IASBABA

[GEOGRAPHY VALUE ADD SET 4 – BLOCK 3-PART 2]

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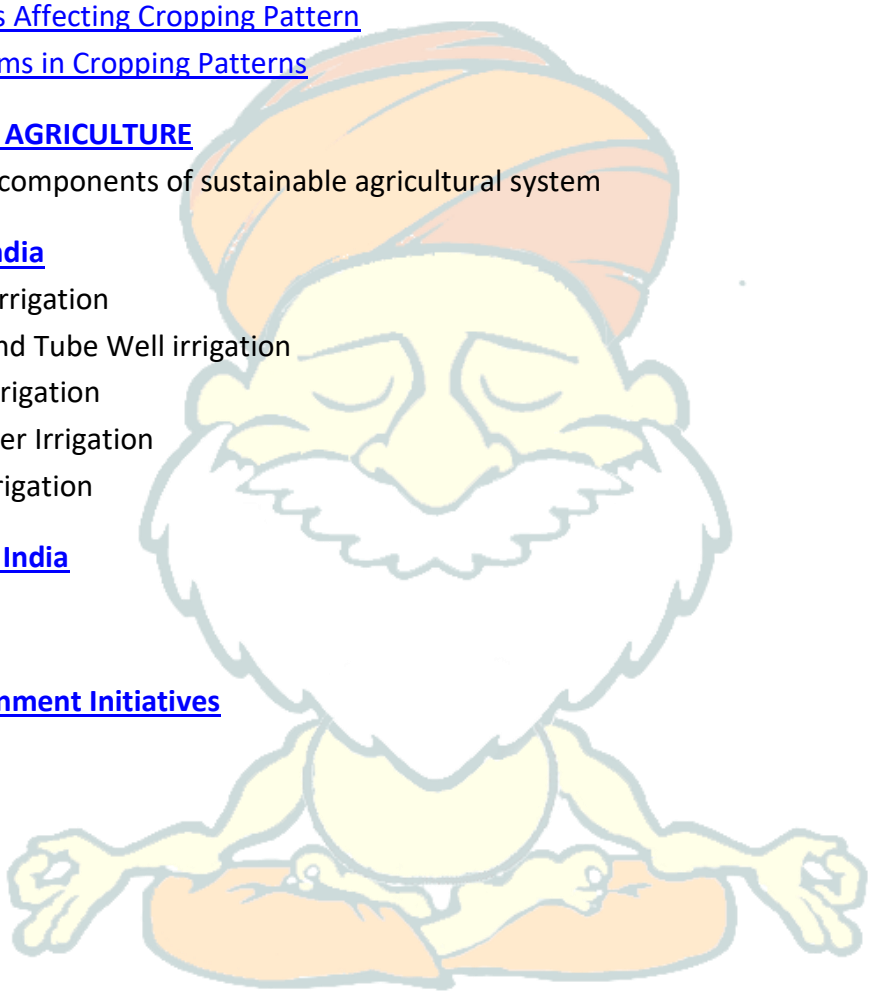


Land Resource and Agriculture

Land:

Land is the most important resource not only for the mankind, but for all living organisms.

Land covers only about 30% of the total earth's surface, and rest is covered by oceans.

Basic uses of Land:

- Land provides a solid surface to the living organisms.
- We get our food directly or indirectly from plants and trees grown on land.
- The entire hard infrastructure (houses, roads, railway tracks etc) is built on the land as a base.
- Minerals are extracted from the land.

Almost 90% of the world's population is concentrated on 30% of the available area. This distribution of population is mainly because of varied land and climatic conditions. Land has many topographical features which makes it difficult for man to settle anywhere. There are varieties of landforms.

- Valleys
- Plateaus
- Mountains
- Plains
- Hills
- Glaciers

Places where Population is sparsely populated:

- Steep slopes of the mountains
- Deserts
- Low lying areas susceptible to water logging
- Thick forested areas
- Areas with permafrost

Places with dense population:

- Plains
- River valleys

The utilization of land is determined by the physical features of the region:

- Landscape
- Soil
- Climate
- Availability of minerals
- Human Population
- Technology

On the basis of ownership, land can be divided into-

- **Private Land:** Land owned by individuals
- **Community Land:** Land owned by the community or government and which is used for common purposes.

Increasing Demand for Land:

- With rapid increase in population, there has been an exponential rise in the demand of usable land.
- Encroachment of humans is increasing on wild lands. More land is required for housing and other infrastructure.
- More forests are being cleared for agricultural land to feed the teaming billions.
- More land is needed for mining and resultant industries.

This over exploitation of land has resulted into disastrous environmental changes:

- Land degradation
- Land slides
- Soil erosion
- Desertification
- Loss of habitat

SOIL

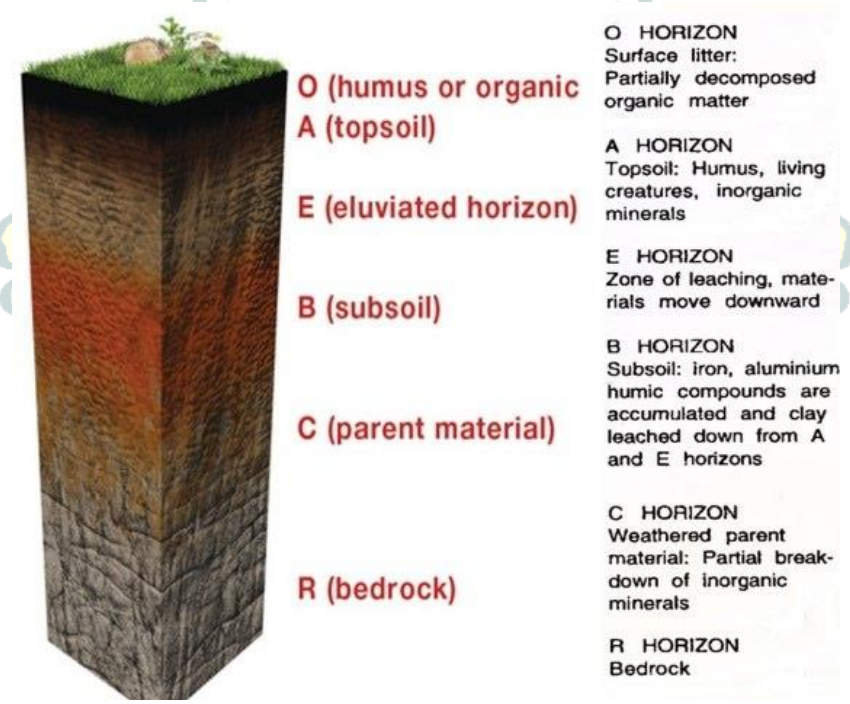
Soil can be defined as the organic and inorganic materials on the surface of the Earth that provides the medium for plant growth.

Inorganic materials, or those materials that are not living, include weathered rocks and minerals. **Weathering** is the mechanical or chemical process by which rocks are broken down into smaller pieces. As rocks are broken down, they mix with organic materials, which are those materials that originate from living organisms. For example, plants and animals die and decompose, releasing nutrients back into the soil.

Soil Profile:

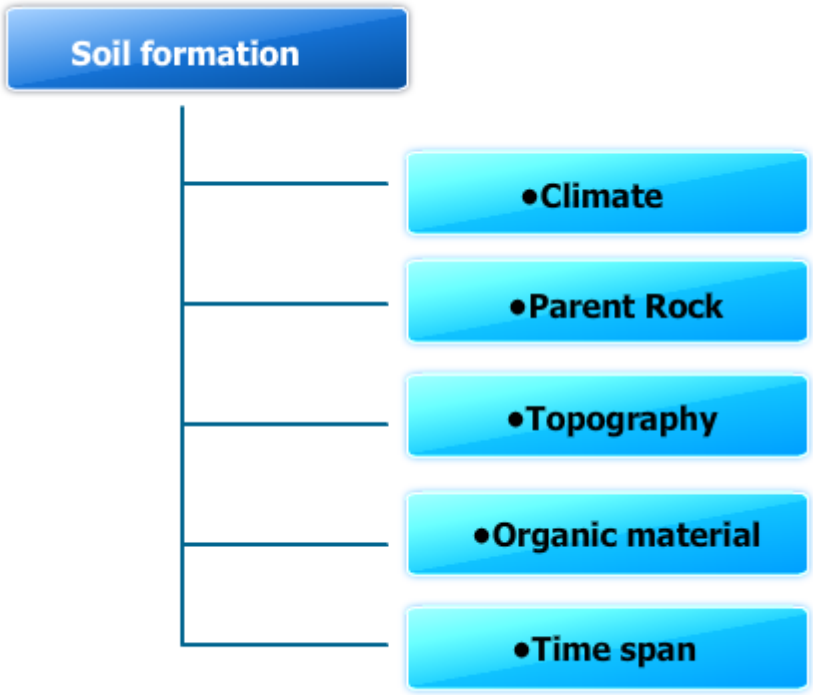
If you look in a soil pit or on a roadside cut, you will see various layers in the soil. These layers are called **soil horizons**. The arrangement of these horizons in a soil is known as a **soil profile**. Soil scientists, who are also called pedologists, observe and describe soil profiles and soil horizons to classify and interpret the soil for various uses.

