to a commercialized farming and, thus, increasingly assuming the character of market oriented farming.

1.3.6.2. End of feudalism

The National Commission on Agriculture also pointed out that as a result of farmland reforms that have taken place since the independence, the feudal and semi-feudal farmland owning classes have lost their erstwhile domination over the Indian agrarian economy as a whole. Moreover, the decline in the semi-feudal relations have followedthe growth of farming on commercial lines. However, some of the evils such as share-cropping, extraction of high rates of rents, usury, eviction of tenants, social and caste oppression, etc. Still prevail in some parts of the country but the degree of their intensity is negligible.

1.3.6.3. Leasing in of land by big owners

One of the important effects of farmland reforms is that, the subsistence farming is changing over to commercial farming. In this context NCA has pointed out that under commercial tenancy, leasing in of farmland by the big farmland owners from the small farmers takes place and such tenancy prevails more in areas where farming is modernized. It is common in Punjab and other areas where the impact of the green revolution has been appreciable. It is almost absent in the eastern regions of the country where farming is far less developed and where the old type of tenancy still persists.

1.3.6.4. Emergence of modern entrepreneurs

As a result of land reforms a class of modem entrepreneur farmers has emerged. These farmers have substantial farmland holdings and cultivate their farmland through hired labour and new technology. They are drawn largely from the ranks of exfeudal zamindars, upper strata of privileged tenants and the bigger raiyots, financiers, f merchants and various other categories of substantial zamindars.

Besides the growth of commercial farming and the rise in the prices of farm commodities and also I progress in techniques, have strengthened the economic position of this class of big farmers. They are also the main beneficiaries of governmental expenditure on farm development. It is this class which has been treated as the main custodian of the 'green-revolution'.

1.3.6.5. Reduction of poverty

Besides several negative impacts, land reform measures have certainly reduced the disparities in farm holdings. The surplus farmlands of big zamindars have been distributed among the tenants and small farmers. The injusticeof tenants by the farmland owners has been reduced considerably. The cultivator-owner has been given assistance by the credit institutions to increase the productivity of their farmlands. The cultivator-owner has been brought in direct contact with the state. They are no longer required to share their produce with their zamindars. All these steps have led to an increase in the earnings of the small farmers and thus reduced poverty in the rural areas.

1.3.6.7. Use of institutional credit

Agrarian reforms have significant implications in facilitating the use of institutional credit. The farmland re- form measures have influenced the working of financial institutions viz. Co-operative banks, regional rural banks and commercial banks, etc.

1.3.7**. Review of Land Reform Measures**

Though the farmland reform measures have been instrumental in bringing about some desirable changes in Indian agrarian structure, yet, they have failed to secure a justice to a large section of the rural population. The results of land reforms implemented so far have been far from satisfactory.

Because of certain loopholes in the reform policies and implementation methodology, the progress has been very slow. In 1980.81 more than 54% holdings were less than 1 hectare each. Only 32% holdings were in the range of 1 to 4 hectares. More than 70% of the farmers still have to survive on less than 30 % of the total arable farmland of the country. These figures reveal the existing wide disparities in farm holdings despite 40 years of planned economic development.

Some of the glaring examples of weakness in farmland reform measures are listed as below.

1. There has been no uniformity in execution of farmland reform policies and legislations in different states. For example, the rent to be charged from the farmers shows a wide variation from 20 % to 50 % of the gross product.
2. Land reform measures have failed to prevent subletting and rack-renting.
3. The identification of self-cultivation was wrong which allowed the big zamindars to keep large holdings with them.
4. Ex-zamindars and zamindars have showed on papers that they have been cultivating the land. However, they get them tilled by hired labourers.
5. Eviction of tenants has occurred on a large scale out of the suspicion of land being lost and under the guise of "voluntary surrenders".
6. Administrative arrangements for enforcement and : supervision of land reforms have been fully inadequate.
7. Records of tenants did not exist in several states and often incomplete and out of date records were used for the implementation purposes.
8. The several states the existing provisions of security of tenure were of an interim nature and comprehensive measures to bring tenants into direct relation with the state are yet to be adopted.
9. The rights to resumption widened the scope of ejectment.
10. To provide security of tenure to the tiller, the landlord tenant bond was to be broken by the state interposing between them to collect fair rents from the tenant and pay it to the landlord after deducting the land revenue and collection charges.

1.3.8. Reasons for Low Progress of Land Reforms

The task force on agrarian relations set up by the Planning Commission to appraise the progress and problems of farmland reforms, identified the following reasons for the poor performance of land reform measures.

1.3.8.1. Lack of political will

In the context of the socioeconomic conditions prevailing in the country, no tangible progress can be expected in the field of land reforms in the absence of requisite political will. The sad truth is that this crucial factor has been wanting. In no sphere of public activity in our country since independence has had such a big gap between precept and practice i.e. Between policy pronouncement and actual execution.

1.3.8.2. Absence of pressure from below

Except in a few scattered and localized pockets, practically all over the country, the poor farmers and farm workers are passive, unorganized and inarticulate. The basic difficulty in our situation arises from the fact that the beneficiaries of farmland reforms do not constitute a homogeneous social or economic group.

1.3.8.3. Negative attitude of the bureaucracy

Towards the implementation of farmland reforms, attitude of the bureaucracy has been generally lukewarm and indifferent. This is, of course, unavoidable because, as in the case of men who wield political power, those in the high echelons of the administration also are either big farmland- owners themselves or have a close nexus with big farmland- owners.

1.3.8.4. Legal hurdles

Legal hurdles also stand in the way of farmland reforms. The task force categorically states: "in a society in which the entire weight of civil and criminal laws, judicial pronouncements and precedents, .Administrative procedure and practice is thrown on the side of the existing social order based on the inviolability of the private property, an isolated law aiming at the restructuring of the property relation in the rural area has little chance of success. And whatever little chance of success was there, completely evaporated because of the loopholes in the laws and protracted legislations".

1.3.8.5. Absence of correct and up-to-date land records

The absence of correct and complete farmland records further added a good deal of confusion. It is because of this that no amount of legislative measures could help the tenant in the court unless he could prove that he is the e actual tenant. This he could only do if there were reliable, and up-to-date records of tenants. The main reason for the unsatisfactory state of affairs are (a) many of the areas in the country have never been cadastrally surveyed, (b) in some areas where cadastral surveys were done for a r long time, no resurveys have been taken, (c) no machinery , of any kind existed for maintaining village records, (d) even where records were kept by government

officials, there is no uniform method , and (e) it has been found that even official records in many cases have not been correct.

1.3.8.6. Lack of financial support

Lack of financial support plagued the Farmland Reform Act from the beginning. No separate allocation of funds was made in the fifth plan for financing farm land reforms. Many states declined to include even expenditure of such essential items like preparation of records of rights in their plan budget. The state plans which are nothing but the aggregate of expenditure programs hardly made any reference to farmland reforms. Whatever funds were needed for finalizing of this program had to be provided in non-plan budgets. It is because of this that the expenditure for farmland reforms was always postponed. Or kept to ' the minimum.

1.3.8.7. Land reforms have been treated as an administrative issue

The implementation of farmland reforms is not an administrative issue, it is more of a political issue. Therefore, it is necessary to strengthen the political will for implementing farmland reforms. The task force of the Planning Commission in a very forthright manner states: "it should, however, be clearly understood that the mere setting up of an efficient administrative machinery will not by itself lead to any substantial progress unless the political and economic hurdles operating against the program are removed."

1.3.9 **Progress**

The farmland reform measures were thoroughly reviewed by the Planning Commission and other committees. Based on their findings, National Commission on Agriculture has suggested following measures to reinforce the implementation of farmland reforms.

1.3.9.1. Breaking of landlord-tenant nexus

The private owner who rents out farmland today is undoubtedly intermediary between the tiller and the state and, as such, does not fit into the fundamental pattern of farmland reforms. It is, therefore, high time that tenancy I reforms were directed towards the state of finally breaking up the farmlandlord-tenant nexus.

A potent practice of farming i.e. landlordism should be discouraged and ultimately curbed. Farming should be treated as a family occupation of the peasant-cultivator and not a source of

subsidiary unearned earnings. In a normal peasant-proprietor economy absentee landlordism should find no place.

1.3.9.2. Restricted tenancy should be allowed

Under the present farmland-man ratio existing in India, tenancy as such cannot be banned though undesirable. Experience has shown that wherever such an overall ban has been imposed, it has led to the emergence of concealed tenancy with all its evils. Hence, until such time as socioeconomic development in the country bring about a radical change in man-farmland ratio and create possibilities of transfer of population from the farming to non-farm sectors on a big scale, the tenancy shall have to be permitted in a restricted form. It will have to be strictly controlled and regulated.

All tenants of landowners excepting such landowners who possess land up to a marginal holding should be vested with proprietary rights and simultaneously declared virtual owners on a date to be specified by the state government. However, disabled persons, minors, widows and army personnel's are given some concession, the nature of which may be decided by the state governments. This provision shall not apply to those cases where a bigger landowner has leased in land from a small landowner. Share-harvesters who have so far been not treated as tenants should be recognized and regarded as tenants and given all due protection as such.

1.3.9.3. Effective implementation of ceiling laws

The studies have revealed that ceiling laws have not been able to make any appreciable breakthrough in reducing concentration of land in the hands of a few big farmers. These laws are devised to achieve the purpose of substantially reducing the present inequalities in farmland holdings. It is, therefore, suggested that present ceiling legislations should be enforced vigorously. For instance, it is necessary to take firm measures against fiction and *benami* transfers which have been intentionally manipulated by big farmland owners in order to by-pass ceiling legislations. The state government should conduct a proper inquiry into such transfers. If it is found that the transfers were made purposely to evade the provisions of ceiling laws, the farmland so transferred should be vested in the state after imposition of any penalty on the transfer. In cases where fictions co-operative societies have been organized with a view to concealing the surplus farmland, such co-operatives should be subjected to proper investi- gation. And where many partners have been shown in a holding, but the holding as a whole is under a single management, such cases should also be brought to the lime- light and adequate actions should be taken to undo it.

1.3.9.4. Control on land held by trusts and institutions

The Planning Commission holds the view that the land possessed by trusts or institutions used for religions, charitable or educational purposes should be brought under ceiling laws. It would not be proper to give them a blanket exemption because a large number of such institutions and trusts are fictions or have been intentionally created to evade ceiling laws. Some of them are not being used for the purpose which on paper they profess to serve. Arable lands held by such trusts and endowments should be brought under the ceiling laws and more ceiling should also be made applicable to forests and water areas held by such institutions.

1.3.9.5. Distribution of surplus land

For distributing the surplus land accumulated out of enforcing ceiling legislations, opinions are different as to who should be preferred for allotment, landless labourers or small farmers owing less land than the minimum limit in order to make such holding viable. There is enough force in the argument that land should be distributed. To a small farmers owning less land than the economic holding or the minimum operational holding. Some have also argued that it is not only important to fix a ceiling on land holding, but it is also important to fix floor so that a large number of farmers may have at least a small operational holdings.

But in the view of massive landlessness, a serious lack of employment opportunities and a subsistence level of, almost half of the rural population below the poverty line, the land should be distributed to the landless labourer to whom land, however small, is the source of employment and relief from destitution. Hence for a long time to come a floor or ownership cannot be applied.

1.3.9.6. Simplification of legal procedure and administrative machinery

The Planning Commission has observed that ceiling legislations have suffered not only because of certain political and economic constraints but also because of a very inadequate and inefficient administrative machinery for enforcing it. The same is true for other kinds of land reform measures. It means that existing administrative machinery has generally failed to prevent the evasion of effected laws and has been functioning largely in collusion with the vested interests, especially in the village and tehsil levels.

The existing districts civil and revenue courts cannot properly discharge those functions being already over- burdened with other kinds of litigations. Besides, the existing method causes unnecessary delays and makes justice very costly. It often results in the dispensation of a doubtful

nature. These courts are far away from villages and the poor man is generally at a disadvantage. Hence, the restructuring of administrative machinery is required.

1.3.9.7. Voluntary surrender should not be accepted

Voluntary surrender have generally been used to cover up forcible and illegal eviction of tenants. Such surrenders should not be accepted as valid unless they are certified as genuine by an appropriate authority. In this context, the commission suggested that land surrendered should not revert to the landowner but should vest in the state to be allotted to any other eligible person. It can also be argued that it should revert to the owner if he possesses land less than the ceiling limit.

1.3.9.8. Higher rent should be curbed

Despite the fixation of rent in most states on the lines recommended under various plans, higher rent still prevails in many parts of the country. It is, therefore, suggested that such rent receipts should be strictly enforced. The tenants should be entitled to remit their rents through financiers or deposit them in the tehsil.

1.3.9.9. Preparation of up-to-date land records

Tenancy legislation cannot be properly implemented without adequate and proper land records. Therefore, it is imperative that the preparation of land records should be given top priority in the whole scheme of enforcement of land reforms. Tenants, tenants-at will, and share- harvesters should be promptly and properly identified and their names should be recorded forthwith. It can, how- ever, be said that the interest of the owner should not be ignored.

1.3.9.10. Ensure security of tenure

So far as the tenure is concerned, the most important requirements would be:

-Recording the names of all the persons who hold land including share-harvesters in the record of right;

-Ensuring that not more than the legally stipulated share of the harvest is taken from the shore-harvesters by land owners;

-Ensuring that no ejectments takes place either on the basis of voluntary or through other extra-legal or illegal methods;

-A ensuring inheritance to the heirs of the share-harvesters on their death where the law provides it; and providing supportive services including credit to share-harvesters to free them from the clutches of landowners and financiers.

1.4 Land Relations in Pre-British India

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

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

1.4.1 Early history

Wheat, barley and jujube were domesticated in the Indian subcontinent by 9000 BP. Domestication of sheep and goat soon followed. This period also saw the first domestication of the elephant. Barley and wheat cultivation—along with the domestication of cattle, primarily sheep and goat—was visible in Mehrgarh by 8000-6000 BCE. Agro pastoralism in India included threshing, planting harvests in rows—either of two or of six—and storing grain in granaries. In the period of the Neolithic revolution (roughly 8000-5000 BCE.), Farming was far from the dominant mode of support for human societies. But those who adopted it, have survived and increased, and passed their techniques of production to the next generation. This transformation of knowledge was the base of further development in farming. By the 5th millennium BCE farm communities became widespread in Kashmir. Zaheer Baber (1996) writes that 'the first evidence of cultivation of cotton had already developed'. Cotton was cultivated by the 5th millennium BCE-4th millennium BCE. The Indus cotton industry was well developed and some methods used in cotton spinning and fabrication continued to be practiced till the modern Industrialization of India.

A variety of tropical fruit such as mango and muskmelon are native to the Indian subcontinent. The Indians also domesticated hemp, which they used for a number of applications including making narcotics, fiber, and oil. The farmers of the Indus Valley, which thrived in modern-day Pakistan and North India, grew peas, sesame, and dates. Sugar cane was originally from tropical

South Asia and Southeast Asia. Different species likely originated in different locations with *S. Barberi*originates in India and *S. edule* and *S. officinarum* coming from New Guinea.

Wild Oryza rice appeared in the Belan and Ganges valley regions of northern India as early as 4530 BCE and 5440 BCE respectively. Rice was cultivated in the Indus Valley Civilization. Farm activity during the second millennium BC included rice cultivation in the Kashmir and Harrappan regions.

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

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

Gupta (2004) finds it likely that summer monsoons may have been longer and may have contained moisture in excess than required for normal food production. One effect of this excessive moisture would have been to aid the winter monsoon rainfall required for winter harvests. In India, both wheat and barley are held to be *Rabi* (winter) harvests and—like other parts of the world—would have largely depended on winter monsoons before the irrigation became widespread. The growth of the *Kharif*harvests would have probably suffered as a result of excessive moisture. Jute was first cultivated in India, where it was used to make ropes and cordage. Some animals—thought of the Indians as being vital to their survival—came to be worshiped. Trees were also domesticated, worshiped, and venerated—*Pipal* and *Banyan* in particular. Others came to be known for their medicinal uses and found mention in the holistic medical method *Ayurveda*.

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

The Tamil people cultivated a wide range of harvests such as rice, sugarcane, millets, black pepper, various grains, coconuts, beans, cotton, plantain, tamarind and sandalwood. Jackfruit, coconut, palm, areca and plantain trees were also known. Method attic ploughing, manuring, weeding, irrigation and harvest protection were practiced for sustained farming. Water storage methods were designed during this period. Kallanai (1st-2nd century CE), a dam built on river

Kaveri during this period, is considered the as one of the oldest water-regulation structures in the world still in use.

Spice trade involving spices native to India—including cinnamon and black pepper—gained momentum as India starts shipping spices in the Mediterranean. Roman trade with India followed as detailed by the archaeological record and the *Periplus of the Erythraean Sea*. Chinese sericulture attracted Indian sailors during the early centuries of the common era. Crystallized sugar was discovered by the time of the Guptas (320-550 CE), and the earliest reference of candied sugar come from India. The process was soon transmitted to China with traveling Buddhist monks. Chinese documents confirm at least two missions to India, initiated in 647 CE, for obtaining technology for sugar-refining. Each mission returned with the results on refining sugar. Indian spice exports find mention in the works of Ibn Khurdadhbeh (850), al-Ghafiqi (1150), Ishak bin Imaran (907) and Al Kalkashandi (fourteenth century).

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

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

The construction of waterworks and aspects of water technology in India is described in Arabic and Persian works. The diffusion of Indian and Persian irrigation technologies gave rise to an irrigation method which brought about economic growth and growth of material culture. Farmers 'zones' were broadly divided into those producing rice, wheat or millets. Rice production continued to dominate Gujarat and wheat dominated north and central India.

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

Review Questions

1. Define the Indian Agriculture?
2. Explain the Agrarian Relations during British Rule in India?
3. Explain the Land Reforms?
4. Explain the Land Relations in Pre-British India?

Discussion Questions

Discuss the Institutional Perspectives of Indian Agriculture?

Lesson 2 – Agricultural Economy of India

Learning Objectives

- To define the Diversification Trends of Indian Agriculture.
- To explain the linkage of forestry with agriculture
- To explain the Rural Industrialisation Program.
- To describe the Importance of Agriculture in Indian Economy.

2.1 Introduction

Application of principles of general economic to farming is called as farm economics.

2.2.1 The importance of agriculture in the National Economy:

India is an farm country, where 70 percent population is dependent on farming. This forms the main source of earnings. The contribution of farming in the national earnings in India is more, hence, it is said that farming in India is a backbone of Indian Economy.
The importance of farming in the National Economy is explained by the following points.

2.2.1.1 Share of Agriculture in the national earnings:

Year	Contribution of agriculture in National Earnings
1950-51	57%
1970-71	43%
1930-31	40%
1938-39	33%

It is seen that farming contributes a major share in the national earnings of India.
Secondly, the share of farming in national earnings has been decreasing. At present the contribution is about 28%. This steady and gradual decline is due to the rapid Industrialization in the different part of the country.
The contribution of farming in national earnings in case of some developing countries are as follows. USA – 3% Canada 4% Australia 5%.

This indicates that the role of farming in the national earnings in the developed countries is negligible. More developed a country, the smaller is the contribution of farming in the national earnings and vice-versa.

2.2.1.2 Agriculture as a source of livelihood:

In India about 65 to 70 percent population dependent on farming, the population remains almost constant for a number of years. On the other hand in the developed countries less than 10 per population dependent on farming

2.2.1.3 Indian agriculture and pattern of employment:

Year	Percentage of working population in agriculture
1961	69.5%
1981	59.4%
While in U.K.	23%
France	7%

2.2.1.4 The importance of agriculture in Industrial development:

Many industries dependent on farming, raw material from farming is supplied to many industries e.g. Sugar industries, Cotton Industries, Paper Industries, tobacco industries, Chilies, turmeric etc. Many industries supply the inputs to the farm industry e.g. Fertilizers, insecticides, pesticides, implement and machineries like tractors etc.

2.2.1.5 The role of agriculture in the field of international trade:

Many farm products like tea, sugar, oilseeds, tobacco, spices contribute the major share in export. In addition to this, we are exporting fruits some vegetables and flowers to the other countries. Now days we are exporting basmati rice to foreign countries. The proportion of agri. Goods is to the tune of 50%. In addition to those goods manufactured from farming products contribute 20 percent. Thus, farming contributes 70% in export.
In addition to the above the role played by farming in Indian is as under.

- If the farm production is good, farmers will earn more earnings. They will be in a position to purchase manufactured products and other inputs required in farming. In

short, we can say that the prosperity of the country will depend upon the prosperity of farming.

- Many farming produce like food grains, fruits are transported by roadways and railways. Thus, it helps with employment of many people in this field.

2.3 Diversification Trends of Indian Agriculture

2.3.1 ***Introduction***

Farming is the backbone of Indian economy. The sector plays a vital role in the development of India with over 60 per cent of the country's population deriving their subsistence from it. Most of the industries also depend upon the farming sector for their raw materials.

India ranks first in the production of milk, pulses, jute and jute-like fibers; second in rice, wheat, sugarcane, groundnut, vegetables, fruits and cotton production; and is a leading producer of spices and plantation harvests as well as livestock, fisheries and poultry. The rapid growth of farming is essential not only for self-reliance but also for meeting the food and nutritional security of the people, to bring about equitable distribution of earnings and wealth in rural areas as well as to reduce poverty and improve the quality of life.

Department of Agriculture and Cooperation under the Ministry of Agriculture is the nodal organization responsible for the development of the farming sector in India. The organization is responsible for formulation and implementation of national policies and programs aimed at achieving rapid farm growth through optimum utilization of land, water, soil and plant resources of the country.

2.3.2 ***Market Dynamics***

India has improved its position in the farm and food exports to 10th globally, backed by policy impetus by the government. "Exports of farm products are expected to cross US$ 22 billion mark by 2014 and account for 5 per cent of the world's farming exports," according to the Farm and Processed Food Products Export Development Authority (APEDA).

Total exports of Indian Agri and processed food products from April 2012 to March 2013 stood at Rs 11,633,168.41 lakh (US$ 17.26 billion) as compared to Rs 8,248,025.32 lakh (US$ 12.23 billion) during the same period last year, according to the data provided by APEDA.

India recorded an increase of 22 per cent in the export of spices and spice-based products during 2012-13 to touch 699,170 tonnes, as against 575,270 tonnes in the previous financial year. The Soymeal exports during June 2013 was 213,400 tonnes as compared to 180,900 tonnes in the same period of previous year, registering an increase of 18 per cent.

Groundnut sowing in Gujarat has touched 1.41 million hectares as on July 1, 2013 as against 0.22 million hectares in the corresponding period last year, according to Agriculture &the Co-operation Department, Government of Gujarat.

The foreign direct investment (FDI) inflows in farm services and machinery sector during April 2000 to June 2013 stood at US$ 1,620.65 million and US$ 337.21 million respectively, as per the data released by the Department of Industrial Policy and Promotion (DIPP).

*2.3.3 **Major Developments and Investments***

A number of memorandum of understandings (MoU) was signed between the Indian Council of Agricultural Research (ICAR) and the industry. MoUs have been signed for more than 60 ready-to-commercialize agro-technologies from different farm sectors like harvests, horticulture, food technology, veterinary, Agri-engineering, Agri-inputs and fisheries.

The Abu Dhabi-based Al Dahra International Investment LLC is set to invest about Rs 112 crore (US$ 16.61 million) in Kohinoor Foods Ltd (KFL).

Private equity (PE) and venture capital (VC) firms invested US$ 126 million across nine Indian agribusiness companies during the first six months of 2013, as per data from Venture Intelligence.

Coromandel International Ltd, India's leading fertilizer manufacturer, with its joint venture (JV) partners have inaugurated a 1.4 million tonne (MT) phosphoric acid plant in Tunisia.

The Indo-Dutch joint initiative in farming envisages setting up about 10 centers of excellence (CoE) in Punjab, Gujarat, Kerala, Maharashtra and Karnataka in the next few years, a move that could help raise output and yields.

The total outlay of Rs 27,049 crore (US$ 4.01 billion) has proposed to the Ministry of Agriculture in the Union Budget 2013-14, which is 22 per cent more than the revised estimates by the year 2012-13. Further, Rs 1,000 crore (US$ 148.38 million) has been allocated to continue support to the new green revolution in Eastern States like Assam, Bihar, Chhattisgarh and West Bengal to

increase the rice production. An outlay of Rs 500 crore (US$ 74.19 million) is also proposed for starting a program of harvest diversification that would promote scientific innovation and encourage farmers to choose harvest alternatives in the original green revolution States.

2.3.4 ***Government Initiatives***

Some of the major initiatives taken by the Government of India are:

- The Government of India has set a target of 259 million tonnes (MT) of foodgrains production in 2013-14. It is implementing various harvest development programs/ schemes for achieving production targets of various harvests
- The government has permitted 100 per cent FDI under the automatic route, subject to certain conditions in Floriculture, Horticulture, Apiculture and Cultivation of Vegetables & Mushrooms under controlled conditions; Development and production of Seeds and planting material; Animal Husbandry (including breeding of dogs), Pisciculture, Aquaculture, under controlled conditions; and Services related to agro and allied sectors. 100 per cent FDI is also permitted in the tea sector.
- For ensuring quality of Agrochemicals, the government has set up 71 pesticides testing laboratories across the country that include 68 state laboratories, 2 regional laboratories and 1 central laboratory
- The Government of Punjab gave its approval to the expansion plan of state-owned Milkfed entailing setting up of four mega milk plants worth Rs 250 crore (US$ 37.09 million) each in the state
- The government has launched an SMS Portal for Farmers on July 16, 2013 for disseminating relevant information, giving topical & seasonal advisories and providing services through SMSs to farmers in the language of the State

Under the Union Budget 2013-14,

- The government has substantially improved the availability of farm credit to improve investments in the farm sector. The annual farming credit target for the financial year 2013-14 has increased to Rs 7 lakh crore (US$ 105.96 billion) from Rs 5.75 lakh crore (US$ 85.32 billion) in 2012-13
- The allocation for the Integrated Watershed Program has been increased to Rs 5,387 crore (US$ 799.37 million) from Rs 3,050 crore (US$ 452.58 million) to provide relief to small and marginal farmers especially in drought prone and ecologically-stressed regions

- The National Livestock Mission will be launched to attract investment and to enhance productivity of livestock, taking into account local agro-climatic conditions. Rs 307 crore (US$ 45.55 million) have been provided to the Mission

2.3.5 ***Road Ahead***

With nearly a 1.2 billion population, India requires a robust, modernizedfarming sector to ensure the food security for its population. In order to meet the food grain requirements of the country, the farm productivity and its growth need to be sustained and further improved. The growth target for farming in the 12th Five Year Plan is estimated to be 4 per cent as compared to 3.6 percent for the 11th Plan.

The Ministry of Agriculture is promoting a new strategy for farm mechanization through its various schemes and programs. A dedicated Submission on Farm Mechanization has been proposed in the 12th Plan which includes custom-hiring facilities for farm machinery as one of its major components.

2.4 Diversification Trends of Indian Agriculture

2.4.1 **Diversification explained**

Diversification of farming refers to the shift from the regional dominance of one harvest to regional production of a number of harvests, to meet ever-increasing demand for cereals, pulses, vegetables, fruits, oilseeds, fibers, fodder and grasses, fuel, etc. It aims to improve soil health and a dynamic equilibrium of the Agri-ecomethod. Harvest diversification takes into account the economic returns from different value-added harvests. It is different from the concept of multiple harvesting or succession planting in which multiple harvests are planted in succession over the course of a growing season. Moreover, it implies the use of environmental and human resources to grow a mix of harvests with complementary marketing opportunities, and it implies a shifting of resources from low value harvests to high value harvests, usually intended for human consumption such as fresh market fruits and vegetables. With globalization of the market, harvest diversification in farming means to increase the total harvest productivity in terms of quality, quantity and monetary value under specific, diverse agro-climatic situations world-wide. There are two approaches to harvest diversification in farming. First is horizontal diversification, which is the primary approach to harvest diversification in production farming. Here, diversification takes place through harvest intensification by adding new high-value harvests two existing

harvestingmethods as a way to improve the overall productivity of a farm or region's farming economy. The second is the vertical diversification approach in which farmers and others add value to products through processing, regional branding, packaging, merchandising, or other efforts to enhance the product. Opportunities for harvest diversification vary depending on the risks, opportunities and the feasibility of proposed changes within a socioeconomic and agro-economic context. Harvest diversification may occur because of government policies. The "Technology Mission on Oilseeds", "Spices Development Board", "Coconut Development Board" etc. Are examples where the Indian government created policies to thrust change upon farmers and the food supply chain at large as a way to promote harvest diversity. Harvest diversification is the outcome of several interactive effects of many factors:

1. Environmental factors including irrigation, rainfall, temperature, and soil fertility.
2. Technology-related factors including seeds, fertilizers and water technologies, but also those related to marketing, harvest, storage, agro-processing, distribution, logistics, etc.
3. Household-related factors including regional food traditions, fodder and fuel as well as the labor and investment capacity of farm people and their communities.
4. Price-related factors including output and input prices as well as national and international trade policies and other economic policies that affect the prices either directly or indirectly.
5. Institutional and Infrastructure-related factors including farm size, location and tenancy arrangements, research, in-field technical support, marketing methods and government regulating policies, etc.

All these five factors are interrelated. The adoption of harvest technologies is commonly assumed to be influenced primarily by resource-related factors when institutional and infrastructure factors can play as much or more of a role in their adoption.

2.4.2 **Area Expansion Problems under Rice and Wheat Harvests**

Scaling up production area poses several new problems of significance such as:

1. Excessive use of groundwater leading to poor water use efficiency and depletion of groundwater.
2. Deterioration of soil health or soil fertility.
3. Multiple infestations of weed flora, insect pests and diseases.
4. Indiscriminate use of energy such as chemical, electrical or disease, etc.

5. Reduction in the availability of other protective food and high value harvests.
6. Pollution of agro-Eco methods.

On the other hand, harvest diversification has potential as an economic driver in farming regions. It may prove to be of paramount importance in meeting challenges that arise from a post-green revolution scenario. In view of shrinkage of farm land and operational holdings due to the expansion of urban centers, changes in consumer food habits, exponential population growth rate, farmers are pressured to include or substitute additional harvests in to the harvestingmethod .

2.4.3 **Major Driving Forces for Harvest Diversification**

The major driving forces for harvest diversification are:

1. Increasing earnings on small farm holdings.
2. Withstanding price fluctuation.
3. Mitigating ill-effects of aberrant weather.
4. Balancing food demand.
5. Improving fodder for livestock animals.
6. Conservation of natural resources (soil, water, etc.).
7. Minimizing environmental pollution.
8. Reducing dependence on off-farm inputs.
9. Decreasing insect pests, diseases and weed problems.
10. Increasing community Food Security

Indian farming is characterized by a dominance of small and marginal farmers (almost 68 per cent) who suffer as a result of difficult socioeconomic conditions. 75 per cent of the farm holdings are below 2 hectares, and a large portion of rural people subsists as small holders. Earnings from these farmscannot be raised up to the desired level to sufficiently alleviate poverty in the countryside unless existing harvest production methods are diversified through inclusion of high value horticultural and arable harvests. Furthermore, increased dependence on one or two major cereal harvests (wheat, rice, etc.) Witnessed after the green revolution makes the farming economy vulnerable to price fluctuation rising due to demand-supply or export-import equations especially after the WTO began influencing markets. Harvest diversification on the other hand, can better tolerate the ups and downs in the market value of farm products and may ensure economic stability for the farm families of the country. The adverse effects of aberrant weather, such as erratic and insufficient rainfall and drought are very common in a vast area in farm

production of the country. Incidence of flood in one part of the country and drought in the other part is a very frequent phenomenon in India. Under these aberrant weather situations, dependence on one or two major cereals (rice, wheat, etc.) Is always risky.

Hence, harvest diversification through substitution of one harvest or mixed harvesting/inter-harvesting may be a useful tool to mitigate problems associated with aberrant weather to some extent, especially in the arid and semi-arid drought-prone/dryland areas.

2.4.4 **Immediate Need**

Harvest diversification in farming in India is taking place vertically or horizontally, mostly due to market forces and occasionally due to domestic needs. Where there are concerns regarding land and water use and quality, there is an immediate need to consider:

1. There is a need to generate place-based approaches for diverse farming situations under various socioeconomic conditions, domestic needs, market infrastructure, input supply, etc.
2. A concept of sustainable productivity for each unit of land and water through harvest diversification needs to be fostered.
3. Processing of farm produces into value added products offered scope for employment in non-farm works such as distillation of active ingredients from medicinal and aromatic plants (herbal products), scope of industrialization in farming for sugar, paper board manufacturing, etc. To increase employment in rural areas.
4. The research on harvest diversification is best done in a farmer-participatory mode in which a multi-disciplinary team of scientists involves farmers from project planning through arriving at conclusions.
5. There is a need for promoting co-operatives in rural areas to solve micro-level and location-specific problems.
6. Major thrust should be given on horticulture (vegetables, fruits, flowers, spices, etc.) And animal husbandry (dairying, poultry, jittery, piggery, duckery, etc.) To support a vigorous and expanding export market, balanced with supplying local markets with affordable, healthy food.
7. Strengthening food processing and other value-added industries in rural areas is a means to provide employment to rural youth.

8. There is a need to develop rural infrastructure such as roads, markets, medical and educational facilities in the villages with efficient utilization of local resources for farming community in a more pragmatic way.
9. Harvest diversification provides efficient use of farm inputs and contributes to a strong rural economy.
10. Alternate harvestingmethods and farm enterprise diversification are most important for generating higher earnings, employment and protecting the environment.
11. There are numerous opportunities to adopt subsidiary occupations to the rice-wheat harvestingmethods common in India. These include vegetable cultivation, fruit cultivation, floriculture, medicinal and aromatic plant cultivation, mushroom cultivation, dairying, piggery, goatery, poultry and Duckery, fishery or aquaculture, beekeeping, Agroforestry, biodiesel farming with Jatropha Curcas (veranda), palm, neem, Karanja, etc. To provide ample scope for diversification of rice-wheat harvestingmethod in northwestern and south India and north-eastern states.
12. Enterprise diversification generates more earnings and rural employment year round.

2.4.5 **Conclusion**

Diversification in farming' has tremendous impact on the agro-socio-economic impact and uplifting of resource-poor communities. It generates earnings and employment for rural youth year round for the ultimate benefits of the farmers in the country. It implies the use of local resources in a larger mix of diverse harvestingmethods and livestock, aquaculture and other non-farm sectors in the rural areas. With the globalization of markets in the WTO era, diversification in farming is one means to increase the total production and productivity in terms of quality, quantity and monetary gains under diverse agro-climatic situations of the country. There are many opportunities of harvest diversification both in the irrigated and non-irrigated vast areas in the rural India.

2.5 Forestry in India: Linkage with Farming Sector

2.5.1 Total geographical area of India is 32, 80,500 sq. Km (328.8M ha)

2.5.2 Total forest area 7, 50,500.00 sq. Km (75.06 M ha)

2.5.3 Farm area is about 46.4%

2.5.4 Introduction

The second National Forest Policy was enunciated (decided) in 1952 as per which 33.33% of land should be under forest for proper ecological balance. In hills 60% area should be covered under tree cover. During last two decades 2 million ha forest was diverted for non-forest purpose, Agro-industry, power and irrigation projects, housing etc. **The government has enacted the Forest Conservation Act. 1980** to ensure that no reserve forest can be diverted to any other type of forest and that no forest and that no forest land can be used for any non forest purpose.

Out of the total area under forest, 45.6 million ha (60%) area is in use and another 14.8 million ha (20%) is a potentially exploited and remaining unexploited area as on Himalayan states, North Eastern regions and Andaman Nicobar islands.

Sources of energy consumption in India are: Coal, 16.5% Oil 10.0% Electricity 15.7% wood 37.6% Cow dung 8.7% and Vegetation waste 11.5%

2.5.5 Forest:

The wood is derived from the Latin word "Eairs" means "outside' Therefore forests are areas covering practically all uncultivated or untended lands covered with rather tall and dense tree growth.

2.5.6 Branches of Forestry

2.5.6.1. Silviculture:
If refers to certain aspects of the theory and practices of raising forestharvests, methods of raising tree harvests, their growth and after care up to the time of final harvesting.

2.5.6.2. Mensuration:
It deals with the measurement of forest produce ex. Dimension from volume, age and increment of individual trees and forest harvest.

2.5.6.3. Silviculturemethod :
Process by which the harvests constituting a forest are tended, removed and replaced by new harvests

2.5.6.4. Management:

Practical application of sequence technique and economics to forest estate for the production of certain desired results

2.5.6.5. Utilization:

Branch of forestry which deals with harvesting, marketing conservation and applying the forest produce to a variety of uses eg. Timber, fuel, charcoal, pulp wood, plywood.

2.5.7 Forestry:

The theory and practice of all that constitutes the creation conservation and scientific management of forest and the utilization of their resources, based on the aims or objectives, the forestry may be:

1. **Protection of Environmental forestry:** Protection of land, regulation of water cycle, Wild life conservation Transformation of climate conditions, combination of above. Ex. Buddha Jayanti Park in New Delhi.
2. **Commercial or Production forestry:** Timber and other raw materials.
3. **Social Forestry:** Raising forests outside the traditional forest with the involvement of society.
4. **Farms Forestry:** Raising forest trees on farm lands. It is further classified as:

- **Noncommercial farm forestry**: raising of trees by individuals for domestic needs (usually by the farmers)
- **Commercial farms forestry:** Farmers grow trees on a commercial basis on farmlands.

5. **Community forestry:** Raising of forests on public or community land
6. **Urban forestry:** Management of public and private owned lands in and adjacent to urban centers. They have more aesthetic value.
7. **Agro Forestry:** Cultivating forest trees along with farmharvests.

2.5.8 Silviculture

2.5.8.1 Introduction:

Silviculture pertains to the raising, development, care, reproduction and overall management of forest harvests.

Definition: If has been defined variously as follows:

- By Toumey and Korstain:

Silviculture is that branch of forestry which deals with the establishment, development, care and reproduction of stands of timber.

- By Champion and Seth:

The termsilviculture, in English refers only to certain aspects of the theory and practices of raising of forestharvests.

- **By Iffprt (IFR Dehradun)**

The art and science of cultivated forestharvests. On the other hands, silvics is the study of trees and forests and biological entities, the laws of their growth and development, and impact of environment on them. Thus, silviculture can be described to include all practical and theoretical aspects of silvics.

2.5.8.2 Objects of Silviculture:

Study of silviculture helps to attain the following object:

1. **To derive environmental benefits:** Soil and water conservation, control of air and noise pollution, wildlife conservation, regulation of climatic condition, regulation of the water cycle.
2. **Raising species of more economic value:** Industrial and economic growth through.
3. Production of high-quality timber: Silviculture techniques help of avoiding the problem of crooked, malformed, disease or defective timber and thus help to produce good quality timber.
4. **Production of more volume per unit area:** Unmanaged forests may be too dense or too open, less production, premature death of trees silviculture helps to solve these problems.
5. **Reduction of rotation period:** In Unmanaged forests the rotation tends to be longer.
6. **Afforestation of blank areas:**Wastelands can be used for forests
7. **Creation of plantation:** Man made forest or plantations may be created in place of natural forests.

8. **Introduction of exotic:** Successful introduction of exotic species is possible.
9. **Employment potential:** In any plantation operation, the labor component account for 60 to 70% of the total financial input.
10. **Increase in the production of fuel and fodder:** In developing countries like India it is important aspect.
11. **Forest Industries:** Resin for resin and turpentine industry, pulpwood for paper industry, industrial wood for match and timber industry, railway, etc., Minorforest product based industries.

2.5.9 Branches of Forestry

2.5.9.1. **Basic Forestry**

Basic Forestry deals with the theory and practice of the constitution and management of forests and utilization of their products. Farming is the study of science and art of production of plants and animals used by man In India, the geographical, areas are about 32,80,500 km2. The forests occupy about 7,50,000 km2. (22.9% approximately) whereas farm (cultivated) area is about 46% However, farming is the largest enterprise in India. Nearly, 70% of the population are employed in this profession. But unfortunately, in spite of this, it is not able to meet the requirements of the ever - increasing population. Forestry, just like farming, is a good professional with the difference of long lifespan.

2.5.9.1.1 Basic Forestry has the following Branches:

A) Silviculture: This refers to certain aspects to the theory and practice of raising forest, harvests, methods of raising tree, their growth and aftercare up to the time of final harvesting. However, in simple words, it is the cultivation of forest trees.

