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CROPS

- **Importance**
- **Diversification**
- **Classification**



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What are crops?



A crop is a **plant or animal product** that can be grown and harvested in an area with a target to earn profit or achieve subsistence. Crop may refer either to the harvested parts or to the harvest in a more refined state (husked, shelled, etc.). Most crops are cultivated in agriculture or aquaculture.

A crop is usually expanded to include **macroscopic fungus** (e.g. mushrooms), or **alga** (alga-culture). Most crops are harvested as food for humans or livestock (fodder crops) or to get raw materials if industry.



- Some crops are gathered from the **wild collection** (including intensive gathering, example, ginseng).
- The important **non-food crops** include horticulture, floriculture and industrial crops.
- Industrial crops are produced for clothing (fibre crops), biofuel (jatropha, energy crops, algal fuel), or medicine (medicinal plants).
- Animals and microbes (fungi, bacteria or viruses) are rarely referred to as crops.
- Animals raised for human or animal consumption are referred to as livestock and microbes as microbiological cultures.
- Microbes are not typically grown for food itself, but are rather used to alter food (e.g., for production of citric acid, fermenting yogurt, soya sauce and so on).



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Why crops are Important?



- **The importance of a crop** varies greatly by region.
- Crop production depends on the availability of arable land and is affected in particular by yields, macro-economic uncertainty, as well as consumption patterns; it also has a great incidence on agricultural commodities' prices.
- The importance of crop production is related to harvested areas, returns per hectare (yields) and quantities produced.
- Crop yields are the harvested production per unit of harvested area for crop products. In most of the cases yield data are not recorded, but are obtained by dividing the production data by the data on area harvested.



- The actual yield that is captured on farm depends on several factors such as the crop's genetic potential, the amount of sunlight, water and nutrients absorbed by the crop, the presence of weeds and pests and management practices adopted. This indicator is presented for wheat, maize, rice and other cultivated crops.
- Crop production is **measured in tonnes per hectare.**
- **Today, India ranks second worldwide in farm output.**
- The country produces innumerable crops ranging from medicinal to cereal crops. These commodities are used for various purposes from human consumption, in industries, for animal feed and so on.



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Crop Diversification



- Crop diversification provides the farmers with a **wider choice** in the production of a variety of crops in a given area so as to expand production related activities on various crops and also to **minimize the possible risk.**
- Crop diversification in India is generally viewed **as a shift from traditionally grown less remunerative crops to more remunerative crops.**



- In recent years, the crop diversification is also taking place **due to governmental policies**, thrust on some crops, market reforms, infrastructure development, government subsidies, price support mechanisms, higher profitability and stability in production.
- Crop diversification and growing of large number of crops are practiced **in dry-land areas** to reduce the risk factor of crop failures due to climatic abnormality and recurring droughts.
- Crop substitution and crop shift are also taking place in the **areas suffering with some specific soil related problems**.



The main **causes for the crop diversification in drylands** are as follows.

- In the areas where the variability of rainfall is high and adequate sources of irrigation are not available, farmers grow several crops in a season, requiring different quantities of moisture. It is being done mainly to get something from their fields even in the case of extreme weather (flood or drought or deluge) conditions as natural insurance.
- In the tradition bound subsistent farming systems the farmers grow several crops to meet the family requirements resulting in a high degree of crop diversification.



- Diversification has usually been done by the farmers **to enhance nitrogen in the soil and to replenish the soil fertility**, and thus maintenance of a good crop rotation.
- The diversification of crops also generates more **employment as the farmers including family labourers and agricultural workers** remain busy in different farming operations of different crops throughout the year.
- One important advantage of diversification is assurance of **frequent cash flow** which is beneficial to small and marginal farmers.
- Diversification of crops also enables the farmers to provide a reasonable quantity of the costly inputs to their crops as different crops need different quantities of inputs (chemical fertilizers, insecticides, pesticides and irrigation).