Soil horizons differ in a number of easily seen soil properties such as color, texture, structure, and thickness. Other properties are less visible. Properties, such as chemical and mineral content, consistence, and reaction require special laboratory tests. All these properties are used to define types of soil horizons.



Soil scientists use the capital letters **O**, **A**, **B**, **C**, and **E** to identify the master horizons, and lowercase letters for distinctions of these horizons. Most soils have three major horizons -- the surface horizon (**A**), the subsoil (**B**), and the substratum (**C**). Some soils have an organic horizon (**O**) on the surface, but this horizon can also be buried. The master horizon, **E**, is used for subsurface horizons that have a significant loss of minerals (eluviation). Hard bedrock, which is not soil, uses the letter **R**.

Factors of Soil formation:



Formation of soil is a very slow process and it takes thousands of years for the formation of one cm soil.

Climate: Temperature and humidity decides the rate of weathering of rocks and amount of humus in soil.

Parent Rock: Decides the colour, minerals and grain size of soil.

Topography: Slope and altitude decides the accumulation of soil on the surface. Slopes usually have thin layer of soil.

Organic Material: flora, fauna and microorganisms decide the formation of humus in the soil.

Time: Time is the most important factor for the soil formation. Time decides the formation of zones in soil. It also decides it thickness.

Soil Degradation:

Soil degradation is the decline in soil quality caused by its improper use, usually for agricultural, pastural, industrial or urban purposes.

Soil degradation is a serious global environmental problem and may be exacerbated by climate change. It encompasses physical, chemical and biological deterioration. Examples of soil degradation include

- Loss of organic matter
- Decline in soil fertility
- Decline in structural condition
- Erosion
- Adverse changes in salinity
- Acidity or alkalinity
- The effects of toxic chemicals, pollutants or excessive flooding.

Soils host the majority of the world's biodiversity and healthy soils are essential to securing food and fibre production and providing an adequate water supply over the long term. Ecosystem services provided by soils are integral to the carbon and water cycles and include cultural functions. There are strong links between climate change and soil condition.

Some factors leading to Soil degradation are:

- Deforestation
- Overgrazing
- Overuse of Chemical fertilizers and pesticides
- Rain
- Landslides
- Floods

Some of the methods used across the world to conserve soil are:

- **Mulching:** The bare ground between plants is covered with a layer of organic material like straw. This helps to retain soil moisture.

Mulching

- **Contour Barriers:** Stones, soil, grass are used to build barriers along the contours. Trenches are made in front of the barrier to collect water.
- **Rock Dam:** Rocks are piled up to slow down the flow of water which prevents gully formation.

Rock Dam

- **Terrace Farming:** The terraces are cut on the slopes to provide a flat surface for farming. This also prevents the direct flow of water down the slope.

Terrace Farming

- **Intercropping:** Different crops are grown in the same field in different rows and at different times to avoid exposing the bare land to water or wind.

Intercropping

- **Crop Rotation:** It is a practice of growing different crops in systematic succession. This helps in maintaining the level of nutrients in the soil and also pest control.
- **Contour Ploughing:** In slopes farmers plough the land across the slope rather than up and down the slope.
- **Shelter belts:** In coastal and dry regions, rows of trees are planted to check the wind movement to protect soil cover.

Shelter belts

- **Afforestation:** Planting of trees on a large scale to create a barrier against flowing water and wind. It also increases water penetration in soil.
- **Prevention of overgrazing.**

Agriculture

Agriculture is the main Economic Activity done on soil.

Agriculture is the cultivation and breeding of animals, plants and fungi for food, fiber, biofuel, medicinal plants and other products used to sustain and enhance human life. Agriculture was the key development in the rise of sedentary human civilization, whereby farming of domesticated species created food surpluses that nurtured the development of civilization. The study of agriculture is known as agricultural science. The history of agriculture dates back thousands of years, and its development has been driven and defined by greatly different climates, cultures, and technologies. Industrial agriculture based on large-scale monoculture farming has become the dominant agricultural method.

Types of Agriculture:

You will find different types of categorisation of Agriculture/ farming practices given in different books. One of the most widely accepted classification was given by an economist named **Whittelesey**.

NOTE: As far as GS geography is concerned, even if you forget the name, there is no problem, by this classification you won't miss any angle of agricultural.

Whittlesey's Classification was based on the following factors:

1. Crop and livestock association

2. Labour and capital intensity

3. Productivity

4. Consumption pattern of production

5. Methods and techniques used for production.

Following types of agricultural practices are found in the world:

Nomadic Herding:

This is one of the most primitive types of agricultural practice. Nomadic herding is practiced in the drylands of Sahara, Saudi Arabia, Iraq, Iran, Afghanistan, Central Asia, Mongolia and China. Nomadic herding is also practiced in south-west Africa, western Madagascar and along the southern boundary of the Tundra region in Eurasia where the Tungus rear reindeers.

This type of economic activity is characterised by a frequent change of habitation in search of ammal fodder, fruits, nuts, edible roots, trading opportunities, etc. The migration may even be of 'seasonal' nature. For instance, the Tundras move northwards to mountains during summer and southwards to forests during winter. Similarly, the Gujjars of Jammu and Kashmir and Himachal Pradesh move to upper altitudes during summer and to the plains during winter.

Shifting Cultivation:

This is a subsistence type of agriculture practised in forested highlands of South America, Africa, India (North-East, Orissa, Bihar, Andhra Pradesh, and Madhya Pradesh) and in the belt from Myanmar to south China.

This is an unscientific, wasteful and inefficient agricultural practice with low productivity in which primitive techniques and rudimentary implements are used.

Shifting cultivation is an agricultural system in which plots of land are cultivated temporarily, then abandoned and allowed to revert to their natural vegetation while the cultivator moves on to another plot. The period of cultivation is usually terminated when the soil shows signs of exhaustion or, more commonly, when the field is overrun by weeds. The length of time that a field is cultivated is usually shorter than the period over which the land is allowed to regenerate by lying fallow.

In shifting agriculture, after two or three years of producing vegetable and grain crops on cleared land, the migrants abandon it for another plot. Trees, bushes and forests are cleared by slashing, and the remaining vegetation is burnt. The ashes add potash to the soil. Then the seeds are sown after the rains.It is practised in West Bengal.

Intensive Subsistence Farming:

Subsistence agriculture is the type of farming in which crops grown are consumed by the grower and his family.

In intensive subsistence farming, farmers use simple tools, such as spades and ploughs, and manual labour to cultivate a small plot of land. Intensive subsistence farming is practiced in areas having fertile soil and receiving plenty of sunshine throughout the year. For example, it is practiced in the tropical and sub-tropical areas of West Bengal and Andhra Pradesh.

Intensive subsistence farming is practised by farmers in the monsoon regions of south, southeast and east Asia. It is more common in the thickly populated areas in these regions. Rice is the main crop grown through intensive farming in addition to wheat, maize, pulses and oilseeds on the same plot of land.

Intensive Subsistence Agriculture

Terraces create flat land for wet (irrigated) rice on hilly land in Indonesia.

Commercial Grain Farming:

Commercial grain farming, is the cultivation of crops for commercial purposes where crops are grown for sale in the market. This type of farming is common in the sparsely populated areas of the temperate grasslands of North America, Europe and Asia. The main crops grown are wheat and maize.

Availability of land is the greatest reason for the successful development of commercial grain farming in temperate regions. Low density of population (50-200 persons/ sq. km.) facilitates higher per capita land availability.

Since the labour in these places is too costly, most of the work is mechanized and labour used is very less.

Monoculture is dominated, i.e. one crop is grown in large stretches of land.

Mixed Farming:

In mixed farming, the same plot of land is used for cultivating crops and rearing livestock. Farmers cultivate food crops like rice and wheat, and fodder crops like barley and grass. This type of farming is common in Europe, parts of eastern USA, Argentina, southeast Australia, New Zealand and South Africa.

In India to increase their sources of income, farmers are going for mixed farming.

Apatani tribe of Arunachal Pradesh farms fishes in paddy fields.

In developed countries, the mixed farming is highly developed and market oriented. Farms are specialized and crops are grown to feed the animals. While in under developed countries, mixed farming is done for subsistence and to have multiple sources of income.

Paddy – Fish Mixed farming

Plantation Agriculture:

Plantation refers to large farms or estates growing a single crop for commercial usage. This type requires a large amount of labour, and capital investment in building an extensive transportation network. Plantations involve the cultivation of crops like tea, sugarcane and rubber for supply to agro-based industries as raw material.

Generally once the crop is sown, It can be harvested multiple times.

The produce from these plantations, like tea leaves and rubber latex, are processed to produce market-ready output, i.e. tea and rubber sheets. Plantations are common in tropical and sub-tropical regions of the world, like India, Sri Lanka, Malaysia, and Brazil.