B) Forest Mensuration: In simple language, it is the measurement of forest produce. However, it is defined as the determination of dimensions (e.g. Height, diameter, volume, etc.) From, volume, age and increment of single trees, stands or whole woods, either standing or after felling. It concerns with linear area, volume and weight measurements.

C) SilviculturalMethods: A Silvicultural method can be defined as a method of Silvicultural procedure worked out in accordance with accepted sets of Silvicultural principles by which harvests constituting forests are tended, harvested and replaced by new harvests of distinctive forms.

D) Forest Management: It is the practical application of science, technique, and the economics to a forest estate for the production of some wanted results. In actual sense, it is the application of business methods to the operation of a forest estate. The Society of American Foresters (SAF) has described it as an application of business methods and technical forestry principles to the operation of a forest property.

E) Forest Utilization: It is a branch of forestry concerned with the harvesting, conversion, disposal and use of forest produce (British Common Wealth Forest Terminology, 1953.).According to SAF (1983) it is a branch of forestry concerned with the harvesting, any necessary processing, and delivery to the consumer of forest produce.

F) Forest Law: Law includes any rule of action. The rules and law imposed by the state upon the actions of its citizens for the breach of which they are punishable. Forest law is classified as:

a) Constitutional laws

b) Public laws

c) Private laws; Very essential for protection of forests; Some terms - Forest offense / Forest right / Forest settlement

d) Forest wildlife Act WL (protection) Act 1972 Animals / bird.

G) Forest Policy: Branch of forestry concerned essentially, with social and economic aims underlying forest management and forestry development (SAF - 1983)

2.5.9.2. Applied Forestry

This includes those subjects which how the references to other subject but make the essence of, forestry

a) Dendrology

b) Forest Ecology

c) Forest Economy

d) Forest Entomology

e) Forest Fire

f) Forest Genetics

g) Forest Pathology

h) Forest Seed technology

i) Forest soils

j) Forest statistics

k) Forests surveying

l) Remote sensing

m) Social Forestry-Social Resent

I. Agroforestry

II. Forestry Extension

III. Afforestation

iv. Recreation Forestry etc.

Some Other Forestry Branches:

1. Aesthetic forestry
2. Commercial Forestry
3. Community Forestry
4. Extensive Forestry
5. Farm Forestry
6. Extensive Forestry
7. Multiple use Forestry.

2.5.9.3 Agroforestry

Social forestry pertains to those areas and forest which are man made. Agroforestry is conspicuous and important part of Social forestry and is it a dual method of production i.e. Production of forest harvests and food harvests, fodders or medicinal plant becomes possible. It meets simultaneously at least two requirements of the participating persons. Agroforestry is defined as a sustainable land management method which increase the overall yield of land, combined with the production of harvests (including tree harvests) and forest plants and animal simultaneously or sequentially on the same unit byapplying management practices that are compatible with the cultural practice of the local population. Thus in Agroforestry co-existence of farm and forestry is adopted on a scientific basis and consequently, the total yield of land is raised significantly. Present status of forest in India is as follows:

Total land area	329 m. Ha.
Area under Agriculture	143 m. Ha. (47%)
Area under Forest	75 m. Ha. (22.7%)
Barren Land	21 m. Ha.
Under non Agriculture	18 m. Ha.
Illegally occupied	24 m.ha.
Population	1000 M.
Cattle production	400 m

• Half of the Forests in India are denuded, various degrees due to increased human activities.
• India's fast growing population stands at a count of more than 1000 in. And cattle population about 400 m, in which demands for huge amount of food, fodder, timber, fuel, Medicines, employment etc. It has been internationally acknowledged that 30 to 33% of the total geographical area must be under good forest cover.
• For balance environment and ecomethod
• All the above situations calls for a massive program of Afforestation and planting with people's participation. This program should attempt is restore ecological balance and meet the various needs of rural people. This is feasible only if tree growing to become a people's program which brought to be combined with farming.
• The forest land area of 75 in ha under forest cover was not adequate to maintain good environment. It was therefore, rightly resolved through a National Policy Resolution in the year 1952 to add 35 m ha to the forest cover and to bring 33% of our land under forests. The decision though wise, timely and far-sighted, was never implemented with the same spirit.

Against this background Agroforestry should become an important land use method , conventionally which was duly recognized by planners while preparing the seventh plan document. At this stage a recommendation was also made that Agroforestry might be included as a core subject in the curriculum by all the State Farm Universities.

2.5.10 Scope of Agro-forestry In India

There is tremendous scope for Agroforestry because India has achieved self-sufficiency in food production. Now its attention is becoming more focused on the ecological problems and shortage

of fuel, fodder and other outputs as well as unemployment. Agroforestry has vast scope in meeting this requirement through multipurpose tree species as:

(I) Large area is available in the form of farm boundaries, bounds, waste lands where this method can be adopted
(II) This method permits the growing suitable tree species in the field where most annual harvests are growing well
(III) By growing trees and harvests on a farm or forest land, Resources are utilized efficiently
(IV) Method has potential to generate employment.
(V) Provides raw material for the cottage industries
(VI) Helps in maintaining ecological balance
(VII) Soil and water conservation, soil progress.
(VIII) Helps in meeting various needs of a growing population.

2.5.11 Benefits from Agro-forestry

Combining trees with foodharvests on harvested farms yield certain environmental benefits such as,

1. Reduction of pressure on Forrest.
2. More efficient recycling of nutrients from deep rooted trees on the site.
3. Better protection of ecological methods.
4. Reduction of surface run-off, nutrient leaching and soil erosion.
5. The progress of microclimate, such as lowering of soils surface temperature and reduction of evaporation of soil moisture due to mulching and shading.
6. Increment in soil fertility through addition and decomposition of litter fall.

2.5.11.1 Economic Benefits:

Agro-forestry brings significant economic benefits to the farmers, the community, the region and the nation such as:
1. Increment in outputs of food, fodder, fuel wood, timber and organic matter.
2. Reduction in incidence of total harvest failure.
3. Increase in levels of farm earnings due to improved and sustained productivity.

2.5.11.2 Social Benefits:

1. Progress in rural living standards for sustained employment and higher earnings.
2. Progress in nutrition and health due to increased quality and diversity of food.
3. Provides stability to rural peoples.
4. Ecological balance.
5. Pollution reduction.

2.5.12 Limitations of Agro-forestry

2.5.12.1 Agro-forestry does have Certain Negative Aspects:

1. Possible competition from trees with goodharvests for space, sunlight, moisture and nutrient which may reduce harvest yield.
2. Damage to food harvests during harvesting of trees.
3. Potential of trees is serving as hosts to insects and birds.
4. Rapid regeneration of profile trees may displace food harvests and take over entire fields.

Through skilled management practices any or all these aspects can be controlled. For example, once it is known that trees complete with food harvests and may reduce food yields, it is easy to adopt some of the following strategies.

1. Select legume trees that have small or light crowns so that sunlight will reach the food harvests.
2. Select trees that are deep-rooted so that they will also absorb moisture and nutrients from the deeper subsoil.
3. Space the trees further apart to reduce their competitive effect on the food harvest.

2.5.13 Socioeconomic Aspect of Agroforestry

1. The requirement for more labor inputs, which may cause search at times in other farm activation.
2. Competition between food or fore harvests which could cause aggregate field, to be grown than those of a single harvest.
3. Longer period required for trees to grow to mature and acquire an economic value.
4. Resistance by farmers to displace food harvests with trees especially where land is scarce.

2.5.14 Classification of Agro-forestry Method

Different types of Agroforestry methods exist in different parts of the world. These methods are highly diverse and complex in character and functions. To evaluate understand and seek to improve them requires their classification into different categories. Several criteria can be used in classifying them, but the most common include the method 's structure, functions, and socioeconomic scale of management and ecological spread. According to Nair (1987), Agro-forestry methods can be classified according to the following sets of criteria.

2.5.14.1. **Structural Basis**:

Consider the composition of the components; specially refer including spatial admixture of the woody component, vertical stratification or the component mix and temporal arrangement of different components.

2.5.14.2. Functional Basis:

This is based on the major function or role of the method ; mainly of the wood components (This can be productive or protective).

2.5.14.3. Socioeconomic Basis:

Consider the level of inputs or management (low input, high input) or intensity/scale or management and commercial goals.

2.5.14.4. **Ecological Basis**:

Take into account the environmental conditions on the assumption that certain types of methods can be more appropriate for certain ecological conditions.

2.5.15 Classification of Structural Basis Agro-forestry Method :

In these methods the type of component and their arrangement are important. On the basis of structure, Agroforestry methods can be grouped into two categories

2.5.15.1. **Nature of Components:**

(A) Agri-silviculturalMethods
(B) Silvipastoral Methods

(C) Agro Slivipastoral Methods
(D) Other Methods

2.5.15.2. Arrangement of Components:

(A) Spatial Arrangement
(B) Temporal Arrangement

2.6 Rural Industrialisation Program

In India the rural dwellers, who constitute more than 70 per cent of India's population are facing the acute problems of unemployment and under-employment. The miseries of these people led Mahatma Gandhi to come out with the 'Back to the village' ideology with its emphasis on uplifting the poor. To stress the importance of the development of the rural areas and people who inhabited therein, he said, "Swaraj has no meaning for the millions if they do not know how to employ their enforced idleness. Gandhiji said that, "The economic development is meaningful if aimed at the lifting up of the small peasant and converting the small producer himself into an active participant in productive activity. Therefore, he said that the purpose of real development means the development of the rural people.

The rural industries principally depend on rural production of their raw material and on the rural population for marketing their products. The process has certain essential conditions.
The scope of rural industrialization is considered basically a question of properly utilizing the rich but unexploited national resources in the rural areas. It is a process concerned with the involvement of industries in the development of an area and also participation by rural entrepreneurs in the growth of the industries best suited to that specific area. The process of rural industrialization, however, is distinguished from the situation under which certain industries are transplanted in a specific rural area.

Rural industrialization term connotes that its sole purpose should be uplifting of the rural lot by tapping vast material and human resources existing in the countryside. The process of rural industrialization should have its own features such as low investment of capital, labor intensity and use of simple technology by employing local human and material resources. Thus, a judicious mix of local manpower with the local resource is necessary to bring about a viable development in these areas.

2.6. 1An approach to Rural Industrialization

1. The rural industries provides immediate large scale employment and they also offer a method of ensuring a more equitable distribution of national earnings.
2. They facilitate an effective mobilization of resources, capital and skills which might otherwise remain unutilized, and
3. Some of the problems that unplanned urbanization tends to create will be avoided by the establishment of small centers of industrial production all over the country.

Therefore, the development of small industries was, thus, seen as a way of serving the following objectives:
1. Employment generation
2. An equitable distribution of earnings
3. Mobilization of capital
4. Entrepreneurial skill
5. Regional industrial dispersal

The protective measures are further combined with direct subsidies to cottage industries in one form or the other along with the reservation of production spheres for the industries.
Second, the promotion policies and programs are adopted to increase the productivity and competitive strength of village industries. The Second Five Year Plan (1956-61) stressed the need for the expansion of the village and small industries at different levels so as to provide the facilities of raw materials, technical advice, credit, marketing, etc. The plan also suggested the policy of providing satisfactory arrangements for marketing research, rural electrification, progress of the housing conditions of artisans, and of credit and finance, etc.

The Fourth Five Year plan (1969-74) document states that, "it would be necessary to improve skills and provide a combination of incentives and disincentives for securing decentralization and dispersal of small industries.

The fifth plan document of different small industries is to facilitate the attainment of some of the major tasks for the removal of poverty and inequality in consumption standards of these persons (artisans dependent of traditional industries) through the creation of large scale opportunities for fuller and additional productive employment and progress of their skills so as to improve their

level of earnings.

The Sixth Five Year Plan (1980-85) states: “The dispersal of small scale units far away from metropolitan areas and large cities had not taken place to an appreciable extent. Further, it states that, “in spite of credit expansion, the share of tiny units with the investment option Rs.1 lakh has been very little. The entrepreneurial development program has not made significant progress.

The Seventh Five Year Plan (1985-90) the plan aimed at “the rationalization of the fiscal regime to ensure rapid growth; strengthening of infrastructural facilities at various levels.

The Eighth Five Year Plan (1992-97) also visualized this sector as a major part of the manufacturing growth since, “it yielded employment elasticity of 0.6 as against 0.15 in the organized sector during the period 1977-83”. Therefore, the government has proposed various policy measures for the smooth development of this sector. As for example, the investment limit in plant and machinery has been raised to Rs.60 lakh and Rs.5 lakh for small scale industries and tiny industries respectively.

Further, to facilitate location of industries in rural backward areas and to integrate farming and industry, a new scheme of ‘Integrated Infrastructural Development for Small Industries’ is being implemented with the active participation of State Governments and financial institutions. Besides, certain measures to strengthen the KVI and State Khadi and Village Industries Boards and improving the quality and marketability of their products with consumer preferences instead of merely depending on rebates and subsidies through the area development approach (that is the programs which have been tied up with DRDA, TRYSEM, and others related to weaker sections like Scheduled Castes/Scheduled Tribes and women) has been extended throughout the country.

2.6. 2Problems of Administration

The administrative set-up for executing the rural industrial development program has been manifested with certain problems, such as the multiplicity of agencies (which result in the overlapping of the organizational structure, function, programs and schemes, etc., Particularly at the field level of defying of the principle of integration of efforts), absence of adequate coordination, inconsistent personnel method (such as lack of adequate staff, particularly at the field level, maladjusted officials, lack of motivation among personnel), bureaucratization, red-tapism, corruption, favoritism and nepotism, the prevailing inefficiency, rigidity and delay in

decision-making.

The prospects of rural industrialization though the KVIC although optimistic, can become the only when the programs and policies are formulated in a broader perspective and implementation is successfully carried on through proper co-ordination. To provide marketing support it is suggested to set up a marketing development corporation in this sector. In order to able the financial problem, it is recommended that the financial institutions should have a greater role to play in the expansion of rural industrialization and steps should be taken to promote smoother credit flow. In order to make the rural industrialization program an effective instrument for removal of poverty and ameliorating the conditions of the rural weaker sections they need it to adopt appropriate strategies to meet the set purpose and willharmonize the output, employment and scientific suitability of the khadi and village industries sector.

2.7Role and Importance of Agriculture in Indian Economy

Farming is the backbone of the **Indian economy**. Despite major emphasis on industrial development during the last four decades, farming continues to occupy a place of pride in our economy. The **importance of farming** can be brought out from the following facts:

2.7.1 ***Share in national earnings***

Although the share of farming in the total national earnings has been gradually decreasing on account of the development of the secondary and tertiary sectors, it still contributed about 18 % of nation earnings in 2006-07. (In 1950-51, it was 59%)

2.7.2 ***Source of employment***

In India, farming is the main source of employment. Even in 2004-05, more than 56% of the total labour force of India is engaged in farming and depend on it for their livelihood (1950-51: 69.5%). It becomes evident from this fact that other sectors of the economy could not generate enough employment for the growing population.

2.7.3 ***Provision of food grains***

In a developing country like India where a very large proportion of earningsare spent on food and the population is increasing rapidly, the demand for foodgrains has been increasing at a fast rate. Farming In India has played an important role in meeting almost the entire food needs of the

people. The production of foodgrains in India has increased from 51 million tones in 1950-51 to 208.3 million tones in 2005-06, i.e. By a little more than 4 times since 1950-51. This has enabled the country to overcome the problems of foodgrain shortages. The country is almost self-sufficient in food grains and it no longer depends on import of food grains.

2.7.4 ***Supply of raw materials to industrial sector***

Farming plays an important role in industrial development. Many industries like cotton industry, jute industries, sugar industries, food processing industries, etc. Depends on farming for their raw material requirements. Moreover, workers engaged in various industries depend on farming for their food requirement.

2.7.5 ***Market for industrial product***

Farming provides markets for a large number of industrial products. Since about two thirds of India lives in rural areas, there has been a large rural purchasing power which has created a large demand for all types of industrial products. Green revolution has considerably increased the purchasing power of the large farmers substantially in the recent years. Thus for the demand for various products like soaps, detergents, clothes, cycles, scooters, radios, television, torches, lead batteries, etc. Has witnessed a marked increase. Likewise, the demand for a variety of farm inputs like chemical fertilizer, tractors, pump-sets, pesticides etc. Has increased sharply. This has stimulated the development of industries producing these inputs.

2.7.6 ***Earner of foreign exchange***

Farming plays an important role in the Indian economy as an earner of foreign exchange through exports of farm commodities like tea, cotton, coffee, jute, fruits, vegetables, spices, tobacco, sugar, oil, cashew kernels, etc. In the past, export of farm products accounted for about 70% of the export earnings of the country. However, with economic development and consequent diversification of our exports, the share of farming in total exports has come down to about 10% in 2005-06. All these exports bring valuable foreign exchange to pay for the increased imports of machinery and raw materials required in the non- farm sector.

2.7.7 ***Significance for trade and transport***

Farming helps in the development of tertiary (or service) sector. For example various means of transport like roadways and railways get the bulk of their business from the movement of farm

commodities and raw materials. A significant part of internal trade constitutes mainly of farm products.

2.7.8 ***Source of revenue for the government***

Through the direct contribution of farm taxes to the central and state governments is not significant, they get a
significant part of their total revenue in terms of land revenue, irrigation charges, taxes imposed on the commodities purchased by the farmers etc. The central government also earns revenue from export duties on farm production. Freight charges imposed by Indian Railways for carrying farm products generate huge revenue to the central exchequer.

On over all view, India has always been benefited by farming. Though the future of India is industrialization, the contribution of farming would always prove to be vital for making India a powerful and stable economy in the future.

2.8 **Importance of Farming**

Farming, for decades, had been associated with the production of basic food harvests. Farming and farmingwere synonymous so long as farming was not commercialized. But as the process of economic development accelerated, many more other occupations allied to farming came to be recognized as a part of agriculture.

At present, farming and agriculture besides include forestry, fruit cultivation, dairy, poultry, mushroom, bee keeping, arbitrary, etc. Today, marketing, processing, distribution of farm products etc. Are all accepted as a part of modern agriculture.

Thus, agriculture may be defined as the production, processing, marketing and distribution of harvests and livestock products. According to Webster's Dictionary, "farming is the art or science of production of harvests and livestock on farm."

2.9Importance of Agriculture

India is an farm country. The Indian economy is basically agrarian. In spite of economic development and industrialization, farming is the backbone of the Indian economy. As Mahatma Gandhi said, "India lives in villages and farming is the soul of Indian economy". Nearly two-

thirds of its population depend directly on farming for its livelihood. Farming is the mainstay of India's economy. It contributes about 26 percent of the gross domestic product. Farming meets food requirements of the people and produces several raw materials for industries.

From the farm point of view, India is a unique country. It has a vast expanse of level land, rich soils, wild climatic variations suited for various types of harvests, ample sunshine and a long growing season. The net sown area in India today is about 143 million hectares. India has the highest percentage of land under cultivation in the world. In spite of the fact that large areas in India, after independence, have been brought under irrigation, only one-third of the harvested area is actually irrigated. The productivity of farming is very low. Farming depends mainly upon monsoon rain. Most of the production comprises food harvests. About one-third of the land holdings is small, less than one hectare in size. Farmers on their own small prices of land and grow harvests primarily for consumption. Even storage facilities for harvests are inadequate. Now use of pesticides and fertilizers has increased and large areas have been brought under a high yielding variety of seeds. This led to the green revolution in several parts of India. This has helped in increasing yields per hectare as well as total production of different harvests.

There are many reasons responsible for the low productivity of farming. About one-third of land holdings is very small less than one hectare in size. Due to the small size of land holdings we cannot use modern way of cultivation. Even today the farmers are using very old methods, tools and implements for farming. Farmers are not using artificial ways of cultivation. Inputs like-better quality of seeds, fertilizers and pesticides are also not used by most of the farmers. The injustice of marginal farmers is also responsible. There is also a low productivity because of increasing pressure on land and absence of bank credit.

Farming is the backbone of our Indian economy. Farm development is a precondition of our national prosperity. It is the main source of earning livelihood of the people. Nearly two-thirds of its population depend directly on farming. Farming provides direct employment to 70 percent of working people in the country. It is the mainstay of India's economy.

Apart from those who are directly involved in the agrarian sector, a large number of the population is also engaged in agro-based activities. Farming meets the food requirements of large population of India. It ensures food security for the country. Substantial increase in the production of food grain like-rice, wheat etc. And non-food grains like-tea, coffee, spices, fruits and vegetables, sugar, cotton etc. Has made India self-sufficient. Farming also contributes to the national earnings of our country. It accounts for 26 percent of the gross domestic product. The

growth of most of the industries depends on farming. It produces several materials for industries. It forms the basis of many industries of India like-cotton, textile, jute, sugar industries etc.By providing cotton, sugarcane, oilseeds etc. People engaged in farming also buy the products of industries like-tractors, pesticides, fertilizers, pump-set etc. Farming contributes in foreign exchange of our country. India exports farm products like tea, coffee, sugar, tobacco, spices etc.And earns foreign currency. Exports from the farm sector have helped India in earning valuable foreign exchange and thereby boosting economic development. From above mentioned facts it is very clear that in spite of industrial development still farming is the backbone of the Indian economy.

The Five-year Plans accorded priority to the farm sector. In the past 50 years the food grain production in the country increased substantially from 51 million tonnes in 1950-51 to 209 million tonnes in 1999-2000. In spite of the constant rise of population, we have been able to build a good stock of 44.7 million tonnes in 2001. This is because of the scientific and institutional reforms in our country. The Indian government took several steps to improve the farm condition in the country. The government has encouraged consolidation of land holdings to promote the use of modern farm machines. Land reforms were introduced. The government took the lands of big land owners away and redistributed to landless laborers. The government abolished the Zamindari Method . Modern methods of cultivation were introduced in the country. The government provided better infrastructure facilities such as— irrigation, electricity and transportation. Farm equipments such as— tractors, pump harvesters, fertilizers, pesticides were made available to farmers. Getting finance from banks was made easier for the farmers. The harvest insurance was another step to protect the farmers against losses caused by the harvest failure on account of natural calamities like drought, flood cyclone etc. High-yielding varieties of seeds, fertilizers and irrigation gave birth to Green Revolution. All these led to a tremendous increase in the production of harvests.

The country on an average, has enough in stock to meet the food requirements of its citizens. India has emerged as the largest producer of coconut, ginger, cashew nut, black-peeper and as the second largest producers of fruits and vegetables. The productivity of the land has increased through the years, but has not reached international productivity levels. Indian farming has diversified into various sectors and contributes significantly to the nation's economy. But this situation is not likely to remain so easy in the years to come. The population of India is likely to be around 1300 million. This would require a huge amount of food grains along with non-food grains. India has to use its vast potential of farming in a method etc.And planned manner. We have developed some of the techniques which the developed countries have been using.

2.9.1. Source of Livelihood:

In India the main occupation of our working population is farming. About 70 per cent of our population is directly engaged in farming. In advanced countries, this ratio is very small being 5 per cent in U.K., 4 per cent in the USA., 16 per cent in Australia, 14 per cent in France, 21 per cent in Japan and 32 per cent in USSR.

This high proportion in farming is due to the fact that the non-farm activities have not been developed to absorb the rapidly growing population.

2.9.2. Contribution to National Earnings:

Framing is the premier source of our national earnings. According to National Earnings Committee and C.S.O., in 1960-61, 52 per cent of national earnings was contributed by farming and allied occupations. In 1976-77, this sector alone contributed 42.2 per cent while in 1981-82, its contribution was to the tune of 41.8 per cent.

In 2001-02, it contributed around 32.4 per cent of national earnings. This was further reduced to 28 per cent in 1999-2000. Contrary to this, the proportion of farming in the U.K. is only 3.1, in the USA it is 3 percent, 2.5 per cent in Canada, 6 per cent in Japan, 7.6 per cent in Australia.

The mere conclusion of all this is that more developed a country the smaller is the contribution of farming in national output.

2.9.3. Supply of Food and Fodder:

Farming sector also provides fodder for livestock (35.33 cores). Cow and buffalo provide protective food in the form of milk and they also provide draught power for farm operations. Moreover, it also meets the food requirements of the people. Import of food grains has been very small in recent years, rather export avenues are being looked for.

2.9.4. Importance in International Trade:

It is the farm sector that feeds the country's trade. Farm products like tea, sugar, rice, tobacco, spices etc. Constitute the main items of exports of India. If the development process of farming is smooth, export increases and imports are reduced considerably.

Thus, it helps to reduce the adverse balance of payments and save our foreign exchange. This amount can be well utilized to import other necessary inputs, raw-material, machinery and other infrastructure which is otherwise useful for the promotion of economic development of the country.

2.9.5. Marketable Surplus:

The development of farm sector leads to marketable surplus. As a country develops more and more people are to be engaged in mining, manufacturing and other non- farm sector. All these people depend upon the food production which they can meet from the marketable surplus.

As farm development takes place, output increases and marketable surplus expand. This can be sold to other countries. Here, it is worth mentioning that the development of Japan and other countries were made possible by the surplus of farming. There is no reason why this could not be done in our own case.

2.9.6. Source of Raw Material:

Farming has been the source of raw materials to the leading industries like cotton and jute textiles, sugar, tobacco, edible and non-edible oils etc. All these depend directly on farming.

Apart from this, many others like processing of fruits and vegetables, dal milling, rice husking, gur making also depend on farming for their raw material. According to United Nations Survey, the industries with raw material of farm origin accounted for 50 per cent of the value added and 64 percent of all jobs in the industrial sector.

2.9.7. Importance in Transport:

Farming is the main support for railways and roadways which transport bulk of farm produce from the farm to the man dies and factories. Internal trade is mostly in farm products. Besides, the finance of the govt, also, to the largest extent, depends upon the prosperity of the farm sector.

2.9.8. Contribute to Foreign Exchange Resources:

Farm sector constitutes an important place in the country's export trade. According to an estimate, farm commodities like jute, tobacco, oilseeds, spices, raw cotton, tea and coffee accounted for about 18 per cent of the total value of exports in India. This shows that farming products still continue to be a significant source of earning foreign exchange.

2.9.9. Vast Employment Opportunities:

The farm sector is significant as it provides greater employment opportunities in the construction of irrigation projects, drainage method and other such activities.

With the fast growing population and high incidence of unemployment and disguised unemployment in backward countries, it is the only farming sector which provides more employment chances to the labour force. In this way, significance of farming emerges more and more.

2.9.10. Overall Economic Development:

In the course of economic development, farming employs the majority of people. This means raising the level of the national earnings and standard of living of the common man.

The rapid" rate of growth in farming sector gives a progressive outlook and further motivation for development. As a result, it helps to create proper atmosphere for general economic development of the economy. Thus, economic development depends on the rate at which farming grows.

2.9.11. Source of Saving:

Progress in farming can go a long way in increasing savings. It is seen that rich farmers have started saving especially after the green revolution in the country.

This surplus amount can be invested in the farming sector for further; development of the sector. Saving potentials are large in farming sector which can be properly tapped for the development of the country.

2.9.12. Source of Government Earnings:

In India, many state governments get sizeable revenue from the farming sector. Land revenue, farmearnings tax, irrigation tax and some other types of taxes are being levied on farming by the state governments.

Moreover, considerable revenue is earned by way of excise duty and export duty on farm products. Raj committee on Farm Taxation has suggested the imposition of taxation on farmearnings for raising revenue.

2.9.13. Basis of Economic Development:

Prof. Nurkse has laid sufficient emphasis on the progress of farming for a balanced growth of an economy. The development of farming provides the necessary capital for the development of other sectors like industry, transport and foreign trade. In fact, a balanced development of farming and industry is the need of the day.

From the above explanation, it may be concluded that farming occupies an important place in the development of an economy. It is in fact, a pre-condition for economic upliftment.

Review Questions

1. Define the Diversification Trends of Indian Agriculture?
2. Explain the linkage of forestry with agriculture?
3. Explain the Rural Industrialisation Program?
4. Explain the role of Agriculture in Indian Economy?

Discussion Questions

Discuss the Agricultural Economy of India?

Lesson 3 -Agricultural Resources

Learning Objectives

- To define the Irrigation in India.
- To explain the Dryland Farming Agro-climatic Zoning.
- To explain the Agro-climatic Zoning.
- To describe the Land Utilization and Harvestping Pattern.

3.1 Agriculture, Resources & Environment

3.1.1 Introduction

Farming continues to be the engine of broad and accelerated economic growth and livelihood security in the developing Asia-Pacific region, that holds over 55% of the world's total and 70% of the world's farm population but in terms of land availability it holds only one-fifth of that in the rest of the world. While farming in the Asia-Pacific region is rapidly becoming commercialized with a focus on both domestic and export markets, the region is also experiencing stagnation in farm production and productivity. Changing consumer preferences coupled with issues such as food safety, labeling, traceability, and WTO trade regimes are influencing significantly the way food is produced, processed, packaged and transported. At the same time, several Megatrends are transforming the landscape of farming both in Asia and elsewhere. Recent economic pressure to find alternative fuels has seen the emergence of biofuel harvest production, presenting both new economic opportunities, and threats, to sustainable land usage, water usage and forests.

The potential for production is also being transformed by biotechnology and genetic engineering, offering hope for better farm productivity and protection against pests and other environmental impacts. However, biotechnology presents policy dilemmas, and remains politically divisive, in the absence of sound bio-safety mechanisms to ensure compliance with safety standards, especially in developed markets. Avian flu and other livestock-related diseases present new challenges, not least to the institutional capability of developing countries to manage, coordinate, monitor and implement appropriate measures to control current and emerging threats, and avert future ones. Not least of the challenges facing the farm sector are those presented by trade subsidies in the developed world, their impact on developing countries, and how these pressures shape the WTO and other global trade fora. Again, standards and certification remain central issues.

On the other hand the challenges of climate change and anthropogenic global warming now transcend national and international political concerns, and are central to the survival of the planet. Indeed, the conflict in Darfur has recently been called the first war, climate change, and Lester Brown argues that the number of failed states is a bio-indicator for the health of the planet. Whether or not this is so, it is likely that conflicts over natural resources will increase dramatically in the 21st century, not least in Asia, many of whose three billion citizens aspire to standards of living already attained in developing countries – aspirations that are driving economic growth and now placing intolerable strains on the natural environment, and are fuelling climate change. Tropical rainforests and wetlands are being cleared at an unprecedented rate, for farm use and aquaculture development, and increasingly for production of biofuel harvests. As this happens, much of the world's biodiversity is being lost – and with it the hope for solutions to the long intractable farm and health problems. At sea, largely unregulated commercial fisheries have already destroyed many of our most valuable marine and coastal ecomethods. On land, more than half the world's population now lives in towns, cities, and mega-cities, creating unprecedented demands for energy, water supply, waste management and transportation.

In both the developed and the developing world, public awareness of what is at stake has never been greater. But how should governments, corporations, NGOs, educational establishments and individuals respond to the challenges we face? The challenges faced in Asia, as in Africa and South America, however, are qualitatively and quantitatively different to those faced in Europe and North America. For example, a congestion charge may work in cities such as London or Singapore, but would be impossible to apply in Dhaka or Phnom Penh, or even in Bangkok. Forests, wetlands and natural resources in Europe are superbly managed and protected in ways that cannot be easily replicated in Southeast and South Asia.

3.2 Irrigation in India

3.2.1 Introduction

Water is an important constituent of the plant body. Plants need water to carry on different physiological processes essential to their growth and development. A great deal of water from plant body is wasted through the process of transpiration. Therefore, to compensate this loss of water, absorption of water from the soil is an important phenomenon. Soil gets water mainly from two sources viz. Precipitation and irrigation.

Hence, irrigation is a process, other than natural precipitation, which supplies water to harvest, orchards, grass, or any other cultivated Plants. In the wetter parts of the world where rain-fed cultivation is practiced, the farmer's activities consist of selecting suitable land, preparing the soil for cultivation; sowing, tending and harvesting the harvests. Natural rainfall provides the water needed. But in many other places otherwise favorable for cultivation, natural rainfall does not provide all the water needed and, as such, irrigation of harvests is required to make up this deficiency.

Techniques adopted for carrying water from its source to the harvest are called methods or modes of application. These are:

1. Flooding -wetting all the land surface;
2. Furrows -wetting only certain part of the ground level;
3. Sprinkler -in which the soil is wet in much the same way as the rains;
4. sub-surface irrigation -in which surface is wetted very lightly, but the subsoil is fully saturated; and
5. Localized irrigation -in which water is applied at each individual plant at. A near daily rate.

3.2.2 Characteristics of an Efficient Irrigation Method

An efficient method of irrigation should fulfill five major objectives viz. (1) Distribution of water uniformly over the field according to harvest need, (2) storage of the maximum fraction of water in the root zone for plant use, (3) harvest growth should not be adversely affected, (4) soil transport or loss is negligible, and (5) the technique used is economically sound and adoptable at the farm.

3.2.3 Factors Affecting Suitability of Irrigation Method

The selection of a suitable irrigation method for a particular farm location depends upon the following factors.

3.2.3.1. Soil

Textural, crusting, cracking and infiltration characteristics of surface soils; nature and depth of relatively impermeable layers in sub-soil, if any; water storage capacity of the root zone; nature

and extent of land slope; size of the field; surface drainage; nature and extent of salts in surface and sub-soil are the salient soil factors influencing between of an irrigation method.

3.2.3.2. Water

Nature of water supply (continuous or rational). Source (pump or canal), size of water delivery, quality of irrigation water, and quantity of water supply (adequate or limited) are few factors that must be taken into consideration while deciding the method of irrigation.

3.2.3.3. Harvests

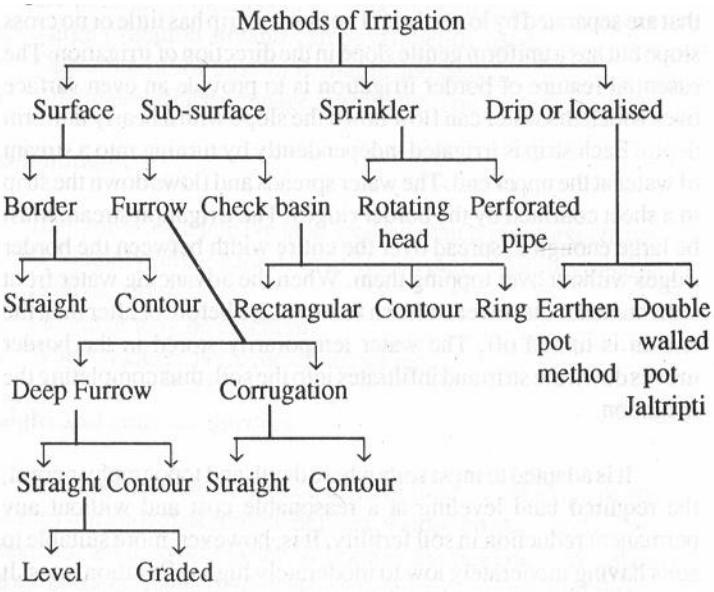
Nature of harvests, area under different harvests and their rooting behavior, optimum depth and timing of irrigation, sensitivity of harvests to excessive soil moisture, cultural operations required, etc. Must be considered at the time of selection of irrigation method for a harvest.

3.2.3.4. Others

There are other factors influencing irrigation method like outlook, managerial efficiency and financial resources of the farmer; the nature of the farm machinery used; availability and cost of labour; wear and tear maintenance facilities and costs of irrigation equipments; and availability of power supply. As far as possible, an irrigation method should not only provide a high level of water application efficiency, but also ensure its economic viability, sustained soil productivity and wide' adaptability to a prevalent feature of the farm. Generally, irrigation methods followed in India lack in an economical use of irrigation water.

3.2.4 Methods of Irrigation

Methods of irrigation, generally adopted in India, can be represented in the flow chart.



Diagrammatic representation of methods of irrigation

3

3.2.4.1 **Surface irrigation**

In this method, water from an irrigation channel is allowed to reach a part or whole of the field and spread by the gravitational flow incidental to the slope of the land. Water may be distributed to the harvests in border strips, check basins or furrows. The important requirements to obtain high efficiency in surface method are (1) properly constructed water distribution methods to provide adequate flow of water to the fields; and (2) proper grading and leveling of land to achieve uniform distribution of water.

3.2.4.1.1. Border strip method

The border method of irrigation makes use of parallel ridges to guide a sheet of flowing water as it moves down the slope. The land is divided into a number of long parallel strips called borders that are separated by low ridges. The border strip has little or no cross slope but has a uniform gentle slope in the direction of irrigation. The essential feature of border irrigation is to provide an even surface over which the water can flow down the slope with a nearly uniform depth. Each strip is irrigated independently by turning into a stream of water at the upper end. The water spreads and flows down the strip in a sheet confined by the border ridges. The irrigation stream must be large enough to spread over the entire width between the border ridges without over topping them. When the advancing water front either reaches the lower end, or a few minutes before or after that, the stream is turned off. The water temporarily stored in the border moves down the strip and infiltrates into the soil, thus completing the irrigation. It adapts to most soils where depth and topography permit, the required land leveling at a reasonable cost and without

any permanent reduction in soil fertility. It is, however, more suitable for soils having moderately low to moderately high infiltration rates. It is generally not used in coarse sandy soils that have very high infiltration rates. It is also not well suited to soils having a very low infiltration rate. This method is suitable to irrigate all close growing harvests like wheat, barley, fodder harvests and legumes. It is, however, not suitable for harvests like rice which requires standing water during most part of its growing season.

3.2.4.1.1.1 **Advantages**

I. It is easy to construct border ridges even with some simple farm implements like a bullock drawn A-frame Ridger or tractor-drawn disc Ridger.

II. A Labour requirement in irrigation is greatly reduced as compared to the conventional check basin method of irrigation.

III. Uniform distribution and high water application efficiencies are possible if the method is properly designed.

iv. Large irrigation streams can be efficiently used.

v. Operation of the method is simple and easy.

VI. Adequate surface drainage is provided if outlets are available.

3.2.4.1.1.2 **Disadvantages**

I. It requires an extensive land grading which is too expensive.

II. It is mainly suitable for deep soils with the availability of large flows of water.

III. Drainage may be essential.

iv. Water wastage is frequently observed.

3.2.4.1.1.3 ***Straight and contour borders***

If the borders are constructed along the general slope of the field, they are known as straight borders or slope borders, and if they are constructed across the general slope of the field they are called contour borders. When fields can be leveled to desirable land slopes economically and without affecting its productivity, graded borders are easier to construct and operate. In case where land slopes exceeds safe limits, fields are undulating and leveling is not feasible, borders may be laid across the slope. The design of a contour border is the same as that of a straight border. Each contour border is level crosswise and has a uniform longitudinal gradient as in a

straight border. The width and length of a contour border are identical to that of a straight border for a particular set of conditions.

In laying contour borders, the field is divided into a series of strips on the approximate contour, and each strip is leveled as an independent area. Thus, a series of strips are formed in successive elevations around the slope. The vertical interval between the adjacent benches should, as far as possible, be limited to 30 cm, but should not exceed 60 cm. The height of the ridge should be sufficient to check both the normal irrigation stream and run-off.

3.2.4.2. Check basin irrigation

Check basin irrigation is the most common method of irrigation in India and in many other countries. This is the simplest in principle of all methods of irrigation. There are many methods in its use, but all involve dividing the field into smaller units so that each has a nearly level surface. Ridges-are-constructed around the areas forming basins within which the irrigation water can be controlled. The basins are filled to the desired depth and the water is retained until it infiltrates into the soil. The depth of water may be maintained for considerable periods of time by allowing the water to continue to flow into the basins.

The distinguishing features of various uses of the check basin method of irrigation involve the size and shape of the basins and " whether irrigation is accomplished by intermittent or continuous" collection of water in the basins. The ridges or bonds may be temporary for a single irrigation as in the pre-sowing irrigation of seasonal harvests. They may be semi-permanently constructed for the repeated use in the case of paddy fields. The size of the ridge will depend on the depth of water to be impounded as well as to the stability of the soil when wet.

Water is conveyed to the field by a method of supply channels and lateral field channels. The supply channel is aligned on the upper side of the area and there is usually one lateral channel for every two rows of check basins. Water from the laterals is turned into the beds and is cut off when sufficient water has been administered into the basin. Water is retained in the basin until it soaks into the soil. The size of the irrigation stream is not critical as long as it is sufficient to provide a coverage of the entire strip in a relatively short time span required to apply the desired amount of water into the soil. As the infiltration rate of the soil increases, stream size must be increased or the size of the basins reduced in order to cover the area within a short period of time. A large size irrigation stream will permit a comparatively larger size of the basin.