Factors affecting for crop diversification

- **Resource** related factors mainly irrigation, amount and distribution of rainfall pattern and soil health;
- **Technology** related factors mainly seed, fertilizer, water use, marketing, storage and post-harvest technologies;
- **Household** related factors mainly food and fodder self-sufficiency requirement as well as investment capacity of the small and marginal farmers;
- Factors related to **output and input prices**, marketing infrastructure;
- **Institutional and infrastructure** related factors covering farm size and tenancy issues, and regulatory policies of the government.



Constraints in crop diversification

- >60% of the cropped area is rain-fed;
- Sub-optimal and over-use of resources causing a negative impact on the environment and sustainability of agriculture;
- Inadequate supply of improved and quality seeds and planting material of improved cultivars;
- Fragmentation of land holdings;
- Poor basic infrastructure;
- Inadequate post-harvest technologies and infrastructure for post-harvest handling of perishable horticultural produce;
- Very weak agro-based industry;
- Inadequate research - extension - farmer linkages;
- Inadequately trained human resources and large scale illiteracy amongst farmers;
- Emerging diseases and pests problems;
- Poor database for horticultural crops;
- insufficient investments in the agricultural sector.



Bhatia (1965) developed a formula

Index of Crop Diversification =

$$\frac{\text{Percent of sown area under 'x' crops}}{\text{Number of 'x' crops}}$$

Where 'x' crops are those crops that individually occupy 10 per cent or more of the gross cropped area in the area under study.

Reference

Bhatia S S. 1965. Patterns of crop concentration and diversification in India, *Economic Geography*, 14:41-56



Classification of Crops

There are > 600 cultivated plant species, of which about 200 play important role in the world trade.

About only 15 field crops as well as plant species represent the most important economic crops.

Crops must be classified or grouped in a convenient way to facilitate communication, dissemination and retrieval of scientific information as well as promotion of conservation, and improvement of certain plants.



Reasons for classification of crops

- To get acquainted with crops.
- To understand the requirement of soil & water different crops.
- To know adaptability of crops.
- To know the growing habit of crops.
- To understand climatic requirement of different crops.
- To know the economic produce of the crop plant & its use.
- To know the growing season of the crop
- Overall to know the actual condition required to the cultivation of plant.



Classification types used in field crops

1. Based on ontogeny (Life cycle)
2. Based on economic use (Agronomic)
3. Based on Botany (Scientific)
4. Based on seasons
5. Based on climate
6. Based on special purpose
7. Based on root depth
8. Based on CO₂ fixation
9. Mode of pollination
10. Based on leaf morphology
11. Based on cultural requirements
12. Based on origin



Based on Ontogeny (Life cycle)

- **Annual crops**

Crop plants that complete life cycle within a season or year. Example, wheat, rice, maize, mustard etc.

- **Biennial crops**

Plants that have life span of two consecutive seasons or years. First years/ season, these plants have purely vegetative growth usually confined to rosette of leaves. During the second year / season, they produce flower stocks from the crown and after producing seeds the plants die. Example, sugar beet, onion etc.

- **Perennial crops**

They live for three or more years. They may be seed bearing or non-seed bearing. Example, Napier fodder grass, coconut, lemon grass etc.



Based economic use (Agronomic)

Cereals

Rice: *Oryza sativa*

Wheat: *Triticum aestivum*

Maize: *Zea mays*

Major millets

Sorghum (Jowar): *Sorghum bicolor*

Pearl millet (Bajra): *Pennisetum glaucum*

Finger millet (Ragi): *Eleusine coracana*

Minor millets

Foxtail millet: *Setaria italica*

Little millet: *Panicum miliare*

Common millet: *Panicum miliaceum*

Barnyard millet: *Echinochloa colona* var *frumentaceae*

Kodo millet: *Paspalum scrobiculatum*



Pulses

1. Red gram: *Cajanus cajan*
2. Black gram: *Vigna mungo*
3. Green gram: *Vigna radiata*
4. Cowpea: *Vigna unguiculata*
5. Bengalgram: *Cicer arietinum*
6. Horsegram: *Macrotyloma uniflorum*
7. Lentil: *Lens esculentus*
8. Soybean: *Glycine max*
9. Pea: *Pisum sativum*
10. Grass pea - *Lathyrus sativus*