Tea plantations

Mediterranean Agriculture:

This is a fairly widespread agricultural practice which takes place in the European countries bordering the Mediterranean Sea (Spain, France, Italy and former republics of the Yugoslav Federation), along western edges of continents (central California, central Chile), temperate regions between 30° and 40° in both the hemispheres (southern tip of South Africa and south-western and southern Australia).

These regions are reputed for good quality citrus fruits—grapes, olives, oranges, lemons, pineapples etc.

Commercial Dairy Farming:

Commercial dairy farming type is practiced on the western shores of France, the UK and Ireland, the Great Lakes region and the north-west in the USA, south-eastern Australia and in New Zealand.

These areas receive rainfall throughout the year and produce good quality, nourishing grass. Mainly cattle and poultry are reared. These regions are known for good quality milk products—cheese, butter etc., which are even exported.

Rotary milking parlour

Livestock Ranching:

Livestock ranching is undertaken in the vast prairies of western USA and western Canada, central Mexico, the belt from Venezuela to Argentina, the veld region of South Africa, temperate grasslands of Australia and New Zealand, and the region to the north of Caspian Sea.

In agricultural regions of this type, cattle rearing is done in relatively rainy parts, sheep are reared in less rainy parts and goats and camels are reared in low rainfall and warmer regions.

Livestock rearing is highly specialized and in one region only one type of animal is kept. The rearing is on scientific lines, which is highly mechanized and labour intensive.

Livestock Ranching in Canada

Types of Crops

Crops are plants that are grown and harvested for eating or selling. On the basis of usage, crops are classified into three types: Crops grown for food, Beverage Crops, and Crops grown for agro-based industries. These include fibre crops.

Food Crops:

The Crops which are grown for food are called food crops like rice, wheat, millets and maize. Every food crop needs a specific environment and geographical conditions to grow and thrive. Hence different crops are produced at different places.

Rice: Rice is the main component of people's diet in the tropical and subtropical regions of Asia. This is because rice crops show best yield with high temperature, high humidity and rainfall. Alluvial clayey soil is the best for growing rice as it can retain water.

China is the leading producer of rice, followed by India which together account for half of the world's total rice production. Japan, Sri Lanka, Egypt and Bangladesh are the other major producers of rice.

Rice plant

Wheat: Wheat requires a well-drained loamy soil. This crop grows best in moderate rainfall and moderate temperature and requires loads of sunshine in the harvest season. Hence, in India, wheat is sown in the winter season and harvested in the summer. Bangladesh, West Bengal, the Prairies of the USA, Canada, Russia, Australia and Pakistan are major producers of wheat.

Wheat

Millets: Millets are also known as coarse grains and are available in the form of jowar, bajra and ragi in India. Millets grow well on soils of relatively low fertility or sandy soil and require low to adequate rainfall and temperatures ranging from high to moderate. Along with India other major producers of millets in the world are China, Niger and Nigeria.

Maize: Maize another popular food crop is commonly referred to as corn. The soil needs to be well drained and fertile for growing maize with moderate temperatures, moderate rainfall and abundance of sunshine. The major producers of maize in the world are: USA, Brazil, China, Mexico, India, Canada, and South Africa.

Maize

The major crops grown for agro-based industries are cotton and jute and are also known as fibre crops. Cotton is the main raw material for the cotton textile industry and owing to its light and airy texture, it is ideal for clothing.

Cotton: A good yield of cotton requires: high temperatures, light rainfall, 210 frost-free days and plenty of sunlight. Black soil and alluvial soil are best suited for growing cotton. Hence, in India, cotton is mostly grown in parts of the Deccan Plateau. Apart from Indian the leading producers of cotton in the world are: China, The USA, Pakistan, Brazil and Egypt.

Cotton

Jute: Jute on the other hand is golden in colour with a silky shine and is popularly known as the Golden Fibre. Jute requires high temperatures, plain alluvial soil, plenty of rainfall and a humid climate to thrive. India and Bangladesh are the primary providers of jute.

Bevarage Crops

Beverage crops include crops like tea and coffee.

Tea grows best in regions with a cool and humid climate, well-distributed rainfall through the year and well-drained soil, like the loamy soil. Hence tea planters need areas with sloping grounds as the slope ensures that water does not clog.

China, India, Kenya and Sri Lanka are known to produce the finest tea in the world. Darjeeling tea is recognized by consumers worldwide for its unique flavor and quality.

Coffee: Coffee is another popular beverage crop worldwide. Coffee grows well in: well-drained loamy soil and hilly slopes. The climate needs to be warm and wet like in subtropical regions. Brazil is the world leader in the production of coffee, followed by Columbia and India.

Coffee

Land Utilization in India

The utilization of land depends upon physical factors like topography, soil and climate as well as upon human factors such as the density of population, duration of occupation of the area, land tenure and technical levels of the people.

India has total geographical area of about 328.73 million hectors but statistics pertaining to land utilization were available for about 306.05 million hectares

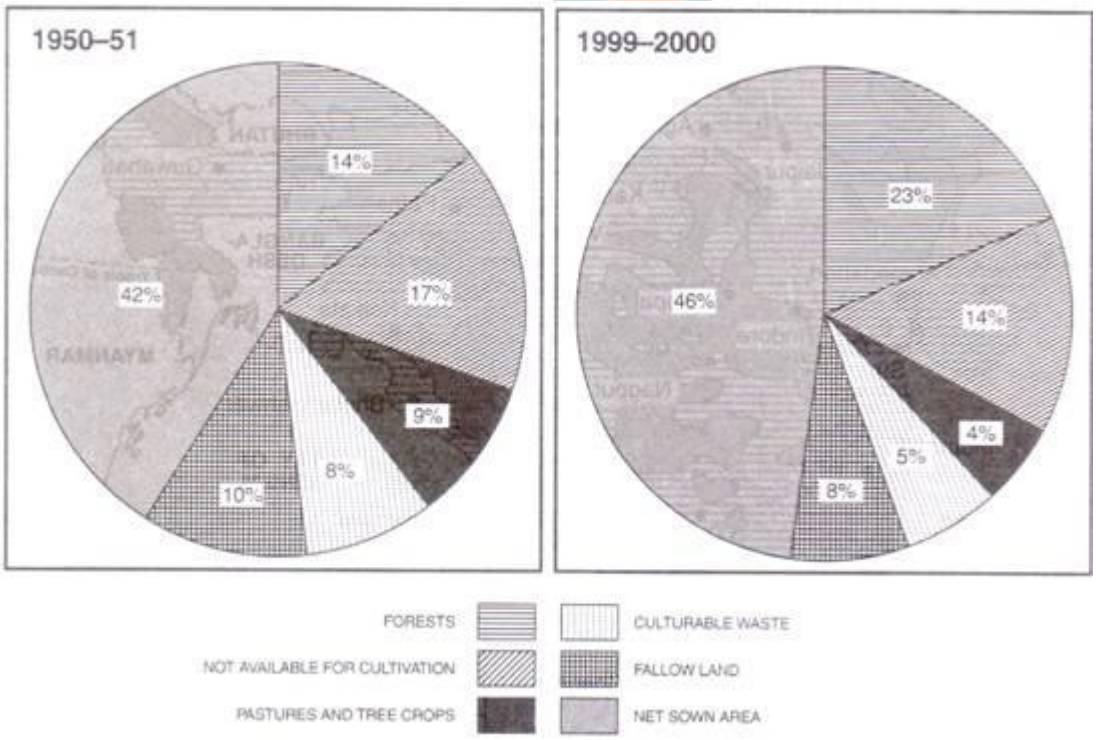


FIG. 21.1. India : Land use 1950-51 and 1999-2000

Land usage can be broadly categorized as follows:

Net Sown Area:

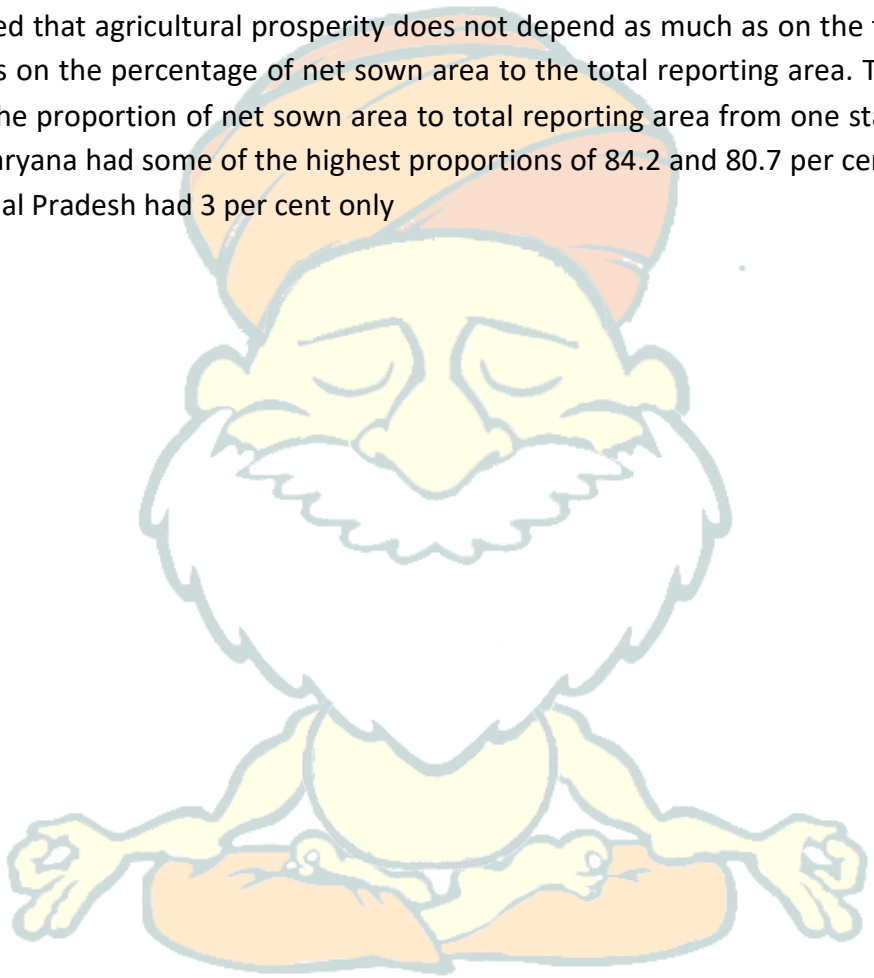
Cropped area in the year under consideration is called net sown area. This area has a special significance in an agricultural country like India because agricultural production largely depends upon this type of land.