The size of check basin may vary from one square meter, used for growing vegetables and other intensive cultivation, to as large as two hectares or more, used for growing rice under wetland conditions. When the land can be graded economically into nearly level fields, the basins are rectangular in shape. In rolling topography the ridges follow the contours of the land surface. The contour ridges are connected by cross ridges at intervals. The vertical interval between contour ridges usually varies from 6 to 12 cm. In case of upland irrigated harvests like wheat and 15 to 30 cm in the case of low land irrigated harvests .Like rice.

In irrigating orchards, square to contour basins may be used as in other harvests. When the plants are widely spaced the ring method of basin irrigation is adopted. The rings are circular basins formed around each tree. The ring basins are small when the plant is young. The size is increased as the plant grows.

Check basin irrigation is suited to smooth, gentle and uniform land slopes and for soils having moderate to slow infiltration rates. Steep slopes require complex layouts and heavy land leveling. Both row harvests as well as close growing harvests are adapted to basins as long as the harvest is not affected by temporary inundation. The method is especially adopted for, irrigation of grain and fodder harvests in heavy , soils where water is absorbed very slowly. It is also suitable in very permeable soils which must be covered with water rapidly to prevent excessive deep percolation loss of water at the upstream end.

3.2.4.2.1 **Advantages**

I. Since in this method the entire area is not flooded, it ensures -high water use efficiency.

II. Excessive seepage loss can be avoided by adopting this practice

III. Damage to plants and loss of soil nutrients do not occur in this practice:..

3.2.4.2.2 **Disadvantages**

I. The major disadvantage of the check basin method of irrigation is that the ridges interfere with the movement of animal drawn or tractor drawn implements for inter culture operations or the harvesting of harvests.

II. Considerable land is occupied by ridges and lateral field channels and harvest yields are substantially reduced.

III. The method impedes surface drainage.

iv. Precise land grading and shaping are required.

v. A Labour requirement in land preparation and irrigation are much higher.

3.2.4.3. Furrow irrigation

The furrow method of irrigation is used in the irrigation of row harvests with furrows developed between the harvest rows in the planting and cultivating processes. The size and shape of the furrow depend on the harvest grown, equipment used and spacing between harvest rows. Water is applied by running small streams in the furrows between the harvest rows. Water infiltrates into the soil and spreads laterally to , irrigate the areas between the furrows. The length of time water takes to flow in the furrows depends on .The amount of water required to replenish root zone and the infiltration rate of the soil. Both large and small irrigation streams can be used by adjusting the number of furrows irrigated at any one time to suit the available flow. In areas where surface drainage is necessary, the furrows can be used to dispose of the run-off from rainfall rapidly.

Furrow irrigation can be used to irrigate all cultivated harvests planted in rows, including orchards and vegetables. Among the common cultivated harvests of India, the method is suitable for irrigating maize, sorghum, sugarcane, cotton, tobacco, groundnut, potato and other vegetables. Furrows are particularly well adapted to irrigating harvests which are subject to injury from accumulated surface water or susceptible to fungal root rot. Furrow irrigation is suitable for most soils except sands that have a very high infiltration rate and provide poor lateral distribution of water between furrows.

3.2.4.3.1 **Advantages**

I. Water in the furrows contacts only one half to one fifth of the land surface, thereby reducing puddling and crusting of the soil, and evaporation losses.
II. Early sowing is possible which is a distinct advantage in heavy soils.
III. It can be safely adopted on the sloppy lands by opening the furrows across the slope.
iv. This method reduces labour requirement in land preparation and Irrigation.
v. Compared to check basin method, there is no wastage of land in field ditches.

3.2.4.3.2 **Disadvantages**

i. It requires skilled laborers to operate. .
ii. It may cause serious erosion, if excess water flows over the ridges.
iii. Difficult to carry on mechanical operations.

Irrigation furrows may be classified into two general types is based on their alignment. They are (i) straight furrows, (ii) contour furrows. Based on their size and spacing furrows, may be classified as deep furrows and corrugation.

3.2.4.3.3. Deep furrows

As mentioned above, deep furrows are of two types i.e. Straight furrows and contour furrows.

3.2.4.3.3.1. Straight furrows

Straight furrows, like borders, are laid down across the prevailing land slope. They are best suited to sites where the land slope does not exceed 0.75 per cent. In areas of intense rainfall, however, the furrow grade should not exceed 0.5 % so as to minimize
The erosion hazard.

3.2.4.3.3.2. Contour furrows

The contour furrow method is similar to the graded furrow method in that the irrigation water is applied in furrows, but the furrows carry water across the sloping field rather than down the slope. Contour furrows are curved to fit the topography of the land. The furrows are given gentle slope along its length as in the case of graded furrows. Field supply channels run down the land slope to feed the individual furrows and are provided with erosion control structures.

3.2.4.3.4 Corrugation irrigation

Corrugation irrigation consists of running water in small I: furrows, called corrugatio'1s which direct the flow down the slope. It is commonly used for irrigating non-cultivated close growing harvests such as small grains and for pasture growing on steep slopes. Corrugation may be used in conjunction with border irrigation on lands with relatively flat slopes in order to get uniform coverage with water. The water is applied to small furrows and the harvest rows are I not necessarily related to the irrigation furrows.
In this method the soil may be prepared and the harvest plan without regard for irrigation layout After the seed is sown, but before the germination has taken place, a corrugation is used to make small furrows or corrugation to aid in controlling irrigation water. The corrugation may be used with a simple bamboo corrugators or farmers equipped with small furrowers or other similar implements. Corrugations are V -shaped or U shaped channels about 6 to 10 cm deep. They are spaced 40 to 75 cm apart. The entire soil surface is wetted slowly by the capillary movement of the water which flows in the corrugations.

This method of irrigation is the most suitable in loamy soils in which the lateral movement of water occurs readily. Clay soil having a poor infiltration capacityis quite unsuitable for irrigation

by corrugations. This method is also not suitable for irrigation in deep sandy soils due to excessive loss of water by deep percolation before the entire soil surface is wetted.

Saline or alkaline soils or irrigation water having salt content is not suitable for this method because of the danger of salt accumulation on surface soils due to capillary movement of water.

3.2.4.3.4.1 **Advantages**

I. Corrugation irrigation minimizes the crusting effect on the surface soil which may occur when the entire surface is flooded.

II. High water use efficiency is ensured.

III. It can be used for germinating seeds which are drilled or broadcast on the soil.

3.2.4.3.4.2 **Disadvantages**

I. Not suitable for a wide range of soils.

II. This is a labour intensive method.

III. If the corrugations are placed across the land slope, the overflow of water may move down into the lower corrugations and may cause severe soil erosion.

3.2.4.4**Subsurface irrigation**

In this method of irrigation water is applied below the ground surface by maintaining an artificial water table at some depth depending upon the soil texture and the depth of the plant roots. Water reaches the plant roots through capillary action. Water may be introduced through open ditches or underground pipelines such as tile drains or mole drains. The depth of open ditches varies from 30 to l00cm and they are spaced about 15 to 30 meters apart. This water application method consists of field supply channels, ditches or trenches and drainage ditches for the disposal of excess water. The irrigation ditches should be suitably spaced to cover the whole field adequately.

This method is suited to soils having a reasonably uniform texture and are permeable enough for water to move rapidly both vertically as well horizontally within and for some distance below the harvest root zone. The soil profile must control a barrier against excessive loss through deep percolation. The topography must be smooth and nearly level or slight slopes very gentle and uniform.

3.2.4.4 **.1Advantages**

I. In soils having low water capacity and a high infiltration rate.: Where surface methods cannot be used and sprinkler method : is very expensive, sub-surface irrigation method can be used effectively.

II. Evaporation loss from ground surface are minimized.

III. In this method, it is possible to maintain the water level at the optimum depth for harvests required at different growth stages.

3.2.4.4 **.2Disadvantages**

I. It is quite expensive and labour intensive in the beginning.

II. The method requires an unusual combination of natural conditions, therefore its scope is limited.

III. Frequent removal of accumulated soil and other materials from channels is necessary.

3.2.4.5 **Sprinkler irrigation**

In the sprinkler method of irrigation, water is applied above the ground surface as a spray. The spray is developed by the tilt flow of water under pressure through small orifices or nozzles. The pressure is obtained by pumping with careful selection of nozzle sizes, operating pressures and sprinkler spacing. Higher efficiency in water application/distribution can be obtained with sprinkler method .

Sprinkler methods are of generally two major types viz. (i) Rotating head method , and (ii) perforated pipe method .

In case of rotating head method small nozzles are placed on riser pipes and these riser pipes are fixed at an even interval along the length of lateral pipes which are placed on the ground surface. However, they can be mounted on posts exceeding the harvest height and made rotating through 90 degrees. In rotating sprinkler, the most, important device to rotate the sprinkler head is a small hammer activated by the thrust of water striking the vane connected to it.

In case of perforated pipe method , holes are perforated in lateral irrigation pipes which is specially designed to distribute water with a good deal of uniformity. This method is usually designed for low operating pressures (i.e. 0.5 to 2.5 kg/sq cm). Due to this low pressure, the method is attached to an overhead tank to achieve the requisite pressure head. The sprays are directed at both sides of the pipe which cover a strip of land from 6 to 15 meters wide.

Nearly all cultivable soils can be sprinkler irrigated. It is, however, not suitable in very high textured soils where the infiltration rates are very low (i.e. Less than 4 mm per hour). Most harvests excepting rice and jute can be sprinkler irrigated. The flexibility of sprinkler equipment and efficient control of its application make this method adaptable to most of the topographic conditions. However, extremely high temperature and wind velocity markedly reduce the uniformity of water distribution and irrigation efficiency. This I method of irrigation is especially useful to the soils that have steep slopes or irregular topography and soils which are too shallow to level.

3.2.4.5.1. Advantages

I. This technique enables judicious utilization of even small water flows and permits efficient irrigation of undulated lands, and soils with shallow depths.

II. It saves 10to 16% land that is used in construction of channels and ridges in other methods.

III. Highly permeable as well as relatively less permeable soils can be easily irrigated by sprinkler method without any risk of runoff and erosion, inundation and seepage losses.

iv. Fertilizers, pesticides and weedicides can be applied along with water spray, thus, saving extra labour.

3.2.4.5 **.2 Disadvantages**

I. High initial cost of equipments.

II. Operating costs are generally higher than irrigation by surface methods.

III. Winds disturb the sprinkler pattern giving the uneven distribution of the irrigation water.

iv. Sprinkling with water containing an appreciable amount of salts may result in the bum or death of the plants.

v. Under certain climatic conditions diseases may be encouraged. The problem of fruit rotting in tomato and strawberry gets aggravated especially in moist soil condition.

3.2.4.6 **Localized irrigation**

3.2.4.6.1 Drip irrigation

As the name signifies, drip irrigation, also termed as trickle irrigation, involves the slow application of water to the root zone of a harvest. The method was initiated in Israel and is now being tried in other countries. In this method, water can be used very economically, since loss due to deep percolation and surface evaporation are reduced to the minimum. This method, therefore,

is highly suitable for arid regions and orchard harvests. The successful raising of orchards even on saline soils has been made possible by the drip method of irrigation. The method can also be used for applying fertilizers in solutions.

In this method , water is applied more frequently, close to the stems of plants through suitably spaced droppers (emitters) attached to a plastic or metallic pipes spread above or below soils along harvest rows. The pipes are hooked to a source of water supply through a storage tank or pressure device which provides necessary hydraulic head or pressure for movement of water to the drippers. A pumping unit creates a pressure of about 2.5kg/sq cm. In this case only a part of the soil in the vicinity of plant roots is wetted and kept close to field capacity. The amount of water dripping from nozzles can be regulated as desired by varying the pressure at the nozzles and the size of the orifice of the nozzles. The initial high cost of the equipment and its maintenance are the major limitations in this method . It may, however, work out to be cheaper than the sprinkler method especially for the orchards and other widely spaced harvests.

3.2.4.6.2 Earthen pot irrigation

This method has been recently developed by the Haryana Farming University, Hissar. It is very cheap and convenient method and can be easily adopted. In this method, first a pit (60 cm deep and 90 cm wide) is dug out and the earthen pot is embedded up to the neck level and then it is filled with water. The water is absorbed by the soil through capillary action. One pot is sufficient to moisten one square meter area. Care should be taken to cover the pot with lid and supply water from time to .Time. The pots may be replaced by new ones after two or three seasons. This method is especially useful for irrigating vegetable.

3.2.4.6.2.1 **Advantages**

I. It is the most suitable method for vegetable and orchard harvests where plants are widely spaced.

II. It can be mainly used in sandy and undulating land.

III. Saline water can be freely used because salts are deposited at the bottom of the pot

iv. High water use efficiency.

v. A simple and comparatively cheap method.

3.2.4.6.3 Double walled pot "Jaltripti"

It is a useful irrigation device for the desert, developed by the Central Arid Zone Research Institute (CAZRI), Regional Station, Bikaner. It reduces the frequency and total amount of water

needed and ensures a regulated constant supply of moisture to tree planting for survival and better growth.

This device consists of a double walled earthen pot called "Jaltripti" (water satisfaction). The diameter of the outer pot is kept , approximately 25 cm at the top and at the base it is 18 cm. The diameter ; of inner pot is 15 cm on top and 12cm at the base. The height is kept 30 cm. (Since it is prepared on the potter's wheel, approximate dimensions have been given. Moreover, some variations in the measurement may occur). The dimensions of the inner pot have been kept slightly bigger than the size of the polythene bags (25 cm long measuring 10 : cm across) used for raising plants in the nursery. Both the pots are joined together at the base and the basal portion of inner pots is kept almost open. The external side of the outer pot is made impervious with the f help of paint, cement or coaltar.

The "Jaltripti" functions on two simple principles:

1. Soil moisture tension and plant roots create a suction force which draws moisture towards it from the neighboring high moisture zone.
II. Earthen pots have many micro-pores in their wall which do not allow water to flow freely but allow its seepage in the direction where suction develops.

At the place where planting has to be done, the device is fixed in the soil in such a way that the brim of the outer pot is above the soil surface. A tree sapling along with a soil ball is transplanted in the inner pot The water is filled in the space between two pots and the circular surface of water is caused by a polythene sheet to avoid direct evaporation of water. The paint on the external surface of the pot prevents outward movement of water through seepage. But the suction force created by the inner pot allows for the seepage of water steadily in that direction and keeps the soil sufficiently moist for the I growth of the plants. Water is filled weekly or fortnightly depending upon the season and the size of the pot. The device has been named 'Jaltripti'.

3.2.4.6.3.1 **Advantages**

I. Economy of water (80 to 90 per cent).
II. It saves more water than drip and sprinkler method .
III. Low irrigation frequency.
iv. Labour saving.
v. No loss through percolation, evaporation and seepage.
VI. Regulated supply of moisture. Moisture is always available at field capacity.

vii. Promising in the stabilization of sand dunes.

3.2.4.6.4Tueboponics

Tueboponics is a fairly recent development in the field of irrigation. This technique has been developed in Israel and practiced in the desert areas of that country in order to convert it into green lush forests.

In tueboponics, water is provided to the plants/trees through injections. The needle is inserted into the plant stem and water is delivered into the phloem. The needle and injection used for this purpose are of special shape and design prepared only for this purpose.

In India, this technique has not yet arrived but it may prove very useful in Indian deserts where water is very scarce. Its use ofharvest plants seems to be impracticable. It is a very simple device.

3.2.5 Drip and Sprinkler Irrigation in India: Constraints

India ranks first in respect of total irrigated area existing in the world. It has got approximately 80 million hectares of irrigated land. But the methods of irrigations employed are still very primitive and inefficient. Recent achievements in the field of irrigation for instance drip and sprinkler irrigations are yet not sufficiently popular in India.

More than 10 million hectaresare irrigated by sprinkler method and I million hectare by drip irrigation in the world. But in India, it is only about 0.7 m. Ha under sprinkler irrigation and less than 20,000 ha with drip irrigation. Therefore, it is necessary to popularize these advanced methods of irrigation especially in those areas where water is a scarce resource.

India is blessed with abundant water resources. However, the available water, particularly for irrigation is tending to diminish and at the same time its demand is gravely felt due to population explosion. The emerging challenge is to tap all the available resources of water.

Technological innovations are to be exploited to achieve the twin objectives of higher productivity and better water use efficiency. For this, we will have to popularize drip and sprinkler irrigation methods. On account of certain financial, technical and institutional constraints, these methods have not got their due place in India and consequently, the area

benefited is negligible. Therefore, the question arises as to what are the constraints and problems holding up progress.

The following are the major constraints faced by the farmers in adopting the drip and sprinkler methods of irrigation.

1. High initial cost.
2. Inadequate subsidy amount.
3. Difficulty in getting subsidy amount
4. Lack of availability of technical input and after sale services.
5. Clogging of dripper and cracking of laterals.
6. Damages due to rats and squirrels.
7. High cost of spares and components.
8. Discrimination in subsidy distribution among different categories of farmers.

To exploit the full potential of these two innovations, the constraints are to be overcome by appropriate policy instruments. Financial support and technical guidance. This calls for an integrated approach and endeavor on the part of government. Implementing agencies, manufacturing companies, voluntary organizations and the ultimate users of the methods i.e.The farmers.

3.2.6 Adverse Effect of Improper Irrigation

As water is a limited resource with no substitute. Its efficient and judicious utilization is of utmost importance in sustaining and increasing farm production. If irrigation water is used inefficiently and unscientifically, it may cause certain adverse effects, rather than being useful, to the harvest and soil.

Seepage from main and branch canals, distributaries, and field channels along with the deep drainage loss of the base and harvested fields due to heavy rains and over irrigation add to the ground water and cause a rise of the water table. If not checked, the water table may rise closer to the surface and cause water logging of soil. If here is a salty layer in the soil, the salts may get dissolved in the rising water table and come up on the surface soil thereby rendering the soil less productive due to salinity. Soil aeration is also badly affected.

Rising fromthe water table beyond the threshold depth can be prevented by providing requisite sub-surface drainage. Alternatively, in areas with good quality ground water, radial drainage with shallow pumps and recycling the water for irrigation can be practiced with advantage to keep down the water tables and stretch the irrigation supplies.

Another aspect associated with injudicious irrigation is leaching of the mobile nutrients like nitrate below the root zone of harvests, which decreases the nutrient use efficiency by harvests. In order to minimize this loss through leaching, it becomes necessary to regulate irrigation and fertilizer applications.

3.2.7 Cultural Practices to Increase Water Use Efficiency in India

Water has become a precious commodity in modern farming. Therefore, the adoption of certain practices is greatly beneficial in the judicious harnessing of available water resources. These cultural practices are:

3.2.7.1 Tillage

Tillage operations have a great bearing on irrigation requirements of the harvests through their effect on sub-surface water storage and utilization by harvests. Tillage increases infiltration rate, reduces evaporation and enhances penetration of roots into deeper layers. With an increased infiltration, higher water storage in the root zone of soil becomes possible. Greater availability of soil decreases too need of supplemental irrigation.

It is a well known fact that direct evaporation from the soil is an unproductive water loss. Tillage for seed bed preparation opens up soil and increases evaporation from the tilled layer, but at the same time, it also breaks the continuity of the upward flow of water (capillary water) from the moist layers below and as such, reduces water loss through evaporation.

Puddling (a tillage practice, especially useful for paddy cultivation) and compaction of soil with suitable implements is a useful measure to reduce percolation loss in coarse-textured soils.

3.2.7.2 Land grading

It is an essential process for bringing about the uniform distribution of irrigation water (especially in surface irrigation) on undulating and sloping lands. It minimizes the danger of flooding of low lying areas and under-irrigation of raising locations.

3.2.7.3 Fertilizer use

Recent studies have proved that fertilization of harvests enhances water use efficiency. Besides, fertilization promotes deeper and more profuse root method which extracts more water stored in deeper layers of soil. Care should be taken not to use high doses of fertilizers where water supplies are limited.

3.2.7.4Harvesting patterns

Much attention has not been paid towards the development of appropriate harvesting patterns which can suit the irrigation supplies available at the farm. The usual tendency is to match irrigation needs to harvests on considerations other than availability of water. The role of harvest planning in respect of efficient use of water has not been well recognized .Such planning is important because:

a. Harvests differ marked by in timings and amounts of their irrigation need;
b. They exhibit a wide range of photosynthetic efficiency of similar water requirements;
c. They exhibit differential sensitivity to water stress imposed at various growth stages.

The harvests that develop their covers rapidly, permit more efficient use of water by reducing direct evaporation. Harvests with deeper and more profuse root method utilize a greater amount of profile-stored water and can stand drought better-than the shallow rooted harvests. In some harvests, better tolerance of water deficits arises from higher physiological adaptation.

3.2.7.5 Mulching

Mulching is the practice of spreading an extraneous material on the surface of soil to increase water retention, check evaporation, reduce soil erosion, improve the edaphic environment and suppress weeds. Various types of mulches, viz. Paperpolyethylene film, harvest residues, petroleum products, etc., Has been used to realize these objectives. But unavailability and high costs of most of these materials discourage their large scale use as mulch. In those regions where paddy straw and wheat straw are available in plenty, they can be used for mulching.

Straw mulching in harvests, sown during hot and dry summer has been found to increase harvest yields and economize irrigation water and fertilizer use. Therefore, it can be an important practical aid in improving water use efficiency of harvests.

3.2.7.6 Weed control

As weed competes with the harvests for light, water and nutrients, their development along with the harvest growth enhances the rate of soil- water depletion. Further, weeds obstruct the movements of water in the irrigation channels and fields and thus promote percolation loss. These weed-induced effects necessitate more frequent watering. The adverse effect of weed on soil water use is more pronounced during early stages of growth when the harvest cover is sparse and weeds significantly contribute to canopy and, hence, evapo transpiration loss is high. Thus, an efficient weed control in the irrigation channels as well as in fallow and harvested fields through mechanical operations and weedicides is essential to economize farm irrigation supplies and to increase water utilization efficiency for harvest production.

3.2.7.7 Irrigation scheduling

In irrigated areas, optimum irrigation scheduling to harvests constitutes a major cultural practice because it is one of the most important factors governing the yields of harvests. Besides, irrigation scheduling has profound influence not only on the efficient management of an individual farmer's irrigation supply, but also on judicious planning in relation to canal, command development and optimal allocation of water resources among harvests and regions. A farmer can easily adopt an optimum irrigation schedule provided it is simple and economical.

3.2.8 **Importance of Irrigation in India**

The rainfall of our country is dependent on the monsoons. Rainfall controls our farming. But the farming of our country is said to be, "the gambling of the monsoon" as the monsoon rainfalls are uncertain, irregular and uneven or unequal.

So irrigation is essential for farming. The following are the primary reasons of irrigation in our country.

(1) About 80 per cent of the total annual rainfall in India occurs in four months, i.e. From mid-June to mid-October. So it is essential to provide irrigation for the production of harvests etc., During the rest of the eight months.

(2) The monsoons are uncertain. So irrigation is necessary to protect harvests from drought as a result of uncertain rainfall.

(3) It does not rain equally in all parts of the country. So irrigation is necessary for farming in less rainfall areas.

(4) Soils of some areas are sandy and loamy and therefore porous for which a major portion of rainwater sinks down very quickly. So, sandy and loamy soils can't retain water like the alluvial soil and the black soil. That is why irrigation is essential for farming in the areas having, sandy and loamy soils.

(5) The rainwater flows down very quickly along the slopes of hillsides. So irrigation is necessary to grow harvests in such areas.

(6) India is afarm and populous country. About 70 per cent of people depend on farming. In order to grow food-harvests and farm products in large quantities to feed the growing millions, intensive farming and rotation of harvests is essential. Extensive irrigation is, therefore, necessary for more production.

When our country got freedom, there was provision of irrigation only in 17 per cent of the total farmland. More attention was paid to irrigation in order to make the country self-sufficient in production of food-harvests, as a result of which about 37 per cent of the total farm landhas been provided with irrigation facilities by now.

3.3Dryland Farming and Agro-climatic Zoning

3.3.1 **Dryland Farming**

3.3.1.1 **Introduction**

India has about 108 million hectares of rain-fed area which constitutes nearly 75% of the total 143 million hectares of arable land. In such areas harvest production becomes relatively difficult as it mainly depends upon the intensity and frequency of rainfall. The harvest production, therefore, in such areas is called rain-fed farming as there is no facility to give any irrigation, and even protective or life saving irrigation is not possible. These areas get an annual rainfall between 400 mm to 1000 mm which is unevenly distributed, highly uncertain and erratic. In certain areas the total annual rainfall does not exceed 500mm. The harvest production, depending upon this rain, is technically called dry land and farming areas are known as dry lands.

India has about 47 million hectares of dry lands out of 108 million hectares of total rain fed area. Dry lands contribute 42% of the total food grain production of the country. These areas produce 75% of pulses and more than 90% of sorghum, millet, groundnut and pulses from arid and semi-

arid regions. Thus, dry lands and rain-fed farming will continue to play a dominant role in farm production.

Dry lands, besides being water deficient, are characterized by high evaporation rates, exceptionally high day temperature during summer, low humidity and high runoff and soil erosion. The soil of such areas is often found to be sullen and low in fertility. As water is the most important factor of harvest production, inadequacy and uncertainty of rainfall often cause partial or complete failure of the harvests which leads to a period of scarcities and famines. Thus the life of both human being and cattle in such areas becomes difficult and insecure.

Despite all thisprogress in farming, we have yet not been able to evolve an appropriate package of practices for our dry land areas. The earnings of farmers of dry land regions are still very low land areas. The earnings of farmers of dry land regions are still very low. To feed our one billion population that we will have by 2000 A.D., we will require food grains 10 the tune of 240 million tonnes approximately. For achieving this target we will have to harness every inch of our cultivable lands, dry lands, with utmost care.

Dry farming or dry land farming may be defined as: "a practice of growing beneficial harvests without irrigation in areas which receive an annual rainfall of 500 mm or even less".

Efforts are being made to bring more area under irrigated farming and thereby to increase harvesting intensity. But, even when we achieve our target of 113 million hectares of irrigated area by 2000 A.D., we would still have about 45% area under rain-fed cultivation. We continue to stress on intensive farming on irrigated land but we cannot afford to be complacent with our dry lands. Therefore, improved dry farming is necessary for equity and prosperity. As such we cannot achieve stability in food production with unstabilized dry land farming. Therefore, we are required to ~ adopt improved technology especially developed for dry land farming.

3.3.1.2. Characteristics of Dryland Agriculture

Dry land areas may be characterized by the following features:

1. Uncertain, ill-. Distributed and limited annual rainfall;
2. Occurrence of extensive climatic hazards like drought, flood etc.;
3. Undulating soil surface;

4. Occurrence of extensive and large holdings;
5. Practice of extensive agriculture i.e. Prevalence of monoharvestingetc.;
6. Relatively large size of fields;
7. Similarity in the types of harvests raised by almost all the farmers of a particular region;
8. Very low harvest yield;
9. Poor market facility for the production;
10. Poor economy of the farmers; and
11. Poor health of cattle as well as farmers.

3.3.1.3. Problems of Dry Farming in India

The major problem which the farmers have to face very often is to keep the harvested plants alive and to get some economic returns from the harvest production. But this single problem is influenced by several factors which are briefly described below.

3.3.1.3.1 Moisture stress and uncertain rainfall

According to definition the dry farming areas receive an annual rainfall of 500 mm or even less. The rains are very erratic, uncertain and unevenly distributed. Therefore, the farming in these areas has become a sort of a gamble with the nature and very often the harvests have to face climatic hazards. The farmers also take up farming halfheartedly as they are not sure of being able to harvest the harvests. Thus, water scarcity becomes a serious bottleneck in dry land farming.

3.3.1.3.2. Effective storage of rainwater

According to characteristics of dry farming, either there will be no rain at all or there will be torrential rain with very high intensity. Thus, in the former case the harvests will have to suffer a severe drought and in the latter case they suffer either food or water logging and they will be spoilt In case of very heavy downpour, the excess water gets lost as run-off which goes to the ponds and ditches etc. This water could be stored for providing life saving or protective irrigation to the harvests grown in dry land areas. The loss of water takes place in several ways namely run-off, evaporation, uptake through weeds etc. The water could be stored for a short period or long period and it can be preserved either in the soil, pond or ditches based on situation and utilized for irrigation during dry periods.

3.3.1.3.3 Disposal or dry farming products

In dry farming all the farmers grow similar harvests which are drought resistant. These harvests mature at the same time and the growers like to dispose of their products soon after the harvest. This results in a glut of products in the market and the situation is badly exploited by the grain traders and middlemen. Therefore, marketing becomes a serious problem in dry farming areas.

3.3.1.3.4 Selection or limited harvests

Only drought resistant harvests namely oilseeds, pulses and coarse grains like jowar, Bajra, millets etc. Can be grown in dryland areas. Thus, the farmers have to purchase other food grains and household commodities that unbalance their economic position.

3.3.1.3.5 Careful and judicious manual scheduling

In case of irrigated farming the farmers are at a liberty to apply [manures and fertilizers according to their availability and facility but in case of dry farming they have to be very careful in fertilizer application. Due to lack of available moisture, broadcasting or top dressing becomes wasteful and meaningless. These can be applied ' by only deep placement and foliar spray for an improved harvest production.

3.3.1.3.6 Utilization of preserved moisture

Judicious and purposeful utilization of preserved moisture water depends upon soil type, plant type and other factors. The amount of available water to the plants depends upon the depth of plant roots, their proliferation and density. In case of limited moisture condition, the yield directly depends upon the rooting depth. The rooting depth can be desirably increased by mechanical manipulation of the soil. If the planting is very dense and all the plants have the same kind of rooting then there will be a tough competition among the roots for moisture and scarce moisture condition will result in the wilting of plants. Therefore, utilization of preserved moisture is an art in dry farming. The water collected in ponds or brooks may be used to give protective or life saving irrigation. The widely spaced harvests can be interharvestped with oilseeds or pulses for increasing the productivity of the land per unit area and per unit time. Therefore, the water. , collected during the rainy season need special technique and skill for its efficient utilization.

3.3.1.3.7 Quality or the produce

The quality of the produce from dry farming areas is often found to be inferior as the grains are not fully developed or they are not filled properly; often mixed with other harvest seeds owing to mixed .Harvestingmethod prevalent in these areas and the fodder becomes more fibrous. All

these factors reduce the market value of produce and the farmers do not get the profit of their labour and Investment.

3.3.1.4 Work on Dry Farming in India

As it has already been stated, that harvest production is highly risky in arid and semi-arid climates. In such conditions generally two types of farmingare practiced. One is harvest production or arable farming and the other is mixed farming i.e. Animal husbandry together with harvest production and pasture management. But this type of farming holds true only in those countries where the population is limited and farm land is extensive such as Australia, South Africa and some states of the USA. In India, with high population and limited available land for farming, we have no other option than adopting arable farming.

The repeated and frequent harvest failure in the past, resulting in short food grain supply, attracted the attention of our scientists and administration. Thus the scarcity of food grains in India was made the subject of inquiry in the year 1880 and the first Famine Commission was appointed in the same year. The commission after thorough study of the situation recommended the establishment of protective irrigation projects in South India and formation of department of farming in all the states. Thus, as a beginning, Bombay research scheme on dry farming was started in 1934 at Solapur and Bijapur after the establishment of Indian Council of Farm Research (ICAR). After some time the work on dry farming wasi81so started in Punjab, Madras and Hyderabad. Dry farming work in U.P. started in Jhansi and Agra at dry farming centers established~ 1943-44 and 1948-50, respectively. Since then the work has been in progress. Harvestprogress brought out very promising strains during sixties which received our interest in finding out ways and means through which the harvest production can be maximized in semi - arid and periodically dry areas of the country. Keeping this in view, the ICAR launched the All India Coordinated Research Project for Dry Land Farming in 1970 which was in active collaboration with the government of Canada. The project started with multi disciplinary research units at 23 coordinating research centers located in various typical agro climatic regions of India with Hyderabad as headquarter. The project started with the identification of the constraints responsible for lower yields in different regions : and then to develop a relevant location specific research program to solve production constraints. Presently a joint team of senior scientists of India and Canada is working in Hyderabad. To make the programs more effective it is expanded to 16 agro-economic research centres. These centers have been established with an obvious purpose of accelerating the conservation development and efficient, long term use of the basic

resources of soil and water in a self sustaining production. The main areas of investigations of these centres are given below:

-Identification of different harvests and selection of high yielding varieties for different agro-climatic zones of the country.
-Developing harvesting sequences and harvestingmethods suitable for dry farming.
-Determining the optimal harvest population and planting pattern.
-Evaluating tillage implements and practices for water intake and storage in the soil profile, establishment of a better harvest stand and control of weeds.
-Designing and developing animal drawn implements for speedy and efficient cultural operations.
-Evaluating the use of surface mulches, both organic and inorganic for short term moisture conservation.
-Determining ideal fertilizer doses and improving fertilizer use efficiency.
-Testing new planting materials for introduction/substitution after they have proved their superiority over existing ones. -Harvesting and storing unavoidable run off and recycling it as life saving or protective irrigation.

3.3.1.4 Principal Dry Farming Zones in India

Almost all the states have some area under rain-fed culture depending upon topography and irrigation facilities, but only the major dry farming areas are discussed here.

3.3.1.4.1 The Indo-Gangetic plains of North India

This zone is the youngest in the geological formation. This zone includes districts of Rajasthan, Punjab, Haryana, North- western M.P., and V.P. This zone is characterized by two major soil types namely light loam and heavy loam. The land is nearly level with a modest slope of 2 ft/mile length. The soils are very deep and situated at about 700 to 800 ft. Above sea level. Because of heavy sand and silt fractions in the soil it has large pore spaces. The soils are rich in essential nutrients like nitrogen, phosphorus, potash, calcium etc. And, therefore, quite good for raising the harvest excepting few with high water requirements. The harvesting intensity, in this zone, stands around 120% and the major harvests which are grown in this zone are millets, cereals, oil seeds and pulses.

As far as rainfall patterns in this zone is concerned, it is observed that about 60% or more of the total rainfall is observed between the end of July to the end of August, and the rainfall in

remaining months is quite poor. Thus, due to very high intensity of rainfall, floods are of frequent occurrence during the first week of September followed by a long spell of drought subsequently.

3.3.1.4.2 The trapian plateau of peninsular India

This zone comprises the states of Maharashtra, Karnataka and Andhra Pradesh. The soil of this zone has been derived from the Deccan trap .The tract is undulating and consists of low ridges and valleys due to erosion which results in rapid run-off. About 40% of the land of this zone is not fit for cultivation. This tract is situated ; at an elevation of 1400 -2(XX) feet from sea level. The soil may be grouped into three types based on its depth as deep. medium deep and shallow soils. Leaching of lime has resulted in the formation of lime nodules or kanker on the surface soil. The soil is quite rich in total and available nitrogen. phosphorus and potash which favours production of harvests if moisture is efficiently conserved.

In this zone. two high peaks of rain are observed because the area is affected by both south-west monsoon as well as northeast i monsoon. About 40-55% of total annual rainfall is obtained from south-west monsoon and the rest from north-east monsoon. Mostly the millets and some oil seeds like groundnut. are grown in this zone.

3.3.1.4.3 Plateau of granite formation

The soils of this zone are grouped as red soils and black cotton soils. Red soils are shallow while black cotton soils are very deep like clayey soils. The topography is of gentle undulations which favour run-off and soil erosion. The high pore space and high swelling of soil obstruct the permeability of rain water in to the lower layers of soil and its shrinkage results in hardening and clod formation on the surface which is unfavorable for plant growth. The red laterite and black cotton soils are deficient in nitrogen and phosphoric acids.

This zone also gets rain from two months namely south-west and north-east and the distribution pattern is more or less like peninsular group. Upland rice, millets, ragi, are the main harvests of this zone. However. the yield of these harvests is very low.

3.3.1.5Steps for Raising Productivity in Dry Fanning

To boost the harvest production under dry farming, we will have to efficiently manage our soil and water resources in the respective areas as dry land fanning gets more complex and intractable when droughts occur frequently. An efficient soil and water conservation method will playa vital

role in boosting the harvest yield in dry fanning. The different interdisciplinary approaches which are recommended for dry land fanning are categorized in to four major groups namely engineering, physiological, genetic and agronomic approaches.

3.3.1.5.1 **Engineering approaches**

These approaches are aimed at soil and moisture conservation through regulation of run-off, collection of surplus rain water checking evaporation and seepage losses of water. and recycling of collected water as irrigation in times of critical need.

3.3.1.5.1.1Contouring across the slope

Contouring is practiced on the lands with 3-5% slope. This method consists of constructing earthen bunds and the distance between the two bunds ranges from 30-50 m depending on the degree of slope. This is carried out with an object to provide a check to the flow of run-off water which then gets accumulated in the bunded area and is absorbed by the soil. Thus, contour bunding conserves moisture and prevents soil erosion.

a. Smoothening of contour inter-bund areas

This is practiced only in those areas which have a slope of less than 1 per cent The smoothening may be achieved by running bullock drawn harrows or farmers but small undulations are leveled during the process so that impounding of water may take place and maximum water absorption by the soil may be achieved.

b. Contour border strips method

This method is suitable for areas having a slope of 3-4 per cent In this case parallel strips across the slope ranging from 10-15 m in width are laid down on contours and the soil surface is leveled by scrapping and placing the soil according to the need of the spot It is done to reduce the run-off and to conserve soil and water from the field. It is, however, an expensive method as it requires culling and filling up the soil from higher spots to lower ones.

3.3.1.5.1.2Scooping or land

In this practice, the land is generally scooped before the beginning of monsoon showers. By scooping, the soil is exposed for proper absorption and conservation of moisture. However, this is also a tedious as well as an expensive operation.

3.3.1.5.1.3Opening or ridges and furrows

In this practice, the entire land is laid out into ridges and furrows across the slope. The ridges and furrows are opened before onset of monsoon so that the flow of water may be reduced and erosion may be controlled to the minimum. During rainy season, harvests like maize, jowar, bajra, etc. may be grown in the furrows and legumes like soybean, arhar, urd, mung, cowpea, etc. may be grown on the ridges. After the monsoon is over the land is again leveled. This way the furrows are used to accumulate maximum water which will supply moisture for winter season harvests.

3.3.1.5.1.4Compartmental bunding

Areas having a slope of 1% or less are suitable for compartmental bunding. It helps in accumulation of more water and a uniform spread of water in the entire area. Leveling is also done with nominal or no additional expenditure.

3.3.1.5.1.5Bedding method

In this method , small furrows are opened and the soil from the furrows is uniformly spread in space left between the furrows. Thus, inter furrow spaces form the raised beds of about 4-5 metres width. This method helps in the conservation of soil, moisture and checking the excess run-off of water.

The raised beds, in this practice, are used for growing such harvests which need less water like legumes and oil seed harvests, while the furrows are used for the harvests which need more water.

3.3.1.5.1.6Broad-based bunding

This method is especially suitable for heavy black soil. Water is allowed to spread over a vast area by constructing a broad- based bund on a sloppy side. The water stays for a longer time because of high water holding capacity, lower leaching and seepage losses.

The stored water may be used for fish culture and also for [providing life saving irrigation grown in surrounding areas of catchment portion. These bunds are also called check dams and are I given a regulated drain or outlet for protecting the bunds from breaking.

3.3.1.5.1.7Deep summer Ploughing followed by surface tilling

The field is ploughed deep by mould hard plough soon after harvesting rabi season harvest with the objectives of (a) exposing the soil for perfect drying, (b) killing the disease pathogens, (c) destroying eggs of insect pests, and (d) controlling weeds by sun drying. The surface tilling

during other seasons forms natural mulch and thereby reduces evaporation loss of water from soil.

3.3.1.5.1.8Water harvesting

Water harvesting is a technology of utilizing the collected and conserved water for the purpose of harvest production. It includes tillage practices for an efficient use of moisture between and within the harvest rows. Frequent stirring of the land by surface tilling provides mulch and prevents the evaporation loss of water from the soil.

Besides harvesting moisture from between and within the harvest rows, run off losses are considerably reduced. The store water is used for providing life sowing irrigation to the harvests grown in the surrounding areas. The water harvesting of this type can be done in areas situated near hill and on greatly undulated lands. In these cases, check dam tanks, and other reservoirs are constructed. The infiltration or percolation loss of water is prevented by spraying of asphalt compounds or by covering the bottom of the tanks or ponds through thin plastic sheets. The seepage loss may also be checked by providing a plastic lining. The evaporation loss of water is controlled by pouring some burnt crude oil over water surface.

