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## CHAPTER 1

# AGRICULTURE

### 1.1 LAND AND AGRICULTURE

Land is to be considered the most important aspect of production or especially agricultural production. Regardless of the advancement of power-machine civilisation and the subsequent decline of vegetable civilisation or agriculture, the problem of food production and supply and the question of limitations in the availability of cultivable or arable land still remains crucial. The problem seems to be quite insoluble due to the fact that explosive population growth in some parts of the world is fast outpacing the growth of agricultural output. Thus, the problem of providing sustenance to very rapidly increasing human family is serious. We, therefore, require more and more of agricultural crops to supplement their demand. But the supply of land area is rather limited and cannot be increased at our wish. Hence, a proper assessment or evaluation of a country's cultivable land resources is of fundamental importance in the present day world.

Agricultural scientists are of opinion that, about 40% of 37 million acres of land in the world may be considered cultivable under the existing pattern of cultural environment. We have already emphasized the fact that nature sets outer limits to man's potential resources. But within these outer limits there is very wide scope for human choice, initiative and skill. This, in fact, applies to cultivable land as to all other natural phenomena. The degree of availability of cultivable land is determined by a multiplicity of physical as well as cultural limitations. Physical limitations, in their turn, fix up the outer limit of cultivable land. The four main physical limitations can be summarized as follows :

(a) **Temperature** : Temperature conditions which determine, at the outset, the possibility of introducing agriculture and subsequently growing season temperature and dates of occurrence of spring and fall.

(b) **Moisture Condition** : This includes rainfall, snowfall, hail, fog, humidity, rate of evaporation which may or may not be conducive to the growth of agricultural crops.

(c) **Physiography** : Physiography or configuration of the earth that determines the flatness or ruggedness, degree and direction of slope etc.

(d) **Soil Character** : Soil is perhaps of fundamental importance and is comprised of certain physical structure, chemical composition and biological characteristics.

It has been estimated that the total land area of the earth is about 58 million square miles, of which about 6 million square miles lie in the hostile Polar regions. Apart from the Polar Regions the earth has 52 million square miles of land surface. The physical limitations, mainly unfavourable climatic conditions rule out  $\frac{4}{5}$ ths of this area for wheat cultivation. Of the remaining 11 million square miles more than half is again unfavourable for ruggedness of the terrain and infertility of soil. Therefore, only 5.5 million square miles or 10% of the land surface is physically suitable for wheat cultivation. This area of 5.5 million square miles is to be considered as the outer limit of the land suitable for wheat

growing, set by the physical factors. How much of it will ultimately be utilized for what growing is determined by cultural and human limitations.

In addition to the physical limitations there are some cultural and human limitations which are equally important in determining the availability of land. Man always wants to adapt himself perfectly with his immediate surroundings but he never succeeds not only because of the physical constraints alone but also, more importantly perhaps, because of his incapacities within himself. Thus, even the areas which are physically so favourable for wheat growing, remain either unutilized or used for growing inferior grades of crops.

The actual range of cultivation is usually determined by the following cultural and human factors :

- (a) Land required for purposes other than agriculture.
- (b) Competition with pasture lands and forests.
- (c) Volume of population and human wants.
- (d) Act and organisation of agriculture.
- (e) Types of energy used.

(a) A large proportion of land of a country which could otherwise be used for cultivation is utilized for the construction of houses, factories, villages, cities, roads etc. The greater the proportion of land required for such purposes, the lesser shall be the proportion of land available for cultivation.

(b) It is important to note that all the land available for cultivation is not only used for raising food crops. Some people also live on animal rearing and, therefore, use their land for raising hay crops. Similarly, in order to restore the ecological balance of a country some portion of land is kept under forests. This also reduces, to some extent, the proportions of cultivable land.

(c) Volume of population also affects the degree of utilization of land. Generally, sparsely populated areas contribute to the underutilization of land since the people show least interest for crop growing because of lesser demands. In Australia, Argentina and Canada the underutilization of land can be explained in terms of low population in those countries. Human wants also augment cultivability of land. However, in a market economy, where a steady demand persists, even sparsely populated areas can be brought under farming if the means of transporting the surpluses are well developed.

(d) The physical frontiers determining the cultivability of land may be extended further with the help of more advanced methods of farming and farm-technology. The development of short ripening varieties of seeds has helped to extend the physical boundaries of cultivation to the sub-polar regions with very short summer. For example, wheat growing in the CIS had penetrated into the cooler Northern regions following the introduction of short maturing variety of wheat seeds.

The increase in the proportion of cultivable land does not only mean the physical inclusion of land, but it also refers to such processes like the extension of irrigation networks, introduction of multiple cropping pattern, applications of chemical fertilizers etc, by which the gross output can be raised substantially and the range of cultivation may also be increased.

(e) The use of the type of energy is another important determinant of cultivability of land. The use of animate energy certainly delimits the amount of cultivable land and under such conditions most people tend to concentrate to the more fertile lands. Thus, the regions

with less fertile soils remain almost unused and barren. But with the increasing use of inanimate energy, cultivation extends to the far off corners of the country with the subsequent increase in the proportion of the cultivable lands. The use of inanimate energy in cultivation also enhances modernization. Thus, the relatively backward subsistence farming gives way to more developed commercial farming. The inanimate energy helps to increase the productivity as well as the gross output.

## 1.2 CULTIVABILITY IN AN EXCHANGE ECONOMY

The peasants of the underdeveloped countries primarily produce crops for themselves and for the members of their family. Under such subsistence level of economy there is hardly any marketable surplus. But in contrast, the farmers of more advanced nations, like the United States, Canada etc., produce to sell their products in the market. In an exchange economy, the cultivability of land largely depends on the cost of production and also on the cost of selling. If the selling price for an agricultural commodity is high enough and if the facilities for transporting the product from the region of production to the region of consumption is readily available at a relatively lower cost then the relatively infertile lands would also be cultivated to raise crops. On the other hand, low selling price and insufficient transportation system reduces the margin of profit and, thereby, the lands partially remain unused.

It is important to note that the sum total of the cost of production of a crop does not only depend on the fertility status of the soil, wage rates, prices of purchased goods, interest rates, taxes etc., but also upon the skill of the farmers, quality of management, application of science, the types of energy used, etc. Actually, in an exchange economy, the concept of cultivability thus becomes a function of a multiplicity of factors associated with different phases of culture. A country which is more advanced in regard to technology, knowledge and in the use of superior energy—inanimate energy—has greater proportion of cultivable lands. Thus, the aspect of cultivability of land varies both with time and space.

## 1.3 THE ORIGIN OF AGRICULTURE

Agriculture is, by far, the most fundamental form of human activity which includes not only the cultivation of various crops but also domestication of animals, forestry, irrigation and many other diversified activities. In fact, in a broad sense, agriculture relates to the entire gamut of man's basic or primary activities except mining. In the words of Prof. E. W. Zimmermann : "Agriculture covers those productive efforts by which man settled on land, seeks to make use of, and, if possible, accelerate and improve upon the natural genetic or growth processes of plant and animal life, to the end that these processes will yield the vegetable and animal products needed or wanted by man". In short, agriculture denotes man's involvement with soil or land in connection with the growth of plants and animals for food and clothing.

It is very difficult to say when ancient man first started agriculture or when agriculture actually originated. Primitive men were certainly food gatherers, eating whatever fruits, leaves and roots they could obtain. Number of human beings were small and nature was bountiful to meet their demand for food. As time passed, human members grew in number and fishing and hunting increasingly became important in supplementing the demand for food.