Currently the net sown area in India is almost 46% which is much higher than the world average of 32%. In most of the developed nations it is less than 10%. Unfortunately because of very high population, the per capita net sown area is very low.

In order to have food security, we need to increase the net sown area in India. But now this is not possible as the limit is already saturated. The only way is to increase the productivity of the available land or to cure the barren/ waste land for agriculture.

Madhya Pradesh has the largest net sown area of 19.89 million hectares which is about 13.89 per cent of the total reporting net sown area of India. This is followed by Maharashtra (17 69 million hectares), Uttar Pradesh (17.58 million hectares), Rajasthan (15.51 million hectares), Andhra Pradesh (10.66 million hectares) and Karnataka (10.26 million hectares).

It may be noted that agricultural prosperity does not depend as much as on the total net sown area as it does on the percentage of net sown area to the total reporting area. There are large variations in the proportion of net sown area to total reporting area from one state to another Punjab and Haryana had some of the highest proportions of 84.2 and 80.7 per cent respectively while Arunachal Pradesh had 3 per cent only



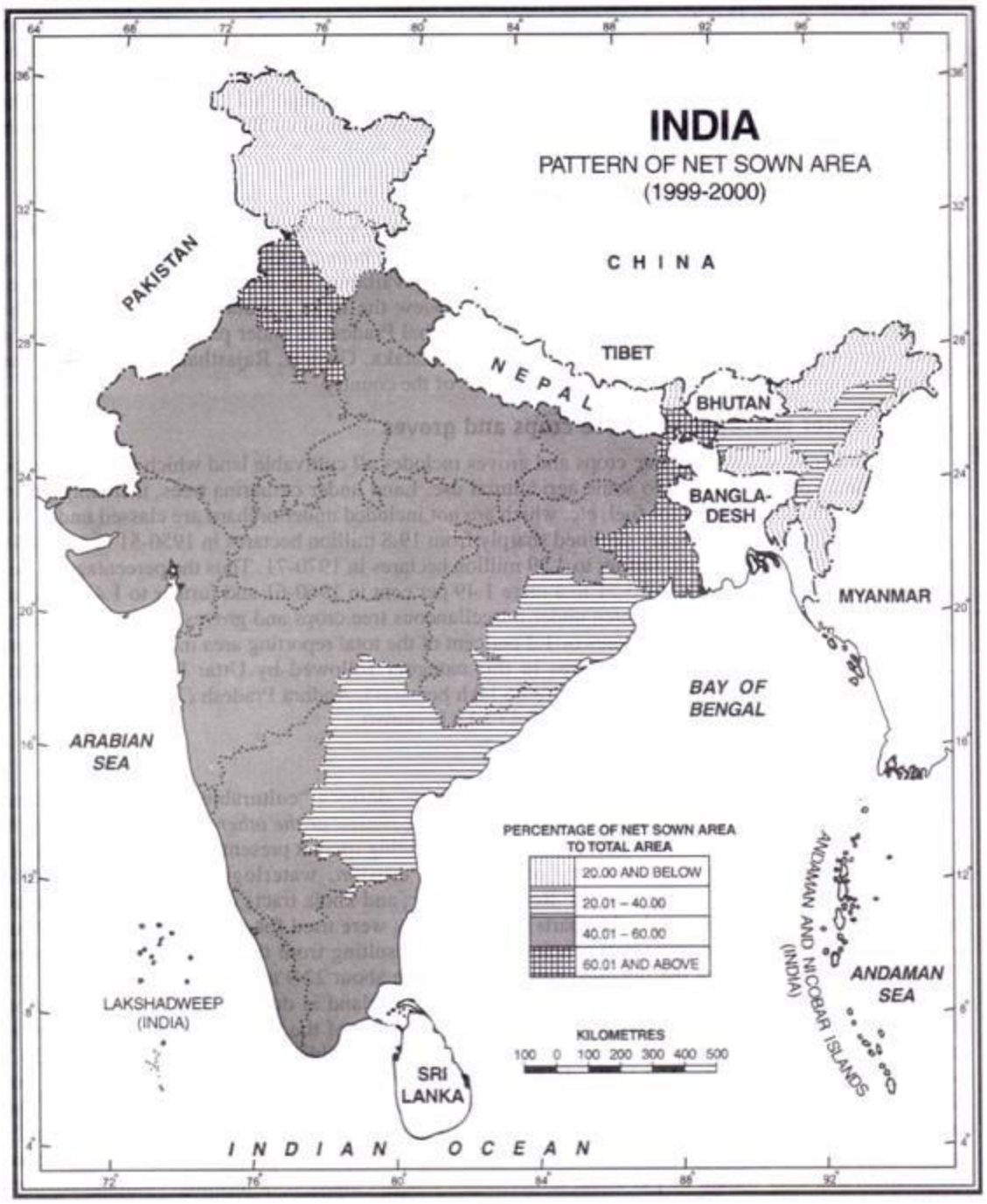


FIG. 21.3. India : Pattern of net sown area

Forests:

According to the India State of Forest Report (ISFR) 2015, the total forest and tree cover is 79.42 million hectare, which is **24.16 percent** of the total geographical area.

However, 24.16 per cent of forest land to the total reporting area is not sufficient for a tropical country like India where about 33 per cent of the total land should be under forests.

This will require massive tree plantations and vigorous restrictions on the reckless felling of trees. According to the expert committee recommendations, much of the area reclaimed from the forest for agriculture should be retired from cultivation and brought back under forests to save the land from the adverse effects of deforestation.

Land not available for cultivation:

This class consists of two types of land viz. (i) land put to nonagricultural uses and (ii) barren and unculturable waste. The area put to non-agricultural uses includes land occupied by villages, towns, roads, railways or under water i.e. rivers, lakes, canals, tanks, ponds, etc.

The barren land covers all barren and uncultivated lands in mountains and hill slopes, deserts and rocky areas. These areas cannot be brought under plough except at high input cost with possible low returns. The amount of this land has been variable right from 1950-51 to 1999-2000, the data for which are available.

Land not available for cultivation accounted for 13.8 per cent of the total reported area in 1999-2000. The largest amount of land in this category is in Andhra Pradesh followed by Rajasthan, Madhya Pradesh, Gujarat, Uttar Pradesh and Bihar.

Pastures and grazing lands:

A total area of 11 million hectares is devoted to permanent pastures and other grazing lands. This amounts to about 4 per cent of the total reporting area of the country. Grazing takes place mostly in forests and other uncultivated land wherever pasturage is available.

The area presently under pastures and other grazing lands is not sufficient keeping in view the large population of livestock in the country. About one-third of the reporting area in Himachal Pradesh is under pastures. The proportion varies from 4 to 10 per cent in Madhya Pradesh, Karnataka, Gujarat, Rajasthan, Maharashtra and Orissa. It is less than 4 per cent in the remaining parts of the country.

Culturable waste:

The “wasteland survey and reclamation committee” defines “culturable waste” as the land available for cultivation but not used for cultivation for one reason or the other. This land was used in the past but has been abandoned for some reason. It is not being used at present due to such constraints as lack of water, salinity or alkalinity of soil, soil erosion, water-logging, an unfavourable physiographic position, or human neglect.

Reh, bhur, usar, and khola tracts of Uttar Pradesh, Punjab and Haryana as well as in several other parts of the country were used for agriculture in the past but had to be abandoned due to some deficiencies in the soil resulting from faulty agricultural practices.

This decline in the wasteland is due to some land reclamation schemes launched in India after Independence. About one-sixth of the total reporting area in Goa is termed as culturable waste. Rajasthan has 4.9 lakh hectare of cultivable waste land which is about 36.1 per cent of the total waste land of India.