On a highly eroded soil or soils having very high slopes, terraces are made for providing a gentle flow of run off water so that the soil is not further eroded and some harvest may be grown on these terraces.

3.3.1.5.1.9**Physiological approaches**

Hardly 1 % of the water absorbed by the plant roots is used for the growth and development of plants and remaining 99% is wasted through transpiration back to atmosphere. Thus one of the greatest causes of soil water wastage is loss of water through transpiration.

The extent of transpiration can be greatly influenced by using certain chemicals. These chemicals reduce transpiration, encourage root growth and protect the cytoplasmic proteins of the plants. These chemicals bring about more drought resistance in the plants. These compounds, according to their role, are classified as given below.

3.3.1.5.1.9.1Anti-transpirants

Any chemical substance, which reduces rate of transpiration on its application to the plant surface, is called anti-transpirant. Any j substance which reduces the vapour pressure gradient in

the stomatal cavity or increases stomatal resistance to water vapour diffusion, will act as anti-transpirant These substances have been used for arresting water loss from plant body with various degree of success. These are Phenylmercuric Acetate (PMA), Hydroxy Sulphonates (HS), Alkenyl Succinic Acid (ASA), Adol:-52 (a formulation of alcohol), and S-600 (a plastic transplanting spray).

3.3.1.5.1.9.2Chemicals for improved cell membrane permeability of water

Dry fanning areas are characterized by scarce rainfall and usually the roots have lipid layers which lower the absorption of water from the roots. Some chemicals like Alkenyl Succinic Acid (ASA) and Decenyl Succinic Acid (DSA), when applied, penetrate into the root and increase its water absorption power 8 times. Therefore, these chemicals are applied in the root zone for increased water absorption along with some chemicals to retard the transpiration from foliage.

3.3.1.5.1.9.3 Use of plant hormones and growth retardants

Some plant hormones like Indole acetic acid (IAA) and Abscissic acid (ABA) may be used for reducing the frequency and period of stomatal opening thereby minimizing the water loss from the plant body.

There are certain other chemicals known as growth retardants which either modify the plant structure or dwarf the plants by considerably reducing the total water requirement of the plants. The most important chemical of this group is cycocel or CCC (2- chlorocthyl trichloromethyl ammonium chloride). This chemical t\ also induces moisture stress tolerance in plants. Cycocel is presently used in cotton to encourage production of more fruiting branches (sympodial rather than monopodial or vegetative branches) and , Ii thereby even under drought condition it results in higher yield. In case of wheat, the use of Cycocel decreases the cell size and increases the density of the cytoplasm which ultimately results into a drought resistance into the plants.

3.3.1.5.1.9.4Use of chemicals

There are certain chemicals which are used for seed treatment to bring about drought resistance in plants right from seedling stage. Soaking of seeds in calcium chloride solution (0.25%) for 20 hours soaking of seeds with frequent shaking results in better germination and drought resistance in the plants.

Boron solution is also used for soaking seeds. Agrosan is a fungicide but also induces drought resistance in the plants when seeds are treated with this chemical.

3.3.1.5.1.10 **Genetic approaches**

Because of insufficient and unreliable rains the farmers of dry farming areas are still practicing harvest husbandry on the basis of traditional approaches like low intensity harvestping, little or no use of fertilizers or manures, raising low value harvests. Harvest varieties grown till the recent past were generally of long duration and slow growing. It, They were poor yielders too.

As nearly 70% of our total farm land is rainfed and 45% -of rainfed area is dryland, there is no way out but to evolve suitable varieties as well as appropriate technology for getting the most from our rainfed or dryland areas. As such, the concerted efforts of our plant breeders have resulted in the cultivation of several new plant types which possess all the characters needed for rainfed areas or dry lands. In terms of modem technology, such plant materials are called "Ideo types". These are the suitable strains of dry land harvests which are characterized by short growth duration, effective and extensive root method , drought tolerance, high yield potential having altered morphology of plants which are conducive to dry lands.

According to breeders, an ideal 'Ideo type" should have following qualities to give desired results in dry farming:

i. Early in growth duration and early vigour.
ii. Deeper root method with maximum branching at deeper zones.
iii. Dwarf plant types with lesser number of erect leaves.
iv. Moderate tillering; as profuse tillering causes competition. v. Good expression of ear heads even at higher planting density.
vi. Resistance to diseases.
vii. Bolder grains with moderate dormancy in them.
viii. Effective photosynthetic behaviour with greater sink capacity.

3.3.1.5.1.11**Agronomic approaches**

The major purpose of dry farn1ingprogramme is to conserve the soil and moisture and to achieve maximum production from the dry farn1ing areas. In the past two decades, we have been able to' solve many hurdles in the aforesaid areas but there had been no break through as in case of irrigated harvest production. Now we have the promising harvest varieties and technology available with us about the maximum soil and water conservation.

The agronomic approaches can be dealt with under the following four heads based on land types.

3.3.1.5.1.11.1Agronomic approaches for highly undulating lands

These lands are confined to the hills of the locations which have suffered serious soil erosion problems and have been divided into various gullies. The soils of these areas are more prone to further erosion if they are not properly managed. Therefore, in this category, the harvest management practices are entirely different from other areas. The object of soil and harvest management under such situation should be :

a. to stabilize the soil by forestry and pasture management with a regulated grazing or no grazing at all.
b. to level the land gradually through contour bunding, terracing, etc.
c. to practise strip harvestping and pitcher farn1ing.

3.3.1.5.1.11.2Agronomical approaches for marginal lands

Generally, marginal lands are very poor in fertility. The harvest management in these lands is carried out in lines of harvest management for leveled lands or flat lands which will be discussed later in this chapter.

3.3.1.5.1.11.3 Agronomical approaches for diara lands

Diara lands are located on either side of rivers or between two rivers and are often flooded by these rivers. These diara lands are formed due to flood and may have deposition of fine to coarse sands.

These areas often lack irrigation and need a careful harvest management. Since the land of this areas is highly susceptible to floods, kharif harvestping is practically impossible. But certain fodder harvests can easily be grown soon after the onset of monsoon and harvested depending upon position of floods. The harvesting or cutting of harvests is started from close to the river beds and as the water spreads the harvesting is also advanced. The life saving irrigations can be given by lifting water from the river or by drilling cavity wells or bam boo borings. However, in most of the cases these wells go out of order after a flood occurs. Therefore, the cavity wells or bamboo borings are made at a distant location from river stream.

3.3.1.5.1.11.4 Agronomical approaches for plain lands

Plain lands form the main dry land tracts of the country. There has been major emphasis on finding out ways and means through which the total soil productivity could be increased. Following recommendations should be followed on plain lands for an improved harvest productivity and an efficient soil and water conservation.

3.3.1.5.1.11.4.1Tillage requirements of the harvests

Tillage starts with the seed red preparation and ends with mulching and control of weeds. Deep ploughing during summer helps in destroying weeds and suppressing insect pests and diseases. It also helps in an efficient root penetration very deep into soil Placement of seed at 5 cm and fertilizers at 7.5 cm in the same furrow followed by soil compaction have resulted in better germination, plant vigour, extensive root development and higher harvest yields.

3.3.1.5.1.11.4.2Selection or harvests and varieties

There are a number of improved varieties of different harvests which are drought tolerant or resistant to water stress. The most commonly grown harvests in dry lands are rice, maize, sorghum, pearl millet. finger millet, wheat, barley, pulses, oilseeds, etc. The improved varieties of these harvests have already been described area-wise.

3.3.1.5.1.11.4.3Sowing or harvests

Sowing of harvests deals with several associated factors namely sowing time, method of sowing, depth of sowing etc. It is important in the sense that once the ideal plant population is achieved. the harvest is bound to give yield.

Sowing time can markedly influence the production and productivity of dry land harvests. Early sowing of kharif harvests results in early harvest maturity and thereby it facilitates early sowing of succeeding rabi harvests. Early sowing of rabi harvests helps in overcoming the moisture stress at later stages of plant growth, particularly at grain filling stage.

Broadcasting of seeds should be avoided as it involves several losses and seed does not properly come in contact with moisture. Placing the seeds at about 5 cm depth through pora or seed drill is desirable.

To get an ideal plant population it is necessary that about 25% higher than required seed rate should be applied. Care must be taken to reduce plant competition for moisture by removing excess plant population about 2-3 weeks after the sowing depending upon the

harvests.

3.3.1.5.1.12Fertilizer management

Use of fertilizers in dry lands is limited as compared to irrigated areas. Today we use on 'an average only 60kg/ha fertilizers in dry fanning areas as against 60 kg/ha national average. Reasons for application of fertilizers in dry fanning are as follows:

i. poor response because of faulty method of application;

ii. poor financial condition of fanners to purchase fertilizer;

ill. wrong concept of the fanners that fertilizers will burn the seedlings, and harm to the soil; and

iv. application of organic manure only, which cannot meet the total nutrient requirement of the harvest.

There are different Schools of thoughts about the application of fertilizers in the dry lands. Some people think that application of fertilizers in dry lands results in a better harvest yield than that in irrigated areas because in the latter case the soil becomes very poor in residual fertility due to high intensity of harvestping, whereas, the dry lands still preserve nutrients as they are not depleted badly due to low harvestping intensity. Some people think that fertilizer application in dry lands aggravates the moisture problem, but truly speaking deep placement of fertilizers followed by foliar application results in extensive rooting up to deeper soil layers where the plants extract moisture to meet their demands.

Spreading of fertilizers at the surface or applying them at the seed layer is not so beneficial. Therefore, a careful and judicious fertilizer scheduling is a must frr achieving higher and better harvest productivity in dry lands. Use of organic manures is always desirable but they alone are not enough as-they can not supply nutrients at the required speed and dose. Therefore, atleast half of the nutrient requirement of the harvest must be met by readily available source of nutrient i.e. fertilizers. This also improves water use efficiency.

Following points should be considered to improve the fertility status of dry lands.

-Green manuring should be practised in kharif season.

-Inclusion of a legume harvest in rotation adds about 20-25 kg of nitrogen per hectare, reduces cost of fertilization and increases harvest productivity.

-Inoculation of legumes through Rhizobium culture and nonlegumes with Azotobactor adds about 30-35 kg of nitrogen per hectare.

-Foliar application of urea having lowest biuret content along with micro-nutrient fertilizers like zinc sulphate will increase grain yields in dry farming.
-Growing forage legumes in rotation with pearl millet in kharif season will provide a better condition for rabi harvest.

Therefore, proper fertilizer scheduling will help the farmers to induce drought tolerance/resistance in the harvests and provide - higher yields.

3.3.1.5.1.13 ropping method s

Harvestping method refers to an arrangement in which various harvests are grown together in the same field. The harvestping method s followed in dry lands differ from those followed under normal conditions. Only those harvests can be grown under dry land conditions which require less water to complete their life cycle or which can stand or yield under drought conditions. This can include both drought resistant and drought tolerant plants. In addition, plants can be grown only where some water is available to sustain the growth of plants. Following are a few interharvestping method s for dryland areas:

Moong + Bajra
Guar + Bajra
Til + Guar/moth/mung

Mixed harvestping is also followed to minimize the effect of unpredictability of rain. Mixed harvestping may have low yield potential but it works as a buffer against failure under possible unfavourable conditions. Mixed harvestping may be defined as sowing of two or more harvests simultaneously on the same piece of land in separate rows. Examples: Guar + Arhar + Moong, Bajra + Arhar + Moong and Maize + Urd etc.

3.3.1.5.1.14 Harvestping pattern

Harvestping pattern is defined as sequence of growing harvests in a particular field at a particular period.

3.3.1.5.1.15Weed control

Presence of weeds in the harvest field, especially in case of dry lands, cause a severe harvest weed competition for water, nutrients and light The reduction in yield due to weeds varies from 30-75% depending upon the harvest and nature and extent of weed infestation. Weeds may be

controlled by hand weeding, intercultural operations and herbicidal application or by adopting an integrated approach.

3.3.1.5.1.16Plant protection measures

In light textured soils of arid and semi arid regions termites and white grubs cause extensive damage to emerging seedlings and also to grown up plants. Use of BHC 10% dust@ 25-30 kg or Aldrin 5% dust@ 10-15 k/ha, in the soil and incorporating it well into the soil at the time of the last ploughing will control termites. The white grubs may be controlled by drilling of Thimet 200 granules @ 15 k/ha along with seeds.

Aphids in mustard are very destructive, therefore, they are controlled by spraying 0.2% Metasystox or Dimecron. Similarly, the pod borers in pulses are controlled by spraying 0.05% Endosulfon.

The viral diseases of pulses should be controlled by seed treatment and spray of some fungicides to kill the insect vectors.

3.3.1.6**Agro-forestry and Dryland Agriculture**

Agroforestry is the cultivation of trees in association with harvests. It has assumed a great importance in order to solve a number of problems of dryland farmers. The twin objectives of Agroforestry are to increase the farmers earnings and sustain the ecological! Environmental balance. Agroforestry, as it provides fuel wood to the fanners, enables them to save the animal dung and use it as manure. The following points should be considered while choosing trees for cultivation in association with harvests:

-The tree should grow fast and stand repeated prunings.
-Its roots should explore soil layers not tapped by farmharvests.
-The crown should not be too large to prevent sun light from reaching the harvest.
-The peak period of flush and leaf faII should not be detrimental to the harvest grown in association.
-As far as possible, the tree species should be a legume, the root nodules of which accommodate nitrogen manufacturing bacteria.
-The branching should be sparse and light.
-The tree should meet the socio-economic and ecological needs of the region.

Some agro-forestry combinations are given for the main dry fanning areas of the country. Trees suitable for growing in association with harvests in different dry land regions are given below:

3.3.1.6.1 For northwestern arid and semi arid zones

Prosopis cineraria (khejri), Zizyphus mauriliana (jujube), Acacia IOrlilis(israely babool),Leucaena leucocephala (su-babool), Acacia auriculiformis.

3.3.1.6.2 For Central arid Vindhyan zone

Acacia nilolica var. cuprissiformis, Punica granalwn (anar) .Kinnow (citrus), Psydiwn guajava (guava).

3.3.1.6.3 South Eastern regions 1

Acacia albida, Acacia ferruginea, Prosopis cineraria, Leucaena leucocephala.

3.3.1.6.4 Himalayan regions

Alnus neplensis (utis), Sehima wallichianum, Citrus species, Sesbania sesban, Prosopsis juliflora

3.3.1.7 Recommendations for Dry Farming Areas

The research programs of all India coordinated research projects for dry land farming have concluded into certain recommendations to the farmers of dry land areas which are described below.

1. Bounding across the slope and leveling the land should be done before the onset of monsoon.
2. Deep summer ploughing should be followed by surface tillage during monsoon months and also rest of the year.
3. Application of organic manures like FYM compost. Etc. @ 15-20 tonnes/ha or green manuring should be done. These manures should be applied about 20-25 days before sowing and should be well mixed in the soil.
4. Fertilizers should be basal placed at a depth of7. 5 to 10cm in the soil and the seeds should be sown in the same furrows about 3 cm. Above the fertilizers. This is important especially during winter season. The nitrogen (20-50% of total) should be top dressed by side or band placement method at about 10- 15 cm apart. The harvest rows should be done soon after the rains but if there is not sufficient moisture in the soil, the nitrogen should betrayed over the foliage with a urea solution containing 3-5% nitrogen.

5. Soil application of BHC (10%) dust @ 25-30 kg/ha for termites and Thimet 20 G @ 15 kg/ha for white grub should be done. These chemicals must be mixed with soil properly while ploughing or at the time of sowing.

6. Selection of suitable harvests and their varieties should be done, according to their suitability to a particular region/micro climate.

7. Seeds must be treated with a suitable fungicide and that of legume with Rhizobium culture before sowing. Soaking seeds in plain water for Rabi sowing helps in getting higher gem1ination, better seedling vigor and an early maturity within a weeks time.

8. Proper harvest rotation should be followed which should preferably have at least one legume every year.

9. For better seed soil moisture contact through soil compaction should be done by running a plank or roller especially for Rabiharvest.

10. In the event of total harvest failure during kharif season a suitable catch harvest like Urd (T-9) or Toriaetc.Should be sown.

11. Interharvesting of oil seeds and pulses should be done with jowar, Bajra and maize harvests for the purpose of making best use of soil and inter row moisture harvesting.

12. Line sowing by drilling the seed at a depth of 7. 5 to 10cm or even more depending upon the situation should be practiced because it helps in better seed germination. This also helps in stabilizing the required plant population and thereby getting better yield.

13. Proper weed management practices should be followed by adopting integrated weed control measures.

14. Mulching should be done by providing frequent interculture and pulverizing the soil. If intercultural operations are not possible then use of artificial mulches like covering the
Surface with tree leaves, uprooted weeds, sugarcane leaves, sawdust or polyethylene sheets are used to check the evaporation of water from the soil.

15. Water harvesting between the rows should be done by growing some pulse harvests and run off water should be collected in some nearby located ponds and used as life saving irrigation.

16. An efficient plant protection measure should be adopted to protect the harvest from insect pests and disease damage.

17. The harvest should be harvested at proper physiological maturity so that the following or succeeding harvest may be sown slightly earlier than the scheduled time and best use of rainwater or residual moisture may be made for harvest production.

18. Harvests like cotton, chilies, etc. should be sprayed with CCC or cycocel and groundnut should be sprayed with planofix for modified growth, higher drought resistance and better yield.

3.3.1.8Conclusion

Even after utilizing all the available water resources, about 50% of our culturable area will still depend on rains. Therefore, our farm scientists, policy formulators and farmers should appropriately realize the magnitude of the role that. Rain-fed farming or dry land farming can play. They should thoroughly examine the problems of dry land farming from different viewpoints and evolve appropriate technologies, harvest varieties, etc. For these areas to better the economic position of the farmers. Dry farming areas, therefore, need a much closer attention.

Farmers should utilize well in time whatever improved technology and varieties suitable for dry farming are available. They should be extra careful about the utilization of available rain water, selection of harvests and protection of harvests from different harmful physiological or biological agencies. And only then they can make dry farming as beneficial as irrigated farming itself.

3.3.1.10Challenges and Opportunities in the Drylands

Drylands are inhabited by approximately 2 billion people globally accounting for nearly 40% of the world's population. Approximately 54 million km2 or 40% of the land area of the Earth can be classified as drylands. Asia contains substantial drylands, with 39% of its total land mass, most of the arid, semi-arid categories found in Central Asia and Western China.

Drylands have evolved as a result of the climate, other environmental factors and a long history of human occupation and management. Renewable water resources are limited in the drylands and rainfall is highly variable and unpredictable both spatially and temporally, increasing the risks and uncertainty involved in farm production. This short-term climatic variability is likely to be exacerbated by longer-term climate change. For example, the climate change models predict that West Asia and North America will become hotter and drier with changes in seasonal and spatial distribution of precipitation and increasing incidence and magnitude of extreme weather events (droughts and floods). Populations in the drylands with predominantly rural economies and high dependence on farming will be at most risk as they are highly vulnerable to shifts in seasonal climatic patterns and changes in hydrology cycles.

Drylandfarming, also referred to as rain-fedfarming, is practiced on 84% of the total area cultivated in the world and provides about 67% of the world's total food output. If we don't improve the efficiency of dryland farming, we will potentially face food insecurity for basically

one-third of the world's population. Improving both the productivity and sustainability of rain-fedfarming is a challenging task. Of India's 143 million hectares of land under cultivation around 100 million hectares are under rain-fed cultivation. Of the total farming population, around 70 per cent are involved in dryland farming in India. While greater attention is given to irrigated farming, rain-fedfarming has drawn less attention until very recently.

The Green Revolution had indeed benefited rich farmers who had access to irrigation water, improved seeds and other farm inputs, while contributing the minimum to dryland farmers. Water was a major factor that determined the success of the green revolution. Dryland areas, which had no assured water supply, obviously did not benefit from the green revolution. Bring Green Revolution to the drylands, "the water barrier" has to be removed. Water harvesting provides the opportunity to remove the water barrier. If properly implemented, water harvesting can bring the same prosperity to the millions of rain-fed farmers in the drylands that green revolution brought to irrigated farmers in the 1960s.

3.3.2 Agro-climatic Zoning

3.3.2.1 Introduction

Agro-meteorology, abbreviated from Farm Meteorology and also referred to as Agro-climatology, has been defined in several ways. The name itself implies that it is the study of those aspects of meteorology which have direct relevance to farming. Agrometeorology puts the science of meteorology to the service of farming, in its various forms and facets, to help the sensible use of land, accelerate production of food and to avoid the irreversible abuse of land re-sources.

The task of an agrometeorologist is to apply every relevant meteorological skill to help the farmer to make the most efficient use of his physical environment for improving farm production both in quality and quantity .

3.3.2.2 Climatic Divisions of India

To work out the suitable harvesting plan for field harvests in different agro-climatic regions of the country, it is essential to .Know how the country is divided into homogeneous climatic regions. Subdivisions can be formed on the basis of (a) potential evapo-transpiration, or on the basis of the (b) periodic occurrence of temperature conditions favorable for the growth of annual harvests.

3.3.2.1 Based on potential evapo-transpiration

Under this climate has been classified on the basis of potential evapo-transpiration which represents a climatic index of plant development and a heat index of the agro- climate, soil moisture supply, plant cover and soil management. Among these, first two are of far greater importance than the other factors. According to this classification, the country may be divided into four climatic regions, as detailed in the table

Table 1 : Climatic divisions of India based on Heat Index and moisture supply

Sl.No	Climatic type	Index or potential Evapo-transpiration	Region & State covered
1	Arid	-40 to -60	West Rajasthan
2	Semiarid	-20 to -40	Northern & Eastern Rajasthan, Gujarat, Marathwada, Mysore, Rayalaseema, Punjab, Delhi, Western U.P
3	Sub-humid	-20 to +20	Central U.P, Western & Central M.P, Vidarbha, Eastern U.P, Bihar, Sub-mountain tracts of U.P, H.P., West Bengal and Nilgiri
4	Humid	+20 to 100	Konkan, Kerala, Coastal Madras, Assam, Orissa, West Bengal, Eastern M.P and coastal Andhra Pradesh

Each of these regions are further explained.

3.3.2.1.1 **Arid region**

In the arid region, the rainfall is below 30 cm and fluctuation in rainfall is of the order of -49 per cent. One in every five is extremely lean years and one in five has an abundance of rainfall. In other years the precipitation approaches normal but the distribution of rainfall is extremely uncertain even in the rainy season. Drought resistant types of harvests like jowar, Bajra etc. Are grown during the monsoon season. Production of harvest is extremely precarious. A good harvest may be expected once in five years, the rest is usually below normal.

Climatically, the area is more suitable for production of livestock than for cultivation of harvests. It is presumed that by adaptation of better standards of livestock feeding and improving cattle management practices, greater return can be achieved. This will require the introduction of improved methods of grassland management and readjustment of cultivation of harvests supplementary to livestock production which will result in a more stable form of land use than hitherto.

3.3.2.1.2 **Semiarid zone**

This is the dry farming region of the country and roughly covers an area of 77 million acres. Except in the Punjab and Western Uttar Pradesh, there are large scale irrigation projects to provide protective irrigation to the harvests. The cultivated harvests elsewhere have to depend largely upon the erratic monsoon rains which occur within the specified periods. As the coefficient of variation of rainfall is 15-25%, there occur wide variations in the yield of harvests grown under irrigated conditions. The important harvests grown in this region are millets, Ragi, cotton, groundnut, castor and linseed. Evolving drought resistant strains of harvests are the most fruitful line of research. The introduction of such strains obtaining maximum population, efficient use of soil moisture and application of fertilizers is important for increased harvest production.,

3.3.2.1.3 **Sub-humid zone**

This climatic complex consists of temperate sub-tropical conditions. The region is important for the production of wheat, rice, sugarcane, jowar, arhar, maize and mustard. This region is potentially very productive. Rains may occur often. The coefficient of variation of rainfall is less than -20 per cent. By proper management of land, water and harvesting the yields can be appreciably stepped up. Introduction of short duration varieties of harvest, application of organic manures to increase moisture holding capacity of the soil and judicial application of fertilizers and proper management of land are essential to increase harvest production in these regions.

3.3.2.1.4 **Humid zone**

This represents conditions of tropical harvest cultivation which mostly cover hot humid conditions. Due to heavy rain- fall the soils are either neutral or acidic in nature. In southern India, humid zone receives more than 80 inches of annual rainfall. The coefficient of variation of rainfall is less than 15 per cent. The conditions for harvest production are more stable in this region than in the previous three zones. The principal harvest of this region is rice. One, two or three harvests of rice per year are commonly taken in this region. The subsidiary harvests are

sugar cane and pulses. It is a region of plantation harvests. This region should have long duration varieties of rice, long staple cotton and sugarcane. Priority is given to plantation harvests.

3.3.2.2 Based on periodic climate change

The second method of classifying climatic regions is based on harvest growing season. This classification is based on the periodic occurrence of temperature conditions favorable for the growth of annual harvests. The relative lengths of the growing seasons are indicated by the Roman Numerals I to IV. Capital letters A, B and C are used to indicate warm, moderate and cool temperate climates. The growing season climates are classified progressively from the longest to the shortest and from the warmest to the coolest.

3.3.2.2.1 **Class I: Year-long growing season climate**

The average monthly temperature is 20°C or above and the average monthly minimum temperature is at least 2°C during the entire year.

Location

The whole India, except the northern portion of Himachal Pradesh, Uttar Pradesh, Punjab, Jammu and Kashmir comes under class I. Class I is further sub-divided into class IA, IB, and IC.

Class I A

Average monthly temperature 25.5°C or above for at least 8 months in a year. Average monthly minimum temperature 9°C, or above year long.

Harvest adaptation

Warm weather harvests capable of growing in high temperature, such as sugar cane, sweet potatoes, rice, Bhindi and sorghums are grown in this class.

Class I B

The average monthly temperature in IB is 18°C or above for at least 8 months, and average monthly minimum temperature 9^{o}C or above year long.

Harvest adaptation

Nearly all warm and moderate temperature harvests and many cool season harvests capable of growing in moderate warm climates, such as onions, beets, carrots and small grains are grown under this climate.

Class I C

The average monthly temperature in this region ranges from 15.5 -22°C and average monthly minimum temperature $9^{o}C$ or above for at least 2 months.

Harvest adaptation

Moderate and cool temperature harvests such as green beans, summer squash, onions, beets, potatoes, carrots, celery, cabbage, lettuce and small grains.

3.3.2.2.2 **Class II: Three quarter year growing season climate**

In this region at least eight months with average monthly temperature 10°C growing season is available.

Location

Lower Valley of Himachal Pradesh, part of Uttar Pradesh, Punjab and Jammu & Kashmir fall under class 11.

Class II A

In class II. A the average monthly temperature is $25.5^{o}C$ or above for atleast 2 months, and average minimum monthly temperature $9^{o}C$ or above for at least 4 months.

Harvest adaptation

Warm and moderate temperature harvests such as corn, rice, cotton and fruit harvests are more suitable for this region.

Class II B

The average monthly temperature in class II. B in 18.3^{o}C or above and average monthly minimum temperature 8.8^{o}C or above for at least 4 months.

Harvest adaptation

Warm and moderate temperature harvests such as cotton, corn, rice, sweet potatoes, melons and tobacco with small grains in season are generally cultivated.

Class II C

The average monthly temperature is l5. 5^{o} C or above and the average monthly minimum temperature 8.8^{OC} or above for at least 2 months.

Harvest adaptation

Moderate and cool temperature harvests such as green beans, summer squash, cucumbers, onions, celery, peas, cabbage, potatoes and lettuce are suited to this region.

3. Class IlI : One-half year growing season climate

Five months or more with average monthly temperature 10°C or above and the average monthly minimum temperature of at least 2°C is prevalent in this region.

Location

Extreme north of Himachal Pradesh, Kulu valley, parts of Punjab and North of Jammu & Kashmir fall under this class III.

Class IlI A

The average monthly temperature in class III B is 25.5°C or above for at least one month, and average monthly minimum temperature 8.8°C or above for at least 3 months.

Harvest adaptation

Warm weather, harvests such as sorghum, sweet potatoes and melons, moderate temperature harvests which resist high temperatures such as corn, soya beans, and small grains can be planted.

Class III B

The average monthly temperature range from 15.5°C to 22.2°C and average monthly minimum temperature 8.8°C for at least 3 months.

Harvest adaptation

Moderate temperature harvests such as corn, soya beans, tomatoes, squash cucumbers and cantaloupes also small grains in season are cultivated.

Class III C

The average monthly temperature ranges from 15.5°C to 22.2°C and the average monthly minimum temperature at least 8.8°C for 2 months or more.

Harvest adaptation

Moderate and cool temperature harvests such as dry beans, summer squash, cucumbers, canning and fodder corn, peas, beets, onions, celery, potatoes and small grains are planted.

Class IV : One-third year growing season climate:
At least 2.5 months with average temperature 10°C or above and average monthly minimum temperature at least 1.6° centigrade.

Location

No portion of cultivated area is normally covered by class IV.

Class IV A

The average monthly temperature is 15.5°C or above and the average monthly minimum temperature at least 8.8°C for at least 2 months.

Harvest adaptation

Short season moderate and cool temperature harvests such as green beans, early sweet corn, summer squash, cucumbers, beets, potatoes, cabbage and small grains are cultivated.

5. Class V: Non farm climate

This region has less than 2.5 months with an average temperature of 10°C or above and average monthly temperatures of 1.6°C or above.

Location

Himalayan region, above the sea level at 9000 feet fall under class V.

Harvest adaptation

The land under this class are not generally suitable for cultivatingharvests, although some economic returns may be secured from forage, hay, wildlife or forest products.

3.3.2.3. List of Agro-climatic Zones of India

The Planning Commission, as a result of midterm appraisal of the planning targets of the VII plan (1985-1990) divided the country into 15 broad agro-climatic zones based on physiography and climate. They are:

1. Western Himalayan Region,
2. Eastern Himalayan Region,
3. Lower Gangetic Plains Region
4. Middle Gangetic Plains Region,
5. Upper Gangetic Plains Region,
6. Trans Gangetic Plains Region,
7. Eastern Plateau and Hills Region,
8. Central Plateau and Hills Region,

9. Western Plateau and Hills Region,
10. Southern Plateau and Hills Region,
11. East Coast Plains and Hills Region,
12. West Coast Plains and Hills Region,
13. Gujarat Plains and Hills Region,
14. Western Dry Region,
15. The Island Region

The State Farm universities were advised to divide each zone/state into sub-zones, under the National Farm Research Project (NARP). Accordingly a 127 subzone map, based primarily on rainfall, existing harvesting pattern and administrative units was prepared.

3.3.2.4Conclusion

Indian sub-continent falls under a wide variety of agro-climatic regions. At the same time identification (the agro - climatic region is done based on a number of climatic parameters. Among them sunshine and moisture content are the most important. Hence we have agro-climatic regions based on the combined effect of the intensity of heat and the humidity which is expressed as potential evapo-transpiration rate. The drier the area greater will be the evapo-transpiration rate. The higher the humidity lesser will be evapo transpiration. The growth and development of harvests are seriously affected by the rate of evapo-transpiration of a place and hence it forms a basis for the classification of agro-climatic regions in arid zone, semi arid zone, sub humid and humid zone.

The duration of the growing season is another parameter that is closely related to agro-climatic consideration. Of course growing season too is related to the temperature, light and the moisture availability. As we all know plants require an optimum range of temperature, duration of light and moisture. The duration of the growing period will last as long as that temperature and light intensity range. So we have a full year growing season, three fourth the year, half the year one third of the year and non farm growing seasons.

3.4**Land Utilization and Harvesting Pattern**

3.4.1 Land Use Pattern of India

Land use pattern in India relates to the physical characteristics of land, the institutional and other resources framework like labour, capital available. All these aspects are associated with the economic development. India has a total land area of approximately 328 million hectares. Mostly, land utilization statistics are obtainable for almost 93 % of the entire area that is around 306 million hectares. It is considerable to note that every forefather over the past 8,000 years or so have been successful in harboring nearly 140 million hectares of land from the natural ecomethod to farming. From the time of independence, people have been successful to add another 22 million hectares. As a result, 162 million hectares of land excel as the net sown area at present. It forms a stupendous percentage of as high as 51%. No other large country is as fortunate as India in this regard.

3.4.2 Reporting and Non-Reporting Land

The land for which the data on classification of land-use is available is known as Reporting Land. In some cases the reporting land is that land, where the land use pattern figures are supported on land records and are based on village records or papers. These records are preserved by the village revenue agency and here the data are completely based on details of entire areas. In cases, where the records are not preserved, the estimates are mostly based on a sample survey. Thus, the statistics of land use pattern are based on these two methods. On the other hand, the lands where no data are available are known as Non-Reporting Lands.

3.4.3 Uncultivated Land

According to the available land use statistics, there has been a slight increase in the net sown area. Almost 28 million hectares have been added over the passing few decades. Around 1.3 % of the land is under fruit trees. Nearly 5 % of the land fall in the category of uncultivated land which is cultivated once every 2 to 3 years. Thus, near about 51% of the whole area, on an average, is cultivated once a year. The uncultivated lands are subsidiary lands and are kept so to re-establish their richness. Its use depends upon high-quality and timely rains also.

3.4.4 Pastures and other Grazing Lands

The area separated as cultivable waste, has remained stationary at around 6.4 % for several decades. The land under permanent pastures is despondently low and suggests a remarkable population pressure on the land. Also, credit must be confirmed on the farmers that with so modest land under pastures, they have the biggest number of cattle. They are nurtured mainly on the husk, grain chaff, farm waste and few fodder harvests. This is definitely the most economical

way to have a larger number of drought animals and bovine cattle. Areas that have been classed under forests are also used for cattle grazing.

Forested land in India is far less in scientific norm. For a self-sufficient economy and accurate ecological steadiness, at least one third of the total land area must be kept under forests and natural vegetation. In India, it is as low as 19.27%. Photographic proof, gained from satellites has confirmed that only about 46 million hectares come under real forests, as opposed to the estimated 63 million hectares, according to the figures of land use pattern. However, this outline establishes a tiny rise from 40 million hectares.

3.4.5 Forest Lands

It is important for the populace to ensure that they increase the area under forests for reasons more than one. A bigger area under forests is an obligation, to maintain the ecological balance and for absorption of carbon dioxide, the assemblage of which is likely to heighten the greenhouse effect. This in turn would raise atmospheric temperature at the global stage. It may lead to thawing of ice caps and equivalent rise in sea level, jeopardizing low-lying densely populated parts of the world. Forests supply home to wildlife and help their continuation. They help in enhancing the level of rainfall, minimizing cases of famine. Forested lands also help in permeation of rainwater in the subsoil and modulating the flow of river waters in both rainy and dry seasons. Forests safeguard not only water but soil as well. They, thus, help in plunging the volume of floodwaters and their ferocity.

3.4.6 Wasteland

A part of the land that is not utilized for the moment is classified as wasteland. This embraces the baked and rocky deserts. High mountainous and uneven lands also fall into this category. At times humankind has also been responsible to add to such areas of deforestation and overgrazing.

3.4.7 Measures for proper Land Use

The mounting population and advanced standards of living have resulted in an ever increasing demand for residential land, both in villages and towns. Cities and towns are obligated to grow vertically rather than horizontally. Land is needed to develop industry, commerce, transport and recreational facilities. In view of mounting pressure on land for numerous purposes, it is customary to plan appropriate use of all the obtainable land. This may be done by following fitting measures to control soil erosion, desertification etc. Which turns cultivatable land into wildernesses. In addition, some of the barrens may be brought around for different uses. Likewise, with the help of up-to-date and scientific methods of farming, productivity of land can

also be amplified. All endeavors should be made to strike a balance amongst diverse use of land.

In India the capacity for expansion of cultivation to further new areas is very restricted. As of now, 49% of the entire reporting land are cultured. Fallow and other wastelands, including grazing pastures, which are not currently cultivated, is presumed around 42 million hectares, and further expansion of cultivation of such lands would be expensive as progress should be made on irrigation and water and soil conservation.

In the dynamic context, keeping in view the natural endowments and the recent advances in technology, the overall interests of a country may dictate a certain modification of or a change in the existing land-use pattern of a region. A proper study of the present land-use patterns and the developing trends will help to suggest the scope for planned shift in the patterns in India.

3.5**Land use and ownership**

Out of 304 million hectares of land in India for which records are available, roughly 40 million hectares are considered unfit for vegetation as they are either in urban areas, occupied by roads and rivers, or under permanent snow, rock or desert.

Of the remaining 264 million hectares of land that have some potential for vegetation, 142 million hectares are cultivated, 67 million hectares are classified as forestland, and 55 million hectares as fallow or wasteland, or land with pastures or groves.

In percentage terms, according to World Bank estimates:

- Cultivable land amounts to around 58% of land that has potential for vegetation.
- 22% are forestland.
- 7% are uncultivated (revenue) ‘wasteland’.
- 7% are rocky, barren land.
- 7% is urban/non-farm land.

Roughly 20% of the total land area are ‘commons’, which includes both cultivable and uncultivable wasteland and some forest land.

The Central Statistical Organization puts the percentage distribution of the country’s total land area of land use (1992-93 figures) as follows:

- Forests: 22.2%
- Land not available for cultivation: 13.3%
- Permanent pastures and other grazing land: 3.3%
- Land under tree harvests included in net area sown: 1.2%
- Cultivable waste land: 5.1%
- Fallow land: 8.2%
- Net area sown: 46.3%
- Area sown more than once as percentage of net sown: 25.7%

3.5 .1**Land ownership in India**

During the two centuries of British rule, India's traditional land ownership and land use patterns were changed. The concept of private property was introduced, de-legitimizing community ownership methods in tribal societies.

The British introduced the 'zamindari' or 'permanent settlement method ' in 1793, whereby feudal lords became owners of large tracts of land against fixed revenue payments to the government. Farmers became tenant farmers and had to pay rent. This method prevailed in most of northern India.

In the south and west, the 'Riyatwari method ' was followed. Individual farmers (ryots or raiyats) were proprietors of land against revenue payments, with rights to sub-let, mortgage and transfer land.

A third method under British rule was the 'mahalwarimethod ' whereby entire villages had to pay revenue, with farmers contributing their share in proportion to their holdings.

Land distribution under these methods became extremely unequal, and rural society got polarized into zamindars and rich farmers versus tenants and farmlaborers.

The land transfer was institutionalized under British rule and financiers secured land against loans. Combined with high revenue rates, this led to growing indebtedness, dispossession of land, rising tenancy, and a widening of the earnings gap between rich zamindars and poor tenants and farmlaborers. By Independence, about 40% of India's rural population was working as landless farm labour.

Thus India has inherited a semi-feudal method of land distribution that followed the social hierarchy. Most landowners belong to the upper castes and farmers to the middle castes; farm labourers are largely Dalits and adivasis.

After Independence, India brought in legislation for land reform that included:

- Abolition of the zamindarimethod .
- Abolition of intermediaries.
- Protection to tenants.
- Rationalization of different tenure methods.
- Imposition of ceilings on land holdings.

However, the legislation did not lead to substantial progress towards equitable land distribution. Most studies in fact show that inequalities have increased rather than decreased. The number of landless in India has progressively increased.

Landholding distribution too has become skewed. According to government data compiled from sources such as the All India Report on Agriculture Census 1991-2000, in 1995-96:

- 1.2% of landholdings in the country accounted for 14.8% of the total operational holdings with large holdings of 10 hectares and above (average holding: 17.21 hectares).
- 6.1% of holdings accounted for 25.3% of the total operational holdings with medium holdings of 4 to 10 hectares (average holding: 5.8 hectares).
- 12.3% of holdings accounted for 23.8% of the total operational holdings with semi-medium holdings of 2 to 4 hectares (average holding: 2.73 hectares).
- 18.7% of holdings accounted for 19.8% of the total operational holdings with holdings of 1 to 2 hectares (average holding: 1.42 hectares).

As many as 61.2% of holdings accounted for only 17.2% of the total operational holdings. On average, the size of these marginal holdings was 0.4 hectares.

3.5 .2**Landless labour**

According to the India Rural Development Report of 1992, 43% of the country's rural population were absolutely or near landless. Landless farm labour makes up almost half of those living below the poverty line in rural India.

A majority of the economically and socially weaker sections of society, such as scheduled castes and tribes, Dalits, adivasis and women, make up the majority of landless population working as labor.