To meet the scarcity of food the necessity of food production was soon realized by man. Wild animals were tamed to provide them meat, milk and skin. Later, such animals were used as draught animals. The women who used to gather edible grains made a great

discovery : they noticed that a new plant grew from the seed. Women began to bury seeds in the ground. In this way farming originated from food gathering. It is assumed that such crude farming appeared about 10,000 to 9,000 years ago. Since the principal implement in the earliest farming was the hoe, it was called 'hoe culture' or 'hoe agriculture'. Hoe agriculture, in fact, yielded low harvests. Still, it was far better than gathering in providing the clan with plant food. Following the invention of agriculture, men began to live in settled or permanent communities, because there were hardly any more for chasing the wild animals for food or for migrating in search of edible forest products. They had time to develop the various arts, crafts and skills that formed the basis of modern industries and also evolved religious and political ideas. Thus, the appearance of land tillage and livestock breeding were tremendously important for the primitive people. With the advent of permanent agriculture, a measurable degree of cultivation was not possible. As time passed, the simplest means of land tillage expanded in more complex forms and thus formed the basis of modern industrial civilisation.

The importance of agriculture in the present days hardly requires any mention. nearly 70% of the world's population are engaged in farming—either in the crop-growing or the rearing of animals. But the relative percentage of employment in agriculture is a widely varied phenomenon. Approximately 2% of the total employed persons are engaged in agriculture in the UK, about 8% in Germany, 12.5% in Japan, about 60% in India and as high as 95% in Guinea. It is to be noted that the percentage of agricultural employment is inversely related to the level of economic development of a country, but it is difficult to accept that Japan is less developed than the UK or Germany. Such generalization, however, be made in the wider sense of the term.

#### 1.4 FARM MECHANIZATION AND ITS RELATIVE IMPORTANCE IN MODERN AGRICULTURE

The degree of success, which a country attains, in agriculture can be explained in terms of degree of farm mechanization in the modern times. There is a great deal of disparity in the relative degree of farm mechanization in different countries of the world. As a rule, the farm in North America, Australia and in some parts of Europe have long been mechanized. In the former USSR and China, farm mechanization played an important role in the upliftment of agricultural output following the Socialist revolution. But in most parts of Asia, Africa and Latin America, as well as in economically backward parts of Europe, manual labour and use of draught animals retains its traditional importance. In the beginning, most farm machines were geared to large-scale operations, but at present smaller and more compact machines have been devised to fit with the environment of many underdeveloped countries.

Now, that increasing yields and larger harvests are being obtained as a result of plant breeding or the introduction of new irrigation or drainage schemes, more and more countries are thereby experiencing a rapid increase in farm mechanization to allow the farmers to cope with the extra work. In fact, the prime objective of farm mechanization is to lessen the burden of farmers, to increase their productivity and to establish better controls over the natural conditions which, if not hospitable, hinder agriculture.

Farm mechanization has many advantages which can be discussed in brief in the following paragraphs :

1. **Speed of Operation** : One of the basic advantages of farm mechanization is that it speeds up the various jobs on the farm. It has been estimated that, for the preparation of a paddy field of about one hectare area with a buffalo drawn plough requires about 90 hours of time. As a buffalo can constantly work for about 5 to 6 hours a day, it will take several days' time to plough the entire field. While, on the other hand, a tractor can do the same

work only within seven and half hours time. Thus, mechanization speeds up the farming operation to an incredible degree.

2. **Reduced Labour Input** : Farm mechanization greatly reduces the amount of labour needed to perform various farm activities. In a country with substantially lower population density or in areas where there is a relative shortage of farm-labour as in most of the highly industrialized countries of North America and Western Europe, farm mechanization is particularly important and essential. Machines are in crying need at certain seasons, for example, during the harvest, when there is most work to do. Mechanization is also essential on large farms, which would otherwise be uneconomic to work if great numbers of farm-hands had to be employed.

Introduction of modern means of irrigation have greatly intensified the land utilization pattern in various countries. Double cropping or even triple cropping has been made possible through the integrated development of irrigation systems. The regions which remained fallow, primarily because of short supply of moisture, have thus been brought under cultivation. We must note the fact that following the introduction of modern irrigation systems the amount of work of the farmer and his assistants has greatly increased, but by making use of a little bit of machines the work can be done at little extra cost in man hours. Productivity per worker will thus be much greater.

3. **Better Quality, Less Wastage** : The use of machinery for harvesting a crop may often lead to better quality of output. For example, machine harvested grain crops, like wheat or rice, are much cleaner and freer of unwanted dirt or rubbish than they would probably be if they were harvested manually. This means that the value of the crop is enhanced and less processing is required. Moreover, the use of machines speeds up the operation of harvesting of such crops like sugar cane, cotton etc. which cannot be kept long in the field if they once mature. Thus, if the crops can be gathered quickly by harvesting machinery, the resulting product will certainly be of much better quality and will yield more money, if sold in the market.

Mechanization of the crop protection devices also ensures that more of the plants remain in good health and larger crops can be raised. Mechanization also minimises the degree of wastage to a great extent; for instance, the use of a combine harvester—which can cut, thresh and sack grain crops alone—will certainly result in less wastage than if such processes were to be done separately.

4. **Cheapness of the Products** : Since the use of machines can speed up the farming processes and reduce labour requirements, they are often cheaper in the long term in comparison to human or animal labours, in spite of the fact that mechanization requires greater outlay of initial capital.

Despite the many advantages which are to be gained from farm mechanization, a lack of necessary planning can lead to many problems which may partially out rank the advantages in the short term. The basic disadvantages which may result from rapid mechanization of agriculture are :

1. **Unemployment** → Mechanization results in the subsequent reduction of labour requirements which in turn will reduce the cost on wages to a great extent, but in areas where agriculture is out and out labour intensive, mechanization will lead to unemployment of farm labourers. The problem of unemployment resulting from rapid mechanization is most acute in the third world nations, where there is hardly any scope for alternative means for livelihood. But in the long term, mechanization will create the scope for greater employment opportunities, because greater output of labour will be required for handling, packing, sorting or processing the crops and there will be many more jobs for mechanics, drivers and machine operators. The problem of unemployment can be overcome most

successfully through advance planning so that a country can reap the benefit of mechanization in a fruitful way.

2. **Overequipment** — Overequipment is another problem which may also result if a country lacks planning in this regard, because the farmers will tend to buy more machines for the size of their farms. To meet this problem the government should make necessary planning or should extend loan service either through a government agency or a co-operative so that the farmers can borrow money for necessary machines. In most of the third world nations farms are extremely fragmented and thereby the introduction of costly equipment will certainly prove to be very uneconomic.

3. **Uneven Mechanization** — Uneven degree of mechanization is another problem which may often bring about other adverse socio-economic consequences. As the initial investment for mechanization is too high only the richer section of the farmers would be able to use of them to reap more profits from the increased harvest. But, on the other hand the poorer segment of the farmers would remain poor, more because of the fact of mechanization. This may lead to increase of the disparity between the richer and poorer sections of the farmers.

4. **Machine Management** — Machines are efficient only if they are regularly and carefully serviced and maintained. The physical conditions of the machines will deteriorate if they are most frequently used. Moreover, reduction in the efficiency of machines will certainly increase the cost of production of crops. Lack of trained personnel in most of the underdeveloped countries will also cause a lot of problems in maintaining the machines in good conditions.

Summarizing the relative advantages and disadvantages, it is quite clear that mechanization is not properly planned or if it is too rapidly introduced in areas where traditional methods of farming are of greater use, it can lead to certain problems. In general these can be overcome by adequate planning and thus, in the long run, farm mechanization will increase efficiency, output and productivity.