The other states with considerable culturable waste land are Gujarat (13.6%), Madhya Pradesh (10.2%), Uttar Pradesh (6.93%) and Maharashtra (6.83%). The cultivable waste, if brought under cultivation can be an important factor in augmenting the country’s agricultural production.

Fallow lands:

This category includes all that land which was used for cultivation but is temporarily out of cultivation. Fallow land is of two type’s viz., current fallow and fallow other than current fallow. Fallow of one year is called ‘current fallow’ while that of 2 to 5 years is classified as ‘fallow other than current fallow’. Fallow land is left uncultivated from 1 to 5 years to help soil recoup its fertility in the natural way depending upon the nature of soil and the nature of fanning.

There is need to reduce the extent and frequency of fallow land in order to increase agricultural production. This can be done by proper dose of fertilizers, providing irrigation facilities, crop rotation and combination and several other similar farm techniques.

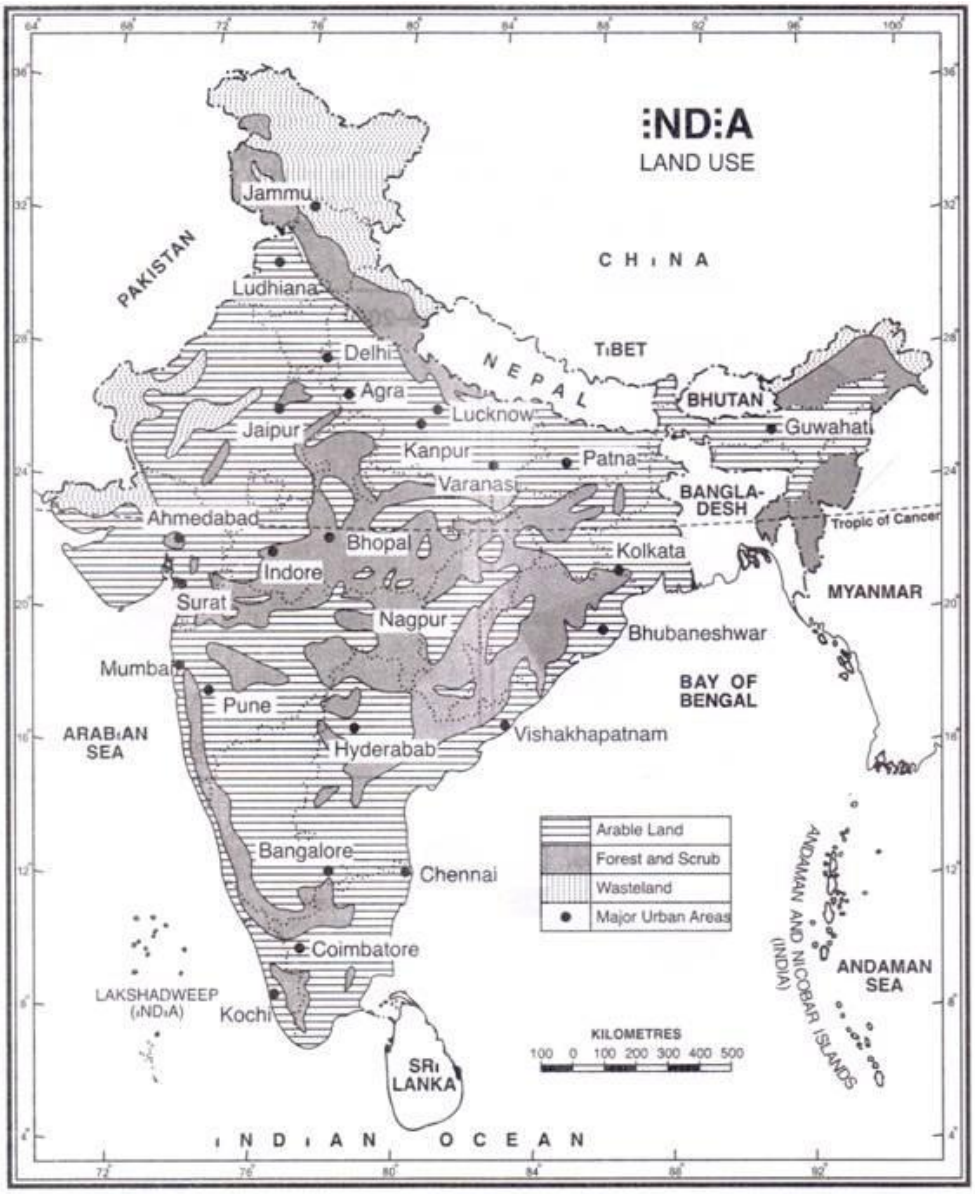


FIG. 21.2. India : Land use

CROPPING PATTERN AND CROPPING SYSTEM

A cropping system refers to a set of crop systems, making up the cropping activities of a farm system.

The cropping system comprises all components required for the production of a particular crop and the interrelationships between them and an environment

In other words, a cropping system usually refers to a **combination of crops in time and space**.

TYPES OF CROPPING SYSTEMS

Mono-Cropping:

1. Mono-cropping or monoculture refers to **growing of only one crop on a piece of land year after year.**
2. It may be due to **climatological** and **socio-economic** conditions or due to **specialisation of a farmer** in growing a particular crop, e.g., under rained conditions, groundnut or cotton or sorghum are grown year after year due to limitation of rainfall. In canal irrigated areas, under a waterlogged condition, rice crop is grown as it is not possible to grow any other crop.

Multiple-cropping:

1. Growing two or more crops on the same piece of land in **one calendar year** is known as multiple-cropping.
2. It is the **intensification of cropping in time and space dimensions**, i.e., more number of crops within year and more number of crops on same piece of land any give period.
3. It includes **inter-cropping, mixed-cropping and sequence cropping**.
4. **Double-cropping** is a case where the land is occupied by two crops, which are grown in a year in sequence.

Inter-cropping:

1. Growing two or more crops **simultaneously** on the same field.
2. Crop intensification is in **both time and space dimensions**.
3. There is **intercrop competition** during all or part of crop growth.
4. Inter-cropping was originally practiced as an **insurance against crop failure** under rained conditions. At present main objective of inter-cropping is higher productivity per unit

area in addition to stability in production. Inter-cropping system utilizes resources efficiently and their productivity is increased.

Relay cropping

1. Refers to planting of the succeeding crop before harvesting the preceding one.
2. Relay intercropping is a kind of intercropping in which two or more crops grow simultaneously during part of the life cycle of each.
3. A second crop is planted before the first crop matures; in other words, **the second crop is planted in the same field as the first crop after the first has achieved reproductive maturity but before it has reached physiological maturity**. This allows farmers to grow two crops in one season in places where the growing season is not long enough to accommodate two crops.

Ratoon cropping

1. Ratooning refers to raising a crop with re-growth coming out of roots or stalks after harvest of crops.
2. Ratooning is a method of harvesting a crop which leaves the roots and the lower parts of the plant uncut to give the ratoon or the stubble crop.
3. The main benefit of ratooning is that the **crop matures earlier in the season**. Ratooning can also **decrease the cost of preparing the field** and planting.
4. This method cannot be used endlessly as the yield of the ratoon crop decreases after each cycle. Ratooning is most often used with crops which are known to give a steady yield for three years under most conditions.

Cropping pattern

1. The yearly sequence and spatial arrangement of crops or of crops and fallow on a given area.
2. The cropping pattern indicates the proportion of area under different crops at a point of time. Cropping activities go on all the year round in India provided water is availed for the crops

In India, the cropping pattern follows two distinct seasons; Kharif season from July to October and Rabi season from October to March. The crops grown between March to June called Zaid. The crops are grown solo or mixed (mixed-cropping) or in a definite sequence (rotational cropping). The land may be occupied by one crop during one session (mono-cropping) or by two crops during one season (double- cropping) which may be grown in a year in a sequence.

The cropping patterns of a region or areal unit may be determined on the basis of areal strength of individual crops. The first, second and third ranking crops of an areal unit may be called as the dominant crops of that unit. These crops, if occupying more or less the same percentage of the total cropped area, shall be competing for area with each other and the farmer will decide which crop may fetch him more profit in a given year under the prevailing rainfall and demand, supply and commodity price condition.

In general, for the determination of cropping patterns of a region, the minor crops (crops occupying insignificant proportion of the total cropped area) are eliminated.