Landlessness has been steadily rising among the scheduled castes and scheduled tribes. According to a government Rural Labour Inquiry report, the percentage of landless households among scheduled castes increased from 56.8% in 1977-98 to 61.5% in 1983, while among adivasis it increased from 48.5% in 1977-78 to 49.4% in 1983.

Even among those who own land, a majority own marginal plot that provides them little or no food security. The government describes such marginal landowners as 'mere landless' (those who own less than 0.002 hectares) and 'near landless' (those who own between 0.002 and 0.2 hectares).

3.5 .3THE PRESENT HARVESTPING PATTERNS

As indicated earlier in this chapter, we can hardly describe all the harvesting patterns within the framework of this chapter. Therefore only important ones are highlighted. There are many ways in which a harvesting pattern can be discussed.

A broad picture of the major harvesting patterns in India can be presented by taking the major harvests into consideration. To begin with, the southwesterly monsoon harvests (kharif), Bajra, maize, Ragi, groundnut and cotton. Among the post-monsoon harvests (Rabi), wheat, sorghum (Rabi) and gram can also be considered to be the base harvests for describing the harvesting patterns. With such an approach, the harvest occupying the highest percentage of the sown area of the region is taken as the base harvest and all other possible alternative harvests which are sown in the region either as substitutes of the base harvest in the same season or as the harvests which fit in the rotation in the subsequent season, are considered in the pattern. Also these harvests have been identified as associating themselves with a particular type of agroclimate, and certain other minor harvests with similar requirements are grouped in one category. For example, wheat, barley and oats, are taken as one category. Similarly the minor millets (Paspalum, Setaria and Panicum spp.) Are grouped with sorghum or Bajra. Certain other harvests, such as the plantation harvests and other industrial harvests are discussed separately.

3.5 .4THE KHARIF-SEASON HARVESTPING PATTERNS

Among the kharifharvests, rice, jowar, Bajra, maize, groundnut and cotton are the prominent harvests to be considered the base harvests for describing the kharifharvesting patterns.

3.5 .4.1The rice-based harvesting patterns

Rice is grown in the high-rainfall area or in areas where supplemental irrigation is available to ensure good yields. If the harvest has to depend solely on rainfall, it requires not less than 30 cm per month of rainfall over the entire growing period. However, only 9 per cent of the area in the country comes under this category, and it lies in the eastern parts. Nearly 45 percent of the total rice area in India receives 30 cm per month of rainfall during at least two months (July and August) of the southwesterly monsoon and much less during other months. In contrast to these parts, the eastern and southern regions comprising Assam, West Bengal, coastal Orissa, coastal Andhra Pradesh, Karnataka (most part), Tamil Nadu and Kerala receive rainfall of 10 to 20 cm per month in four to eight consecutive months, starting earlier or going over later than the southwesterly monsoon months. With supplemental irrigation, 2 or 3 harvests are taken in these areas. However, it has been observed that on an all-India basis, nearly 80% of rice is sown during June-September and the rest during the rest of the season. Areawise the mono-season belt occupies 53.6 per cent of the area (comprising Assam, West Bengal, coastal Orissa, coastal Andhra Pradesh, parts of Tamil Nadu, Karnataka and Kerala).

On an all-India basis, about 30 rice-based harvesting patterns have been identified in different states. In the most humid areas of eastern India comprising Tripura, Manipur and Mizoram, rice are the exclusive harvest. In Meghalaya, rice is alternated with cotton, vegetable and food-harvests, whereas in Arunachal Pradesh, where rice is not grown exclusively, the alternative harvests being maize, small millets and oilseeds. In parts of Assam, West Bengal, Bihar, Orissa and northern coastal districts of Andhra Pradesh, jute forms an important commercial harvest alternative to rice. In West Bengal, besides rice and jute, pulses and maize are grown on a limited scale. In Bihar, rice is grown over 49 per cent (5.3 m ha) of its harvested area (14.2 per cent of all-India area), whereas pulses, wheat, jute, maize, sugarcane and oilseeds are the alternative harvests. In Uttar Pradesh rice is grown on 19 per cent (4.6 m ha) of its harvested area and represents about 12.4 per cent of the all-India are under this harvest. Rice is concentrated in the eastern districts of Uttar Pradesh where the alternative harvests are pulses, groundnut, sugarcane, Bajra and jowar in the decreasing order of their importance. Tobacco is grown in some districts.

In Orissa, rice is grown on more than 50 per cent of the area, whereas the alternative harvests are: pulses, Ragi, oilseeds, maize and small millets. In Madhya Pradesh rice is grown in the

Chattisgarh area on 4.3 m ha (11.7 per cent of the all-India rice area), but the harvest suffers because of inadequate rainfall and irrigation. The important alternative harvests of this area are: small millets, pulses and groundnut. Wheat is also grown on a limited scale.

In the southern states, namely Andhra Pradesh, Tamil Nadu and Kerala rice are grown in more than one season and mostly under irrigation or under sufficient rainfall. Together, these three states have over 6.0 m ha, representing over 17 per cent of the all-India area under rice. Important alternative plantation harvests in Andhra Pradesh are: pulses, groundnut, jowar, maize, sugarcane and tobacco. In Karnataka the harvests alternative to rice are: Ragi, plantation harvests, Bajra, cotton, groundnut, jowar and maize. In Kerala plantation harvests and tapioca form the main plantation harvests alternative to rice. In Maharashtra rice is grown mostly in the Konkan area over 1.3 m ha, along with Ragi, pulses, Rabijowar, sugarcane, groundnuts and oilseeds. In other states, namely Gujarat, Jammu and Kashmir, Rajasthan and Himachal Pradesh, rice form a minor plantation harvest and is mostly grown with irrigation. However, in Punjab and Haryana and to some extent in western Uttar Pradesh owing to the high water - table during this monsoon season, rice has become a major harvest in such areas.

3.5 .4.2The kharif cereals other than rice

Maize, jowar and bajra form the main kharif cereals, whereas ragi and small millets come next and are grown on a limited area. By and large, maize is a harvest grown commonly in high-rainfall areas, or on soils with a better capacity for retaining moisture, but with good drainage. Next comes jowar in the medium rainfall regions whereas Bajra has been the main harvest in areas with low or less dependable rainfall and on light textured soils. The extent of the area under these harvests during the south-westerly monsoon season is maize, 5.6 m ha; jowar (kharif), 11 mha, and bajra,12.4 m ha. Even though these harvests are spread all over the western, northern and southern India, the regions of these harvest patterns are demarcated well to the west of 80^{o} longitude (except that of maize). Ragi as a kharif cereal (2.4 m ha) is mainly concentrated in Karnataka, Tamil Nadu and Andhra Pradesh which account for main than 60 per cent of the total area under this harvest in India. The harvesting patterns based on each of these kharif cereals are discussed.

3.5 .4.3The maize-based harvesting patterns

The largest area under the kharif maize is in Uttar Pradesh (1.4m ha), followed by Bihar (0.96 m ha), Rajasthan (0.78 m ha), Madhya Pradesh (0.58 m ha) and Punjab (0.52 m ha). In four states

namely Gujarat, Jammu and Kashmir, Himachal Pradesh and Andhra Pradesh, the area under maize ranges from 0.24 to 0.28 m ha in each, whereas other states have much less area under it. Taking the rainfall of the maize growing areas under consideration, over 72 per cent of the areas receive 20-30 cm per month of rainfall in at least two months or more during the south west monsoon season.

On the all-India basis, about 12 harvesting patterns has been identified. They have maize as the base harvest. In the maize growing areas of Uttar Pradesh and Bihar, rice in kharif and wheat in rabi are the main alternative harvests. In some areas, Bajra, groundnut, sugarcane, Ragi and pulses are taken as alternative harvests. In Rajasthan maize is grown as an extendedharvest in some areas, whereas in other places, it is replaced by small millets, pulses, groundnut and wheat (Rabi) as alternative harvest. InMadhya Pradesh mainly the kharifgear is replaced by maize, whereas rice and groundnut are also grown to a limited extent. In Punjab maize has groundnut, fodder harvests and wheat (Rabi) as alternative harvests. In other states, e.g. Gujarat, rice, groundnut, cotton and wheat form the alternative harvests in the maize-growing areas of Himachal Pradesh, whereas in Andhra Pradesh, rice, kharif jowar, and oilseeds are grown in these areas.

3.5 .4.4The kharifjowar-based harvesting patterns

The area under the kharifjowar in India is highest in Maharashtra (2.5 m ha), closely followed by Madhya Pradesh (2.3 m ha), whereas in each of the states of Rajasthan, Andhra Pradesh, Karnataka and Gujarat, the area under this harvest is between 1.0 and 1.4 m ha. Jowar is mainly grown where rainfall distribution ranges from 10-20 per month at least for 3 to 4 months of the south-westerly monsoon or is still more abundant.

On the all-India basis, about 17 major harvesting patterns has been identified. In them the base harvestsarekharif. Most of the alternative harvests are also of the type which can be grown under medium rainfall.

In Maharashtra cotton, pulses, groundnut and small millets are sown as alternative harvests. In the adjacent states of Madhya Pradesh, besides the above alternative harvests, wheat and fodder are sown. In Rajasthan wheat, cotton, Bajra and maize are grown in the kharif-Jowar tract, whereas in Andhra Pradesh, groundnuts, cotton, oilseeds and pulses form the main alternative harvests. Besides cotton and groundnut, ragi is sown in the kharif-jowar tarct of Karnataka, whereas in Gujarat, bajra, cotton and groundnut are the major alternative harvests.

3.5 .4.5The Bajra-based harvesting patterns

Bajra is more drought-resistantharvest than several other cereal harvests and is generally preferred in low-rainfall areas and on light soils. The area under the Bajraharvest in India is about 12.4 m ha and Rajasthan (4.6 m ha) shares about the 2/3 total area. Maharashtra, Gujarat and Uttar Pradesh together have over 4.6 m ha, constituting an additional 1/3 area under Bajra, in India. Over 66 percent of this harvest is grown in areas receiving 10-20 cm per month of rainfall, extending over 1 to 4 months of the southwesterly monsoon.

On the all-India basis, about 20 major harvesting patterns have been identified with Bajra. However, it may be observed that jowar and bajra are grown mostly under identical environmental conditions and both have a wide spectrum adaptability in respect of rainfall, temperature and rainfall.

Considering the harvesting patterns in different states, Bajra is grown along with pulses, groundnut, oilseeds and kharifgrower in Rajasthan. Gujarat has a similar harvesting pattern in its Bajra areas, except that cotton and tobacco are also grown. In Maharashtra besides having some areas solely under Bajra, pulses, wheat, Rabijowar, groundnut and cotton are substituted for it.

3.5 .4.6The groundnut based harvesting patterns

Groundnut is sown over an area of about 7.2 m ha, mostly in five major groundnut-producing states of Gujarat (24.4 per cent area), Andhra Pradesh (20.2) per cent), Tamil Nadu (13.5 per cent), Maharashtra (12.2 per cent) and Karnataka (12.0 per cent). Five other states viz. Madhya Pradesh, Uttar Pradesh, Punjab, Rajasthan and Orissa together have about 17.3 per cent of the total area under this harvest. The rainfall in the groundnut area ranges from 20-30 cm per month in one of the monsoon months and much less in the other months. In some cases the rainfall is even less than 10 cm. Per month during the growth of the harvest. The irrigated area under groundnut is very small and that too, in a few states only, viz. Punjab(16.4 per cent), Tamil Nadu (13.3 per cent)and Andhra Pradesh (12.5 per cent).

On the all-India level, about 9 harvesting patterns has been identified with this harvest. In Gujarat besides the sole harvest of groundnut in some areas, Bajra, is the major alternative harvest, whereas the kharifjowar, cotton and pulses are also grown in this tract. In Andhra Pradesh and Tamil Nadu, this harvest receives irrigation in some areas and rice forms an alternative harvest. Under rain-fed conditions, Bajra, kharifjowar, small millets, cotton and pulses are grown as alternative harvests. In Maharashtra both the kharif and Rabi jowar and small millets are

important alternative harvests. In Karnataka also, the grower is the major alternative harvest, whereas cotton, tobacco, sugarcane and wheat are also grown in this tract.

3.5 .4.7The cotton-based harvesting patterns

Cotton is grown over 7.6 m ha in India. Maharashtra shares 36 percent (2.8 m ha), followed by Gujarat with 21 per cent (1.6 m ha), Karnataka with 13 per cent (1 m ha) and Madhya Pradesh with 9 per cent (0.6 m ha) of the area. Together, these four states account for about 80 per cent of the area under cotton. Other Cottom-growing states with smaller areas are Punjab, with 5 per cent (0.4 m ha), Andhra Pradesh and Tamil Nadu each with 4 per cent (0.31 m ha), Haryana and Rajasthan with 3 per cent of each (0.2 m ha each). Most of the cotton areas in the country are under the high to medium rainfall zone. The cotton grown in Madhya Pradesh, Maharashtra, Karnataka, and Andhra Pradesh (4.8 m ha) is rain-fed, whereas in Gujarat and Tamil Nadu (1.93 m ha) it receives partial irrigation 16-20 per cent of the area). The area under cotton in Punjab, Haryana, Rajasthan and Uttar Pradesh (0.8 m ha) gets adequate irrigation, ranging from 71 to 97 per cent of the area. These growing conditions, together with the species of cotton grown, determine the duration of the harvest which may vary from about 5 to 9 months.

On the all-India basis, about 16 broad harvesting pattens has been identified. In Maharashtra, Madhya Pradesh, Andhra Pradesh and Karnataka, the harvesting patterns in the cotton-growing areas are mostly similar owing to identical rainfall. These patterns include Jowar (kharif and Rabi), groundnut and small millets. Pulses and wheat are also grown in a limited area. In some pockets, where irrigation is available, rice and sugarcane are also grown. In Gujarat, rice, tobacco and maize are grown, besides the rain-fedharvests, e.g. Jowar and Bajra.

3.5 .5THE RABI SEASON HARVESTPING PATTERNS

Among the rabi harvests, wheat, together with barley and oats, jowar and gram, are the main base harvests among the rabi harvesting patterns. Generally, wheat and gram are concentrated in the subtropical region in northern India, whereas the Rabi sorghum is grown mostly in the Deccan. The extent of these areas in different states is as follows;

Harvest	Area	Region (per cent of all-India area)
Sugar cane	2.5 m ha	Uttar Pradesh (51), Haryana (6),Bihar (6), Punjab (6), Maharashtra (8), Andhra Pradesh (5),Tamil Nadu (5), Karnataka (3)

Tobacco	0.427 m ha	Andhra Pradesh (48), Gujarat (19.5), Karnataka (8.7), Maharashtra (3.5), Tamil Nadu (3.5)
Potato	0.491	Uttar Pradesh (33.6), Bihar (20.4), West Bengal (13.3), Assam (5.2), Orissa (4.8)
Jute	0.778	West Bengal (60), North East Region (18.7), Bihar (17.6), Orissa (6.1), Uttar Pradesh (1.7)
Coconut	1.05 m ha	Kerala (68.3), Karnataka (12.4), Tamil Nadu (9.7), Andhra Pradesh (3.5)
Rubber	0.197 m ha	Kerala (92.8), Tamil Nadu (5.0), Karnataka (1.9)
Cashew	0.264 m ha	Kerala (67.4), Karnataka (12.1), Andhra Pradesh (10.8), Tamil Nadu (9.8), Maharashtra (4.8)
Tea	0.35 m ha	West Bengal, Assam and Tripura (77), Kerala, Tamil Nadu and Karnataka (20)
Coffee	0.138 m ha	Kerala , Tamil Nadu and Karnataka (99)
All fruit-harvests"	1.8 m ha	Spread allover India
Onion	0.16 m ha	Maharashtra (18.5), Karnataka (11.7), Andhra Pradesh (12.8), Tamil Nadu (11.2), West Bengal (7.6), Madhya Pradesh (7.2), Orissa (6.8), Punjab (6.2)
Chillies	0.733 m ha	Andhra Pradesh (26.9), Maharashtra (20.4), Karnataka(14.5), Madhya Pradesh (5.5), Tamil Nadu (10.1)
Coriander	0.283 m ha	Andhra Pradesh (36), Rajasthan (23.6), Madhya Pradesh (11.1), Tamil Nadu (10.0)

In several sugarcane-growing areas, mono-harvesting is practiced, and during the interval between the harvests, short duration seasonal harvests are grown. In U.P., Bihar, Punjab and Haryana, wheat and maize are the rotation harvests. Rice is also grown in some areas. In the southern states, namely Tamil Nadu, Karnataka and Andhra Pradesh, Ragi, rice and pulses are grown along with sugar cane. In Maharashtra, pulses, jowar and cotton are grown.

In the potato-growing region, maize, pulses, wheat is the alternative harvests. In the tobacco-growing areas, depending on the season and the type of tobacco, jowar, oilseeds and maize are grown in rotation. In the jute-growing areas, rice is the usual alternative harvest.

In the case of the plantation-harvests, interharvesting with pulses and fodder harvests is common.Spices and condiments are generally grown on fertile soils. Chillies are rotated with jowar, whereas onion, corriander, turmeric and ginger are grown as mixed harvests with other seasonal harvests.

3.5 .6Mixed Harvestping

Harvests mixtures are widely grown, especially during the kharif season. Pulses and some oilseeds are grown with maize, jowar and Bajra. Lowland rice is invariably grown unmixed, but in the case of upland rice, several mixtures are prevalent in eastern Uttar Pradesh, with the Chotanagpur Division of Bihar and in the Chhatisgarh Division of Madhya Pradesh. During the rabi season, especially in the unirrigated area of the north, wheat and barley and wheat and gram or wheat + barley + gram are the mixtures of grain harvests. Brassica and safflower are grown mixed with gram or even with wheat. Mixed harvesting was considered by researchers a primitive practice, but now many researchers regard mixed harvesting as the most efficient way of using land. Several new mixtures have recently been suggested. They ensure an efficient utilization of sunshine and land. Breeders are developing plant types in pulses and oilseeds, with good compatibility with row harvests.

3.5 .6The future of harvesting patterns

With the increase in population, the irrigated area is increasing and with advances in farm science, most of the extensive harvesting patterns are giving way to intensive harvesting. The development in minor irrigation works has especially provided the farmers with opportunities to harvest their land all the year round with high-yielding varieties. This intensive harvesting will require an easy and the ready availability of balanced fertilizers and plant protection chemicals and an appropriate price policy for inputs and farm produce.

India is a country of small farmers. In the future the size of the holdings will diminish further. The country has to produce enough for its people without deteriorating the quality of the environment.

This is the challenge of the future for the farmers, farm scientists, extension workers and administrators.

Review Questions

1. Define the Irrigation in India?
2. Explain the Dryland Farming?
3. Explain the Agro-climatic Zoning?
4. Explain the Land Utilization and Harvesting Pattern?

Discussion Questions

Discuss the Agricultural Resources in India?

Lesson 4- Technological Change in Agriculture

Learning Objectives

- To define the New Technology and Distribution of Grains.
- To explain the Trends in Agricultural Productivity.
- To explain the Green Revolution.
- To describe the role of green revolution in Indian agriculture.

4.1 Introduction

The history of farming is the story of man's progress in controlling for his own advantage the plants that make products useful to him by applying his knowledge. The country has also one of the largest farm areas in the world. The green revolution in India initiated as a technology mission to increase farm productivity during the 1960s. The food grain production no doubt has increased to comfortable level but there are serious limitations to the seed- fertilizer technology. It has also not solved the problems like low yields and harvest imbalances.

The ecological dimensions of the new farm technology need to be carefully evaluated and thus a revolution in farm technology in the need of the times. Although farm productivity is vital but environmental protection is equally important. Also technology must be both affordable by, and geared to the needs of the poor and undernourished people. As a factor in farm and rural development, infusion of two apparently disparate technologies i.e. Farm biotechnology and information technology are expected to catalyzeprogram changes. Farm biotech and InfoTech together are helping to create new tools to attack the problem of rural poverty, generate employment of farm productivity and production, progress quality and explore marketing and earnings generating opportunities in newer days.

However, the scientific changes in Indian farming started in the 1960s when access to modern inputs, especially high yielding variety of seeds, fertilizers, mechanization, credit and marketing facilities improved. The central government also introduced an intensive area development program in 1960. New yielding varieties of wheat developed in Mexico and the rice developed in the Philippines were brought to India. In addition to HYV sees, chemicals, fertilizers and pesticides were also introduced and irrigation facilities improved and expanded.

The widespread adoption of high yielding variety of wheat, Jawar maize increased their production. The mechanization of farm which introduced during the green revolution period is slowly making inroads ever since its inception in the 1960s. But the pace of farm mechanization has been more spectacular in the states like Punjab, Haryana, and Western Uttar Pradesh.

The most remarkable achievement of the new technologies in the substantial increase in the production and productivity of food grains. As a result to progressat High yielding seed varieties the wheat has registered six fold increase in the production and rice recorded nearly three fold increase. Consequently the country is self sufficient in food grains. But there is still need to improve the quality of seeds, irrigation technology, foodgrain storage technology etc.

4.2 New Technology and Distribution of Grains

Information Technology (IT) has long been viewed as having great potential for improving decision making in farming. IT has connected the world globally and is now changing our lifestyle and social consciousness dynamically. In all phases of the farm industry, information technologies are vital to the management and success of a business. Farming has also been greatly influenced by IT.

Information Technology is rapidly becoming more and more visible in society and farming. IT refers to how we use information, how we compute information, and how we communicate information to people. People must have computer and information technology. To participate and make informed decisions in the farm industry a person must have the ability to gather, process, and manipulate data.

The Internet is a standing topic in newspapers and on television, and the number of users doubles every year. People who use information technology creatively are pioneering career in farming today. Jobs in today's farm workforce require greater use of scientific skills than ever before.

IT support new methods for precision farming like computerized farm machinery that applies for fertilizers and pesticides. Farm animals are fed and monitored by electronic sensors and identification methods. Selling or buying online began to become popular in the world. However, its most important role remains communication, and the Internet has provided us with an ideal opportunity to do so. One such communication tool is the Web Site, which simply replaces the newspaper as a communication tool. Presently, almost every company has its own web site
The following are specific ways information technologies being applied through farm education:

- **Basic Internet Applications**
- **PowerPoint Presentations**
- **Global PositioningMethods (GPS)**
- **E-Commerce**

Applications of Teaching Methods - Anyone who will be involved in teaching, whether in a formal setting like the public schools or in an informal setting like an extension workshop, needs to know how to incorporate information technology into their daily teaching.

Student Teaching - In some instances, it can be difficult to visit student teachers. With fewer faculties available to supervise interns and added responsibilities, sometimes supervision needs to be done in an alternative way.

Alternative Certification Programs - In many countries, there is a shortage of teachers. These "beginning" teachers have no training in program planning or teaching methods, yet countries are willing to place them in classroom situations.

Graduate Education - Many teachers want to earn higher degrees, but have difficulty in finding the time to complete degrees. With the wide array of information technologies available, teachers can complete courses from the convenience of their office or home and never have to set foot on campus again.
Technical Updates - Individuals who need to get updated about technical information in farming can easily look at information if it is placed on a website.

In order to take the real status of farm production and marketing, there is an urgent need to develop the following items:

Farmers' harvest database must be managed. The database includes the kinds of harvests, the size of the cultivated area, time of harvest and yield. Farmers or the extension personnel transmit those data via the Internet to a database server.

There are many ways in which Information Technology can be used to exchange the information rather effectively through communication like information kiosks which provide not only the basic services like email, helps in education, health services, Farming and Irrigation, online trading, community services etc., Expertmethods which helps in determining marketing

alternatives and optimal strategies for producers, integrated harvest management methods for different harvests.

The use of IT in agribusiness in some countries is quite advanced. The situation in Sri Lanka is quite different, with low levels of computer literacy and usage in the farm sector, with technology transfer 'across the last mile' remaining the weakest link in the Sri Lanka. But farmers often go to great efforts to obtain better information, and much attention is being given by the Government and NGOs to the development of wireless networks, tele centers and other methods for promoting IT access and knowledge diffusion in the rural sector in Sri Lanka. Nevertheless, IT is likely to become increasingly important in innovation diffusion in farming, in both developed countries and in developing economies such as Sri Lanka. Implementing policies to this end, Sri Lanka must give due attention to the complex interactions between the many players to the role of tacit knowledge and social actors, and to the low level of the IT literacy in the rural sector.

Lack of information at the proper time causes a huge loss to farmers. This gap in communication may be bridged by information technology. Information of the required quality always has the potential of improving efficiency in all spheres of farming.

In the context of rice processing industry the potential of information technology can be assessed broadly under two heads: (a) as a tool for direct contribution to rice milling productivity and (b) as an indirect tool for empowering millers to take informed and quality decisions which will have a positive impact on the way rice processing and allied activities are conducted.

The techniques of remote sensing using satellite technologies, geographical information methods, and agronomy and soil sciences are used to increase the rice output. This approach is capital intensive and useful where large tracts of land are involved.

The use of IT in farming has grown rapidly in the past few years. It is increasingly being used to help managers make better decisions. However, IT and the problem facing decision makers are constantly changing. Thus, future information methods for research purposes will be significantly different than current methods because of these changes. IT has been one of the most aspired fields in today's world. Integrating IT with farming will help any country to regulate its overall economy and trade. The different Information Technologies like Expert Method in Decision Support Method and Remote Sensing have brought revolution in world farming.

4.3 Trends in Farm Productivity

4.3.1 **Introduction**

Farm progress is normally regarded as a prerequisite of economic development. It is true that the economic development m the modem times has become associated with the industrialization but it is generally accepted that industrialization can follow only on the sound heels of farming. In our country farming is the largest sector of economic activity providing not only food and raw materials but also employment to a very large section of the population. Being the dominant sector, farm output certainly has an effect on national output. Besides, our population is increasing at an alarming rate demanding similar progress in food production and other consumer goods which are farm based. This interaction between farm and non-farm sectors facilitates the growth of both. The demand for non-farm inputs of industrial origin stimulates industrial activity. If the industrial sector improves its growth rate the demand for the wages, goods and materials increases which in turn helps in the expansion of farm employment and earnings. Increase in farmearnings increases the demand for industrial goods and there could be a market developed for them. Thus, development of farm sector depends on industrial development and vice versa.

4.3.2 Role of Agriculture in Indian Economy

The significant role of farming in the national economy can be described under the following heads.

4.3.2.1 Contribution to national earnings

At the time of the first world war, farm contribution was about 2/3 road to the national earnings where there was not much industrial development. Its contribution has shown a declining trend since then. After the Independence, initiation of Five Year Plans stabilized the industrial infrastructure and thus the share of farming towards the national economy slowly decreased from 56.1% (1950-51) to around 30% (1993-94). The fact that farming still is an important contributor to the national earnings: it is often taken as an indicator of the economic development.

Normally, developed countries are less dependent on farming as compared to underdeveloped countries. For example, its contribution is only 3% in the USA and U.K. which confirms that as the country progresses the dependence on farming decreases.

4.3.2.2 Largest employment providing sector

Farming directly or indirectly has continued to be the main source of livelihood for the majority of the population. About 67% -69% of our country's working population is employed in different farm activities. It is only in developing and underdeveloped countries, that a higher percentage of the population is engaged in farming.

4.3.2.3 Contribution towards industrial development

Indian farming is of prime importance in the industrial development as it supplies necessary raw materials for the concerned industries. Some depend on farming directly, like textile industries, sugar factories, etc.And some indirectly like breweries etc. Experiences shows that the growth and diversification of farm production have helped to develop various types of industries and diversification of employment and a shortfall in farm growth for some time had an adverse effect on the industrial production affecting the prices causing imbalances in the economy. But the significance of farming in the industrial sector is decreasing as many industries have come up which are not dependent on farming.

4.3.2.4 Contribution to foreign exchange resources

Farm products like tea, sugar, oil seeds, tobacco, spices etc. Occupy an important place in the country's export trade. The export statistics show that there have been in- crease from 1960s to till date. It was worth 7 crores during 1960-61 which has been increased to 958 crore rupees in 1993-94. Farming and allied products contributed 18.1 % in the total exports during 1993-94.

4.3.2.5 Role of agriculture in economic planning

Importance of farming in the national economy is indicated by many facts. Its internal trading is the main support to our transport method . If there is a bumper production, its transport by road and railways makes business and if there is a depression it leads to loss in business. So, failure in farm front leads to the failure of economic planning.

4.3.2.6 Contribution to capital formation

Since it is the largest source of national earnings it is the primary source of savings and hence capital formation in the economy. Large investments in land development, construction of farm houses and irrigation facilities and other facilities like farm machinery and implements,

warehouses, cold storages etc. Have been made after independence. Both very- able and fixed capital in backward and progressive areas respectively can be built for necessary infrastructures.

So, it is clear that farming has its own place in the national economy and its performance sets the pace of growth in the economy as a whole.

4.3.3 Harvesting Pattern in India

Harvest pattern has been defined as the proportion of area under different harvests at a particular period of time. A change in harvesting pattern means a change in the proportion of area under different harvests. It can be described in a number of ways but the most convenient method is to classify the farm production into two groups i.e.. Food grains and non-food grains, the details of which are-, as follows.

4.3.3.1 Harvesting pattern of food grain harvests

A large proportion of the area under food grains is occupied by cereals. The food grains occupied an area of 97.3 m ha. In 1950-51 has increased to 124.3 m ha. In 1970-71. From 1970-71 it increased to 126.7 and 127.8 million ha. in 1980-81 and 1990-91 respectively. But the figures in 1992- 93 shows a slight decrease to 123 m ha and 1993-94 figures showed a further decrease to 122.4 m ha. In 1993-94, the total area under cereals was 100 m ha. And under pulses was 22.4 m. Hectares. The area under each individual harvest of some food grains is given in table 1.

Table 1: Harvestping pattern of some food grains (million hectares)

Sl. No	Harvest	1970-71	1980-81	1990-91	1992-93	1993-94
1	Rice	37.6	40.1	42.7	41.8	42.0
2	Wheat	18.2	22.3	24.2	24.6	24.9
3	Jowar	17.4	15.8	14.4	13.0	12.9
4	Bajra	12.9	11.7	10.5	10.6	9.5
5	Maize	5.8	6.0	5.9	6.0	6.0
6	Other cereals	9.9	8.3	5.5	4.8	4.7
7	Gram	7.8	6.6	7.5	6.5	6.4
8	Tur	2.7	2.8	3.6	3.6	3.6
9	Other pulses	12.1	13.1	13.6	12.3	12.4

Rice is the major cereal harvest among food grains and showed a gradual increase in the area and so also the wheat. But coarse grains like jowar, bajra and maize showed a de- cline in the percentage of the area. If we study the area of cultivation of food grains and non-food grains, there was a gradual shift from non-food grains to food grains. Important reasons are: the prices of food grains have been rising quite fast and the farmers have started growing food harvests in the similar way they grow commercial harvests like cotton, oilseedharvestsugar cane etc. Secondly, the cultivation of food grains has become highly remunerative and productive under the impact of new technology.

4.3.3.2 Harvesting pattern of non-food grains

Among non-food grain harvests, oil seeds form an important group which also includes other harvests like cotton, jute, sugarcane, tobacco, tea, coffee, etc. The area has shown in- creasing and decreasing trends as given in Table 2.

Table 2: Area tender some important non-food grains

(Million hectares)

Sl. No	Harvest	1970-71	1980-81	1990-91	1992-93	1993-94
1	Groundnut	7.3	6.8	8.3	8.2	8.4
2	Rapeseed & Mustard	3.3	4.1	5.8	6.2	6.3
3	Other oil seeds	6.0	6.7	10.0	10.9	12.1
4	Tobacco	0.4	0.4	0.4	0.4	N.A
5	Cotton	7.6	7.8	7.4	7.5	7.3
6	Jute	0.7	0.9	1.0	1.0	0.9
7	Sugarcane	2.6	2.7	3.7	3.6	3.4
8	Tea	0.4	0.4	0.4	0.4	0.4
9	Coffee	0.1	0.2	0.3	N.A	N.A

N. A. Available

The table 2 shows that sometimes there is an increase in the area and sometimes there is a decrease in the area but overall there was not much change in the area of cultivation.

4.3.3.3 Factors affecting harvests pattern in India

Harvesting pattern of any region depends upon physical characteristics as soil, climate, rainfall, etc. Apart from this, it depends on the nature and availability of irrigation facilities. Besides, physical and scientific factors economic motivations are also important in determining the harvesting pattern. The prices influence the acreage under the harvests in two ways. One is that the variations in the interharvest price disparities led to shifts in acreage between the harvests. Another is that the maintenance of a stable level of prices for a harvest provides a better incentive to the producer to increase the opt put than what a very high level of price does, if there is no uncertainty of this level being maintained over a number of years.

The fixed procurement price of wheat and rice and other Government controls have induced farmers to shift the cultivation to cash harvests like sugar cane.

Farmers also would choose the combination of harvests which would give them maximum earnings. Relative profitability per acre is the main consideration which influences the harvest pattern. Small farmers are first interested in producing food grains for their requirements and devote only a small relative acreage to cash harvests than large farmers. In fact, in recent years, it is the small farmer who have been increasing their sugarcane areas more than large farmers. Food Harvest Acts, Land use Acts, intensive schemes for paddy, cotton, oilseed" etc. All these bring sharply into focus the possibility that while each individual measure may push the harvest pattern in the direction intended to, but if the overall effect of all measures taken together with the entire harvest pattern is taken, it may not be in accordance with national requirements.

4.3.4 Productivity Trends in India

Before independence farm production rose only marginally as compared to the growth of population. With the introduction of economic planning in 1950-51, and with special emphasis on farm development, there was a steady increase in the area, productivity as well as in yield per hectare. Farm production in India viz. area, productivity per hectare and the total output is influenced by a large number of factors like rainfall, weather conditions, etc. The productivity figures of some important countries are given in Table 3.

Table 3: Average yield per hectare in selected countries

Sl. No	Commodity	Country	1951-56	1961-65	1987-88

1	Rice (quintal/ha)				
		India	8	10	17
		China	17	18	35
		U.S.A	19	29	41
		Japan	26	33	40
2	Wheat (quintal/ha)				
		India	7	8	20
		China	9	9	30
		France	21	29	61
		Germany	28	33	68
3	Cotton (lint) (Kgs/ha)				
		India	90	120	202
		China	160	250	764
		USSR	-	700	787
		Mexico	336	640	1100

Before independence the productivity of food grains has shown a decline but with the introduction of planning in 1950- 51, there was a positive increase in the productivity. During the pre-green revolution period, rice recorded the most impressive growth rate in yield from merely 7 quintals per hectare in 1949-50 to 11 quintals by 1964-65. The annual rate of growth was 2.1 per cent. The yield growth rate of wheat during the same period was increased from 6.6 q. to 9.1 quintals per hectare. Among nonfood grains, cotton and sugarcane recorded modest growth rates.

During the post green revolution period, the most spectacular growth rate was recorded by wheat (3.2%) and potato too recorded an impressive growth rate of 3.0% per year. Rice also registered a slow but steady rise of 2.1 % .Per year. In 1987-88, rice recorded an annual yield of 17.0 q/ha as against 41.0 q in USA and 40.0 q in Japan. Even China recorded an average productivity of 35.0 q/ha. which was more than double of the average yield of India.

Under the impact of the green revolution, the average annual yield per hectare in India was 20.0 q/ha in 1987-88 while it was 61.0 q/ha in France and 68.0 q/ha. In West Germany, Netherlands and UK have recorded average annual I yields of 81 and 69 q/ha respectively. Between 1961 and

1988, the yield of wheat per hectare had gone up by only 150% ha India as against 233% in China.

In case of cash harvest cotton, our country's per hectare yield was only 202 kgs. as against 764 kgs. in China, 787 kgs in USSR and 1100 kgs. in Mexico (1987-88). Likewise, maize recorded only 14.0 q/ha in 1987-88 as compared to 37.0 q/ha in China and 70.0 q/ha in the USA. So, the basic conclusion is though there is a rise in productivity, the average yield per hectare is below the world average in all harvests.

From the table 3, it is observed that during the period between 1980-88, other countries have shown rising in productivity for example: between 1965 -88, China has shown an increase of 94% in rice yield (per hectare) whereas India's was only 50 per cent. As it was already mentioned wheat per hectare yield was only 180% as against 233 percent. In cotton harvest, there was an increase of 250% in China as compared to 63% in India.

The farm production trend in different harvests in India is given in Table 4.

Table 4: Yield of different harvests (M. Tonnes)

Sl. No	Harvest	1993-94	19992-93	1990-91	1980-81	1970-71
	Food Grains	182.1	179.5	176.4	129.6	108.4
1	Cereals	169.0	166.6	162.1	119.0	96.6
	Rice	79.0	72.9	74.3	53.6	42.2
	Wheat	59.1	57.2	55.1	36.3	23.8
	Jowar	11.5	12.8	11.7	10.4	8.1
	Bajra	5.0	8.9	6.9	5.3	8.0
	Maize	9.5	10.0	9.0	7.0	7.5
	Others	4.9	4.8	5.1	6.4	7.0
2	Pulses	13.1	12,8	14.3	10.6	11.8
	Gram	4.9	4.4	5.4	4.3	5.2
	Tur	5.5	2.3	2.4	2.0	1.9
	Others	21.5	6.1	6.5	4.3	4.7
3	Oil seeds	21.5	20.1	18.6	9.4	9.6

	Groundnut (in shell)	7.8	8.6	7.5	5.0	6.1
	Rape seed & Mustard	5.4	4.8	5.2	2.3	2.0
	Others	8.3	6.7	5.9	2.1	1.5
4	Tobacco	N.A	0.58	0.56	0.48	0.36
5	Cotton (lint)	10.7	11.4	9.8	7.0	4.8
6	Jute	7.4	7.5	7.9	6.5	4.9
7	Sugarcane	227.1	228.0	241.0	154.2	126.4
8	Tea	0.76	0.7	0.75	0.57	0.42
9	Coffee	0.21	0.16	0.17	0.12	0.11

** Comprises ground nut, Reapeseed, mustard, seasomum, linseed, castor seed, niger seed, safflower, sunflower and soybean.

Cotton in million bales of 170 kg. Each. Jute in million bales of 180 kg. Each.

The food grains production in 1994-95 was 189.8 m. tones and it was 191.8 million tones in 1995-96.

The index numbers of farm production and productivity is given in Table 5.

Table 5: Index numbers of Farm Production and Productivity

Sl. No	Production	1993-94	1992-93	1990-91	1980-81	1970-71
		Triennium ending 1981-82 = 100				
1	All commodities	154.8	151.5	148.4	102.1	85.9
	Food grains	148.3	144.3	143.7	104.9	87.9
	Non food grains	165.8	163.6	156.3	97.4	82.6
2	Selected harvests					
	Rice	158.8	146.5	149.4	107.8	84.4
	Wheat	168.0	162.5	56.6	103.2	67.7
	Gram	119.2	107.4	180.2	105.4	126.3

	Groundnut	129.4	142.8	125.3	83.4	101.8
	Cotton	142.4	151.6	130.9	93.2	63.4
	Jute	121.6	138.3	122.6	100.8	76.5
	Sugarcane	145.3	145.9	154.3	98.8	81.2
	Tea	125.5	125.5	132.3	101.6	74.7
	Coffee	116.2	116.2	122.3	85.1	79.1
	Tobacco	118.5	124.2	115.8	100.2	75.5
3	Productivity					
	All commodities	139.7	137.0	133.8	102.9	92.6
	Food grains	145.5	142.0	137.8	105.9	93.2
	Non food grains	131.7	130.0	128.0	99.2	91.4
4	Selected harvests					
	Rice	151.4	140.6	140.2	107.7	90.2
	Wheat	149.6	146.7	143.8	102.8	82.4
	Gram	132.2	118.8	123.6	114.3	115.3
	Groundnut	110.0	124.6	107.4	87.5	99.0
	Cotton	155.4	160.9	140.8	95.4	66.7
	Jute	137.7	137.0	136.6	92.9	88.6
	Sugarcane	121.3	115.5	118.3	104.6	88.8
	Tea	113.6	113.6	119.9	101.1	80.2
	Coffee	116.4	116.4	110.2	184.6	122.0
	Tobacco	134.9	130.7	124.0	97.7	74.4

The yield of some selected harvests of our country can also be seen in table 6.