## 1.5 MAJOR TYPES OF AGRICULTURAL PRACTICES

The activity of farming is so varied and complex in nature that, it is by no means an easy task to classify the agricultural types of the world. A simplified classification of existing types of farming based on their latitudinal extent, such as tropical agriculture and temperate agriculture, may result in duplication. If, on the other hand, agricultural classification is based on the crops and their regional diversity that would certainly fail to bring out the differences in the farming methods involved in the production of such crops. Thus, a cursory perusal of the world's agriculture reveals a wide variation among the regions in respect of the supply of lands, supply of moisture, cropping systems, volume of production and market, social system and a host of others. It would, therefore, be convenient for us to see how some of the above criteria divide the predominant types of world agricultural practices.

### A. On the basis of supply of land

- (i) Intensive method of agriculture.
- (ii) Extensive method of agriculture.

### B. On the basis of supply of moisture and water

- (i) Humid farming.
- (ii) Irrigation farming.
- (iii) Dry farming.

**C. On the basis of cropping system**

- (i) Monoculture or one crop agriculture.
- (ii) Duoculture of double-crop agriculture.
- (iii) Oligoculture or multiple crop agriculture.

**D. On the basis of volume of production and market**

*Formal crop rotation e.g. mung & fertilizer*

- (i) Primitive subsistence agriculture.
  - (a) Migratory primitive agriculture.
  - (b) Sedentary primitive agriculture.
- (ii) Commercial grain farming.
- (iii) Plantation agriculture.

*is practiced with small patches of land with the help of primitive tools like Dao - Hoe. This type of farming depend upon monsoon*

*Environment Monocultivation Ecological Imbalance*

*Frane place of living change and Agriculture land field change - Resion => poor environmental condition 2-3- year after land fertility low and the move to the place -*

**E. On the basis of regional concentrations**

- (i) Monsoonal agriculture.
- (ii) Mediterranean agriculture.
- (iii) Mixed farming in North-Western Europe.
- (iv) Tropical and subtropical plantation farming.

**F. On the basis of social system**

- (i) Feudalistic.
- (ii) Capitalistic.
- (iii) Socialistic.

**A. (i) Intensive Method of Agriculture :** Intensive method of agriculture refers to either labour or capital intensive method of farming per unit area of land. Such farming methods are characteristic of the areas where the population density is much higher compared to the proportion of arable lands. Intensive methods of farming usually imply the presence of minimum fallow, greater use of fertilizer, methodical crop rotation to optimize the productivity of land, use of high yielding varieties of seeds to maximize production, scientific breeding and feeding of animals. These result in substantially high yield per unit of land but not necessarily per unit of labour force. Intensive method of farming may be advanced or backward depending on the essential characteristic features. Japan and the West European countries have adopted intensive methods of farming because of their greater population pressure on land. In contrast to this, intensive methods have also developed in most of the backward South-East Asian countries like India, Bangladesh, China, Vietnam etc. But the basic difference between these two methods of intensive farming lies mainly in the amount of capital investment and consequently the per unit land, labour production and productivity. In Japan or in West European countries, the system is highly advanced while on the other hand in other regions it is yet backward. Intensive methods of farming in the backward regions are also characterized by the presence of relatively higher proportions of fallow lands.

**A. (ii) Extensive Method of Agriculture :** In contrast to the intensive method of farming, extensive method is most commonly practised in the areas where there is abundant supply of land and the population relatively sparse. Thus, the proportion of per capita arable land is much higher. Extensive method of farming is found in countries like the USA, Argentina, Canada, Australia etc. Under extensive method of farming the farmer generally specialises in one or two major commercial crops and performs farming operations with the help of machines. Thus, extensive method represents a method of mechanized farming. The chief characteristics of this system of farming can be narrated as follows :

- (a) Extensive method of agriculture represents a form of highly capital intensive farming. Under this system almost all the necessary agricultural operations are done by machines of very sophisticated types.
- (b) Farms are very large in size and some cover several hundreds of acres.
- (c) Since farming is less intense in nature, no extra measure is taken to restore soil fertility and in most of the cases the fertility is replenished through natural processes.
- (d) Because of lower demand for food, farmers specialise in mono-crop cultivation, e.g. wheat is the most popular grain crop and is grown extensively in the Prairies in the USA and Canada.
- (e) Large scale operation of farming results in very large aggregate outputs though yield per hectare is substantially low.
- (f) The extensive method of farming enables the farmers to produce large quantities of marketable surpluses.

B. (i) **Humid Farming** : Humid farming, as its name implies, is characteristic of the areas which get sufficient amount of rainfall. Under the system of humid farming the crops are produced without the help of irrigated water. The fields are generally prepared during the rainy season and the seeds are sown. Harvesting is done either in autumn or in winter. The amount of rainfall determines the types of crops that can be grown since the moisture requirements of crops vary greatly from one another. Thus, the wetter crops like rice, jute and sugarcane are grown in the areas having greater amount of rainfall while the areas with moderate amount of rainfall are used for growing relatively drier crops like cotton, tobacco, wheat, barely etc. Monsoon lands, tropical rainy climates, the Mediterranean regions and the cool temperate countries of Europe and America practise humid farming. This method is less costly as the cost of irrigating the fields is totally saved. The characteristic features of humid farming can be summarized as follows :

- (a) The irrigation farming is the cheapest method of farming. Under this method, the farmers can start their farming operation immediately after the rainy season.
- (b) The amount of rainfall received by an area determines the types of crops and also the cropping intensity in a region. Areas dotted with greater amount of rainfall are important for the cultivation of wetter crops like rice, jute, sugarcane; while the low rainfall areas grow cotton, wheat, tobacco etc.
- (c) The quantity and quality of the crops are also determined by the amount and periodicity of rainfall. The timely occurrence of rainfall in substantial quantity enhances bumper crops.

Humid farming is not entirely free from some problems, such as:

- (a) In the areas of excessive rainfall, waterlogging of the land and the draining of water is a great problem.
- (b) Heavy rainfall also results in greater losses of soil through erosion.
- (c) The quantity and quality of the crops are also determined by the wetter months of the year and thus, during the drier months, the lands remain uncultivated.

B. (ii) **Irrigation Farming** : Irrigation farming is practised in those areas where the annual precipitation is either highly seasonal or periodic or inadequate for crops to be raised. It is by far the most important method in the monsoon and sub-tropical regions where the seasonality of rainfall is most conspicuous. India has the largest acreage of land under irrigation farming. However, the areas having more secured supply of perennial sources of water are more important for irrigation farming than the areas which are devoid of such

sources. The important regions of irrigation farming are most closely associated with the areas where gigantic river valley projects have been undertaken. For example, Gangetic Valley, Indus Valley, Nile Valley, Sikiang Valley, Mississippi-Missouri and San Joaquin Valleys practise irrigation farming. The basic characteristics of irrigation farming are like these :

(a) In comparison to humid farming, irrigation farming represents a costlier method of farming. Therefore, the crops which can only bear with the high costs of production are cultivated. Generally, cash crops like sugarcane, tobacco, cotton etc. are cultivated on the irrigated tracts which yield greater return.

(b) Perennial irrigation enables crop cultivation throughout the year and thus no part of the cultivable land is left fallow.

(c) Market condition, to a great extent, determines the nature of crops to be grown on such irrigated fields.

(d) As irrigation farming enables the farmers to produce high priced crops, they get ready cash for their produce. Thus, the farmers are economically more affluent and are able to buy and make use of chemical fertilizers, better seeds, insecticides and sophisticated farm machines for growing crops. This, in fact, results in better quality and higher yields of crops per hectare.

Some of the problems of irrigation farming are :

- (i) In areas close to the irrigation canals and reservoirs, fertile agricultural lands often became useless due to water logging.
- (ii) In certain highly irrigated areas of the world, land often becomes infertile because of the gradual removal of the top layer of the soil by the force of the flowing irrigation water.
- (iii) Excessive irrigation may often results in increase in soil salinity. For example, large tracts of fertile land in the irrigated tracts of the Nile Valley have become useless for cultivation because of excessive salinity.