The relative yield index and the relative spread index for the determination of suitability of crop may be calculated by applying the following formulas:

Relative Yield Index =

Mean yield of the crop in a component areal unit/Mean yield of the total area x 100

Relative Spread Index =

Area of the crop expressed as percentage of the total cultivated area in the areal unit /Area of the crop expressed as percentage of the total cultivated land in the entire region x 100

The area under each crop in a given region may be classified under four categories:

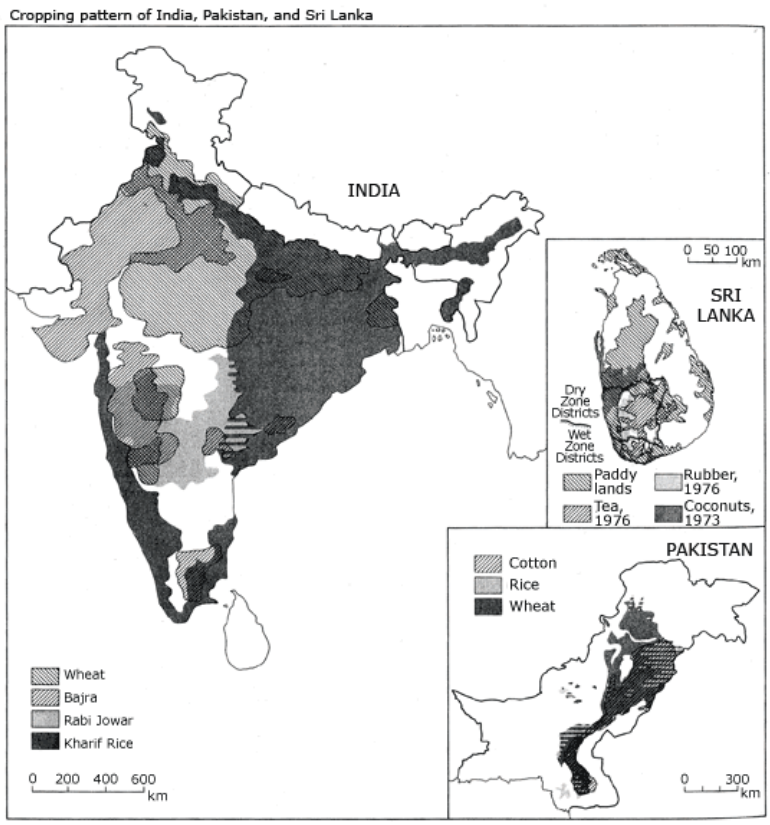
(i) High yield, high spread

(ii) High yield, low spread

(iii) Low yield, high spread

(iv) Low yield, low spread

On the availability of an alternative more efficient crop than the existing ones, new cropping patterns may emerge in a region. The cropping patterns may be intensified with the help of high yielding short duration varieties. Any cropping sequence to be adopted by the cultivators should be flexible.



Factors Affecting Cropping Pattern in India

The cropping pattern is highly influenced by climatic, personal, social, cultural and economic factors of the farmers. The major factors are

i) Size of the Land Holding

In India marginal and small farmers represents the majority of farming community. So the mono crop paddy has become predominant as it fulfils the household needs and perpetuates the subsistence agriculture with little scope for commercial Cop husbandry.

ii) Literacy

Majority of the farmers are ignorant of the scientific methods involved in mixed-cropping, mono cropping and other technological knowhow for practicing better

iii) Disease and pest

The cropping pattern also depends on the possibility of disease and pest infections.

iv) Ecological Suitability

The cropping pattern of a particular region is highly dependent on the ecological condition (temperature, rainfall, humidity, etc.).

v) Moisture Availability

The source of irrigation greatly determines the type of the cropping pattern to be practiced. For example, in low rainfall area, dry land farming is best possible way to profit maximisation.

vi) Financial Stability

The economic condition of the farmers also affects the cropping pattern. As the cash crops (for example, cotton) involve high capital investments, these are practised only in estate farming. The marginal section of the farms community adopts low cost crops.

Problems in Cropping Patterns

Over the years the emerging scenario in the cropping patted points to the following observations.

1. The **dominance of cereal crops** in the foodgrains points to the **poverty** of people. It meets the demand of the low-income people, in whose case a large proportion of income is spent on cereals. Even pulses which are the source of protein for this class of people is not grown on a significant scale. Most of the farmers being marginal and small are the net purchaser of foodgrains and hardly can afford the high input cost for raising a successful non-food cashcrop.
2. The predominance of foodgrains group together with the fact that a significant proportion of agricultural production is concentrated in small farms, leads one to conclude that much of the **cultivation is for self-consumption**.
3. The fact that large areas remains under food grains shows that **land productivity has not increased** at par with technological possibilities,

4. Despite significant changes in cropping pattern, the **shift towards high valued commercial crops has been very small**. The result is an insignificant impact on the growth of the crop output.

SUSTAINABLE AGRICULTURE

A farming systems that are "capable of maintaining their productivity and usefulness to society indefinitely and must be resource-conserving, socially supportive, commercially competitive, and environmentally sound."

Sustainable agriculture means, an integrated system of plant and animal production practices having a site-specific application that will, over the long term:

1. satisfy human food and fiber needs;
2. enhance environmental quality and the natural resource based upon which the agricultural economy depends;
3. make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls;
4. sustain the economic viability of farm operations;
5. enhance the quality of life for farmers and society as a whole.

Major components of sustainable agricultural system

1. **Soil and water conservation** to prevent degradation of soil productivity
2. **Efficient use of limited irrigation water** without leading to problems of soil salinity, alkalinity and high ground water table
3. **Crop rotations** that mitigate weed, disease and insect problems, increase soil productivity and minimize soil erosion
4. **Integrated nutrient management** that reduces the need for chemical fertilizers improves the soil health and minimize environmental pollution by conjunctive use of organics, in-organics and bio-fertilizers.
5. **Integrated pest management** that reduces the need for agrochemicals by crop rotation, weather monitoring, use of resistant cultivar, planting time and biological pest control.
6. Management system to **control weed** by preventive measures, tillage, timely inter cultivation and crop rotation to improve plant health.

Irrigation in India

Artificial watering of Fields to reduce dependence on rain is called irrigation.

In a country like India where rainfall is highly variable and dispersed in time and space, irrigation holds an important position. Importance of irrigation can be understood by the fact that the green revolution of India was successful only in the regions where irrigation was provided.

Main reasons for irrigation in India can be summed up in following points:

Variability in Rainfall:

Rainfall in India is very uncertain which compels irrigation facilities to be provided.

Normal rainfall is marked by its wide fluctuations in different parts as also variation from season to season and year to year in its quantity, incidence and duration.

Unequal Distribution of Rainfall:

In most parts of the country, 80% of the annual rainfall is received from June to September from the south-west monsoon. Saurashtra-Kutch region of Gujarat, western half of Rajasthan and parts of Punjab and Haryana are in the arid zone. Arid and semi-arid irrigation prevails in the rain shadow region of Western Ghats. In order to sustain agriculture, irrigation is required in these regions.

Different water requirements for different crops:

Different crops require different quantities of water supply throughout their growing period making it necessary for irrigation. Sugarcane and rice need more water than wheat and other crops.

To increase Agricultural Production:

To increase the agricultural production and to facilitate multiple crops in the same field.

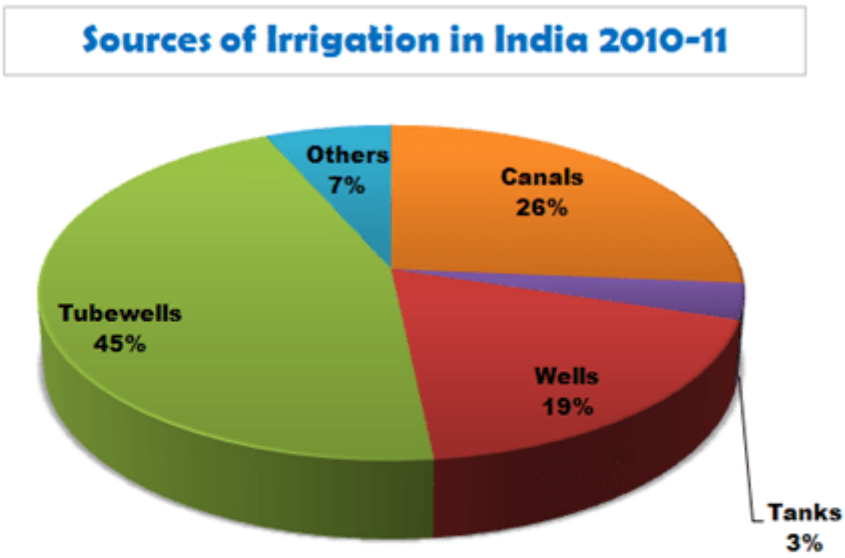
To efficiently used flow of Water of a river stream:

Many of the Indian rivers are not perennial and they carry insignificant flows during the Rabi season. The characteristic of central and southern rivers is that about 80 percent to 90 per cent

of the annual run off takes place during the 4 months of monsoon rains. The rivers are largely dry during the 8 months of the year making it necessary for the provision of irrigation.

To supplement the rainwater

- In good rainfall areas irrigation is required mostly as a supplemental need to protect their single crop agriculture against occasional drought.
- Depending on the region topography and requirement of the crops, different types of irrigation methods are used in India.