Table 6: Yield of selected harvests

Sl. No		1993-94	1992-93 (Kgs/ha)	1990-91	1980-81	1970-71
1	Food grains	1487	1457	1380	1023	872
	Kharif	1308	1302	1231	933	837
	Rabi	1781	1725	1635	1195	942
	Cereals	1690	1654	1571	1142	949
	Kharif	1456	1440	1357	1015	892

	Rabi	2116	2068	2010	1434	1093
	Pulses	584	573	578	473	524
	Kharif	476	495	471	361	410
	Rabi	696	654	672	571	607
	Rice	1879	1744	1740	1336	1123
	Kharif	1797	1677	1670	1303	1100
	Rabi	2814	2653	2671	2071	1625
	Wheat	273	2327	2281	1680	1307
	Jowar	894	982	814	660	466
	Kharif	1084	1030	969	937	533
	Rabi	672	632	582	520	354
	Maize	1583	1676	1518	1159	1279
	Bajra	576	836	658	458	622
	Gram	761	684	412	657	663
	Oilseeds	801	797	771	532	579
	Kharif	753	804	698	492	649
	Rabi	875	780	872	588	449
	Groundnut	926	1049	904	736	834
	Sugarcane (tonnes)	67	64	65	58	48
	Cotton	248	457	225	152	106
	Jute	1907	1857	1833	1245	1186

Even though there has been substantial growth in farm production, this has not been smooth, instead, there have been continuous fluctuations in harvest output from year to year. As already explained India has low farm productivity. There are several causes for low productivity.

4.3.6 Causes of Low Productivity

The farm productivity in India i.e. average yield per hectare is among the lowest in the world. There has been some progress in all the sectors in recent years particularly during the plan period. But there is not much change in the farmsector, especially when we consider the condition of the farmers. The analysis of the factors that are responsible for low productivity may be helpful in improving the situation. Some of the main factors are briefly described here.

4.3.6.1 Overcrowding in agriculture

The main problem in the farm sector is too many people are directly dependent on it though all depending on it indirectly for their existence. The national increase in population could not be absorbed in industries and people engaged in other sectors like handiworks etc. has also adopted farming. Consequently, the pressure of population increased the pressure on land. Also it has led to sub-division and fragmentation of holdings thus there was a decline in the area of land available for cultivation per capita, disguised unemployment in farming and low marginal productivity of labour. The pressure of increased population was so high that between 1901 and 1981, the cultivable area per cultivator has declined from 0.43 hectares to 0.23 hectares. So it is essential to check the growth of the rural population and decrease the pressure on land.

4.3.6.2 Discouraging rural atmosphere

In general, Indian farmers are mostly illiterate ignorant, superstitious and conservative and they feel satisfied with their primitive method of cultivation. Only very few farmers are quick in following modern technology exposed to them; but the vast majority of farmers is not motivated to learn and try new ways. But this atmosphere is slowly changing and unless this is changed there will be no progress in the farm sector.

4.3.6.3 Inadequate non-farm services

In the farm sector, there were inadequate nonfarm services like finance, marketing, etc. Till the recent past, fanners had to depend on the village money lenders paying high rates of interest and there was a risk of losing his land and become landless labourer. Other sources of finance did exist such as cooperatives and the Government but they were almost insignificant. Similarly, the farmers could not secure storage facilities in towns and sometimes they were cheated by wholesalers and commission agents.

4.3.6.4 Size of holdings

The average size of holdings in India is very low and they are fragmented and small. Since they are small, scientific cultivation techniques cannot be adopted; Small sized holdings lead to a great waste of time, labour and cattle power, difficulty in proper utilization of irrigation facilities and

consequent litigation among farmers etc. So the small holdings are one of the causes for poor farm yield.

4.3.6.5 Pattern of land tenure

The zamindarimethod which is abolished now was affecting the tenant farmer. Now, tenancy legislations have been established to protect the tenant farmers. But he has to pay high rent and he has no security and he can be turned out of his land at any time by the landlord. Under these circum- stances, it is impossible to expect the tiller to increase farm productivity.

4.3.6.6 Poor techniques of production

Since our farmers are tradition-bound and poor they have not aborted the techniques which are so widely adopted in the countries of the West and Japan. Only in recent years and that too to a limited extent, the farmers have started adopting improved implements like steel ploughs, sugarcane. Crushers, small pumping sets, water lifts, hose, seed drills etc. Increase in production is only possible if proper and adequate manures are used. To revitalize the fertility and to utilize fallow lands, the use of various kinds of manures is essential. Besides, use of FYM and chemical fertilizers is inadequate. About 10-20% increase in productivity can be brought through the use of better seeds. Our farmers have no access to better seeds and also lack of storage facilities for the preservation of the same for sowing.

4.3.6.7 Inadequate irrigation facilities

Indian farming is mostly dependent on rainfall and very few farmers avail the facility of artificial irrigation. Though the more area was brought under irrigation, still there is a great scope for improving the irrigation facilities.

Besides these enumerated causes the following are also the causes for poor productivity in farming.

4.3.6.8 Law of inheritance

According to the law of inheritance all the children of a property holder demand an equal share resulting in endless fragmentation of the cultivated lands. If a man has 3 to 4 plots of varying soil properties and productivity all the children demand portions of each of the plots in the name of

equality in sharing. This practice of equal division has gone to such an extent that we come across people in some areas owning a number of plots in different places. Some of these plots are as big as an office table or a small living room. Obviously it is impossible to do any worthwhile cultivation on these plots situated in different places.

4.3.6.9 Poor educational standard

Though many farmers are considered literate after implementation of the National Adult Literacy Mission most of them are merely able to sign their names only. They are not able to write their own ideas nor are they able to do the basic arithmatics. They also do not have any basic general knowledge of biology, chemistry or physics which is necessary for understanding various agronomic practices in the farm. Ignorance breeds superstition and superstition inhibits growth not only personal but also economy. Even the so called educated in our country do not have basics of scientific farming. Rural youth when they fail to get any other job they turn to farming. But not knowing the basic they become mere manual labourers.

4.3.6.10Nonviable farm holdings

For a farm to be economically viable, technically feasible and environmentally sound it should have a minimum size ego 10-15 acres or above. Only then a family can produce enough net profit and make a decent living on it which implies that it maintains a satisfactory standard of productivity.

4.3.6.11 Inadequate prices

The prices of farm products are fixed by the government officials whereas that of the nonfarm products is fixed by the producers. If we cost account all the expenses the production per unit farm product is several times higher than the price fixed by the government. That means a farmer is cultivating this land always in the loss. If a man is loosing in his business how can he improve his business. So also who cultivates in loss can not improve his productivity.

4.3.6.12 Caste factor

Cultivation is mostly done by low caste people in India. People engaged in manual work in field are looked down upon. They are there because they have no other way of living. Under such socially oppressive situation productivity cannot be improved.

4.3.6.13 Human energy requirement

To carry out the usual farming operation one requires to spend high amounts of his physical energy. Long hours of hard and strenuous work combined with poor working conditions and low level of food energy availability and less time for reoccupation a farmer gets constantly worn out. As a result he will not be able to improve the farm or his labour productivity.

4.3.6.14 Lack of infra-structural facilities

Most of the farmlands are situated in the areas where there are no road and transportation facilities nor any communication facilities. Hence unable to transport his products in time nor he can buy his requirements.

4.3.6.15 Lack of personal security

The farmer (the cultivator) has probably the least social security. He has no paid holidays no allowances (medical, child, educational, festival, travel etc.) He has no retirement benefits nor his age of retirement fixed. He retires only at his death. In this situation how a farmer makes efforts to increase the productivity.

4.3.6.16 Multifarious responsibilities

The farmer has too many roles and responsibilities. He is the owner! Tenant! cultivator, labourer, purchaser, store keeper, transporter, seller, buyer, accountant, manager, investor of investor, agronomist, pathologist, accountant, manager, pest controller, soil and water conservationist, seed collector, seed processor, storer, mechanic, risk taken etc. Humanly speaking it is not possible for anyone to perform all these roles and responsibilities. Every sphere of organized human activities, we find that each person is doing only the specialized and specified jobs for a specified period of time. Whereas the farmers have to bear the burden of many responsibilities at the same time. Nobody seems to realize this; the pitiable thing is that even the farmer himself is not realized. Under multifarious roles and responsibilities it is not possible for anyone to think of increasing the productivity of harvests.

4.3.7 **General Suggestions for Progress.**

In order to seek a change in the farmers, it is the duty of the Government, other related sectors and organizations to make available all the resources accessible to the farmers. For implementing the necessary programs for a better harvesting pattern, suggestions has to be given tobeneficial harvest rotation suitable to that area. Cooperation from the farm officers is expected which will

help the farmers and establishing a Farm Mechanization Corporation there by an average farmer who cannot manage with hired labour would be benefited. Government should give the greatest importance to the promotion of transport, marketing facilities and consolidation of holdings.

Progress in storage facilities, providing tenant security, implementing the recommended projects in rural areas for improving the irrigation facilities for supplementing better quality seeds and for increasing awareness among the people about hybrids, varieties, disease resistant varieties, drought resistant varieties, etc. are the other major aspects to be concentrated upon. There is no scope for increasing the area of cultivation in the future but through multiple harvesting, relying on irrigation facilities, high yielding varieties, etc. We can raise the farm productivity.

4.3.8 Conclusion

To increase the growth rate it is important to change the harvesting pattern which can be achieved through appropriate changes in economic motive. A conservative farmer does accept the logic for a change wherever he has shown a better harvesting pattern. It is possible only when he feels supported and secured by the government economically and Socially. He should get adequate remuneration for his labour.

4.4Green Revolution: Nature and Extent

Green Revolution refers to a series of research, development, and technology transfer initiatives, occurring between the 1940s and the late 1960s, that increased farming production worldwide, particularly in the developing world, beginning most markedly in the late 1960s. The initiatives, led by Norman Borlaug, the "Father of the Green Revolution" credited with saving over a billion people from starvation, involved the development of high-yielding varieties of cereal grains, expansion of irrigation infrastructure, transformation of management techniques, distribution of hybridized seeds, synthetic fertilizers, and pesticides to farmers.

The term "Green Revolution" was first used in 1968 by the former United States Agency for International Development (USAID) director William Gaud, who noted the spread of the new technologies:

"These and other developments in the field of farming contain the makings of a new revolution. It is not a violent Red Revolution like that of the Soviets, nor is it a White Revolution like that of the Shah of Iran. I call it the Green Revolution."

4.4.1 **History**

In 1961 India was on the brink of mass famine. Borlaug was invited to India by the adviser to the Indian minister of farming M. S. Swaminathan. Despite bureaucratic hurdles imposed by India's grain monopolies, the Ford Foundation and Indian government collaborated import wheat seed from CIMMYT. Punjab was selected by the Indian government to be the first site to try the new harvests because of its reliable water supply and a history of farm success. India began its own Green Revolution program of plant breeding, irrigation development, and financing of Agrochemicals.

India soon adopted IR8 – a semi-dwarf rice variety developed by the International Rice Research Institute (IRRI) that could produce more grains of rice per plant when grown with certain fertilizers and irrigation. In 1968, Indian agronomist S.K. De Datta published his findings that IR8 rice yielded about 5 tons per hectare with no fertilizer, and almost 10 tons per hectare under optimal conditions. This was 10 times the yield of traditional rice. IR8 was a success throughout Asia, and dubbed the "Miracle Rice". IR8 was also developed into Semi-dwarf IR36.

In the 1960s, rice yields in India were about two tons per hectare; by the mid-1990s, they had risen to six tons per hectare. In the 1970s, rice cost about $550 a ton; in 2001, it cost under $200 a ton. India became one of the world's most successful rice producers, and is now a major rice exporter, shipping nearly 4.5 million tons in 2006.

4.4.2**IR8 and the Philippines**

In 1960, the Government of the Republic of the Philippines with Ford and Rockefeller Foundations established IRRI (International Rice Research Institute). A rice crossing between Dee-Geo-woo-Gen and Peta was done at IRRI in 1962. In 1966, one of the breeding lines became a new cultivar, IR8. IR8 required the use of fertilizers and pesticides, but produced substantially higher yields than the traditional cultivars. Annual rice production in the Philippines increased from 3.7 to 7.7 million tons in two decades. The switch to IR8 rice made the Philippines a rice exporter for the first time in the 20th century. But the heavy pesticide use reduced the number of fish and frog species found in rice paddies.

4.4.3 **CIGAR**

In 1970, foundation officials proposed a worldwide network of farm research centers under a permanent secretariat. This was further supported and developed by the World Bank; on 19 May 1971, the Consultative Group on International Farm Research was established, co-sponsored by the FAO, IFAD and UNDP. CGIAR, has added many research centers throughout the world.

The CGIAR has responded, at least in part, to criticisms of Green Revolution methodologies. This began in the 1980s, and mainly was a result of pressure from donor organizations. Methods like Agroecomethod Analysis and Farming Method Research have been adopted to gain a more holistic view of farming. Methods like Rapid Rural Appraisal and Participatory Rural Appraisal have been adopted to help scientists understand the problems faced by farmers and even give farmers a role in the development process.

Problems in Africa

There have been numerous attempts to introduce the successful concepts from the Mexican and Indian projects in Africa. These programs have generally been less successful. Reasons cited include widespread corruption, insecurity, a lack of infrastructure, and a general lack of will on the part of the government. Yet environmental factors, such as the availability of water for irrigation, the high diversity in slope and soil types in one given area are also reasons why the Green Revolution is not so successful in Africa.

A recent program in western Africa is attempting to introduce a new high-yield variety of rice known as "New Rice for Africa" (NERICA). NERICAs yield about 30% more rice under normal conditions, and can double yields with small amounts of fertilizer and very basic irrigation. However the program has been beset by problems getting the rice into the hands of farmers, and to date the only success has been in Guinea where it currently accounts for 16% of rice cultivation.

After a famine in 2001 and years of chronic hunger and poverty, in 2005 the small African country of Malawi launched the "Farm Input Subsidy Program" by which vouchers are given to smallholder farmers to buy subsidized nitrogen fertilizer and maize seeds. Within its first year, the program was reported with extreme success, producing the largest maize harvest of the country's history; enough to feed the country with tons of maize left over. The program has advanced yearly ever since. Various sources claim that the program has been an unusual success, hailing it as a "miracle".

4.4.4 **Technologies**

The Green Revolution spread technologies that had already existed before, but had not been widely used outside industrialized nations. These technologies included modern irrigation projects, pesticides, synthetic nitrogen fertilizer and improved harvest varieties developed through the conventional, science-based methods available at the time.

The novel scientific development of the Green Revolution was the production of novel wheat cultivars. Agronomists bred cultivars of maize, wheat, and rice that is generally referred to as HYVs or "high-yielding varieties". HYVs have higher nitrogen-absorbing more potential than other varieties. Since cereals that absorbed extra nitrogen would typically lodge, or fall over before harvest, semi-dwarfing genes were bred into their genomes. A Japanese dwarf wheat cultivar (Norin 10 wheat), which was sent to Washington, D.C. by Cecil Salmon, was instrumental in developing Green Revolution wheat cultivars. IR8, the first widely implemented HYV rice to be developed by IRRI, was created through a cross between an Indonesian variety named "Peta" and a Chinese variety named "Dee-Geo-woo-Gen."

With advances in molecular genetics, the mutant genes responsible for *Arabidopsis thaliana* genes (GA 20-oxidase, *ga1*, *ga1-3*), wheat reduced-height genes (*Rht*) and a rice semidwarf gene (*sd1*) were cloned. These were identified as gibberellin biosynthesis genes or cellular signaling component genes. Stem growth in the mutant background is significantly reduced leading to the dwarf phenotype. Photosynthetic investment in the stem is reduced dramatically as the shorter plants are inherently more stable mechanically. Assimilates becomes redirected to grain production, amplifying in particular the effect of chemical fertilizers on commercial yield.

HYVs significantly outperform traditional varieties in the presence of adequate irrigation, pesticides, and fertilizers. In the absence of these inputs, traditional varieties may outperform HYVs. Therefore, several authors have challenged the apparent superiority of HYVs not only compared to the traditional varieties alone, but by contrasting the monoculturalmethod associated with HYVs with the polyculturalmethod associated with traditional ones.

4.4.5 **Production increases**

Cereal production more than doubled in developing nations between the years 1961–1985. Yields of rice, maize, and wheat increased steadily during that period. The production increases can be attributed roughly equally to irrigation, fertilizer, and seed development, at least in the case of Asian rice.

While farm output increased as a result of the Green Revolution, the energy input to produce a harvest has increased faster, so that the ratio of harvests produced with energy input has decreased over time. Green Revolution techniques also heavily rely on chemical fertilizers, pesticides and herbicides, some of which must be developed from fossil fuels, making farming increasingly reliant on petroleum products. Proponents of the Peak Oil theory fear that a future decline in oil and gas production would lead to a decline in food production or even a Malthusian catastrophe.

The effects of the Green Revolution on global food security are difficult to assess because of the complexities involved in food methods.

The world population has grown by about four billion since the beginning of the Green Revolution and many believe that, without the Revolution, there would have been greater famine and malnutrition. India saw annual wheat production rise from 10 million tons in the 1960s to 73 million in 2006. The average person in the developing world consumes roughly 25% more calories per day now than before the Green Revolution. Between 1950 and 1984, as the Green Revolution transformed farming around the globe, world grain production increased by over 250%.

The production increases fostered by the Green Revolution are often credited with having helped to avoid widespread famine, and for feeding billions of people.

There are also claims that the Green Revolution has decreased food security for a large number of people. One claim involves the shift of subsistence-oriented crop land to harvest land oriented towards production of grain for export or animal feed. For example, the Green Revolution replaced much of the land used for pulses that fed Indian farmers for wheat, which did not make up a large portion of the peasant diet.

4.4.6 **Criticism**

4.4.6.1 ***Malthusian criticism***

Some criticisms generally involve some variation of the Malthusian principle of population. Such concerns often revolve around the idea that the Green Revolution is unsustainable, and argue that humanity is now in a state of overpopulation with regards to the sustainable carrying capacity and ecological demands on the Earth.

Although 36 million people die each year as a direct or indirect result of hunger and poor nutrition, Malthus' more extreme predictions have frequently failed to materialize. In 1798 Thomas Malthus made his prediction of impending famine. The world's population had doubled by 1923 and doubled again by 1973 without fulfilling Malthus' prediction. Malthusian Paul R. Ehrlich, in his 1968 book *The Population Bomb*, said that "India couldn't possibly feed two hundred million more people by 1980" and "Hundreds of millions of people will starve to death in spite of any crash programs." Ehrlich's warnings failed to materialize when India became self-sustaining in cereal production in 1974 (six years later) as a result of the introduction of Norman Borlaug's dwarf wheat varieties.

Since supplies of oil and gas are essential to modern farming techniques, a fall in global oil supplies could cause spiking food prices in the coming decades.

4.4.6.2 ***Famine***

To some modern Western sociologists and writers, increasing food production is not synonymous with increasing food security, and is only part of a larger equation. For example, Harvard professor Amartya Sen claimed large historic famines were not caused by decreases in food supply, but by socioeconomic dynamics and a failure of public action. However, economist Peter Bowbrick disputes Sen's theory, arguing that Sen relies on inconsistent arguments and contradicts available information, including sources that Sen himself cited. Bowbrick further argues that Sen's views coincided with that of the Bengal government at the time of the Bengal famine of 1943, and the policies Sen advocates failed to relieve the famine.

4.4.6.3 ***Quality of diet***

Some have challenged the value of the increased food production of Green Revolution farming. Miguel A. Altieri, (a pioneer of agroecology and peasant-advocate), writes that the comparison between traditiAgroecologys of farming and Green Revolution farming has been unfair, because Gremethodsution farming produces monocultures of cereal grains, while traditional farming usually incorporates polycultures.

These monoculture harvests are often used for export, feed for polyculturesconversion into biofuel. According to Emile Frison of Bioversity International, the Green Revolution has also led to a change in dietary habits, as fewer people are affected by hunger and die from starvation, but many are affected by malnutrition such as iron or vitamin-A deficiency. Frison further asserts that

almost 60% of yearly deaths of children under age five in developing countries are related to malnutrition.

High-yield rice (HYR), introduced since 1964 to poverty-ridden Asian countries, such as the Philippines, was found to have inferior flavor and be more glutinous and less savory than their native varieties. This caused its price to be lower than the average market value.

In the Philippines the introduction of heavy pesticides to rice production, in the early part of the Green Revolution, poisoned and killed off fish and weedy green vegetables that traditionally coexisted in rice paddies. These were nutritious food sources for many poor Filipino farmers prior to the introduction of pesticides, further impacting the diets of locals.

4.4.6.4 ***Political impact***

A major critic of the Green Revolution, U.S. investigative journalist Mark Dowie, writes:

The primary purpose of the program was geopolitical: to provide food for the populace in undeveloped countries and so bring social stability and weaken the fomenting of the communist insurgency.

Citing internal Foundation documents, Dowie state that the Ford Foundation had a greater concern than Rockefeller in this area.

There is significant evidence that the Green Revolution weakened socialist movements in many nations. In countries such as India, Mexico, and the Philippines, scientific *solutions* were sought as an alternative to expanding *agrarian reform* initiatives, the latter of which were often linked to socialist politics.

4.4.6.5 ***Socioeconomic impacts***

The transition from traditional farming, in which inputs were generated on-farm, to Green Revolution farming, which required the purchase of inputs, led to the widespread establishment of rural credit institutions. Smaller farmers often went into debt, which in many cases results in a loss of their farmland. The increased level of mechanization on larger farms made possible by the Green Revolution removed a large source of employment from the rural economy. Because wealthier farmers had better access to credit and land, the Green Revolution increased class disparities, with the rich–poor gap widening as a result. Because some regions were able to adopt

Green Revolution farming more readily than others (for political or geographical reasons), interregional economic disparities increased as well. Many small farmers are hurt by the dropping prices resulting from increased production overall. However, large-scale farming companies only account for less than 10% of the total farming capacity. This is a criticism held by many small producers in the food sovereignty movement.

The new economic difficulties of small holder farmers and landless farm workers led to increased rural-urban migration. The increase in food production led to a cheaper food for urban dwellers, and the increase in urban population increased the potential for industrialization.

4.4.6.6 ***Globalization***

In the most basic sense, the Green Revolution was a product of globalization as evidenced in the creation of international farm research centers that shared information, and with transnational funding from groups like the Rockefeller Foundation, Ford Foundation, and United States Agency for International Development (USAID). Additionally, the inputs required in Green Revolution farming created new markets for seed and chemical corporations, many of which were based in the United States. For example, Standard Oil of New Jersey established hundreds of distributors in the Philippines to sell farm packages composed of HYV seed, fertilizer, and pesticides.

4.4.7 **Environmental impact**

4.4.7.1 ***Pesticides***

Green Revolution farming relies on extensive use of pesticides, which are necessary to limit the high levels of pest damage that inevitably occur in monoharvesting – the practice of producing or growing one single harvest over a wide area.The practice of producing or growing one single harvest over a wide area.

Biodiversity

The spread of Green Revolution farming affected both farm biodiversity and wild biodiversity. There is little disagreement that the Green Revolution acted to reduce farm biodiversity, as it relied on just a few high-yield varieties of each harvest.

This has led to concerns about the susceptibility of a food supply to pathogens that cannot be controlled by Agrochemicals, as well as the permanent loss of many valuable genetic traits bred

into traditional varieties over thousands of years. To address these concerns, massive seed banks such as the Consultative Group on International Farm Research's (CGIAR) International Plant Genetic Resources Institute (now Bioversity International) have been established.

There are varying opinions about the effect of the Green Revolution on wild biodiversity. One hypothesis speculates that by increasing production per unit of land area, farming will not need to expand into new, uncultivated areas to feed a growing human population. However, land degradation and soil nutrient depletion have forced farmers to clear up formerly forested areas in order to keep up with production. A counter-hypothesis speculates that biodiversity was sacrificed because traditional methods of farming that were displaced sometimes incorporated practices to preserve wild biodiversity, and because the Green Revolution expanded farm development into new areas where it was once unbeneficial or too arid. For example, the development of wheat varieties tolerant of acid soil conditions with high aluminium content, permitted the introduction of farming in sensitive Brazilian ecomethods as Cerrado semi-humid tropical savanna and Amazon rainforest in the geoeconomicmacroregions of Centro-Sul and Amazônia. Before the Green Revolution, other Brazilian ecomethod s were also significantly damaged by human activity, such as the once 1st or 2nd main contributor to Brazilian megadiversity Atlantic Rainforest (above 85% of deforestation in the 1980s, about 95% after 2010s) and the important xeric shrublands called Caatinga mainly in the Northeastern Brazil (about 40% in the 1980s, about 50% after 2010s — deforestation of the Caatinga biome is generally associated with greater risks of desertification).

Nevertheless, the world community has clearly acknowledged the negative aspects of farm expansion as the 1992 Rio Treaty, signed by 189 nations, has generated numerous national Biodiversity Action Plans which assign significant biodiversity loss to farming's expansion into new domains.

4.4.7.2 ***Greenhouse gas emissions***

According to a study published in 2013 in PNAS, in the absence of the harvestgermplasmprogress associated with the Green revolution, greenhouse gas emissions would have been 5.2-7.4 get higher than observed in 1965–2004.

4.4.7.3 **Health impact**

The consumption of the pesticides used to kill pests by humans in some cases may be increasing the likelihood of cancer in some of the rural villages using them. Poor farming practices including

non-compliance with usage of masks and over-usage of the chemical compound this situation. At 1989, WHO and UNEP estimated that there were around 1 million human pesticide poisonings annually. Some 20,000 (mostly in developing countries) ended in death, as a result of poor labeling, loose safety standards etc.

*4.4.7.4**Pesticides and cancer***

Long term exposure to pesticides such as organochlorines, creosote, and sulfate have been correlated with higher cancer rates and organochlorines DDT, chlordane, and London as tumor promoters in animals. Contradictory epidemiologic studies in humans have linked phenoxy acid herbicides or contaminants in them with soft tissue sarcoma (STS) and malignant lymphoma, organochlorine insecticides with STS, non-Hodgkin's lymphoma (NHL), leukemia, and, less consistently, with cancers of the lung and breast, organophosphorous compounds with NHL and leukemia, and triazine herbicides with ovarian cancer.

*4.4.8 **Punjab case***

The Indian state of Punjab pioneered a green revolution among the other states transforming India into a food-surplus country. The state is witnessing serious consequences of intensive farming using chemicals and pesticide. A comprehensive study conducted by the Post Graduate Institute of Medical Education and Research (PGIMER) has underlined the direct relationship between indiscriminate use of these chemicals and increased incidence of cancer in this region. An increase in the number of cancer cases has been reported in several villages including Jhariwala, Koharwala, Puckka, Bhimawali, and Khara.

Environmental activist Vandana Shiva has written extensively about the social, political and economic impacts of the Green Revolution in Punjab. She claims that the Green Revolution's reliance on heavy use of chemical inputs and monocultures has resulted in water scarcity, vulnerability to pests, and incidents of violent conflict and social marginalization.

In 2009, under a Greenpeace Research Laboratory's investigation, Dr Reyes Tirado, from the University of Exeter, UK conducted the study in 50 villages in Muktsar, Bathinda and Ludhiana districts revealed chemical, radiation and biological toxicity rampant in Punjab. Twenty percent of the sampled wells showed nitrate levels above the safety limit of 50 mg/l, established by WHO, the study connected it with high use of synthetic nitrogen fertilizers.

4.4.9 ***Organic farming***

About four decades after the Green Revolution widely helped the world to be able to produce food in sufficient levels, a small percentage of farmers in India have chosen to employ organic farming methods in response to side effects from their adoption of modern farming techniques.

In 2003, Sikkim became the first state in India to pass a resolution in the state assembly to convert all food sources in the state of inorganic to organic methods. There were two main reasons behind Sikkim's switch: First, small farmers were having a food security crisis in the form of negative returns and non-viable farming practices. Secondly, there were health problems looming in Sikkim; food and nutrition related diseases and overall decline of the health status of Sikkim's population became major concerns.[1]

4.4.10**Norman Borlaug's response to criticism**

He dismissed certain claims of critics, but did take other concerns seriously and stated that his work has been:

"A change in the right direction, but it has not transformed the world into a Utopia".

Of environmental lobbyists, he said:

"Some of the environmental lobbyists of the Western nations are the salt of the earth, but many of them are elitists. They've never experienced the physical sensation of hunger. They do their lobbying from comfortable office suites in Washington or Brussels...If they lived just one month amid the misery of the developing world, as I have for fifty years, they'd be crying out for tractors and fertilizer and irrigation canals and be outraged that fashionable elitists back home were trying to deny them these things".

Review Questions

1. Define the New Technology and Distribution of Grains?
2. Explain the Trends in Agricultural Productivity?
3. Explain the Green Revolution?
4. Explain the role of green revolution in Indian agriculture?

Discussion Questions

Discuss the Technological Change in Agriculture

Lesson 5 - State and Agriculture Sector

Learning Objectives

- To define the Agricultural Marketing in India.
- To explain the Cooperative Movement in Agriculture.
- To explain the Cooperative Legislations in India.
- To describe the Capital Formation in Indian Agriculture.

5.1 Introduction

Farming is the mainstay of the Indian economy because of its high share of employment and livelihood creation. It supports more than half a billion people providing employment to 52 per cent of the workforce. Its contribution to the nation's GDP is about 18.5 per cent in 2006-07. It is also an important source of raw material and demand for many industrial products, particularly fertilizers, pesticides, farm implements and a variety of consumer goods.

Department of Agriculture and Cooperation under the Ministry of Agriculture is the nodal organization responsible for the development of the farming sector. It is responsible for formulation and implementation of national policies and programs aimed at achieving rapid farm growth through optimum utilization of land, water, soil and plant resources of the country.

Farmingis a State subject, it is the responsibility of the State Governments to ensure growth and development of the sector within their respective State. Accordingly, separate departments have been set up in several States.

Several significant initiatives have been taken in recent years by the Government Rashtriya Krishi Vikas Yojana (RKVY), National Policy For Farmers, 2007 Expansion of Institutional Credit to Farmers, National Rural Health Mission, National Food Security Mission, Rashtriya Krishi Vikas Yojana to incentivise the states to invest more in farming, Integrated Food Law, Legislative Framework for Warehousing Development and Regulation, Protection of Plant Varieties and Farmers' Rights (PPVFR) Act, 2001, National Bamboo Mission, etc.

The rapid growth of farming is essential not only for self-reliance but also for meeting the food and nutritional security of the people, to bring about equitable distribution of earnings and wealth in rural areas as well as to reduce poverty and improve the quality of life. Growth in farming has

a maximum cascading impact on other sectors, leading to the spread of benefits over the entire economy and the largest segment of the population.

5.2 Farm Marketing in India

5.2.1 **Introduction**

In India Farming was practiced formerly on a subsistence basis; the villages were self sufficient, people exchanged their goods, and services within the village on a barter basis. With the development of the means of transport and storage facilities, farming has become commercial in character, the farmer grows those harvests that fetch a better price. Marketing of farm produce is considered as an integral part of farming, since an agriculturist is encouraged to make more investment and to increase production. Thus there is an increasing awareness that it is not enough to produce a harvest or animal product; it must be marketed as well.

Farm marketing involves in its simplest form the buying and selling of farm produce. This definition of farm marketing may be accepted in olden days, when the village economy was more or less self-sufficient, when the marketing of farm produce presented no difficulty, as the farmer sold his produce directly to the consumer on a cash or barter basis. But, in modem times, marketing of farm produce is different from that of olden days. In modem marketing, farmproduce has to undergo a series of transfers or exchanges from one hand to another before it finally reaches the consumer.

The National Commission on Farming, defined farm marketing as a process which starts with a decision to produce a saleable farm commodity and it involves all aspects of the market structure of the method, both functional and institutional, based on technical and economic considerations and includes pre and post- harvest operations, assembling, grading, storage, transportation and distribution. The Indian council of Farm Research defined involvement of three important functions, namely (a) assembling (concentration) (b) preparation for consumption (process) and (c) distribution.

5.2.2 **Importance and Objectives of Agriculture Marketing**

The farmer has realized the importance of adopting new techniques of production and is making efforts for more earnings and higher standards of living. As a consequence, the harvesting pattern is no longer dictated by what he needs for his own personal consumption but what is responsive to the market in terms of prices received by him. While the trade is very organized the farmers are not Farmer is not conversant with the complexities of the marketing method which is becoming more and more complicated. The cultivator is handicapped by several disabilities as a seller. He sells his produce at an unfavorable place, time and price.

The objectives of an efficient marketing method are:

1. To enable the primary producers to get the best possible returns,

2. To provide facilities for lifting all produce, the farmers are willing, to sell at an incentive price,

3. To reduce the price difference between the primary producer and the ultimate consumer, and

4. To make available all products of farm origin to consumers at reasonable prices without impairing on the quality of the produce.

5.2.3. **Facilities Needed for Farm Marketing**

In order to have the best advantage in marketing of his farm produce the farmer should enjoy certain basic facilities.

1. He should have proper facilities for storing his goods.

2. He should have holding capacity, in the sense, that he should be able to wait for times when he could get better prices for his produce and not dispose of his stocks immediately after the harvest when the prices are very low.

3. He should have adequate and cheap transport facilities which could enable him to take his surplus produce to the Mandi rather than dispose it in the village itself to the village money-lender-cum-merchant at low prices.

4. He should have clear information regarding the market conditions as well as about the ruling prices, otherwise may be cheated. There should be organized and regulated markets where the farmer will not be cheated by the "Dallas" and "arhatiyas".

5. The number of intermediaries should be as small as possible, so that the middleman's profits are reduced. This increases! the returns to the farmers.

5.2.4. Inadequacies of Present Marketing Method

Indian method of farm marketing suffers from a number of defects. As a consequence, the Indian farmer is deprived 'of a fair price for his produce. The main defects of the farm marketing method are discussed here.

5.2.4.1 Improper warehouses

There is an absence of proper warehousing facilities in the villages. Therefore, the farmer is compelled to store his products in pits, mud-vessels, "Kutcha" storehouses, etc. These unscientific methods of storing lead in considerable wastage. Approximately 1.5% of the produce gets rotten and becomes unfit for human consumption. Due to this reason supply in the village market increases substantially and the farmers are not able to get a fair price for their produce. The setting up of Central Warehousing Corporation and State Warehousing Corporation has improved the situation to some extent

5.2.4.2 Lack of grading and standardization

Different varieties of farm produce are not graded properly. The practice usually prevalent is the one known as "Dara" sales wherein heap of all qualities of the produceis sold in one common lot 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.

5.2.4.3 Inadequate transport facilities

Transport facilities are highly inadequate in India. Only a small number of villages are joined by railways and Pucca roads to mandies. Produce has to be carried on slow moving transport vehicles like bullock carts. Obviously such means of transport cannot be used to carry produce to far-off places and the farmer has to dump his produce in nearby markets even if the price obtained in these markets is considerably low. This is even more true with perishable commodities.

5.2.4.4 Presence of a large number of middlemen

The chain of middlemen in the farm marketing is so large that the share of farmers is reduced substantially. For instance, a study of D.D. Sidhan revealed, that farmers obtain only about 53% of the price of rice, 31% being the share of middlemen (the remaining 16% being the marketing cost). In the case of vegetables and fruits the share was even less, 39% in the former case and 34% in the latter. The share of middle- men in the case of vegetables were 29.5% and in the case of fruits was 46.5%. Some of the intermediaries in the farm marketing method are -village traders, Kutcha arhatiyas, Puccaarhatiyas, brokers, wholesalers, retailers, moneylenders, etc.

5.2.4.5 Malpractices in unregulated markets

Even now the number of unregulated markets in the country is substantially large. Arhatiyas and brokers, taking advantage of the ignorance, and illiteracy of the farmers, use unfair means to cheat them. The farmers are required to pay arhat (pledging charge) to the arhatiyas, "tulaii" (weight charge) for weighing the produce, "palledari" to unload the bullock-carts and for doing other miscellaneous types of allied works, "garda" for impurities in the produce, and a number of other undefined and unspecified charges. Another malpractice in the mandies relates to the use of wrong weights and measures in the regulated markets. Wrong weights continue to be used in some unregulated markets with the object of cheating the farmers.

5.2.4.6 Inadequate market information

It is often not possible for the farmers obtain information on exact market prices in different markets. So, they accept, whatever price the traders offer to them. With a view to tackle this problem the government is using the radio and television media to broadcast market prices regularly. The newspapers also keep the farmers posted with the latest changes in prices. However the price quotations are sometimes not reliable and sometimes have a great time-lag. The trader generally offers less than the price quoted by the government news media.

5.2.4.7 Inadequate credit facilities

Indian farmer, being poor, tries to sell off the produce immediately after the harvest is harvested though prices at that time are very low. The safeguard of the farmer from such "forced sales" is to provide him credit so that he can wait for better times and better prices. Since such credit facilities are not available, the farmers are forced to take loans from money lenders, while agreeing to pledge their produce to them at less than market prices. The cooperative marketing

societies generally cater to the needs of the large farmers and the small farmers are left at the mercy of the money lenders.

Thus it is not possible to view the present farm marketing method in India in isolation of (and separated from) the land relations. The regulation of markets broadcasting of prices by All India Radio, progress in transport method , etc., Have undoubtedly benefited the capitalist farmers, and they are now in a better position to obtain favorable prices for their "market produce" but the above mentioned changes have not benefited the small and marginal farmers to any great extent.

5.2.5 **Characteristics of FarmProduce**

Farm products differ in nature and contents from industrial goods in the following respects.

1. Farm products tend to be bulky and their weight and volume is great for their value in comparison with many industrial goods.

2. The demand for storage and transport facilities is more heavy, and more specialized in the case of farm products than in the case of manufactured commodities.

3. Farm commodities are comparatively more perishable than industrial goods. Although some harvests such as rice and paddy retain their quality for a long time, most of the farm products are perishable and cannot remain long on the way to the final consumer without suffering loss and deterioration in quality.

4. There are certain farm products such as mangoes and grapes which are available only in their seasons but this condition of seasonal availability is not found in the case of industrial goods.

5. Farm produce is to be found scattered over a vast geographical area and as such its collection poses a serious problem. But such is not conditioned in the case of industrial goods.

6. There are various kinds and varieties in farm produce and so it is difficult to grade them.

7. The farmers especially in countries like India has low holding-back. Therefore he has to sell his produce immediately after the harvest at whatever price he can fetch because of his pressing needs.

8. Finally, both demand and supply of farm products are inelastic. A bumper harvest, without any minimum guaranteed support price from the government may spell disaster for the farmer. Similarly the farmer may not really be in a position to take advantage of shortages or deficit harvest. These benefits may pass on only to the middleman.

5.2.6 **Methods of Sale and Marketing Agencies**

The marketing of farm produce is generally transacted in one of the following ways.

5.2.6.1Undercover or the Hatta Method

Under this method, the sale is effected by twisting or clasping the fingers of the seller's agent under cover of a cloth. The cultivator is not taken into confidence until the final bid is cleared.

5.2.6.2 Open auction method

Under this method the agent invites bids for the produce and to the highest bidder the produce is sold.

5.2.6.3 Dara method

Another related method is to keep the heaps of grains of different quantities and sell them at fiat rates without indulging in weightment etc.

5.2.6.4 Moghum sale

Under this method, the sale is based on the verbal understanding between buyers and sellers and without mentioning the rate as it is understood that the buyers will pay the prevailing rate.

5.2.6.5 Private agreement

The seller may invite offers for his produce and may sell to one who might have offered the highest price for the produce.

5.2.6.6 Government purchase

The government agencies lay down fixed prices for different qualities of farming commodities. The sale is effected after a gradual process for graduation and proper weightment. This practice is also followed in co-operative and regulated markets.

5.2.6.7 Marketing agencies

The various agencies engaged in the marketing of farm produce can be classified into two categories, viz., (i) Government and quasi private agencies like the co-operative societies and (ii) private agencies. A chain of middlemen may be found operating both in Government and private agencies. Most important among these are as follows:-

a. The merchant is the most usual purchaser of the product, he deals in his individual capacity.
b. Itinerant Beoparis (merchants) visit different villages,
Collect the produce, and take to the nearest market.
c. Take the weighing men from the villages to the dealers in town.
d. Agents are concerned with the assembling and distribution of farm produce.

5.2.7**Farm Marketing in India**

The existing methods of farm marketing in India are as briefly described here.