**B. (iii) Dry Farming** : In contrast to humid farming, dry farming is commonly practised in those areas where the average annual rainfall is less than 50 cm and the irrigation facilities are either absent or very inadequate. Dry farming usually aims at the maximum utilization of available water. It is most commonly practised in the drier plateaus and the interior of the continents. In such areas of scanty rainfall, sandy loam soils are extremely suitable for dry farming. The warmth of the sandy soil is beneficial for the plants. Under such conditions, the farmers make special efforts to retain and conserve the soil moisture and to make the best possible use of the limited rain water. The farmers spend considerable amount of money and effort on levelling or terracing the slopes, by constructing high earthen dykes or wells around the field, and in carrying on regular weeding. Thus, the dry farming becomes too expensive and the crops which can only bear the relatively high cost of production are cultivated. Dry farming is very common in the areas like the drier western part of the USA and Canada, in the drier highlands of Mexico and Central America, South-West Brazil, South Africa, Western Australia, Israel, Lebanon, Syria and Turkey, South-Central parts of the former USSR, Deccan plateau of South India, Western Rajasthan and the interior of China. The characteristic features of dry farming are :

- (i) Land is terraced and divided into a number of small segments so that the rain water moves under regulated conditions.
- (ii) The land is deeply ploughed before the rains to make the surface of the soil loose. Intense ploughing is done after every rain to conserve most of the rain water.

- (iii) A loose mulch of soil or dust is spread over the field to check soil erosion and evaporation of moisture.
- (iv) Small wells are also constructed around the field to check run off.
- (v) Constant weeding is done to remove the unwanted grasses which would otherwise consume the valuable water from the soil.
- (vi) Quick maturing and drought resisting crops like wheat, cotton, millets, pulses etc are preferred.
- (vii) Since dry farming involves high capital outlay, only the valuable crops with greater market value are cultivated.

C. (i) **Monoculture** : Monoculture means cultivation of single crop over years. Monoculture is characteristic of the areas where soil and climatic conditions favour specialisation in the production of such crops like tea, rubber, coffee, etc. Tea cultivation in India, coffee plantation in Brazil, rubber plantation in Malaya, or banana cultivation in Puerto Rico provide examples of monoculture. Monoculture is, thus, found to be solely dependent on external or foreign market to a great extent. Environmental factors are not only important but also the socio-cultural factors are of great significance of such regions. Diversification.

C. (ii) **Duoculture** : It implies the raising of two crops a year from a land. It is more commonly practised in the densely populated areas, where the existing climatic conditions are favourable enough to grow two crops during each cropping year. These crops are distinctly divided according to their water requirements. In India, for example, crops are divided into two distinct classes—'kharif' crops—depending on monsoonal rainfall and the 'rabi' crops—grown in the winter months of the year.

C. (iii) **Oligoculture** : Oligoculture or multiple cropping involves cultivation of a number of crops from a land. Scientific soil management, introduction of quick maturing varieties of seeds, expansion of modern irrigation system, cultivation of cash crops and multiplicity of other methods lead to the development of multiple cropping or oligoculture. This agriculture is very common in the areas where the density of population is very high and also a relative scarcity of arable land. Multiple cropping is greatly developed in Japan and is gradually becoming important in the countries like India, Vietnam, Bangladesh, China, Korea where the demand for food is very great. This type of farming is mainly developed in the tropical and sub-tropical climatic regions of the world where thermal conditions remain favourable throughout the year. Multiple cropping system may also develop in the areas adjacent to the centres with high density of population.

D. (i) **Primitive Subsistence Agriculture** : (a) **Simple subsistence agriculture** or **migratory primitive agriculture**—This form of subsistence agriculture represents the crudest method of land tillage and is therefore termed as rudimental cultivation by some agricultural geographers. This is very widely practised by many tribal groups of people. The greatest concentration of tribal people practising this form of agriculture is seen in the tropical Africa, tropical South and Central America and in South-East Asia. It is very popularly known as migratory or shifting cultivation. To a great extent, the primitive migratory agriculture represents a form of self-sufficient agriculture and thus, the farmers grow food only for their own consumption. Shifting cultivation is practised in the tropics by many isolated groups of tribal peoples and thus it has got different names in different parts of the world, such as *milpa* in Central America and parts of Africa, *conuco* in Venezuela, *roca* in Brazil, *masole* in Zaire, *ladang* in Malayasia, *humah* in Indonesia, *caingin* in the Philippines, *taungya* in Myanmar, *tamrai* in Thailand, *jhum*, *bewar* and *podu* in India and *chena* in Sri Lanka. Shifting cultivation bears the following characteristic features which are quite distinctive of their own :

(i) Sites for the shifting cultivation are normally selected in the virgin forest by the old and experienced members of the group. Hill slopes are generally preferred because of better drainage condition. Many farmlands are most often located in the remote interiors, far away from the principal centres of population concentrations. Their physico-cultural isolation from the more developed economic areas hinders their progress and delays the necessary innovations in the traditional system of agriculture.

(ii) Fire plays a unique role in this primitive form of agriculture. It is generally used to clear the forests and the ashes are added to the soil to retain the fertility status of the soil only to a very limited extent. The unburnt trees are cut out by the man or may be left to decay naturally. Shifting cultivation is thus known as "slash and burn agriculture".

(iii) The average size of the farms under this type of agriculture is very small, about 0.5—1 hectare. Farmlands are very widely scattered from one another by dense forests or bush.

(iv) Degree of mechanization is very low and only very primitive tools such as sticks and hoes are generally used. Therefore, it is often known as the realm of hoe culture. The primitive agriculturists do not even know the use of draught animals and thus most of the works are done by the muscles of men. It is very true that in this form of agriculture very little attention is paid to the crops if they are once planted, but at the same time shifting cultivation involves the most wasteful processes of human energy and very unrewarding.

(v) Shifting cultivation is mostly associated with mono-crop cultivation though a few other crops are also cultivated. Emphasis is usually given to starchy food crops such as tapioca, cassava, yams, maize, millet, upland rice, beans and bananas. Crops are sown at calculated intervals, so that they can obtain assured supply of food all the year round. Crops sown in different farms are more or less of the same type.

(vi) Shifting cultivators usually follow the principal of field rotation rather than 'crop rotation'. A field, being used for short period of cultivation, is kept fallow for a much longer period. This is done intentionally so that the fertility of the soil can be regenerated naturally.

(vii) This form of rudimentary method of agriculture still supports many of the aboriginal tribes of the tropical latitudes. The governments of the concerning countries have made efforts to re-settle them but they have failed. A number of factors are responsible for such migration which include —

- (i) the exhaustion of soil nutrients;
- (ii) deterioration of the lightly constructed bamboo houses;
- (iii) severe attack by insect-pests, diseases or wild animals.

Some other characteristic features of shifting cultivation are :

- (i) little or no application of manure,
- (ii) no private ownership of land; land belongs to communities, village or tribes,
- (iii) each member of the community may use as much land as it can clear and cultivate,
- (iv) small production—not sufficient to leave any surplus,
- (v) most areas of migratory primitive or shifting agriculture have a sparse population.

Though shifting cultivation provides the livelihood for about 75% or more of the people of the tropical rainforests, still it also has some major disadvantages which are becoming increasingly apparent in the modern world.

(i) Firstly, food shortages and famine, which are very common in the tropical areas, are not eliminated in this very crude type of food producing economy, despite the fact that it provides a much more secure basis for subsistence and a more balanced diet than among the hunters and primitive food gatherers. Cultivated crops are more prone to the attack of pests and diseases and to the ravages of birds than those growing wild in the forests.