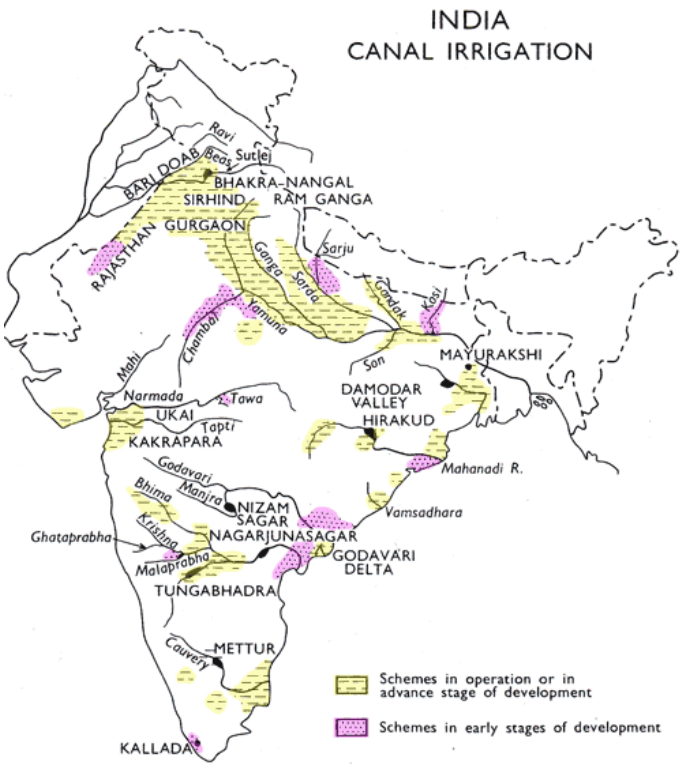
Department of Agriculture and Cooperation (Agricultural Census 2010-11).

Canal irrigation:

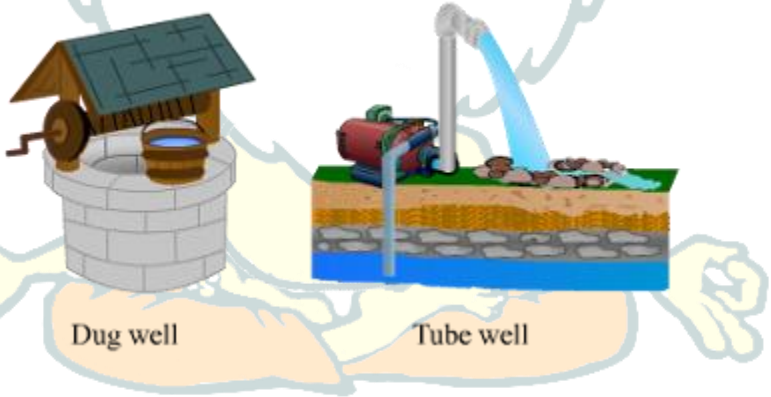
Canals are the main source of irrigation in India. Canals are big water channels taken out from rivers to carry water to places far away from the river.

It is of two types: Canals taken out from rivers without any regulating system like weirs etc. at their head are called inundation canals and canals taking off from perennial rivers with a weir system to regulate flow of water are called perennial canals.

Important region for canal irrigation is in Punjab, Haryana and upper and lower reaches of Ganga in Uttar Pradesh and Bihar.



Well and Tube Well irrigation:



It is more widespread in plains, coasts and some regions of peninsular India. It is less costly and more flexible as water can be drawn whenever needed and 'evaporation loss' is minimised and no fear of "over irrigation". Uttar Pradesh leads in well irrigation and is followed by Punjab, Haryana, Bihar, Gujarat and Andhra Pradesh.

Open wells and tube-wells. Open wells are shallow and irrigate a small area because water available is limited. Tube wells are deep and have the capacity to draw a large volume of water. It has increased in recent years.

This method can be used in regions with high underground water table.

Tank Irrigation:

Tank irrigation in Tamil Nadu

It is prevalent in the uneven and relatively rocky plateau of Peninsular India. Tanks are commonly used in Deccan Plateau, Andhra Pradesh, Karnataka, Tamil Nadu and Maharashtra. About 8% of total irrigated area is irrigated by tanks.

Most of the tanks are small in size and built by individuals or group of farmers by raising bunds across seasonal streams.

Drawbacks: Tanks cover large areas of cultivable land. Evaporation of water is rapid due to large expanse of shallow water of tanks; do not ensure perennial supply of water.

With the changing requirements of Agriculture in India some new methods of irrigation have become important. Most important of them are –

Sprinkler Irrigation

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

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

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

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

Drip Irrigation

With drip irrigation, water is conveyed under pressure through a pipe system to the fields, where it drips slowly onto the soil through emitters or drippers which are located close to the plants. Only the immediate root zone of each plant is wetted. Therefore this can be a very

efficient method of irrigation. Drip and Sprinkler Irrigation involves irrigating crops at the root zone as per the crop requirement. It greatly enhances water use efficiency and can also be used for fertilizer application. Drip irrigation is sometimes called trickle irrigation.

Drip Irrigation

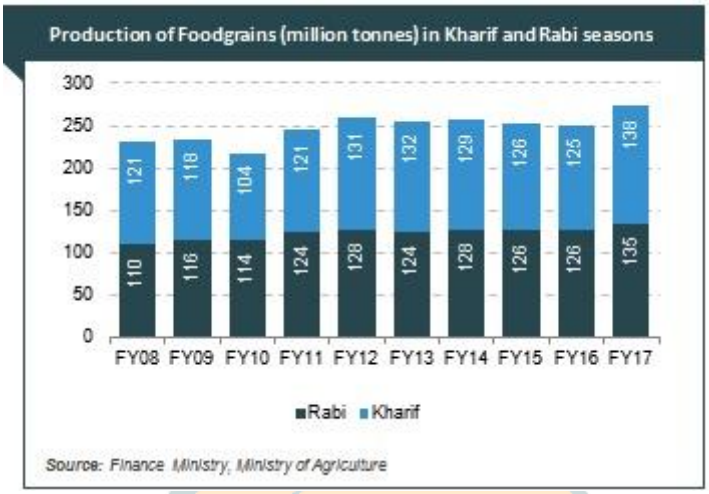
Agriculture in India

Agriculture plays a vital role in India's economy. Over 58 per cent of the rural households depend on agriculture as their principal means of livelihood. As per the 2nd advised estimates by the Central Statistics Office (CSO), the share of agriculture and allied sectors (including agriculture, livestock, forestry and fishery) is estimated to be 17.3 per cent of the Gross Value Added (GVA) during 2016-17 at 2011-12 prices.

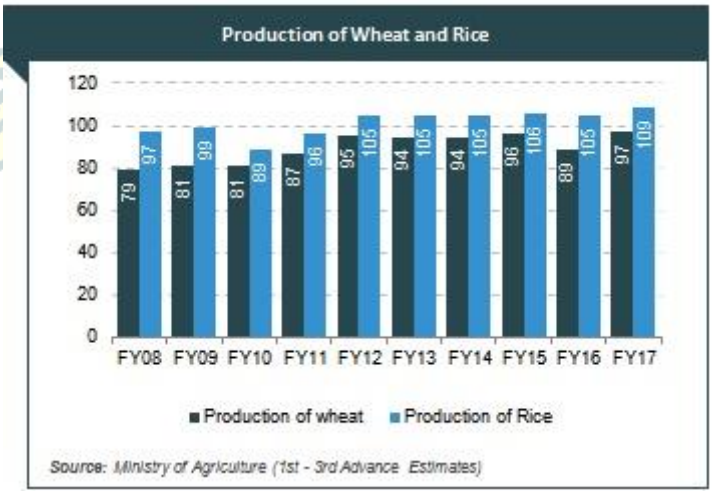
The Indian food industry is poised for huge growth, increasing its contribution to world food trade every year due to its immense potential for value addition, particularly within the food processing industry. The Indian food and grocery market is the world's sixth largest, with retail contributing 70 per cent of the sales. The Indian food processing industry accounts for 32 per cent of the country's total food market, one of the largest industries in India and is ranked fifth in terms of production, consumption, export and expected growth. It contributes around 8.80 and 8.39 per cent of Gross Value Added (GVA) in Manufacturing and Agriculture respectively, 13 per cent of India's exports and six per cent of total industrial investment.

Some of the important points to remember regarding Indian Agriculture are as follows:

- There are 2 major agricultural seasons in India: Kharif and Rabi
- Kharif season lasts from April to September (summer); rice (paddy) is the season's main crop
- Rabi season lasts from October to March (winter); wheat is the season's main crop
- According to the Ministry of Agriculture, total food grain production in the country in May 2017, stood at around 273.38 million tonnes.
- India imported 2.7 million tonnes of wheat in FY17 (till January 16, 2017) and an additional 1.2 million tonnes are to be imported by February 2017
- In March 2017, of 64.5 million hectares of agriculture land, the government insured 19 million hectares during the rabi season, to benefit 16.4 million farmers, under the Pradhan Mantri Fasal Bima Yojana (PMFBY) programme. The total amount for insurance for rabi crops is US$ 10.16 billion.