5.2.7.1 Sale to financiers and traders

A considerable part of the total produce is sold by the farmers to the village traders and financiers. According to an estimate 85% of wheat, 75% of oil seeds in U.P., 90% of jute in West Bengal and 60% of wheat, 70% of oil seeds and 35% of cotton in Punjab are sold by the farmers in the villages themselves. Often the money lenders act as a commission agent of the wholesale trade.

5.2.7.2 Hats and shanties

Hats are village markets often held once or twice a week, while shanties are also village markets held at longer intervals or on special occasions. The agents of the wholesale merchants, operating in different *mandies* also visit these markets.

The area covered by a "hat" usually varies from 5 to 10 miles. Most of "hats" are very poorly equipped, are uncovered and lack storage, drainage, and other facilities. It is important to observe that only small and marginal farmers sell their produce in such markets. The big farmers with large surplus go to the larger wholesale markets.

5.2.7.3 Mandies or wholesale markets

One wholesale market often serves a number of villages and is generally located in a city. In such mandies, the business is carried on by arhatiyas. The farmers sell their produce to these arhatiyas with the help of brokers, who are generally the agents of arhatiyas. Because of the malpractices of

these middlemen, problems of transporting the produce from villages to mandies, the small and marginal farmers are hesitant about coming to these mendies.

The arhatiyas of these mendies sell off the produce to the retail merchants. However, paddy, cotton and oilseeds are sold off to the mills for processing. The marketing method for sugarcane is different. The farmers sell their produce directly to the sugar mills.

5.2.7.4 Co-operative marketing

To improve the efficiency of the farmmarket and to save the farmers from the injustice and malpractices of middlemen, emphasis has been laid on the development of cooperative marketing societies. Such societies are formed by farmers to take advantage of collective bargaining. A marketing society collects surplus from it's 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.

5.2.8 Progress of Farm Marketing Method

Government of India has adopted a number of measures to improve farm marketing, the important ones being - establishment of regulated markets, construction of warehouses, provision for grading, and standardization of produce, standardization of weight and measures, daily broadcasting of market prices of farmharvests on All India Radio, progress of transport facilities, etc.

5.2.8.1 Marketing surveys

In the first place the government has undertaken marketing surveys of various goods and has published these surveys. These surveys have brought out the various problems connected with the marketing of goods and have made suggestions for their removal.

5.2.8.2 Grading and standardization

The government has done much to grade and standardize many farm goods. Under the Farm 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 Farm Marketing Department -AGMARK The «Agmark" goods have a wider market and command better prices. A Central Quality Control Laboratory has been set up in Nagpur and eight other regional laboratories in different parts of the country with the purpose of testing the quality and

quality of farm products applying for the Government's "Agmark" have been created The Government is further streamlining quality control enforcement and inspection and progress in grading.

5.2.8.3 Organization of 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, arhatiyas, brokers and farmers. Thus all interests are represented on the committee. These committees are appointed by the Government for a specified period of time. Important functions performed by the committees can be summarized as follows.

a. Fixation of charges for weighing, brokerages etc.,
b. Prevention of unauthorized deductions, underhand dealings, and wrong practices by the artist,
c. Enforcing the use of standardized weights,
d. Providing up to date and reliable market information to the farmers, and
e. Settling of disputes between the parties arising out of market operations.

The method of regulated markets has been found to be very useful in removing fraudulent practices followed by brokers and commission agents and in standardizing market practices. The committee is responsible for the licensing of brokers and weightmen. It is nested with powers to punish anyone who is found guilty of dishonest and fraudulent practices. 1t is the policy of the government to convert all markets in the country into the regulated type.

Regulated markets aim at the development of the marketing structure to have the following.

1) Ensure remunerative price to the producer of farm commodities,
2) Reduce non functional margins of the traders and commission agents, and
3) Narrow down the price spread between the producer and the consumer.

To achieve these objectives, the government would go in for comprehensive and rapid expansion of regulated marketing methods. The success achieved in states like Punjab and Haryana, where regulated markets have been established in major producing areas with linked up satellite markets in the rural growth centers would be aimed at, in other areas where intensive production is taken up. The regulating marketing method has also proved a good source of generating earnings for

the marketing boards and for use in rural infrastructure. The regulated market complex will also include facilities for grading and for monitoring of prices.

The development of regulated markets is proposed especially in areas where commercial harvests like cotton, jute, tobacco and important non-traditional harvests are produced and sold in weekly markets and hats. Co-operative marketing and distribution and banking will also be linked to the regulated markets. These markets will cover all the major harvests. Separate market yards are proposed for livestock, fish, fruits and vegetables.

There are now over than 6,050 regulated markets with the establishment of these regulated markets. The malpractices in mandies having disappeared and the market charges have been rationalized. As much as 70% of farm produce is now sold in regulated markets.

In this connection, the steps taken to standardize the weight and measures in the country should be mentioned. The government has successfully replaced the different methods of weights and measures prevalent in the country with the metric method .

5.2.8.4 Provision of warehousing facilities

To prevent distress sale by the farmers, particularly the small and marginal farmers, due to prevailing low prices, rural go downs have been set up. The government has done much to provide warehousing in towns and villages.

The Central Warehousing Corporation was set up in 1957 with the purpose of constructing and running go down and warehouses for the storage of farm produce. The states have 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.

5.2.8.5 Dissemination of market information

The government has been giving attention to the broadcasting of market information to the farmers. Since most villages have radio sets, these broadcasts are actually heard from farmers. The newspapers also publish farm prices either daily or weekly accompanied by a short review of trends.

5.2.8.6 Directorate of marketing and inspection

The directorate was set up by the Government of India to co-ordinate the farm marketing of various agencies and to advise the Central and State Governments on the problems of farm marketing. Activities of this directorate include the following.

a. Promotion of grading and standardization of farm and allied commodities;
b. Statutory regulation of markets and market practices;
c. Training of personnel;
d. Market extension;
e. Market research, survey and planning
f. Administration of Old Storage Order, 1980 and the Meat Food Products Order, 1973.

The directorate has so far formulated grade specification for 142 farm commodities. It enforces compulsory quality control before export on as many as 41 farm commodities. It is extending financial assistance to selected regulated markets for providing grading facilities for important commodities like tobacco, jute, cotton, groundnut and cashew nut at the producer level.

An allied task is the one related to marketing research and survey. This should aim at determination of best handling methods to produce to minimize losses, damage and costs, improved methods of wholesaling and retailing and planning for new marketing facilities at appropriate centers. With this aim in view, the Directorate is currently implementing two schemes.

-Market research and planning.
-Market planning and design.

Under the former scheme, the Directorate has been carrying out countrywide marketing surveys on livestock and important farm and horticultural commodities to identify and study the problems of farm marketing. Under the latter scheme, the Directctorate has set up a Marketing Planning and Design Centre at Faridabad and a training center and Workshop in Nagpur to study the packaging grading and marketing of selected fruits and vegetable and also advise the authorities on the designing of fruits and vegetable markets.

5.2.8.7 Government purchases and fixation of support prices

In addition to the measures mentioned above, the Government also announces minimum support price for various farm 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 Farm, Price Commission.

If the prices start falling below the declared level (say, as a result of a glut in the market), the Government agencies like the Food Corporation of India intervene in the market to make a direct purchase from the farmers at the support prices. These purchases are sold off by the Government at reasonable price through the public distribution method .

5.2.9 **Cooperative Marketing**

Though the above measures have improved the method of farm marketing to some extent, a major part of the benefits has been derived by large farmers, who have an adequate marketable surplus. However, the small and marginal farmers continue to sell a major part of their produce to financiers to meet their credit needs and these financiers offer them very low prices. Therefore it is essential to form cooperatives of the small and marginal farmers to enable them to obtain fair prices for their produce. The advantages that co-operative marketing can confer on the farmer are multifarious, some of which are listed below.

5.2.9.1 Increases bargaining strength of the fanners

Many of the defects of the present farm marketing method arise because often one ignorant and illiterate farmer (as an individual) has to face well-organized mass of clever intermediaries. If the farmers join hands and for a cooperative, naturally they will be less prone to injustice and malpractices. Instead of marketing their produce separately, they will market it together through one agency.

5.2.9.2 Direct deals with female buyers

In cases, the co-operatives can altogether skip the intermediaries and enter into direct relations with the final buyers. This practice will eliminate exploiters and ensure fair prices to both the producers and the consumers.

5.2.9.3Provision of credit

The marketing co-operative societies provide credit to the farmers to save them from the necessity of selling their produce immediately after harvesting. This ensures better returns to the farmers.

5.2.9.4 Easier and cheaper transport

Bulk transport of farm produce by the societies is often easier and cheaper. Sometimes the societies have their own means of transport. This further reduces cost and botheration of transporting produce to the market.

5.2.9.5 Storage facilities

The cooperative marketing societies generally have storage facilities. Thus the farmers can wait for better prices. Also there is no danger to their harvest yield from rains, rodents and thefts.

5.2.9.6 Grading and standardization

This task can be done more easily for a cooperative agency than for an individual farmer. For this purpose, they can seek assistance from the government or can even evolve their own grading arrangements.

5.2.9.7 Market intelligence

The co-operatives can arrange to obtain data on market prices, demand and supply and other related information from the markets on a regular basis and can plan their activities accordingly.

5.2.9.8 Influencing marketing prices

While previously in the market prices were determined by the intermediaries and merchants and the helpless farmers were mere spectators force to accept, whatever was offered to them, the co-operative societies have changed the entire complexion of the game. Wherever strong marketing cooperativeis operative, they have bargained for and have achieved, better prices for their farm produce.

5.2.9.9 Provision of inputs and consumer goods

The cooperative marketing societies can easily arrange for bulk purchase of farm inputs, like seeds, manure fertilizers etc. And consumer goods at relatively lower price and can then distribute them to the members.

5.2.9.10Processing of farmproduces

The co-operative societies can undertake processing activities like crushing seeds, ginning 'and pressing of cotton, etc.

In addition to all these advantages, the co-operative marketing method can arouse the spirit of self-confidence and collective action in the farmers without which the program of farm development, howsoever well conceived and implemented, holds no promise of success.

5.2.10 **Warehousing in India**

Warehousing facilities are necessary to prevent the loss arising out of defective storage and also to equip the farmers with a convenient instrument of credit. Both the Farm Finance Subcommittee (1945) and the Rural Banking Enquiry Committee (1950) emphasized the importance of warehousing as a method of promoting rural banking and finance in India.

All India Rural Credit Survey Committee (1954) recommended a three tire method of warehousing: at the national level, state and district level, village and rural level.

At present there are three main agencies in the public sector which are engaged in building large scale storage/warehousing capacity. They are: the Food Corporation of India (FCI), Central Warehousing Corporation (CWC), and State Warehousing Corporation (SWC).

FCI provides storage capacity for food grains. It has its own go downs and it also hires storage capacity from other sources such as CWC, SWC's, State Governments and private parties. In 1960-61, there were only 40 general warehouses in the countries with a total capacity of less than 0.1 million tonnes. By the end of 1988-89, the three public sector units have a storage capacity of nearly 32 million tonnes.

Besides, public sector agencies, co-operatives have also constructed warehouses in rural areas for storage of their members' produce, for stocking of fertilizers and other inputs and consumer articles. To avoid unfair competition with the go downs of the cooperative marketing societies, the state warehousing corporations do not open warehouses at any place below the sub divisional level. By 1987-88, a total storage capacity of over 10 million tonnes in the co-operative sector was available.

5.2.10.1 Kinds of warehouses

There are broadly speaking four kinds of warehouses.
They are:

a. Private warehouses which are usually maintained by joint-stock companies, firms and individuals;
b. Duty-paid public warehouses which are maintained by dock authorities or port trust authorities at the port
c. Bonded warehouses which are maintained either by dock authorities or by the Government and
d. Licensed warehouses which are private warehouses run by co-operative societies or by private agencies, after obtaining a license from the Government.

5.2.10.2 Benefits of the warehouses

The following are some of the benefits of the warehouses.

a. It gives withholding power to the agriculturist to tide over difficulties and helps them to secure better prices for their produce.
b. It gives purchasing power to traders.
c. It tends to cushion the price fluctuation and stabilize prices as it equates supply to demand.
d. It facilitates future trading.
e. It plays a very important role in implementing the farm price policy of the Government
f. It obviates the need for unnecessary cross-transport.
g. Huge wastages which occur owing to improper storage of farm produce will be minimized if warehousing develops on a large scale.
h. Warehouses render various subsidiary services, such as sorting and packing commodities for shipment, cleaning and drying goods and preparing them for the market, acting as forwarding agents for exporters of good, purchasing goods on behalf of clients, and collecting and disseminating marketing intelligence.

5.2.10.3 Progress

Storage and warehousing facilities for farmharvests on a commercial basis are available both in the public and the private sectors. The public sector dominates and accounts for a significantly larger share of the total capacity available in the economy. The main institutional agencies providing these facilities are summarized here as Central and State Warehousing Corporations, the Food Corporation of India and the cooperatives.

The Central Warehousing Corporation was set up in 1962 to do the following functions:

a. Acquire and build godown and warehouses at suitable places,
b. Arrange facilities for the transport of farm produce,and inputs,
c. Subscribe to the share capital of State Warehousing Corporations, and
d. Act as agent of the Government for the purpose of purchase, sale, storage and distribution of farm produce and harvests.

The State Warehousing Corporations have been set-up at places of the state and district importance. Their functions are the same within a state as those of CWC at the national level.

5.2.11 **Ideal Marketing Method**

The ideal marketing method is one that maximizes the long run welfare of society. To do this, it must be physically efficient, otherwise the same output could be produced with fewer resources, and it must be effectively efficient, otherwise a change in allocation could increase the total welfare and where earnings distribution is not a consideration.

For maximum physical efficiency, such basic physical functions as transportation, storage, and processing should be carried on in such a way so as to achieve the highest output per unit of cost incurred on them. Similarly an ideal marketing method must allocate farm products in time, space and form to intermediaries and consumers in such proportions and at such prices as to ensure that no other allocation would make consumers better off. To achieve this condition, prices throughout the marketing method must be efficient and must at the same time be equal to the marginal costs of production and marginal consumer utility.

The following characteristics should exist in a good marketing method .

1. There should not be any government interference in free and market transactions. The method of intervention includes, restrictions on food grain movements, restrictions on the quantity to be processed, or on the construction of a processing plant, price supports, rationing, price ceiling, entry of persons in the trade, etc. When these conditions are violated, the inefficiency in the market method creeps in and commodities pass into the black market. They are not then easily available at the fairest prices.

2. The marketing method should operate on the basis of the independent, decisions of the millions of the individual consumer and producers whose lives are affected by it.

3. The marketing method should be capable of developing into an intricate and far-flung marketing method in view of the rapid development of the urban industrial economy.

4. The marketing method should bring demand and supply together and should establish an equilibrium between the two.

5. The marketing method should be able to generate employment by ensuring the development of processing industries and convincing the people to consume more processed foods, consistent with their tastes, habits and earnings levels.

5.2.12 **Scientific Marketing of Farm Products**

The tendency among the farmers to market their produce has been increasing. Production is complete only when the produce is marketed at a price remunerative to the farmer. Increasing specialization in production of higher marketable/ marketed surplus of the produce and alternative channels of marketing have increased the importance of the marketing activity for the farmers. However, marketing activity should be guided by certain basic principles which are briefly explained. The farmers can gain more if they follow the following principles of scientific marketing.

5.2.12.1 Always bring the produce for sale after cleaning it

Impurities, when present, lower the price offered by the traders-buyers in the market. The fall in price is more than the extent of impurity present in the produce would warrant. Clean produce attracts more buyers.

5.2.12.2 Sell different qualities of products separately

The produce of different varieties should be marketed separately. It has been observed that when different varieties of products are marketed separately, the farmers get a higher price because of the buyers preference for specific varieties.

5.2.12.3 Sell the produce after grading it

Graded produce is sold off quickly. The additional earnings generated by the adoption of grading and standardization is more than the cost incurred in the process of grading and standardization. This shows that there is an incentive for the farmers for the production of good quality products.

5.2.12.4 Keep abreast of market information

Price information helps him to take decisions about when and where to sell the produce, so that a better price may be obtained.

5.2.12.5 Carry bags/packs of standard weights

Farmers should weigh their produce and fill each bag with a fixed quantity. The majority of the farmers does not weigh their produce before taking it for sale and suffer loss by way of a possible malpractice in weighing, or they may have to make excess payments in transit (octroi, transport costs, etc.).

5.2.12.6 Avoid immediate post-harvest sales

The prices of the produce touch the lowest level in the peak marketing season. Farmers can get better prices by availing of warehouse facilities existing in their areas. Farmers can meet their cash needs by pledging the warehouse receipt to nationalized banks.

5.2.12.7 Patronize cooperative marketing societies

Farmers can get better prices by sales through a cooperative and marketing society and can avoid the possibility of being cheated. The cost of marketing particularly the transportation cost for farmers having a small quantity of marketable surplus, is minimized, for transportation is arranged co-operatively by the society and the profit earned by the society is shared among its members.

5.2.12.8 Sell the produce in regulated markets

The farmers should take their produce for sale to the nearly regulated markets rather than sell them in the village or unregulated markets. In regulated markets marketing charges are on very few items. They get the sales slips in the regulated markets, which show the quantity of the produce marketed and the amount of charges deducted from the values of the produce. Sales slip protect farmers against the malpractices of deliberate erroneous accounting or unauthorized deductions.

5.2.13**Conclusion**

A good marketing method is one, where the farmer is assured of a fair price for his produce and this can happen only when the following conditions are obtained.

1. The number of intermediaries between the farmer and the consumer should be small;
2. The farmer has proper storing facilities so that he is not compelled to indulge in distress sales,
3. Efficient transport facilities are available,
4. The malpractices of middlemen are regulated,
5. Farmers are freed from the clutches of village financiers and
6. Regular market information is provided to the farmer.

5.3 Cooperative Movement in Agriculture

Various development activities in farming, small industry marketing and processing, distribution and supplies are now carried on through co-operatives. The co-operatives in the State have made an all-round progress and their role in, and contribution to farm progress has particularly been significant. The schemes regarding the construction of godowns and the conversion of villages into model villages have assumed great importance in the wake of the Greeen Revolution.

The Co-operative Movement was introduced into India by the Government as the only method by which the farmers could overcome their burden of debt and keep them away from the clutches of the moneylenders. The Co-operative Credit Societies Act, 1904 was passed by the Government of India and rural credit societies were formed . Through the appointment of registrars and through vigorous propaganda, the Government attempted to popularize the Movement in the rural areas. Within a short period, the Government realized some of the shortcomings of the 1904 Act and, therefore, passed a more comprehensive Act, known as the Co-operative Societies Act of 1912. This Act recognized non-credit societies also. But the rural credit societies have continued to be predominant till now.

5.3.1 The Primary Farm Credit/Service Societies

The farm co-operative credit structure in the Punjab State is broadly divided into two sectors, one dealing with the short-terms and medium-terms finance and the other with the long-term credit. In the State, the short-term and medium-term credit structure is based on a three-tier method , i.e., The Apex Co-operative Bank at the State level, the Central Co-Coperative Bank at the

district/tehsil level and the Primary Farm Credit Societies at the village level. The major objectives of the primary farm credit service societies are to supply farm credit to meet the requirements of funds for farm production, the distribution of essential consumer commodities, the provision of storage and marketing facilities and for light farm implements and machinery.

Owing to an increasing emphasis on the development of land and farming, long-term co-operative credit has assumed great importance. There is the Punjab State Land Mortgage Bank at the Apex and the Punjab Mortgage Bank at the district/tehsil level. These Primary Land Mortgage Banks advance loans to the farmers for long term purposes.

At the operational level, there exists a primary co-operative to extend credit to the farmer. This unit epitomizes the vitality and service potential of the Co-operative Movement in India. The organization of these societies dates back to 1904, when the first Co-operative Societies Act was passed. These societies were started with the object of providing cheap credit to the agriculturists in order to free them from the clutches of the rapacious moneylenders. Thefarm primary credit society is the foundation-stone on which the whole co-operative edifice is built. Even now these societies dominate the co-operative picture.

The first Farm Credit Society of the Firozpur District was registered on 4 October 1911, at the Village of Khalchi Kadim in the Firozpur Tehsil. Originally, the movement was confined to the credit societies only and, thus, credit dominated till the partition (1947). After the partition, the Co-operative Movement began to spread to other fields, vizlabor, construction and farming.

Farm Non-Credit Societies

While credit is and must remain for some time the chief concern of the Co-operative Movement relatively slow, since 1912, when the non-credit societies were brought officially under the aegis of the Movement. The World War II (1939-45) came as a God send boon with respect to the development of the Co-operative Movement. Prices of farm goods began to rise and touched new peaks. The repayment of loans was accelerated and deposits began to pour in. The number of societies also rose. Another interesting development in co-operative during the War was the extension of the Movement to non-credit activities, viz. Consumer'scooperative marketing societies, consolidation societies, etc.

Farm co-operative Marketing Societies

Marketing has occupied a far smaller place in the co-operative picture in India than in many

countries, notably Denmark and the USA, but not other non-credit line of cooperation, with the possible exception of the consolidation of land holdings and joint farming enterprises, seems to hold greater possibilities of help to the farm population of India. The development of co-operative marketing in India is closely bound up with the problem of credit-the claims of the moneylenders commonly inhibiting the cultivator's freedom of action in disposing of his harvest.

The full utilization of loans advanced depends upon the arrangements for the marketing of surplus produce. For this purpose, there the Punjab State Marketing Federation at the State Level, wholesale societies at the district level and marketing societies at the market level. These societies also provide other farm facilities and make arrangements for the supply of domestic items in the rural areas.

At the State level, the Punjab State co-operative Supply and Marketing Federation (MARKFED) is playing an important role in building up an integrated structure for remunerative marketing and storing of farm produce. It has played an important role in hastening the Green Revolution in the State by arranging ready supplies of essential farm inputs needed by the farmers.

Co-operative Farming Societies.

The Royal Commission on Farming in 1928 observed that its co-operation failed, there would fail the hope of the Indian agriculturist. Co-operative farming is a compromise between collective farming and the peasant proprietorship and gives all merits of large-scale farming without abolishing private property. It implies an organization of the farmers on the basis of common efforts for common interests. Under this method , all landowners in a village form a co-operative society for tilling the land. The land is pooled, but each farmer retains the right of property. The produce is distributed by each. They are allowed to withdraw from the co-operative farm whenever they de3sire. In India, the exceedingly small size of holdings is perhaps the most serious defect in our farming. If farming has to be improved, the size of the holdings must be enlarged.

5.3.2 Type of societies

- Co-operative Weaver's society
- Co-operative Consumer's Societies
- Co-operative Housing Societies
- Co-operative Women's Societies

- Co-operative Milk-Societies

5.3.3 The challenges before co-operatives

The Indian Co-operative Movement has earned distinction of being the largest in the world. This is true in terms of membership and Co-operative network which spread over almost all the villages in the country and the number of Co-operative Societies. In our country, there are about 5.5 lakhs of cooperative Societies with membership of more than 22crores. It covers a wide range of commercial activities and nearly 50% of them are engaged in farming and farming related matters. Nearly 70% of the Indian population being dependant on farming, is thus, connected with farmcooperatives. Cooperatives have covered 100% of villages and 67% of rural households. The co-operative sector contributes 50% of total farm credit and distributes 35% of total fertilizer consumption in the Country. They are procuring 60% of total sugar-cane. They are also playing a crucial role in the Agro-processing sector i.e. processing of sugar-cane, milk, cotton and oilseeds etc.. Dairy Cooperatives have excelled in their area of operation and have enabled India to attain top position in milk production in the world. Edible oil marketed through the Co-operative channel is estimated at 50% and handloom cooperatives account for 55% of the total out-put.

But in spite of being largest movement in the world and strongest link, it faces number of challenges like lack of internal resources and poor mobilization of external resources, inadequate infrastructure, competitive tier structure, apathy of members towards management, lack of accountability increasing sickness, dormancy, low level professionalism, excessive government control, political interference, dominance of vested interest over the management, lack of human resources development, education and training.Despite all challenges, Co-operatives have to be sustainable over a period of time for which professionalism is a must. Cooperatives have been looking for Governmental help. But they have been paying offits like official domination and interference in their day-to-day working etc. Dr. Kuriyan, an eminent co-operator in the country said recently that the cooperatives have undergone a crisis of identity being neither government nor private. He further said that cooperatives need to be more efficient and competitive, but at the same time they cannot sacrifice the basic tenets of co-operation. Inefficient cooperatives will have to either pull up their socks or down their shutters. Cooperatives have many advantages in tackling problem poverty alleviation, employment generation and food security. They also have the potential to deliver goods and services in areas where both the State and Private sectors have failed. Over the past few years, steps like the enactment of mutually aided Co-operative Societies

Act by some States and the Multi-State Co-operative Societies Act have been taken to give the Co-operative sector a boost.

- Lack of supervision and inspection by Registrar of Co-operative Societies resulting into financial misuse and disproportion institutional development.
- Government is hesitating to entrust any important government work since it does not have any participation.
- These cooperatives are away from the mainstream. The Co-operative Banks and other important institutions are not prepared to admit them as members.
- NABARD and RBI are not agreeing for conversion of Central and Urban Co-operative Banks.
- R.B.I. has also objected about the use of word "Co-operative" since the Banking Regulation Act uses the word "Co-operative Society".
- Perhaps we are not prepared or educated or sensitized enough to work without control and supervision.
- Mischievous persons may take advantage of the situation to cheat the general public.
- When the Government is exploring the possibility of regulating the Non-governmental organizations having vast experience, it is doubtful as to whether the mutually aided cooperatives in various fields can give the desired result.

The circumstances and the situation give rise to the Co-operative Movement in the Country are still prevalent. The market is still not accessible to small and marginal farmers. Supply of farm credit is not adequate. About 50% of our rural and tribal household still have no facility for institutional credit. The cooperatives are today at the cross road at their existence, particularly in view of the fast emerging economic liberalization and globalization. The cooperatives still continued to function in a traditional way with poor governance and management, poor resource mobilization, outside interference, depends on Government and lack of professionalization. The cooperatives are neither member-driven nor functioned professionally in a transparent manner with accountability to members. In spite of all these, no doubt, the cooperatives have contributed a lot to the farming development of the Country. We cannot afford to see that these institutions wither away. It needs reform. It is not-worthy to say that in the National Common Minimum Program of the present UPA Government it has been mentioned to bring a constitutional amendment to ensure the democratic autonomous and professional functioning of cooperatives. The constitutional amendment may limit itself to -

- Timely conduct of elections

- Timely conduct of audit,
- Uniform tenure of managing committee
- Conduct of general body meetings
- Right of a member for access to information and
- The accountability of the management.

In this context our strategies may be as follows. -

- Cooperatives need be member-driven; stakeholders should have a command over its affairs and activities. There is a need for more transparency, more interaction and confidence -building measures.
- Aggressive marketing strategy be adopted for sensitizing members and the general public about the service and quality rendered by the cooperatives. Commitment to best
- Service and pursuit of excellence should be the hallmark of Co-operative. Every society should adopt their customers' or members' charter and should meticulously adhere to this charter.
- Co-operative should compete with other players in prevailing market forces without any protectionist or discriminator approach.
- In respect of short-term, medium-term, long-term sector and Urban Bank sectors, restrictions have been stipulated by Reserve Bank of India, NABARD in respect of finance. These restrictions need be liberalized which would help Co-operative to optimize its lendable resources and provide finance to the members.
- Professionalization of management is one of the basic prerequisites of cooperatives. Both the personnel as well as directors of the committee of management should be exposed to regular training, interaction and orientation.
- Adoption of scientific planning for deployment of human resources on the principle of 'right man for the right post at right time' would help cooperatives to accelerate the pace of reforms. Human resources need to be proactive. Motivation, recognition for good work and leadership be inculcated for augmenting productivity.
- Basic tenets corporate governance be adopted like fair play, transparency and accountability.

The PACS, as the foundation of the Co-operative method are meeting the development needs of the farmers by providing credit, inputs and storage and processing and marketing facilities. The Co-operative federated at the district and State level constitutes the Co-operative method . But it is found that the Apex institutions have grown stronger whereas the primaries and in some cases,

Central Cooperatives have gone weaker. The situation has to be changed and the primaries have to grow stronger. The business of the Primary Societies has to be diversified.

5.4Cooperative Legislations in India

The cooperative movement in India owes its origin to farming and allied sectors. Towards the end of the 19th century, the problems of rural indebtedness and the consequent conditions of farmers created an environment for the chit funds and cooperative societies. The farmers generally found the cooperative movement an attractive mechanism for pooling their meagre resources for solving common problems relating to credit, supplies of inputs and marketing of farm produce. The experience gained in the working of cooperatives led to the enactment of the Cooperative Credit Societies Act, 1904. Subsequently, a more comprehensive legislation called the Cooperative Societies Act was enacted. This Act, inter alia, provided for the creation of the post of registrar of cooperative societies and registration of cooperative societies for various purposes and audit. Under the Montague-Chelmsford Reforms of 1919, cooperation became a provincial subject and the provinces were authorized to make their own cooperative laws. Under the Government of India Act, 1935, cooperatives were treated as a provincial subject. The item "Cooperative Societies" is a State Subject under entry No.32 of the State List of the Constitution of India.

In order to cover Cooperative Societies with membership from more than one province, the Government of India enacted the Multi-Unit Cooperative Societies Act, 1942. This Act was an enabling legislative instrument dealing with incorporation and winding up of cooperative societies having jurisdiction in more than one province. With the emergence of national federations of cooperative societies in various functional areas and to obviate the plethora of different laws governing the same types of societies, a need was felt for a comprehensive Central legislation to consolidate the laws governing such cooperative societies. Therefore, the Multi-State Cooperative Societies Act, 1984 was enacted by Parliament under Entry No. 44 of the Union List of the Constitution of India.

After India attained Independence in August, 1947, cooperatives assumed a great significance in poverty removal and faster socioeconomic growth. With the advent of the planning process, cooperatives became an integral part of the Five Year Plans. As a result, they emerged as a distinct segment in our national economy. In the First Five Year Plan, it was specifically stated that the success of the Plan would be judged, among other things, by the extent it was implemented through cooperative organizations.

The All-India Rural Credit Survey Committee Report, 1954 recommended an integrated approach to cooperative credit and emphasized the need for viable credit cooperative societies by expanding their area of operation, encouraging rural savings and diversifying business. The Committee also recommended for Government participation in the share capital of the cooperatives.

In view of these recommendations, different States drew up various schemes for the cooperative movement for organizing large-size societies and provision of State partnership and assistance. During the 1960s, further efforts were made to consolidate the cooperative societies by their re-organization. Consequently, the number of primary farm cooperative credit societies was reduced from around two lakh to 92,000.

5.4.1 *Evolution*

In 1958 the National Development Council (NDC) had recommended a national policy on cooperatives. Jawaharlal Nehru had a strong faith in the cooperative movement. While opening an international seminar on cooperative leadership in South-East Asia he had said " But my outlook at present is not the outlook of spreading the cooperative movement gradually, progressively, as it has done. My outlook is to convulse India with the Cooperative Movement or rather with cooperation to make it, broadly speaking, the basic activity of India, in every village as well as elsewhere; and finally, indeed, to make the cooperative approach the common thinking of India....Therefore, the whole future of India really depends on the success of this approach of ours to these vast numbers, hundreds of millions of people".

The cooperative sector has been playing a distinct and significant role in the country’s process of socioeconomic development. There has been a substantial growth of this sector in diverse areas of the economy during the past few decades. The number of all types of cooperatives increased from 1.81 lakh in 1950-51 to 4.53 lakh in 1996-97. The total membership of cooperative societies increased from 1.55 crore to 20.45 crore during the same period. The cooperatives have been operating in various areas of the economy such as credit, production, processing, marketing, input distribution, housing, dairying and textiles. In some of the areas of their activities like dairying, urban banking and housing, sugar and handlooms, the cooperatives have achieved success to an extent but there are larger areas where they have not been so successful. The failure of cooperatives in the country is mainly attributable to: dormant membership and lack of active participation of members in the management of cooperatives. Mounting overdues in cooperative

credit institution, lack of mobilization of internal resources and over-dependent on Government assistance, lack of professional management.Bureaucratic control and interference in the management, political interference and over-politician have proved harmful to their growth. The predominance of vested interests resulting in non-percolation of benefits to a common member, particularly in the class of persons for whom such cooperatives were basically formed, has also retarded the development of cooperatives. These are the areas which need to be attended to by evolving suitable legislative and policy support.

5.5Capital Formation in Indian Agriculture

India is the first in the world in the production of milk, pulses, jute and jute-like fibers, second in rice, wheat, sugarcane, groundnut, vegetables, fruits and cotton production, and is a leading producer of spices and plantation harvests as well as livestock, fisheries and poultry. In the past few years Indian farming has done remarkably well in terms of output growth, despite weather and price shocks.

Indian farming is broadly a story of success. The Eleventh Five Year Plan (2007-12) witnessed an average annual growth of 3.6 per cent in the gross domestic product (GDP) from farming and allied sector against a target of 4.0 per cent. While it may appear that the performance of the farming and allied sector has fallen short of the target, production has improved remarkably, growing twice as fast as population. India's farm exports are booming at a time when many other leading producers are experiencing difficulties. The better farm performance is a result of farmers' response to better prices; continued technology gains; and appropriate and timely policies coming together.

Although farming, including allied activities, accounted for only 14.1 per cent of the GDP at constant (2004-5) prices in 2011-12, its role in the country's economy is much bigger with its share in total employment according to the 2001 census, continuing to be as high as 58.2 per cent. The declining share of the farming and allied sector in the country's GDP is consistent with the normal developmental trajectory of any economy, but fast farm growth remains vital for jobs, earnings, and the food security. The growth target for farming
in the Twelfth Five Year Plan remains at 4 per cent, as in the Eleventh Five Year Plan.

The rates of growth and share of farming and allied activities in the GDP of the country are given below:

(per cent at 2004-05 prices)				
S.No.	Item	2009-10	2010-11	2011-12
1	Growth in GDP in Agriculture & Allied Sector	0.8	7.9	3.6
	Share of Agriculture & allied sectors in total GDP	14.6	14.5	14.1
	Agriculture	12.3	12.3	12.0
	Forestry and logging	1.5	1.4	1.4
	Fishing	0.8	0.7	0.7
2	Share of agriculture & allied sectors in total Gross Capital Formation (GCF)	7.3	6.2	6.8
	Agriculture	6.7	5.6	6.2
	Forestry and logging	0.1	0.0	0.1
	Fishing	0.5	0.5	0.5
3	GCF in Agriculture and Allied sectors as per cent to GDP of the sector	20.1	18.4	19.8
4	Employment in the agriculture sector as share of total workers (Census 2001)	58.2		
Source : Central Statistics Office, Directorate of Economics & Statistics (Department of Agriculture and Cooperation) and Population Census 2001.				

Review Questions

1. Define the Agricultural Marketing in India?
2. Explain the Cooperative Movement in Agriculture?
3. Explain the Cooperative Legislations in India?
4. Explain the Capital Formation in Indian Agriculture?

Discussion Questions

Discuss the State and Agriculture Sector?

Lesson 6 - Issues Before Agricultural Development

Learning Objectives

- To define the Agricultural Taxation and Subsidies.
- To explain the Public Distribution System and food Security.
- To explain the agriculture and globalization.
- To describe the Agricultural Pricing Policy in India.

6.1 Introduction

India's massive farm sector employs about 60% of the population, yet accounts for only about 17% of total GDP. Growth in farming has stagnated relative to other sectors: last year the farm sector grew at a rate of 2.7%, relative to 11% growth in both the service and industry sector. Farmearnings are lower and growing slower than earnings in other sectors. The government has a clear imperative to seriously examine whether existing policies are optimal.
There is a staggering amount of literature analyzing farm policy in India. From my admittedly cursory review I noticed several recurring themes, which I discuss in no particular order:

The World Bank cites an "almost universal lack of good extension services" to farmers as a major factor inhibiting growth. In addition to the miserable infrastructure in many rural areas, the inability of farmers to directly access markets has sustained the presence of a chain of middlemen through whom most farm commodities must circulate before finally reaching consumers. Many SHGs have, with great success, arranged cooperatives that bypass such middlemen and sell directly to wholesalers. The government should learn from the success of such initiatives and try to help streamline the farm commodity supply chain.

In spite of the gains of the Green Revolution, Indian farming lags behind in terms of technology take-up and production efficiency. Lack of access to credit, which we discussed earlier, may be one of the factors inhibiting farmers from investing in technology. However, the ground reality also suggests that poor education and lack of awareness of the benefits of new technology is also a factor. In addition, the epic and recurring issue of poor irrigation and infrastructure is widely recognized as a drain on productivity in many regions (It's estimated that about 10% of all farm production in India is wasted due to lack of storage, transport, etc.). The government already proved itself capable of stimulating advances in farm productivity with the Green Revolution. Future policies should focus on providing incentives to farmers to adopt better production

technology, bridging the information gap that currently exists in the farm sector, and remedying severe underdevelopment of irrigation and infrastructure facilities.

Currently, the Indian government sets a minimum support price for almost all farm commodities. Farmers who produce various goods are guaranteed the option of selling directly to the government at a price fixed at the beginning of the season. The stated goal of this policy is to "ensuring remunerative prices to the growers for their produce with a view to (sic) encouraging higher investment and production." The inherent endogeneity of MSP policy makes a rigorous impact assessment difficult, but the persistently low productivity growth in farming suggests that the MSP policies have failed to stimulate sufficient capital investments by farmers. Its conceivable the virtual subsidy provided by MSPs might actually dampen incentives for technology take-up by guaranteeing a basic level of earnings security. Furthermore, the existence of MSPs may encourage farm production for which there is actually limited demand in private markets, leading to unbalanced and suboptimal production choices by individual farmers. The process by which which MSPs are set is also somewhat dubious, and many have suggested that the current price-setting method is vulnerable to political manipulation and lack of parity across goods. Although scrapping MSPs would obviously expose a large number of farmers to the risk of price shocks, it seems to me that improving farmers' access to insurance products and commodity futures markets is more sustainable and optimal way to manage such risks.

Even if farm productivity does increase, it is still likely to lag behind the explosive IT and service sectors. However, the public educationalmethod is clearly failing to provide rural children with the skills necessary to enter these labor markets. This is perhaps the single biggest factor inhibiting the transition from farming to service sector employment. The demand for skilled workers in India has exploded, particularly in the service sector, demand which many firms are finding difficult to meet domestically due to extremely skewed distribution of human capital.

Although India's rural poor are by and large uneducated, many of them are capable of operating small businesses that have higher returns than traditional farming. However, their ability to start such business is often hampered by lack of access to credit and capital. In spite of the microfinance "revolution" and government policies designed to stimulate capital flow to the rural population (such as priority sector lending), there is still a massive failure of credit markets to meet the demands of the rural population. Empirical research has demonstrated that returns to capital are extremely high in microenterprises (roughly 80% in Sri Lanka), which of course

suggests that there is tremendous potential for farmers who start operating small businesses to supplement or replace their primary line of work.

6.2Farm Taxation and Subsidies

6.2.1 Farm Subsidies

Farm subsidies are monies given to farmers to support their operations. Subsidies may be provided directly, in the form of cash payments, or they may take the form of indirect support. A government might provide low-cost harvest insurance, for example, keep prices at an artificial level, or assist farmers in other ways. Subsidies are a feature of many government budgets, and a topic of hot debate in some regions of the world.

In the case of a positive subsidy, a farmer is rewarded for growing a harvest, with the money usually being based on the amount of harvest being grown or the amount of the harvest. With negative subsidies, farmers are encouraged not to produce a particular harvest or product. For example, if milk production is extremely high, farmers might be paid subsidies not to raise dairy cows, to reduce the amount of dairy on the open market.

Positive subsidies may be used to compensate for depressed prices, and they can be especially important for commodities. Farmers may stop growing particular commodities if they cannot get fair prices for them, and farm subsidies can be used to make farming worthwhile, ensuring that the supply of a commodity remains stable. Negative subsidies may be used to drive up prices by reducing the supply, or to limit the amount of a harvest deemed to be harmful. For example, farmers in Afghanistan are paid not to grow opium poppies, and people may be paid to slaughter cows to bring the price of milk up if it has fallen.

There are a number of supportive arguments for subsidies. Many people believe that they protect the domestic farm industry by making farming beneficial , especially in developed countries, where farmland may be more valuable as commercial real estate. Protecting domestic farming also contributes to national security by ensuring that there is a secure food supply.