(ii) Secondly, migratory primitive agriculture is an efficient method of land utilization as long as the land can lie fallow, long enough to restore soil fertility after cropping. The natural cycle of cropping and fallow is adjusted to retain the ecological balance, but it can be easily upset.

At present, most areas of traditional shifting cultivation are under tremendous pressure to increase their productivity. This is because of the fact that population in those areas, too, is increasing at a substantially high rate. But there is also a new incentive to grow commercial crops, partly as a result of internal demands for new implements or tools which can only be bought through markets, partly through external pressures from government or major producers. Thus, for example, rubber may be successfully grown in Indonesia, coffee in Latin American countries or oil palm in Africa. In this way, the traditional system of cultivation is gradually undermined and the environment itself may suffer from permanent damage.

D. (i) (b) **Sedentary Primitive Agriculture** : Outside the realm of the tropical rain forest, a more advanced form of subsistence farming is seen which is known as the sedentary subsistence agriculture. Unlike the shifting or migratory primitive agriculture, sedentary primitive agriculture has many features in common and are most widely scattered in the sub-tropical and temperate plateaus and high lands of the tropics.

It is very difficult to generalize the causes of development of this type of farming because of its widespread occurrence under varied climophysical conditions. It is most commonly believed that the stronger moving tribes, previously engaged in shifting cultivation, were forced to adopt more stabilized or permanent form of agriculture because of the development of more advanced form of activities like mining, commercial plantation farming etc. Nevertheless, adaptation to varying physical conditions through ages has developed a great variety of crops, more advanced and distinctive implements and specific methods of village. The natives of South-East Asia, Amazon Basin, and the East Indies now engage in sedentary farming in the neighbourhood of major collecting and transshipment points. In contrast to the shifting cultivation, animals play more important roles but the types of animals reared are also very varied in nature. Cattle, donkeys, goats, sheep and horses are however, most commonly seen. Of the crops raised, aquatic crops, common root crops, cereals are important. In the temperate regions fruits are raised in great quantities.

D. (ii) **Commercial Grain Farming** : In comparison to the other forms of agriculture, extensive mechanized grain cultivation is of recent development in the continental lands of the midlatitudes. Prior to its development such areas were roamed by nomadic herdsmen. The interior location, well away from the oceanic influence and the low rainfall (between 30 cm to 66 cm) make crop cultivation a calculated risk. It was, in fact, the invention of modern farm machinery, which enabled farmers to cultivate grain on a massive scale, and there is a distinctive specialization in wheat monoculture in many areas. Extension of modern transport system has also enabled export of the surplus output to other regions. Thus, it may be designated as the plantation agriculture of the temperate latitudes. This form of modern large-scale grain cultivation is best developed in the Eurasian Steppes in regions of chernozem soil; the Canadian and American Prairies, the Pampas of Argentina, the Veld of South Africa, the Australian Downs and the Canterbury Plain of New Zealand. Its characteristic features can be discussed as follows :

(a) Farmers grow crops for the market, and not for their own or domestic consumption.

(b) Commercial grain farming represents the most modern and sophisticated forms of agriculture. In order to reduce the cost of production, the farmers try to make use of the most developed means of production of crops. The farmers make large scale use of machinery, fertilizers, good quality seeds and insecticides.

(c) Monoculture of wheat is most predominant.

(d) In contrast to the paddy farms of the monsoonal South-East Asia, wheat farms of mid-temperate latitudes are extremely large in size ranging between 600 to 40,000 acres.

(e) Commercial grain farming is mostly concentrated in the areas of low population density. In such areas, labour is scarce and very costly, and therefore, grain farming is highly mechanized.

(f) Low yield per acre but high yield per man is another important characteristic of commercial grain farming. The average yield is not more than 1,700 kg. per hectare, whereas under intensive cultivation the yield may be three times as much.

(g) Commercial farming areas have good transportation linkage with the major market areas.

Some other distinctive features that characterize extensive wheat farms of the Prairies or the Steppes are as follows :

- (i) Lack of irrigation water,
- (ii) Privatization of farm ownership,
- (iii) Prone to climatic hazards,
- (iv) Market fluctuations.

**D. (iii) Plantation Agriculture :** Plantation agriculture, the large-scale production of tropical crops by a rather uniform system of cultivation under central management is most obviously one division of agriculture in the broad sense, but is distinctive in many ways to justify separate study. In many ways, the organization of a modern plantation farm resembles those of a factory. Normally, in case of plantation agriculture, there is specialization on one crop which is produced largely for export and, as far as possible, output is continuous throughout the year. Moreover, the existence of plantations is linked up with the more complex industrial economies of the world. The products of the plantation farms are of little local value, being consumed in only relatively small amounts but provide either the essential raw materials or basic foodstuffs and beverages for the industrial nations.

Modern plantation farms are largely limited to areas of tropical, especially equatorial, climate and in many parts of the tropical belt have introduced a commercial crop—either directly or indirectly—by encouraging small holders into economies that, most probably, otherwise might have remained mainly subsistence.

The great majority of the world's plantation regions are situated in the low latitudes, and only a very few scattered areas are located beyond the tropics. Three principal regions of concentrations can be distinguished : the American region, extending through North America, South America and the Caribbean Islands; the African region including Madagascar; and the Australian region stretching from India through Malaysia and Indonesia to Northern Australia. Unlike primitive subsistence agriculture, plantation farming is found to be located in both the hemispheres. In fact, plantation areas most frequently appear on a map as islands of intensified commercial activity encircled by traditional areas of subsistence agriculture.

The characteristic features of plantation agriculture can be summarized as follows :

(i) In case of plantation agriculture, farming is done on an extensive scale and plantations specialise in the production of single or monocrop. In order to achieve the best results, the best possible methods of cultivation are generally followed.

(ii) Because of the relative backwardness of the equatorial or tropical regions, the managerial ability, technical know-how, farm implements, machinery, fertilizers, transport etc. come from outside the tropical latitudes, mainly from Western Europe and North America.

(iii) Plantation farming requires huge supply of labour which is, in most of the cases, obtained locally but the managerial talents are imported from abroad.

(iv) As the plantation crops are primarily meant for export to the affluent European countries, most of the plantation farms in the tropics are located close to the sea coast so that the products can be transhipped at ease.

(v) Estate farming is an outstanding feature of plantation agriculture. Usually plantation crops are raised on large estates but small sized farms are not very uncommon. In some parts of West Africa small holdings are, however, more important than estates. Small holding rubber production in Malayasia now exceeds the output from the estates. In fact, the average size of the plantation farms significantly varies from one region to another depending upon the nature of crop grown on such farms.

(vi) Plantation agriculture represents a type of commercial farming and therefore, a huge capital outlay is of paramount importance. This is, in fact, a very expensive undertaking especially under tropical conditions where the cost of maintaining the farms is also very high. Since many of the plantation farms are located in the tropical countries which are economically backward, capital formulation is a major problem.

It can hardly be denied that plantation agriculture has brought a revolutionary change in the economy of many of the tropical countries, but such changes are not entirely free from certain problems. Such defects or disadvantages include :

(a) It has undoubtedly a forceful development in the tropical countries by the then colonial rulers, which destroyed the basic foundations of the economies of the affected countries.

(b) As a result of such forceful development many of the farmers had been dispossessed of their lands.

(c) Though plantation agriculture fetch money to the people of tropics, still it does not improve the economic condition of the people of the region where they are most widely produced. Industrial regions of Europe not only invest money but take away the lion's share of the profit.

(d) Plantation agriculture delimits the scope of employment in the regions of production, because of the fact that, being a more centralized pattern of farming, most of the high officials are being appointed from the region of demand, not influencing the employment structure of the regions of production.