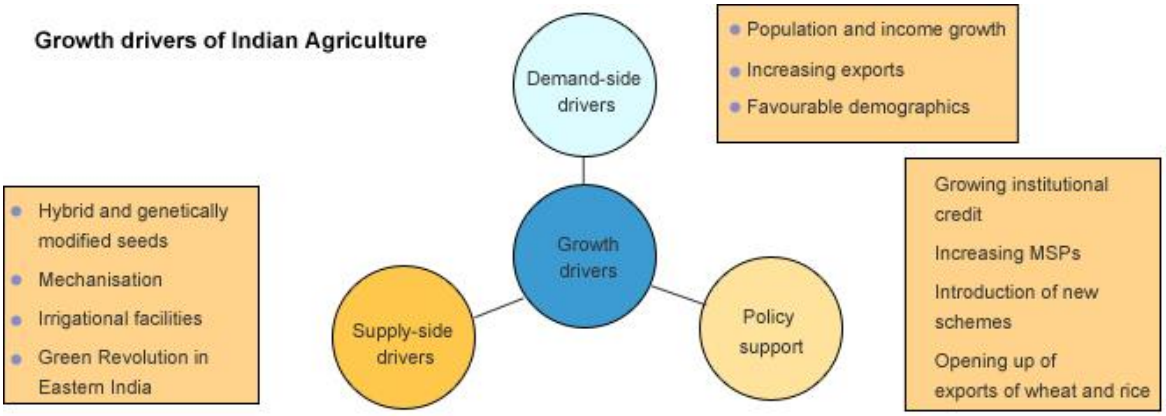
- Since 2010, production as well as yield of both major crops - rice and wheat has increased significantly.
- In FY16, production of rice stood at 103.61 million tonnes, whereas, production of wheat stood at 93.82 million tonnes.
- However, according to 3rd advance estimates, production of wheat in 2016-17 stood at 97.44 million tonnes and that of rice was 109.15 million tonnes.
- In FY16, as per the 4th advance estimates, yield of rice in the country reached 2.39 tonnes/hectare and that of wheat reached 2.4 tonnes/hectare.
- Ministry of Agriculture is targeting to achieve 270.1 million tonnes production of food grains, during 2016-17.
- Backed by robust output of wheat, rice and pulses due to a heavy rainfall in 2016, the country's food grain production increased by 8.7 per cent to a record high 273.83 million tonnes in 2016-17



Market Size

India's GDP is expected to grow at 7.1 per cent in FY 2016-17, led by growth in private consumption, while agriculture GDP is expected to grow above-trend at 4.1 per cent to Rs 1.11 trillion (US$ 1,640 billion).$ It ranks third in farm and agriculture outputs. As per the 2nd Advance Estimates, India's food grain production is expected to be 271.98 MT in 2016-17. Wheat production in India is expected to touch an all-time high of 96.6 MT during 2016-17.! Production of pulses is estimated at 22.14 MT.

- India has been the world's largest producer of milk for the last two decades and contributes 19 per cent of the world's total milk production.
- India is emerging as the export hub of instant coffee which has led to exports of coffee reaching 177,805 tonnes valued at US$ 447 million between April-August 2017, as against 162,641 tonnes valued at US$ 363.1 million during the same period last year.
- India topped the list of shrimp exporters globally, as the value-added shrimp exports rose 130 per cent year-on-year to 23,400 tonnes in 2016.
- The production of food grains in India reached a record 275.68 million tonnes (MT) during FY 2016-17, as per the Fourth Advance Estimates (AE) released by the Department of Agriculture, Cooperation and Farmers Welfare, Government of India.
- The total sown area for kharif crops was 68.53 million hectares as on July 2017, compared to 67.34 million hectares on July, 2016.
- India is the second largest fruit producer in the world. India's horticulture output, is estimated to be 287.3 million tonnes (MT) in 2016-17 after the first advance estimate.
- Agricultural export constitutes 10 per cent of the country’s exports and is the fourth-largest exported principal commodity. India's exports of basmati rice may rise to Rs 22,000-22,500 crore (US$ 3.42-3.49 billion), with volume to around 4.09 MT in 2017-18, backed by a rise in average realisations.# Groundnut exports from India are expected to cross 700,000 tonnes during FY 2016-17 as compared to 537,888 tonnes during FY 2015-16, owing to the expected 70 per cent increase in the crop size due to good monsoons. India’s groundnut exports rose to 653,240 MT during April 2016-February 2017.
- India is the largest producer, consumer and exporter of spices and spice products. Spices exports from India grew by 9 per cent in volume and 5 per cent in value year-on-year to 660,975 tonnes and US$ 1.87 billion respectively, during April-December 2016.
- The online food delivery industry grew at 150 per cent year-on-year with an estimated Gross Merchandise Value (GMV) of US$ 300 million in 2016. The Indian gourmet food market is currently valued at US$ 1.3 billion and is growing at a Compound Annual Growth Rate (CAGR) of 20 per cent. India's organic food market is expected to increase by three times by 2020.



Recent Government Initiatives:

Given the importance of the agriculture sector, the Government of India, in its Budget 2017–18, planned several steps for the sustainable development of agriculture-

- Total allocation for rural, agricultural and allied sectors for FY 2017-18 has been increased by 24 per cent year-on-year to Rs 1,87,223 crore (US$ 28.1 billion). A dedicated micro-irrigation fund will be set up by National Bank for Agriculture and Rural Development (NABARD) with a corpus of Rs 5,000 crore (US$ 750 million). The government plans to set up a dairy processing fund of Rs 8,000 crore (US$ 1.2 billion) over three years with initial corpus of Rs 2,000 crore (US$ 300 million).
- The participation of women in Mahatma Gandhi National Rural Employment Gurantee Act (MGNREGA) has increased to 55 per cent and allocation to the scheme has been increased to a record Rs 48,000 crore (US$ 7.2 billion) for FY2017-18.
- Short-term crop loans up to Rs 300,000 (US$ 4,500) at subsidised interest rate of 7 per cent per annum would be provided to the farmers. An additional incentive of 3 per cent is provided to farmers for prompt repayment of loans within due date, making an effective interest rate for them at 4 per cent.

Some of the recent major government initiatives in the sector are as follows:

- With an aim to boost innovation and entrepreneurship in agriculture, the Government of India is introducing a new AGRI-UDAAN programme to mentor start-ups and to enable them to connect with potential investors.

- The Government of India has launched the Pradhan Mantri Krishi Sinchai Yojana (PMKSY) with an investment of Rs 50,000 crore (US$ 7.7 billion) aimed at development of irrigation sources for providing a permanent solution from drought.
- The Government of India plans to triple the capacity of food processing sector in India from the current 10 per cent of agriculture produce and has also committed Rs 6,000 crore (US$ 936.38 billion) as investments for mega food parks in the country, as a part of the Scheme for Agro-Marine Processing and Development of Agro-Processing Clusters (SAMPADA).
- The Union Cabinet, Government of India, approves Rs 9,020 crore (US$ 1.4 billion) as Extra Budgetary Resources (EBR) for execution of projects under Accelerated Irrigation Benefits Programme (AIBP) and their command area development (CAD) works under PMKSY.
- A new platform for selling agricultural produce named e-RaKam has been launched by the Government of India and will operate as a joint initiative of Metal Scrap Trade Corporation Limited and Central Railside Warehouse Company Limited (CRWC).
- The NITI Aayog has proposed various reforms in India's agriculture sector, including liberal contract farming, direct purchase from farmers by private players, direct sale by farmers to consumers, and single trader license, among other measures, in order to double rural income in the next five years. The Ministry of Agriculture, Government of India, has been conducting various consultations and seeking suggestions from numerous stakeholders in the agriculture sector, in order to devise a strategy to double the income of farmers by 2022.
- The Government of India has allowed 100 per cent FDI in marketing of food products and in food product e-commerce under the automatic route.
- The Maharashtra State Agriculture Marketing Board (MSAMB) has operationalised 31 farmer-to-consumer markets in the state, and plans to open 100 more such markets in the future, which would facilitate better financial remunerations for the farmers by allowing them to directly sell their produce in open markets.
- The Ministry of Labour and Employment plans to amend the Minimum Wage Act to raise the daily minimum wage of unskilled agricultural labour in C-class towns to Rs 350 (US$ 5.2) in the central sphere, from the current wage of Rs 160 (US$ 2.4) per day.
- The Government of India and the Government of Israel have expressed their commitment to further strengthen bilateral relations in the field of agriculture and allied sectors, as well as enhance cooperation at the government-to-government and business-to-business levels between the two countries, in a bid to further enhance the relationship.
- According to the Agriculture Ministry, 50,000 hectares of area is available for coconut cultivation in Bihar, the Coconut Development Board plans to equip the farmers thus

making India the world leader in production, productivity, processing for value addition and export of coconut.

Road Ahead

India is expected to achieve the ambitious goal of doubling farm income by 2022.*@ The agriculture sector in India is expected to generate better momentum in the next few years due to increased investments in agricultural infrastructure such as irrigation facilities, warehousing and cold storage. Furthermore, the growing use of genetically modified crops will likely improve the yield for Indian farmers. India is expected to be self-sufficient in pulses in the coming few years due to concerted efforts of scientists to get early-maturing varieties of pulses and the increase in minimum support price.

India's gross value added (GVA) at basic prices increased by 5.7 per cent during the April-June 2017 quarter, driven by agriculture and government spending. GVA from agriculture, forestry and fishing sector grew 2.5 per cent in this quarter.