Problems with farm subsidies include the fact that they can keep prices for certain commodities artificially low, which may lead people to make poor nutritional choices. If there's an incentive to grow more of one commodity or another because of subsidies, farmers will produce more, and new uses for that commodity need to be developed, which can in turn result in nutritional

imbalances as people eat more of something than they should. Subsidies are also viewed as contrary to the desire for fair competition, especially when they cause a rift in trade relations.

6.2.2 **Farm Earnings**

Farmingearningsare exempt under the Indian Earnings Tax Act. This means that earnings earned from farm operations is not taxed. The reason for the exemption of farmingearnings from Central Taxation is that the Constitution gives exclusive power to make laws with respect to taxes on farmearnings to the State Legislature. However while computing tax on non-farmearningsfarmearnings is also taken into consideration.

6.2.2.1 Meaning of Farm Earnings

As per Earnings Tax Act earnings earned from any of the under given three sources meant FarmEarnings;

(i) Any rent received from land which is used for farm purpose.

(ii) Any earnings derived from such land fromfarm operations including processing of farm produce, raised or received as rent in kind so as to render it fit for the market, or sale of such products.

(iii) Earnings attributable to a farm house subject to the condition that the building is situated on or in the immediate vicinity of the land and is used as a dwelling house, store house etc.

Now earnings earned from carrying nursery operations is also considered as farmearnings and hence exempt from earnings tax.

In order to consider an earnings as farmearnings certain points have to be kept in mind:

(i) There must me a land.

(ii) The land is being used for farm operations.

(iii) Farm operation means that efforts have been induced for the harvest to sprout out of the land .

(iv) If any rent is being received from the land then in order to assess that rental earnings as farmearnings there must be farm activities on the land.

(v) In order to assess earnings of farm house as farmearnings the farm house building must be situated on the land itself only and is used as a store house/dwelling house.

6.2.2.2 Certain earnings which are treated as FarmingEarnings;

(a) Earnings from sale of replanted trees.

(b) Rent received for farm land.

(c) Earnings from growing flowers and creepers.

(d) Share of profit of a partner from a firm engaged in farming operations.

(e) Interest on capital received by a partner from a firm engaged in farming operations.

(f) Earnings derived from the sale of seeds.

6.2.2.3 Certain earnings which are not treated as FarmEarnings;

(a) Earnings from poultry farming.

(b) Earnings from bee hiving.

(c) Earnings from the sale of spontaneously grown trees.

(d) Earnings from dairy farming.

(e) Purchase of standing harvest.

(f) Dividend paid by a company out of its farmingearnings.

(g) Earnings of salt produced by flooding the land with sea water.

(h) Royalty earnings from mines.

(i) Earnings from butter and cheese making.

(j) Receipts from TV serial shooting in farm house is not farmingearnings.

6.3 Public Distribution Method and food Security

6.3.1 Public Distribution Method (PDS)

Public Distribution Method (PDS) is an Indian food security method . Established by the Government of India under Ministry of Consumer Affairs, Food, and Public Distribution and managed jointly with state governments in India, it distributes subsidized food and non-food items for India's poor. Major commodities distributed include staple food grains, such as wheat, rice, sugar, and kerosene, through a network of Public distribution shops, also known as Ration shops established in several states across the country. Food Corporation of India, a Government-owned corporation, procures and maintains the Public Distribution Method.

In terms of both coverage and public expenditure, it is considered to be the most important food security network. However, the food grains supplied with the ration shops are not enough to meet the consumption needs of the poor or are of inferior quality. The average level of consumption of PDS grains in India is only 1 kg per person / month. The PDS has been criticized for its urban bias and its failure to serve the poorer sections of the population effectively. The targeted PDS is costly and gives rise to much corruption in the process of extricating the poor from those who are less needy. Today, India has the largest stock of grain in the world besides China, the government spends Rs. 750 billion ($13.6 billion) per year, almost 1 percent of GDP, yet 21% remains undernourished. Distribution of food grains to poor people throughout the country is managed by state governments. As of date there are about 5 million Fair Price Shops (FPS) across India.

6.3.1.1 Overview

Both the central and state governments shared the responsibility of regulating the PDS. While the central government is responsible for procurement, storage, transportation, and bulk allocation of food grains, state governments holds the responsibility for distributing the same to the consumers through the established network of Fair Price Shops (FPSs). State governments are also responsible for operational responsibilities including allocation and identification of families below the poverty line, issue of ration cards, supervision and monitoring the functioning of FPSs.

Under PDS scheme, each family below the poverty line is eligible for 35 kg of rice or wheat every month, while a household above the poverty line is entitled to 15 kg of foodgrain on a monthly basis.

A BPL card holder should be given 35 kg of food grain and the card holder above BPL should be given 15 kg of food grain as per the norms of PDS. However, there are concerns about the efficiency of the distribution process.

6.3.1.2 Public distribution shop

A **public distribution shop** also known as **Fair Price Shop** (**FPS**), part of India's Public Distribution Method established by the Government of India, is a kind of shop in India which is used to distribute rations at a subsidized price to the poor. As of date there are about 4.99 lakh Fair Price Shops (FPS) across India.

Locally these are known as "ration shop" and chiefly sell wheat, rice, kerosene and sugar at a price lower than the market price. However, other essential commodities may also be sold. These are also called Fair Price Shops. For buying items from this shop one must have a ration card. These shops are operating throughout the country by the joint assistance of central and state government. No doubt the item from these shops are much cheaper but are of poor quality. Ration shops are now present in most localities, villages towns and cities. India has 478,000 shops constituting the largest distribution network in the world.

The introduction of rationing in India dates back to the 1940s Bengal famine. This rationing method was revived in the wake of acute food shortage during the early 1960s, prior to the Green Revolution.

6.3.1.3 Fallouts of P.D.S.

The Public Distribution Method of India is not without its defects. With a coverage of around 40 crore BPL (Below Poverty Line) families, a review of the PDS has discovered the following structural shortcomings and disturbances:

1. Growing instances of the consumers receiving inferior quality food grains in ration shops.
2. Deceitful dealers replace good supplies received from the F.C.I (Food Corporation of India) with inferior stock and sell FCI stock in the black market.
3. Illicit fair price shop owners have been found to create a large number of bogus cards to sell food grains in the open market.
4. Many FPS dealers resort to malpractice, illegal diversions of commodities, hoarding and black marketing due to the minimal salary received by them.
5. Numerous malpractices make safe and nutritious food inaccessible and unaffordable to many poor, thus resulting in their food insecurity.
6. Identification of households to be denoted status and distribution of granted PDS services has been highly irregular and diverse in various states. The recent development of Aadhar

UIDAI cards has taken up the challenge of solving the problem of identification and distribution of PDs services along with Direct Cash Transfers.

7. Regional allocation and coverage of FPS are unsatisfactory and the core purpose of price stabilization of essential commodities has not met.

Several schemes have augmented the number of people aided by PDS, but the number is still extremely low. Poor supervision of FPS and lack of accountabilityhas spurred a number of middlemen who consume a good proportion of the stock meant for the poor. There is also no clarity as to which families should be included in the BPL list and which excluded. This results in the genuinely poor being excluded whilst the ineligible get several cards. Awareness about the presence of the PDS and FPS to poverty-stricken societies, namely the rural poor has been dismal.

The stock assigned to a single family cannot be bought in installments. This is a decisive barrier to the efficient functioning and the overall success of PDS in India. Many BPL families are not able to acquire ration cards either because they are seasonal migrant workers or because they live in unauthorized colonies. A lot of families also mortgage their ration cards for money. Lack of clarity in the planning and structuring of social safety and security programs in India has resulted in the creation of numerous cards for the poor, and limited information about the overall use of cards has discouraged BPL families from registering for new cards and also increased illegal creation of new cards by such families to ensure maximum benefit for the family members

To improve the current method of the PDS, the following suggestions are furnished for:

1. Vigilance squad should be strengthened to detect corruption, which is an added expenditure of taxpayers.
2. Personnel-in-charge of the department should be chosen locally.
3. The margin of profit should be increased for honest businesses, in which case the market method is more apt anyway.
4. F.C.I. and other prominent agencies should provide quality food grains for distribution, which is a tall order for an agency that has no real incentive to do so.
5. Frequent checks & raids should be conducted to eliminate bogus and duplicate cards, which is again an added expenditure and not foolproof.
6. The Civil supplies Corporation should open more Fair Price shops in rural areas.
7. The Fair Price dealers seldom display rate chart and quantity available in the block-boards in front of the shop. This should be enforced.

In the aggregate, only about 42% of subsidized grains issued by the central pool reach the target group, according to a Planning Commission study released in March 2008.

Food stamps given to the needy and to the underprivileged by issue of coupons, vouchers, electronic card transfer etc. They can purchase commodities at any shop or outlet. The state government would then pay back the grocery shops for the stamps said the Finance minister in his budget but the United Progressive alliance which came to power in 2004, it decided on a Common minimum program (CMP) and one of the agenda was food and nutrition security. Under that the government had plans to strengthen the food security program DS.

However the Finance minister P. Chidambaram in his budget speech went contrary to the idea proposed in the CMP and proposed the idea of the food stamp scheme. And has proposed to try the scheme in a few districts of India to know its viability. At the CMP the government had proposed that if it is viable it would universally the PDS but if the Food stamps would be introduced it would be a Targeted public distribution method and a group of about 40 economists have cautioned the NAC headed by Sonia Gandhi against the food security bill as it would put an additional burden on the ex-checker and instead have advised to go ahead and experiment with food stamps and other alternative methods and did point out the flaws in the PDS. These set of 40 economist hail from different institutes like the Delhi School of Economics, Indian Statistical Institute, Jawaharlal Nehru University, Indira Gandhi Institute of Development Research, Centre for Development Studies, Harvard, MIT, Columbia, Princeton, London School of Economics, University of British Columbia, University of California and University of Warwick.

6.3.1.4 Distribution of food stamps

6.3.1.4.1 Opportunities

1. It will reduce India's dependence on buffer stock for price stabilization and in turn reduce costs
2. It provides an incentive to deregulate the domestic market and thus will induce private entrepreneurs
3. There is an immense need to develop appropriate marketing infrastructure and institutions to deal with trade in farm commodities. (Kaushik Basu 2007)
4. Appropriate policy changes are a must, for instance, in the post WTO period the international prices of wheat and rice came to their lowest levels. But in India due to high MSP's the prices were relatively high. Thus as a result importing was cheaper than

buying from the domestic market. As a result, the government levied 50% tariff on wheat and 80% percent tariff on rice which further resulted in one of the outlandish incidents in the Indian history that was an accumulation of buffer stocks which were exported which, incidentally, came back for sale at high MSP's for instance in 2002-03, the government sold 1.6 million tons to exporters but actual exports were only 0.682 million tones

The government may have to set up a complete method for the same or would have to put this responsibility on Post office, banks or such other institutions. In this process there could be leakages which are a matter of concern. Also there would be a burden which would come to the poor class who has to benefit from the same of going and collecting the food stamps.

6.3.2Food security in India

Food security is access to enough food by all people at all time for an active and healthy life. In the past concentrated efforts were made to achieve food security by increasing food grain production. Thanks to the impact of green revolution, though it was limited to same harvests and too in limited states. To ensure easy access to food at the household level, government monopolizes grain management and subsidized food grains.

Paradoxically, India attained national food self-sufficiency 35 years ago yet about 35% of its population remains food insecure. Lowerearnings and high food prices prevent individual food security. Another aspect of the Indian food security situation is that after over three decades of operation, public distribution method meets less than 10% of the consumption of PDS grains– rice and wheat –by the poor.

At the global level, poor harvest coupled with rising demand has led to an overall increase in food prices. Unfavorable weather conditions in parts of Europe and North Africa, together with worst ever drought in Australia put stocks of major food harvests, especially wheat, at record low levels. Tight supply pushed up the prices of wheat to unprecedented heights, significantly affecting food inflation across the globe including India.

Surging food grain prices and worsening global supplies are now bringing the domestic food crisis to the boil. The crisis has been building up for some time. The food grain yields of Indian farmers are not going up. Grain output has been stagnating for over a decade and there is a growing gap between supply and demand.

Attaining long-term food security requires the raising of earnings and making food affordable. To ensure food security for the vulnerable section of the society a multiple pronged stately is to be evolved. To begin with all the existing social safety net programs need amalgamation and should focus on vulnerable and underprivileged regions and groups.

The existing anti-poverty programs may be made more transparent with better government that minimizes leakages and benefits from such programs. Simultaneously, farming needs to be reformed by improving incentives, incentives, increasing investment, etc. So that production of traditional and high-value commodities can be increased.

Unfortunately farming is in the grip of poor performance. Production environment is changing it is not dominated by small holders. With the shrinking land holdings, their sustainability and viability cannot rely solely on production of food grains. To augment their earnings, small holders need to diversify their production and harvests.

Ten years after the dismantling of the universal public distribution method methods, the statistical jugglery of the targeted food distribution method actually excludes millions of poor in both the BPL and APL categories. Targeting links to neoli9beral policies that seek to limit, if not eliminate, the government's welfare responsibilities.

The denial of the right to food for a large section of the Indian population reflected in increased malnourishment strutted growth, ill health and loss of energy and therefore productivity is an issue that deserves more national attention. If countries agree to be graded in terms of provision of food security to their citizens, India would rank along with Ethiopia at the lower end.

The United Nations children's fund report that tone out of every two children in India in malnourished confirms the lopsided priorities of successive governments at the Centre that seek to narrow fiscal deficits by reducing food subsidies.

Until 1996, India has universal PDS. There it introduced the targeted method with the mistaken notion that the infirmities of the PDS should be curbed and that it would enable subsidized grain to reach those who actually needed it.

India now has 10 years of experience of the targeted (into APL and BPL households with access to food grain at different prices) and further targeted (into BPL and Antyodaya households) method . Last year, the planning commission did an evolution of the PDS and found that 57% of the poor hand been actually excluded from the BPL method . Earlier the Abhijit Sen committee

had also come up with similar findings, pointing to the utter failure of the targeted method , and suggested a return to the universal PDS.

For these schemes are a major problem. If only those who are officially identified as poor can have access to food, then clearly the method has ensured accuracy. The prevailing method of identification is entirely unsatisfactory. There are two sets of estimates. The estimate that is linked to allocations of food grain is made by the planning commission.

According to a replay given in parliament, the present concept of the poverty line is based on the per capita consumption expenditure needed to attain a minimum amount of calorie intake out of food consumption along with a minimum amount of not-food expenditure in order to meet the requirements of clothing, shelter and transport, among other things. This is based on the methodology suggested by the Lakdawala committee in 1993 and the population projections of the registrar-general of India as of march 12000. Shockingly, according to the current assessments, it works out to around Rs. 11 an adult a day clearly; this is not a poverty line but a destitution line.

Earlier foodgrain allocations were not linked to poverty line assessments but were open-ended depending on past utilization by the states. The linkages came along with the targeted method . This creates another anomaly. The rural development ministry has set of programs for BPL families.

According to current estimates, 6 crore households in India come under the BPL category. That such a large number of people are earning less than Rs 330 a month is shocking enough. But what is cruel is that anyone earning above this meager monthly earnings is classified as APL and excluded from the right to subsidized foodgrain. The very words ‘Above Poverty Line’ misleading because they include a vast section of the poor who have been denied their entitlements through statistical fraud and jugglery to serve a neoliberal agenda.

The need for subsidized food grains for a wider section of people is also reflected in increased off take. While the off take in the Antyodaya method is around 90%, showing the desperate need of people for cheap foodgrain, the off take for BPL has doubled in the past few 73.67 lakhtonnes to 228.45 lakh tonnes in 2005-06 out of an allocation of 273.20 lakh tonnes which constitutes 83%- of the allocation.

As far as APL is concerned, the off take is much lower not because people do not need the grain but because for several years there was not much difference in the APL price and the market

price. The central issue price for wheat is Rs 7.50 a kg. For rice the price range is from Rs 10 in Gujarat and Maharashtra for a kg to Rs 9 in Andhra Pradesh and West Bengal.

As current market prices of foodgrain have shot up, the demand for APL foodgrain will definitely increase but the poor offtake of the grain in the demand for APL foodgrain will definitely increase but the poor off take of the grains in the past few years is being cited by the government to cut allocations, precisely when people require it more.

Since rice procurement is reportedly up by around 28 lakh tones, it is possible for the central government to replace wheat allocations will rise at least for the time being in consultation with the states. Instead of taking such a step, the Centre is proposing a cut in the allocation. The demand for a revision of poverty assessment also needed. Secondly, the neglect of food grain production consequent to the new farm policy's emphasis on export-oriented cash harvests are a major reason for the current shortfalls in wheat production.

The third Issue is that of procurement of wheat. Wheat deficits to the extent of 29 lakh tones below the buffer stock norms leading to imports for the first time in decades are a result of the deliberate policy of the government to cut down procurement on the one hand and encourage private trade on the other.

Big farmers who could hold on to their stocks would have benefited from the higher price offered later, but the bulk of the peasantry sold their produce to traders at a price below the Rs 700 offered three weeks too late by the government, the FCI had been given the same leeway as private trade, then the present dismal record of low procurement could have been avoided. Shockingly, the government offered the Indian farmer almost Rs 100 less than what it paid foreign trades. The concerning of the stock in private trade has permitted wheat hoarding, which has pushed market prices up by Rs 5-6 a kg.

Decades of building a food security method can be wiped out by such neoliberal ideologies that undermine the principle of self-reliance. Besides, it reflects a naive belief that international prices will remain static whereas clearing international trades are waiting to maximize profits through wheat imports as higher, price to India.

Further, a dangerous concession by way of lowering of phytosanitary standards in the quality of wheat is also being planned- This must be opposed strongly. India can spend thousands of crores to protect itself through nuclear might but can render itself completely vulnerable by losing its greatest achievement, the backbone of sovereignty----- food self-sufficiency.

With this approach, the situation on the rice front could follow a similar disastrous pattern in the future. It also raises the question of whether it is appropriate to combine the Farming Ministry with the food and the Public Distribution Ministry. Fourthly, the FCI is being weakened method ethically.

The employment schemes of the Government, which offer part of the payment in food grains. Play an important part in the provision of food security, through inadequate. The move to cut back on this component will also cut down on the real wages of the worker. With the current high prices of wheat and other essential commodities, What the worker grains in cash are less than what he/she has to pay for his/her foodgrain needs in the market.

What needs to be done is improving the method – whether of procurement agencies, the fair price shops or the methods of distribution – but not to destroy them. But that is what the Food and Public Distribution Department seems to be proposing. People –centered reform requires a return to the universal PDS.

During periods of high inflation in food prices, governments must provide a basic minimum quantity of food grain and other food items at low prices through public distribution methodsfor low-earnings, food-insecure, and vulnerable populations. In India, the ostensible purpose of the Targeted Public Distribution Method (TPDS) was to take food to the poor; in practice, it has resulted in the large scale exclusion of the poor and food-insecure from the public food method .

Recent evidence from a report titled *Public Distribution method and other Sources ofHousehold Consumption 2004-5* (GOI. 2007), which presents data from the 61st Round of the National Sample Survey (NSS), establishes that targeting has led to *high rates of exclusion of needy household from the Public Distribution Method* (PDS) and cleared deterioration of coverage in States like Kerala where the universal PDS was most effective. Let me illustrate with evidence from rural India.

The recent report of the National Sample Survey gives us an insight into the magnitude and nature of this exclusion from the PDS. At the all-India level, 70.5 per cent of rural households either possessed no card or held an APL card. Since household with APL card are effectively excluded from the PDS, the majority of rural households in India is excluded from the PDS.

The NSS Report also allows us to classify-by caste, occupation, land ownership and consumer expenditure category-the household that are excluded from the PDS.

The NSS maintains five types of rural households, based on information on source of earnings; self-employed (farming), self employed (non-farming), farm labour, other labour and other households. We focus on farm labour, since manual farm labour households are undoubtedly among those most in need of access to the PDS.

The all India average indicates that 52percent of farm households either had no card or an APL card. The corresponding proportion was 96 per cent in Manipur, 68 per cent in Rajasthan and Assam, 71 per cent in Bihar and 73 percent in Uttar Pradesh. Can 70 percent of farm labour households be considered as ineligible for the PDS?There were only four States in which two thirds or more of farm labour households were not excluded from the PDS (that is, held a BPL or Antyodaya ration card). These States were Andhra Pradesh, Karnataka, Jammu and Kashmir and Tripura.

Secondly, we examine the social background of households, focusing on Scheduled Caste and Scheduled Treble households. We have selected only those States where the rural Scheduled Caste population is more than 10 percent of the total population. In rural areas, there is known to be a substantial degree of overlap between the Scheduled Caste status, blandness and poverty.

The NSS data shows that 70 percent or more of Scheduled Caste households had no card or an APL card in rural areas of Assam, Bihar, Himachal Pradesh, Jammu and Kashmir, Punjab, Rajasthan and Utter Pradesh. Among these states, only Punjab is a cereal-surplus State. At the all-India level, 60 per cent of the scheduled Caste households in rural areas were effectively excluded from the PDS. States with a lower degree of exclusion of Scheduled Caste households were Karnataka (27 per cent excluded), Andhra Pradesh (31 per cent), and Kerala (38 per cent).

A large number of households belonging to the Scheduled Tribes, Again, do not have access to the PDS: to illustrate, 90 per cent of rural Scheduled Tribe households in Assam, 79 per cent in Arunachal Pradesh and 68 per cent in Chhattisgarh were excluded from the PDS. Surprisingly, the North Eastern Sates did not perform too well on this count (though again there may be a problem of data quality). There were only four states - Andhra Pradesh, Orissa, Gujarat and Maharashtra-where more than 50 per cent of rural Scheduled Tribe Households had received a BPL or Antyodaya card.

The NSS report classifies households by the extent of land they possessed. It is not noted that land possessed" refers to all types of land and includes farm land, homestead land and non-farm

land. It is not surprising, then, that a very small proportion of households are reported as landless. I have therefore grouped together the two categories of landless.

Again, the conclusion is that a very high proportion of landless and near landless households did not possess BPL or Antyodaya cards (86 per cent in Sikkim, 80 percent Goa, 79 per in Uttar Pradesh. 76 per cent in Haryana, 75 per cent in Jharkhand, and 74 per cent in Uttaranchal, for example) and were thus effectively excluded from the PDS.

In striving for "efficiency" by means of narrow targeting households that should be entitled to basic food security through the PDS have been left out. The data from the 61st round of the NSS make it quite clear that a high proportion of farm labour and other labour households, of households belonging to Scheduled Caste and the scheduled Tribes, of households with little or no land and households in the lowest expenditure classes, are effectively excluded from the PDS today.

The exception is Tamilnadu, which is the only State to have introduced a universal method of PDS, with rice available at Rs. 2 a kilogram to all households irrespective of the type of ration card. The only immediate remedy to the problem is to make the PDS universal again, and to ensure that a monthly ration of basic food commodities including aging, pulse and oil is available at affordable prices to all households.

6.3.2.1 Major Problems of Food Security

To maintain the need of food for the growing population and to meet the minimum food requirement, various steps has been taken in these directions.

(i) Biotechnology is used to modify different harvests genetically to increase the yield per hectare.

(ii) Genetically modified harvests require less water compared to other harvests.

(iii) Biotechnology made the harvests more resistant to insect pests and diseases.

(iv) Biotechnology benefits both rich and poor farmers and make the environment safe and free from pollution.

6.3.2.1.1 Problems:

(i) In spite of surplus food-grains stock, it is also a reality that a vast number of people do not have enough money to feed themselves twice a day. Even in 1999-), 20% of the people of India were below the poverty line.

(ii) Though the percentage of people below the poverty line declined substantially from 36% in 1993-94 to 20% in 1999-2000, yet in absolute number it was 210 million which by no means is a small number.

(iii) There has been a gradual shift from the cultivation of food harvests to the cultivation of fruits, vegetables, oilseeds, and harvests which act also as industrial raw materials. This had led to the reduction in the net sown area under cereals, millets and pulses.

(iv) The use of more and more land for construction of factories, warehouses and shelters has reduced the land under cultivation and now fertile land for farming, is no longer available.

(y) The productivity of land has started showing a declining trend. Fertilizers, pesticides and insecticides, which once showed dramatic results, are now being held responsible for reducing fertility of the soil.

6.4 Agriculture in the Context of Globalization of the Economy

6.4.1 Introduction

Globalization refers to increases in the movement of finance, inputs, output, information, and science across vast geographic areas. The gains from globalization increase net earnings in many places and facilitate decreases in levels of poverty and may thereby increase levels of food security. However, there is an implication of frictionless movement and perfect knowledge that understates the requirements for benefiting from globalization.

These trends have been underway throughout history. As reflected in the previous chapter, they have moved unusually rapidly in recent times because the cumulative breakthroughs in basic science have allowed an extraordinary acceleration in the reduction of transfer costs. Real costs of information transfer and shipment of goods have declined rapidly, while perishability and the bulk have been drastically reduced. Concurrently, increases in per capita earnings in many regions, and in the total size of the market, have allowed scale economies to be achieved for myriad new products, most of which involve value added processes that themselves require

investment and improved technology. These rapid changes have allowed a great increase in specialization in farming, and consequently lower costs and rapid growth in trade.

Globalization can greatly enhance the role of farming as an engine of growth in low-earnings countries by making it possible for farming to grow considerably faster than domestic consumption. It also increases the potential for farming to increase food security through enlarged multipliers to the massive, employment-intensive, non-tradable rural non-farm sector. With such potential benefits, it is important to understand what is required for participation and to ensure that the poor and hungry are lifted out of poverty and hunger by these processes.

6.4.2 Competing in the context of globalization

Three features characterize competing in the current globalization context:

Cost reductions in one place have immediate impacts in other places

Cost reduction and associated production increase constantly occur in farming, and the pace is accelerating, partly due to the forces of globalization. Thus, lower prices are often rapidly transmitted to producers who have not participated in cost reduction. If they have not experienced cost reduction in other endeavors either, they will experience a decline in earnings, eventually reverting to minimum subsistence farming. All too many of the least-developed countries fall into this category. They become poorer and more food insecure.

6.4.3 *Cost reduction largely derives from scientific advance*

Cost-reducing scientific change is the product of applied research, which increasingly depends on constantly advancing basic research. Low-earnings countries that are not rapidly expanding and improving their farm research capacity will not experience cost reductions and hence as others reduce costs, and prices decline, earnings of the non-innovators will decline. Nowhere is this more dramatic than in Africa, which has suffered from increasingly efficient production of first oil palm, then cocoa, and now coffee from Asian countries that have been spent on research. Benefiting from research is now far more complex than a few decades ago.

Basic research is moving far faster than ever before, constantly changing the context for applied research. Private firms are more responsible for a much larger absolute and relative share of farm research than in the past. To benefit from modern biological science, the complex relations between low-earnings and high-earnings countries must be developed and even more complex

relations between private sector and public sector research. The first requisite for benefiting from research externalities is a strong national research method . Rate of return analysis shows that all low-earnings countries are vastly under-investing in applied farm research, particularly Africa. For low-earnings countries, the role of the Consultative Group on International Farm Research (CGIAR) should become far more important than in the past as a link to basic research, private sector research and high-earnings countries.

Well operating markets in low-earnings countries are concentrated in major cities with reasonably good physical infrastructure and hence at least moderate transaction costs. Undertaking international trade is constantly decreasing in cost. Thus major urban markets in low-earnings countries are increasingly open to foreign competition. Farm production in these countries takes place in rural areas that are frequently deficit in physical infrastructure. Hence foreign sources of competition may face low transport costs while domestic producers in low-earnings countries may face high transport costs. Such costs are reduced by investment in physical infrastructure - most notably roads, but also communications. However, improved infrastructure also facilitates the movement of imported goods further into the rural economy, posing the threat of increased competition for local production.

Globalization has greatly increased the returns to roads and consequently radical to reductions in costs. Rural roads in low-wage, low-earnings countries can be built with over half the cost oflabor and roughly half the cost represented by the food consumed by labour from their wages.

6.4.4 The commodity composition of agriculture

Globalization has allowed farm production to grow much faster than in the past. A few decades ago fast growth was somewhat over 3 percent per year. Now it is 4 to 6 percent. However, these higher rates of growth involve a substantial change in its composition. The bulk of growth initially came from basic food staples when the scope of export markets is limited, whereas there is now a swing towards much higher value commodities. Explosive growth in earnings of high-earning countries means that large aggregates of production can now occur in what were previously small niche markets. High quality coffee and tea are examples. The market for horticulture exports has also grown immensely and can continue to grow.

As exports of high-value farm commodities increase and the multipliers to per capita earnings develop, domestic demand for high-value livestock and horticulture will increase rapidly. Thus, even in quite low-earnings countries, around half the increments to farm production will be high

value horticulture and livestock for both export and domestic use. As a result, the role of cereal production will become relatively less important.

As the production mix moves more towards export harvests and high-value harvests and livestock, the rate of return for investments that reduce transaction costs will increase rapidly. The same is true for investments in all the value-added enterprises. There is however a caveat on value added. Much of such activity is through capital-intensive processes. There are also complexities in marketing. Both will give a comparative advantage to high-earning countries. Low-earnings countries need to pay attention to comparative advantage at every step in the chain from producer to consumer and should not attempt components in which they lack a comparative advantage.

Cereals play an important role in food security in a global economy. The cost of shipping is declining. Two forces in developing countries may lead to increased cereal imports. First, globalization and specialization may lead to an increase in the area planted to high-value commodities and potentially result in a decline in the area planted to cereals if either increased intensity of production (i.e. Double harvesting) or extensification are not possible. Second, any shift of the earnings distribution towards the low-earnings, food insecure, will shift the demand schedule upwards. Thus, low-earnings countries may be beneficiaries of declining cereal prices, even while they lose from declining prices of other farm commodities.

6.4.5 Converting the benefits of globalization into food security

A major element in ensuring food security is increased earnings of poor people. The marginal propensity of the poor to spend on food is high. The primary means by which low-earnings people increase their earnings and hence their food security is through increased employment.

It is farm growth that reduces poverty, and farming's impact is dependent on growth rates that are considerably higher than population growth rates. The latter is indirect, working through their impact on the demand for rural non-troubles that occupy a high proportion of the total labour force and the bulk of the poor, food insecure.

The great majority of persons below the poverty line work in the rural non-farm sector. They include many with a small tract of land that is insufficient to provide minimum subsistence. The rural non-farm sector uses very little capital and hence is highly employment-intensive. It produces goods and services that are dominantly non-tradable, that is they are dependent on local sources of demand. Farm growth is the underlying source of that demand growth.

The farm demand shows strong growth multipliers since the rural non-farm sector also tends to spend substantially on itself. This sector is highly elastic in supply, as would be expected of a labour-intensive sector in a low-wage economy. The supply of rural non-tradables is highly elastic, mainly because labour is the primary input and labour is elastic in supply as long as earningss are low or underemployment is endemic. It is demanding that constrains growth of the sector and that demand comes from high farm growth rates.

That the impact of farming on poverty is indirect is consistent with the three or four year lag noted before the full impact on poverty. That it works through the rural non-farm consumer-goods sector is consistent with the finding that farming has little impact on poverty decline when land distribution is highly unequal- usually associated with absentee zamindars who have quite different consumption patterns from those of peasant farmers.

For a major effect on employment, farming must grow substantially faster than population growth. If it is to grow in the 4 to 6 percent rate required for achieving employment levels essential to food security, then major components of farming must be exported. This will include the traditional bulk exports such as cotton, coffee, tea, oil palm, and non-traditional exports including horticulture. Globalization requires constant reduction in costs through research and its application as well as constantly declining transaction costs through constantly increasing investment in rural infrastructure. Without these a nation cannot compete: it is no accident that it is African nations that suffer the most from declining commodity prices.

Below, the urgent requirements for low-earnings countries to benefit from globalization are presented.

6.4.6 *Opening the economy to trade and market forces*

The benefits of globalization flow of trade. Exports require imports, but trade restrictions tend to drive up the cost of exports through higher costs of vital inputs and technology. Comparative advantage needs to be seen for each component of a supply chain, not just in the final product. Customs inefficiencies and corruption and a myriad other bureaucratic constraints are just as stifling as tariffs and all need to be dealt with. However, opening to global market forces does little good if costs are not being constantly reduced. Put differently, if the result of global forces interacting with domestic investment and policy is to leave comparative advantage with subsistence production, no amount of opening of markets will help.

Investing in farm research and dissemination

Low-earnings countries need to invest far more than at present in farm research and technology dissemination. Without such investment, opening markets will do little good for farming and hence for poverty reduction and food security. Identifying supporting mechanisms such as research and training to minimize the exclusion of small resource poor farmers from value chains is also important.

6.4.7 *Investing in rural infrastructure*

Given the deplorable state of rural infrastructure in low-earnings countries, massive investments are needed Investment in other economic risk reduction services such as insurance, irrigation, storage are also likely to be required. Lack of such investment gradually shifts comparative advantage back towards subsistence production at very low-earnings and little multiplier to the rural non-farm sector. Winters notes that "the transaction costs of trade with remote villages are often so great that it can be cheaper for grain mills to buy from distant commercial growers than from small farmers located in the region." However, improved infrastructure also lowers the final cost of imports in the producing areas.

6.4.8 *Facilitating private sector activity*

All too often forgotten in these days of removing public sector constraints is the role that the public sector plays in conjunction with the private sector, especially in exports. It is not enough to remove bureaucratic constraints. Private sector investors in low-earnings countries tend to search for quick turnover, particularly in trade. Initially, governments have to play a role in assisting the private sector by participating in the costs of market analysis, assisting in the development of trade associations that can diagnose needs, developing and enforcing grades and standards, meeting health regulations of high-earning importers, diagnosing special niche markets and carrying out analysis of constraints. In the case of most low-earnings countries, such efforts are sometimes financed by foreign aid programs, in a sense acting as public sector. Such efforts need to facilitate private sector action and gradually low-earnings countries need to play that role themselves, rather than relying on foreign aid.

6.4.9 High-earnings country assistance in the context of globalization

High-earnings countries must play a major role in ensuring access to the best of modern science to low-earning countries. That calls for greatly expanded support of the CGIAR method and prodding the method into playing a lead role in linking advanced biological science in high-

earnings countries with the needs of low-earnings countries, as well as bringing private sector research into low-earnings countries and engendering cooperation.

High-earnings countries must also open their markets to low-earning countries, particularly for high-value harvests. They should work with low-earnings countries in meeting phytosanitary rules and other obstacles to trade. They must also ensure that farm earnings transfers do not depress world prices. High-earnings countries must see that their measures to transfer earnings to their farmers do not result in downward pressure on world prices and reduction in markets for low-earnings countries. Delinking payments to farmers from prices is not sufficient, although it is a necessary condition. Payments to farmers keep resources producing that would otherwise be withdrawn serve to depress prices. Withdrawing land from production as part of payments and making payments that encourage lower yields per hectare and per animal, would also help meet environmental objectives.

Lower cotton prices are a disaster for low-earnings cotton producers and lower vegetable oil prices are similarly a strong negative factor. Reduced livestock prices are a particularly onerous burden on farmers of low-earnings countries with little mitigating benefit. The Doha Round should be used to obtain agreement from high-earnings countries to reduce support payments to farmers. This might roll back some of the recent excesses.

While production-increasing policies for cereals hurt some countries, they in general benefit the food insecure. These people are almost always net purchasers of cereals, so lower prices are helpful to them. Low-earnings countries are increasingly importers of cereals, and will be more so as the area devoted to high-value commodities is expanded. Thus, cereals are a special case, and as explained below could be used in the context of building rural public works.

High-earnings countries should provide financial support for a massive program of rural public works. Calculations for Rwanda show that in a context of expanding rural employment (by 14 percent) and domestic farm production to meet major rural infrastructure needs, the demand for basic food staples would expand 9 percent more than supply. That would bring about a roughly 30 percent increase in domestic prices of basic food staples, which are largely non-tradable in Rwanda, because of the quality and transaction costs. This would be a disaster for poor people. Thus, a massive rural public works program would require imports of cereals roughly equal to 9 percent of domestic basic food staple production. Such a program on an Africa-wide basis would absorb the bulk of excess production of cereals in the highest-earning countries. It follows that a massive food-aid program in the context of rural infrastructure development would be an

important contribution of high-earning countries, particularly in the context of their domestic farm-support programs.

6.4.10 Conclusion

Globalization, in the sense of rapid transmission of the impact of technology to all areas of the globe with a highly developed infrastructure, will continue to accelerate. Low-earnings countries that do not spend heavily on research and technology dissemination and do not upgrade their rural infrastructure and reduce transaction costs will experience continual declining prices for farm commodities, but without offsetting decreases in costs of production.

In contrast, where costs are reduced by research and improved infrastructure, farming can attain growth rates of at least 50 percent higher than in the past. That would have powerful multipliers to the rural non-farm sector, thereby reducing poverty, increasing employment, and increasing food security.

High-earnings countries can assist this process though continuing to open trade in farm commodities; preventing domestic farm support programs from dumping commodities on world markets; and, in the case of cereals, massively increasing demand through financing rural public works programs to reduce transaction costs in rural areas and bring them more fully into the global market. Low-earnings countries, especially in Africa, must redirect public expenditure to farm production, especially research and rural infrastructure. They should reduce constraints to trade, including overvalued exchange rates, and consider cutting customs barriers.

6.5 Farm Pricing Policy in India

6.5.1 Farm Price Policy : -

This policy is a tool to influence the price of farm product. It is an incentive for the producer to produce a particular product according to the desired quantity.

6.5.2 Importance of Price Policy : -

The price of farm product fluctuates more quickly as compared to the industrial product. So these changes in prices affect the earnings, standard of living of the farmer and rural population. Even these also affect the trade of other goods.

Example : - In India and Pakistan if the prices of cotton or wheat falls any year, it also affects the trade and other business badly. The farmers aggregate demand falls, which affects the whole

economy.

The govt. in this situation interfere so that prices may not fluctuate beyond a particular limit. Because if the price of any particular product falls in any year, then next year farmers never cultivate that product. It will create a shortage next year in the market. So farm price policy has greater importance in the developing countries of the world.

6.5.3 Objectives of Price Policy: -

The objectives of the farm price policy may differ from country to country. These depend upon the stages of development in a country. Anyhow, following are the important objects of farm price policy :

1. To meet the domestic consumption requirement govt. Promotesa balanced increase in production.

2. To provide price stability in the farm product.

3. To meet the national targets by the planners.

4. To provide the wheat to consumer to a reasonable price.

5. To provide the raw material to the industries at reasonable price.

6. To increase the production and exports of farm product.

6.5.4 Methods of Adopting Farm Price Policy : -

To regulate the prices of the productgot. taken the following measures :

1. Administrative Price : -

Govt. tries to maintain a favorable prices acceptable to both farmer and producer. But generally both the parties remain unhappy. If govt increases the price of farm product, then consumer suffers. As govt. increased the price of wheat to encourage the farmer, public criticized the govt. badly. On the other side if goods are priced low then farmers suffers and production is affected adversely. Govt. tries to protect the interest of the both parties.

The administrative prices consist upon the following the prices :

I. Support Prices :- Every year govt. fixes the support prices of important harvests. The prices are announced before the sowing time, to encourage the farmers.

II. Issue Prices :- To protect the consumer interest govt. provides specified quantity of goods to the consumer at the prices which are lower than market prices.

III. Procurement Prices : - Govt. every year maintains a particular stock of a product. This stock was used at the time to time of emergency and shortage for the purchase of the desired farm product govt. announces procurement prices. These prices are generally reasonable.

6.5.5 Changing in Demand and Supply : - Sometimes govt.Producers some portion of the product it reduces the supply in the open market then price level rises. Govt. allows the sellers to sell their product at market price. Sometime govt. exports the surplus product. It reduces the supply, price level rises. The farmer sells product at a reasonable price.

6.5.6Progress in Facilities : -

The govt. can influence the price of the product by providing the facility of where house and roads and markets. Due to these facilities farmer can sell his product at a reasonable price. Most of the different countries have also revised its farm price policy keeping in view the problems of the farmers and consumers.

The price support policy is implemented through various departments. Food, Cotton and Rice export corporation. Farm marketing and storage limited, and ghee corporation are playing very effective role in this regard. Wheat, rice, cotton, sugarcane, sunflower etc. Prices are set through the price support policy.

Review Questions

1. Define the Agricultural Taxation and Subsidies?
2. Explain the Public Distribution System and food Security?
3. Explain the agriculture and globalization?
4. Explain the Agricultural Pricing Policy in India?

Discussion Questions

Discuss the Issues Before Agricultural Development?

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