(e) It has been noted that plantation agriculture is entirely meant for commercialization of products. It is, therefore, not desirable in the tropical countries, where there is acute shortage of food and where many fertile lands have been engaged in plantation agriculture.

(f) Another important problem of plantation agriculture is its exclusive dependence on external markets. It clearly indicates the fact that plantation agriculture is highly vulnerable to fluctuations in global prices of such commodities, and while Europeans may withdraw their investment if prices fall too low, the workers remain. Alternatively, if prices fall for one crop and prove uneconomic another may take its place. In the search for most profitable enterprises the land itself may be over-exploited, leading to exhaustion of fertility

and massive erosion, while the regional economy suffers by succession of trade booms and slumps.

However, plantation farming has also greatly contributed much to the economic development of tropical countries, by providing the essential infrastructural facilities such as expansion of transportation linkage, building schools and hospitals. The native farmers have most successfully adopted the new crops introduced by the European colonial rulers and thus broadened the base of traditional economy and encouraged new technics in farming which are of great benefit to agriculture as a whole. Plantation crops have also provided the main, and sometimes the only, source of foreign exchange, so vital for further economic expansion. In these ways, the plantation system has done much for the economic upliftment of the people of the tropical latitudes, although the traditional farmers in tropics are yet to make the transition to a fully desired market economy.

**E. (i) Monsoon Agriculture :** Monsoonal agriculture, as its name implies, is characteristic of the regions where monsoonal climate predominates. The principal region of monsoonal agriculture is found in the Far East, the majority of it lies in China and India. Japan and Korean Republics mark the eastern frontier of the realm. It stretches from Manchuria, in the north, towards south to cover all of eastern China. Westward it covers most of Cambodia and Thailand, much of Myanmar, almost all of India, Bangladesh and a large part of Pakistan. A good number of island territories lying adjacent to this region are also included in this realm of agriculture. In most of the countries of South-East Asia intensive method of farming has been adopted to meet the demand for food of ever increasing population. A small plot of land, under monsoonal agriculture, used to support 5 to 10 times the number of people than that of a land of similar size under extensive farming. The intensive monsoonal agriculture bears the following characteristic features :

- (a) Extremely fragmented, dispersed land holdings.
- (b) Primitive or outdated implements and hand tillage for the greater part of monsoonal agricultural lands.
- (c) Intensive subsistence farming method.
- (d) Heavy emphasis on grain crops, particularly on rice.
- (e) Associated crops like fruits, cereal, vegetables are also given due priority.
- (f) Predominance of animate energy in cultivation.
- (g) High proportions of agricultural employment.
- (h) Low per capita yield because of high density of population.

In more recent years, changing outlook and modern technology have greatly modified the traditional means of cultivation in the monsoon lands. The basic characteristic features of the monsoonal agriculture may be narrated as follows :

(a) **Small fragmented plots :** The most striking feature of monsoonal agriculture, that at once draws our attention, is the extremely fragmented nature of the arable lands. In majority of the cases the average farm comprises of only one to two acres or sometimes even smaller sizes. It is quite impossible for a farmer to secure more land because of high population density, little or no surplus output, lack of capital, high percentage of tenancy, high interest rates and high rents. The Hindu Law of Inheritance is also responsible for such high degree of fragmentation of individual holdings in India.

Miniaturization of farmlands is supposed to be the chief reason for rural poverty in these countries. Excessive fragmentation and often scattered location of one's fields hinder modernization and rationalization of agriculture in monsoonal lands.

(b) **Primitive implements and hand tillage** : Despite rapid modernization, economic environment in many monsoonal countries like India, China and Japan, farming is still carried on in the traditional ways. Except for tilling the soil, practically all the farm works are done with hand operated implements. The fragmented nature of the farm lands restricts the use of modern implements and also reduces the productivity of labour to a great extent. Although the farmers use very primitive implements, they are very efficient in understanding the nature and productive capacity of the soil to a remarkable extent. The farmers of the monsoonal lands are perhaps the hardest working farmers on the earth.

(c) **Intensive subsistence farming method** : Most of the agriculture in monsoonal South-East Asia is subsistence in character. The bulk of the agricultural output of the region, which include rice, wheat, barley, beans, peas, millet, grain, sorghum, vegetables and fruits, is consumed by the teeming millions of people of this region. Some of the sparsely populated areas of this region produce substantially large amounts of marketable surpluses. Multiple cropping and interculture are also very carefully practised to supplement the demand for food of ever increasing population of the region. Such practices not only increase the yield but also help to maintain the natural fertility of the soil. Annual flooding helps to retain the fertility of soil. Crop rotation, multiple cropping and interculture also minimize the degree of soil depletion.

(d) **Overwhelming emphasis given on rice growing** : Despite the fact that a great variety of crops are grown, rice is the most distinctive and most important crop of farming areas of monsoon lands. The socio-economic welfare of the millions of people of this agricultural realm depends to a great extent on the success or failure of rice crop. The reason for overwhelming superiority of rice growing in monsoon agriculture is explicable by the facts that, firstly, rice is produced more per acre than any other grain except corn, secondly, because of its tightly fitting husk, the rice kernel keeps well in humid climates. With very primitive tools, but with constant care and strenuous labour, land is prepared and rice grown and harvested in great quantities.

(e) **Associated wet and dry season crops** : Though rice growing overshadows other agricultural interests, a great variety of other wet and dry season crops such as wheat, soyabeans, millets etc. play very important role in agrc-economy of monsoon lands. Variations in micro climatic conditions is the main reason for such diversity in climate. Most of the farmers of monsoon agriculture also augment their food supply with other crops like beans, peas, corn, peanuts and so on.

At present, all the traditional farming systems in different parts of the world are undergoing rapid transformations, because of the ever increasing pressure of growing population. Intensive subsistence agriculture of monsoon climatic region is no exception to this norm. It is important to note that, the rate of increase of population in the countries of monsoonal Asia is among the highest in the world and it is a matter of great doubt whether the existing system of food production would be competent enough to fulfill the demand for food of teeming millions of population. Prior to making radical transformation of the existing system of agrarian economy of most of the monsoonal countries, measures should be taken to restore the balance between the existing pattern of demand and supply of major food crops. With the assistance of the local governments new land may be brought under cultivation without doing any harm to the ecological balance of the concerning region; seeds may be improved; dairy farming may be developed; measures to control pests and diseases may be adopted; floods could also be controlled and transportation improved by co-operative organisations.

E. (ii) **Mediterranean Agriculture** : Mediterranean agriculture exhibits a unique and diverse biological activity localised in some distinguishable physico-climatic area and represents a combination of classical or traditional oriental and advanced occidental agricultural types. Unlike intensive subsistence agriculture of monsoon lands, Mediterranean

agriculture, too, flourished in the riverine flood plains of the Nile, Tigris and Euphrates. The ideal combination of abundant supply of water, highly fertile soil, absolutely suitable climate and vigorous growth of plant helped to give birth to a new form of economy, especially agro-economy.

This agricultural system, though exclusively typified for the countries encircling the Mediterranean Sea, can be seen in each and every continent of the world. The most extensive and traditional area is that about the Mediterranean Sea, common to Africa, Europe and Asia. Other regions which are dominated by this type of climate and agricultural activities include California, Central Chile, Southern Africa, South Western Australia and lower Murray-Darling valley in South Australia. In this way, Mediterranean agriculture occurs in both the hemispheres.

Mediterranean agriculture is characterized by an unusual combination of crops and livestock. This association has prevailed for centuries in the countries surrounding the Mediterranean Sea. It is rather peculiar to note that both commercial and subsistence farming are seen in almost every combination of regions of mediterranean agriculture. Primarily, on the basis of economic diversity, four distinct forms or systems of land tillage and animal husbandry can be distinguished in Mediterranean agriculture.

- (i) Growing of cereals and vegetables with the aid of the seasonal precipitation.
- (ii) Cultivation of planted crops of olives, figs, dates and grapes without irrigation.
- (iii) Raising of widely distributed summer crops of fruits, vegetables and forage plants by irrigation.
- (iv) Grazing and livestock farming.

(i) **Cereals and vegetables cultivated with the help of the precipitation :** Cereals and vegetables cultivated with the help of the autumn, winter and spring rains constitute an important feature of Mediterranean agriculture. In all Mediterranean farming, wheat and barley predominate. The climatic condition of the region, especially of late spring and early summer months, is very much conducive to grain growing of very high grade. Diversity in the seasonal amount of rainfall in the Mediterranean basin led the farmers to adopt dry farming method, which requires an alternate year of crop and fallow, careful ploughing and harrowing and a soil that can retain moisture for a much longer period.

Minor field crops, like lupines, broad beans, chick pea, potatoes, onions, carrots and many others, are planted in the autumn and mature before the summer drought. The crops like peas, lentils, tomatoes and many others, which are very much susceptible to frosts, are generally planted in the spring or only in the areas free from frost.

So far as the methods of tillage are concerned, they are specialized and highly intensive. Unlike the monsoonal farmlands, the Mediterranean farms are, too, very small and thus require more manual labour than machine. But in some specialized areas, such as in California, farming has become highly mechanized. However, in the Mediterranean basin labour is cheap and thereby little machinery is used.

(ii) **Planted crops of olives, figs, dates and grapes grown without artificial watering :** In Mediterranean farming, tree and vine crops growing without the help of artificial watering occupy a significant place. Such crops usually grow on hill sides and piedmont areas, which are not very hospitable for grain crops. The olive is the most distinctive crop of the Mediterranean agriculture. It is, in fact, indigenous to the Mediterranean Basin. Olive can withstand the long summer drought and yield a good harvest, especially in the areas with little precipitation.

The fig is another important tree crop of the Mediterranean region, and yield at least two crops a year—one in early summer and another in autumn. Fig cultivation in the true Mediterranean Basin region excels all other regions. In the drier and warmer parts of the

Mediterranean region, however, dates are very dominant. The growing of grape-vines without irrigation water represents an outstanding feature of Mediterranean agriculture. Areas of heavy concentration of viticulture are found in the Mediterranean Basin, Australia, South Africa and also in Chile.

(iii) **Irrigated fruits, vegetables and forage crops** : Intensive irrigated farming also hold a pride position in Mediterranean agriculture. Prolonged summer droughts, bright sunshine and relatively high temperatures encourage intensive production of fruits, vegetables and forage crops by irrigation. Citrus fruits are much less widely distributed. In general, the citrus fruits require a much longer time to grow and higher degree of moisture especially at the time of ripening. Mediterranean farming not only produces various grades of citrus fruits but also produces almost the entire group of temperate fruits such as apricot, apple, plum, peach, pears and others. These fruit crops can either be sold fresh or may be canned or dried for shipment to far away markets.

The vegetable gardens represent distinctive feature of Mediterranean farming. Almost the whole range of temperate vegetables are grown in this farming method. These vegetables do not only cater the local market but are also exported in various forms. Forage crops such as clover, alfalfa, lupine etc. are also very distinctive.

(iv) **Grazing and livestock farming** : Two distinct types of animal husbandry have flourished in Mediterranean lands :

(a) **Grazing of small animals** occupies an important place in animal raising. Transhumance is a very common practice in most sections. Sheep are most common.

(b) **Livestock farming** include rearing of animals like cattle and horses for draught purposes. The mild temperatures, rains and moderately good pasturage during winter are favourable factors leading to the development of animal husbandry.

Mediterranean agriculture is not free from problems. The basic disadvantages of the Mediterranean agriculture can be summarized as follows :

(a) **Widespread shortage of humus**—Most Mediterranean soils are surprisingly deficient in humus and are thus not very fertile. Moreover, the problem of soil erosion has already reached at an alarming stage. Because of poor pastures animal manures are not available in abundance and very little proportion of chemical fertilizers are used.

(b) **Danger of soil erosion**—Soil erosion is a great menace to the agricultural activity of the Mediterranean region. Torrential winter rain usually causes great damage to soil especially on the high mountainous slopes. Lowland soils, too, are subject to erosion. In every corners of the Mediterranean land, governments are well concerned regarding the problem of soil erosion and have taken due measures, such as contour ploughing, crop alternation and the fixation of gully soils by quick growing plants, to check soil erosion.

(c) **The necessity for irrigation**—The necessity for irrigation in the Mediterranean lands can hardly be denied. Seasonality of annual rainfall and scatteredness of its distribution emphasize the importance of irrigation farming.

(d) **Others problems**—The rapid expansion of agriculture in the low land areas has greatly imbalanced the pattern of life of the nomadic people of the lowland pastures.

E: (iii) **Mixed Farming** : Mixed farming represents a transitional form between the animal rearing economy and crop raising. A great many countries of the developed world have a great inclination for this type of farming, where a farmer combines the cultivation of crops and husbandry of animals and is economically benefited by the both. Mixed farming economy accounts for only 6% of the world's employed persons engaged in agriculture.

Regionally; the mixed farming economy is most extensively developed in two distinct

(i) In Eurasia, mixed farming regions stretches in a belt from the Atlantic to the Pacific being interrupted in continuity by the presence of eastern Siberia.

(ii) In the United States, mixed farming covers a large part in the eastern half portion of the country.

Outside these two principal regions mixed farming has also developed in some other small centres, such as in Central Mexico, southern Africa and southern South America.

Unlike the Mediterranean agriculture, mixed farming economy of West European countries and the USA exhibits a distinguished farming pattern by an unusual combination of crops and livestock farming. On the other hand, from the economic point of view, mixed farm crops are virtually grown both for subsistence and commercial purposes. Thereby, mixed farming represents an ideal combination or balance between the subsistence and commercialized economy. In fact, the various crops grown in mixed farming economy play triple role :

- (a) being grown for animal feed,
- (b) for cash sale,
- (c) for use by the farm family.

(a) **Feed Crops** : Corn is by far the most important feed crop in the United States under mixed farming. The USA corn belt stretches for about 600 km, running from Central Ohio westward through Illinois, Indiana and Iowa where it fans out into Minnesota, South Dakota and Nebraska. Corn is usually preferred by the farmers both because of its effectiveness in fattening animals and its large yields per acre. It has been estimated that, corn alone occupies about 23% of the nation's total harvested cropland. Hay and oats are the secondary feed crops in the country.

In contrast to the USA, the European farmers prefer hay more than corn. Other important feed crops are potatoes, turnips, sugar beets and oats. Only the Danube Basin occupies a significant proportion of land under corn cultivation.

(b) **Cash Crops** : In mixed farming regions of both the United States and Europe wheat is the main cash crop. In recent years, soyabeans have become an important cash crops in the central United States.

(c) **Subsistence Crops** : These, in fact, include wheat and a wide range of field crops such as potatoes, cabbage, beans, peas, sugar beets, turnips etc.

**Crop Rotation** : Crop rotation is an important aspect of farming closely associated with mixed farming economy. In the crop rotation system, each field is devoted to a succession of different uses. Usually a four part sequence is followed under mixed farming :

- (i) a cultivated crop—often crop, it may also be potatoes, turnips or sugar beets as in central Europe,
- (ii) hay—particularly alfalfa and clover,
- (iii) pasture,
- (iv) a small grain, most often wheat, that is usually for cash sale.

It is important to note the fact that, although crop rotation is also practised in other agricultural realms, it is most widely and methodically practised in mixed farming.

**Percentage of land in crops** : Emphasis on crops signifies the fact that a relatively small proportion of animal feed is obtained from natural vegetation. Actually, a very high percentage of each farm acreage is cropped. In some favourable areas as high as 80% of the total acreage is cropped.

**Size of Farms :** The average size of the farms most distinctly varies between 50 to 150 acres. Because of greater pressure of population, the European farms are much smaller in size than their American counterparts. The South American and South African farms are also of greater sizes.

**Role of animal :** In mixed farming economy animals bring the maximum revenue. Hogs, beef cattle, sheep and poultry are raised in greatest numbers on each of the mixed farms. The main animal product is the meat, although other products such as skins, hides, wool and eggs are also raised. An average sized mixed farm in the United States has about 50 heads of beef cattle and nearly 75 hogs. In European mixed farms, however, the number of animals always tend to be fewer because of smaller size of the farms.

**Farming method :** In comparison to American mixed farms, the mixed farms of Europe are less mechanized. The American farmers make use of a wide range of machines to plough, disc, harrow and cultivate the soil as well as to plant and harvest crops.

**Degree of commercialisation :** The degree of commercialisation varies most significantly from one region of mixed farming to another. In West Central Europe, the northern United States and Argentina, mixed farming is highly commercialized. Only an insignificant proportion of farm output is consumed locally and the bulk is exported. At the other extreme, the farmers in the American Appalachian highlands and Eastern Europe and in the former Soviet Union do not have much marketable surplus. So, the farmers in mixed farming are making progress towards rapid commercialisation of farm economy.

F. (i) **Feudalistic agriculture :** Feudalism is a medieval system of political control where land was the prime criteria in determining the economic superiority of one person over others. The majority of the population were appendages of the land. Most surprisingly the man behind the plough had no land of his own and thus he had hardly any control over the gross productivity; therefore, productivity was low both in terms of man and land.

F. (ii) **Capitalistic agriculture :** Feudalism, in fact, made way for capitalism in the process of evolution of the human society. Capitalistic form of production on the whole is, no doubt, more efficient than at least feudalistic agriculture, but individual profit motive impairs the objective of social welfare maximization. Yet capitalistic form of agriculture has brought about a radical transformation in the aggregate production in agriculture, which is not necessarily related to the satisfaction of individual wants and social objectives.

F. (iii) **Socialistic agriculture :** Socialistic agriculture, however, represents the most methodical system of land tillage. Socialism eliminates the control of land by a small group of people and introduces collective or co-operative farming at the initial stage and state farms at the more advanced stage of development of socialism. So far as the fulfilment of both individual want and social objective is concerned, this system satisfies them most successfully.

**Agriculture in the Industrial World :** If the world is viewed as an integrated whole, the Industrial Revolution of the 18th century brought about a radical transformation in productive activities. It is most significantly evident in a stupendous increase in per capita as well as in per unit land production. Of the different sectors of economy, agriculture was no doubt the greatest beneficiary. In this way, mechanization and large scale production of cotton textile industry led to the rapid expansion of cotton acreage in different corners of the world.

Innovations in agriculture have affected all the enterprises and apparatus of farming. Their adoption has become more rapid among variable than fixed inputs. An agricultural innovation can be adopted by a people only if it possesses the following characteristics :

- (a) Geographic feasibility,
- (b) Cultural compatibility,
- (c) Technological simplicity,
- (d) Experimentability,
- (e) Communicability,
- (f) Economic feasibility,
- (g) Economic profitability,
- (h) Reliability,
- (i) Socio-technical compatibility, and
- (j) Availability.

Moreover, adoption and subsequent absorption of innovation waves depend on natural endowment, level of cultural development and the attitudes of the people. Thus, the impact of mechanization of agriculture varies most significantly from one region to another. The people of the equatorial rain-forest and monsoonal South-East Asia have failed to demonstrate the adoption of mechanical devices of farming to their farm lands, mainly because of the fact that the cultural level of the people of those regions is too low to adopt the modern technics of farming; moreover, the underdeveloped countries are so populous that they did not welcome the mechanical devices of farming because of overabundance of manual labour. In contrast to this, the more advanced European countries, Canada, the United States of America, the former Soviet Russia, Australia and Argentina reaped a rich harvest from the mechanical revolution of 18th century. These countries, in fact, demonstrate the relationship between agriculture and industry.

It is most often argued that mechanization of farming can best be adopted by the countries which are very sparsely populated. Mechanization can be introduced even in the densely populated countries currently with the economic progress of the country. In the highly populated advanced nations of the world, mechanization of farming has been quite a success, because of curtailment of population pressure on land and diverting the excess number of labour to the highly developed secondary and tertiary sectors. Thereby, Japan with a very high density of population has only 12% of its labour force in agriculture. However, the impact of mechanization is very conspicuous in the regions of extensive agriculture.

The prime objective of mechanization is to raise per capita production. But to raise production per acre, intensive methods of farming has been adopted. Primarily, on the basis of mechanization the world can be divided into the following regions :

- (a) Countries settled prior to the mechanical revolution, for example the densely populated West European countries.
- (b) Countries inhabited after the mechanical revolution, e.g. Oceania, the United States, Canada and Argentina.

(c) Countries inhabited both before and after the industrial revolution. The existing diversity in the economic well-being of different nations of the world can be explained, to a great extent, by the fact of diversity in the degree of mechanization of farming in different regions. In the beginning, the underdeveloped countries of monsoonal Asia were not in a position to afford modern farm machineries, but with the subsequent upliftment of

economic conditions of the countries machines are slowly appearing in increasing number. Thus, tractors, pumps, refrigerated warehouses are not too uncommon, for example, in India.

The greatest impact of mechanization of farming is felt through the massive commercialization of products. The economic affluency of the European nations and America can be explained, to a large extent, by the fact of commercialization of agriculture. Thus, both the intra-national and international trade also experienced a radical transformation as a result of mechanical revolution. Interdependence, specialization, exchange and a high degree of mobility have replaced the pre-revolution isolation, local self-sufficiency and a high comparative immobility. It can, therefore, be concluded that the mechanization and commercialization are interdependent.

The countries which have already adopted the mechanized form of agriculture are virtually not devoid of some problems. The problems of farm mechanization can be summarised as follows :

- (a) Incompatibility of agriculture and industry is one of the major causes of the farm problems.
- (b) Mechanisation hardly liberates agriculture from its congenital weakness arising out of its dependence on Nature.
- (c) The farmer with his products often remains helpless to the mysterious forces of market.
- (d) Predominance of middleman makes weaker the farmer's market position as a seller.
- (e) The cost of production of crops often exceeds the price.
- (f) Ready rationalization is difficult.
- (g) Demand for various farm products is also determined by general economic conditions of the country and world.
- (h) Substitutes often reduce the market of a particular farm commodity to a great extent.

It is rather peculiar to note that, farm workers constitute a surprisingly low percentage of total workers and even then the proportion of agricultural labourers is very rapidly declining in most of the industrial and economically advanced nations. Yet agriculture is important, for it supplies food for man. We must remember the fact that, continuous exposure to uncertainty may bring about irreparable damage. Both short term and long term programmes are thereby necessary to restore the balance between the agricultural production and the increasing demands for food.

## 1.6 LAND USE PATTERN AND AGRICULTURE

The degree of cultivability of land most significantly varies from one region to another not because of diversity in the natural endowments alone, but more importantly as a result of variation in the adaptability of human beings under a given set of interfunctions of Nature and man. In fact, greater the proportion of arable land greater is the adaptability of human beings. Technological innovations have greater impact in the adaptability of human beings. Technology innovations have greatly increased in the proportion of cultivable lands in many parts of the world, which were seemingly hostile or impossible to cultivate prior to such developments. The following table shows some important aspects of land use pattern and population for selected nations :