Oil seeds

1. Groundnut or peanut: *Arachis hypogaea*
2. Sesame or gingelly: *Sesamum indicum*
3. Sunflower: *Helianthus annuus*
4. Castor: *Ricinus communis*
5. Linseed or flax: *Linum usitatissimum*
6. Niger: *Guizotia abyssinia*
7. Safflower: *Carthamus tinctorius*
8. Indian Mustard: *Brassica juncea*



Sugar crops

1. Sugarcane: *Saccharum officinarum*
2. Sugar beet: *Beta vulgaris*

Fibre crops

1. Cotton: *Gossypium hirsutum*
2. Jute: *Cochchorus olitorius/ C. capsularis*
3. Mesta: *Hibiscus cannabinus*

Forage

1. Grasses:
 - Bajra (*Pennisetum glaucum*)
 - Napier (*Pennisetum purpureum*)
 - Guinea grass (*Megathyrsus maximus*)
 - Para grass (*Brachiaria mutica*)
2. Legumes:
 - Lucerne (*Medicago sativa*)
 - Barseem (*Trifoloiim alexandrium*)



Spices and condiments

Ginger: *Zingiber officinale*

Garlic: *Allium sativum*

Fenugreek: *Trigonella foenum-graecum*

Cumin: *Cuminum cyminum*

Turmeric: *Curcuma longa*

Coriander: *Coriandrum sativum*

Anise: *Pimpinella anisum*

Medicinal plants

Tobacco: *Nicotina tabacum*

Peppermint: *Mentha piperita*

Aswagandha: *Withania somnifera*

Aloe: *Aloe vera*

Beverages

1. Tea: *Camellia sinensis*

2. Coffee: *Coffea arabica*

3. Cocoa: *Theobroma cacao*



Botanical classification

- **Monocotyledons**

Poaceae/ Gramineae: wheat, barley, rice, maize, oat, sugar cane, sorghum, rye grass, sudan grass and different millets.

Liliaceae: onion and garlic.

- **Dicotyledons**

Leguminosae: field bean, lupine, check pea, lentil, fenugreek, Egyptian clover, alfalfa, soybean, peanut, grass pea, caster bean, red clover and white clover.

Malvaceae: cotton.

Linaceae: flax.

Solanceae: potato, tobacco.

Pedaliaceae: sesame.

Composite: sunflower, safflower.



Based on seasons

Kharif crops

Crops grown during June-July to September-October which require a warm wet weather during their major period of growth and shorter day length for flowering. Example, Rice, maize, castor, groundnut.

Rabi crops

Crops grown during October–November to January–February, which require cold dry weather for their major growth period and longer day length for flowering. Example, Wheat, mustard, barley, oats, potato, Bengal gram, berseem, cabbage and cauliflower.

Summer crops

Crops grown during February–March to May–June which require warm dry weather for growth and longer day length for flowering. Example, black gram, green gram, sesame, cowpea.



Based on climatic condition

Tropical crop

Coconut, sugarcane

Sub-tropical crop

Rice, cotton

Temperate crop

Wheat, barley

Polar crop

All pines, pasture grasses



Based on Special purpose

Catch or emergency crops

These crops are used to substitute crops that have failed on account of unfavourable conditions. They are usually quick-grown crops, such as rye, millet, clover, green gram, leafy vegetables.

Cash crop

Any crop grown to generate cash rather than for subsistence. Some crops may be cash crops one year but not the next, or for one farmer but not another. Eg: chilli, cotton, tea

Cover crops

These crops are planted to provide a cover for the soil and to prevent erosion such as clover, rye.

Green manure crops

These crops are turned under while still green. Eg: Sesbania sp, Egyptian clover, lupine and cowpea.

Companion crops

In this case a crop can be intercropped with another one and each crop is harvested separately. Legumes+ can be intercropped with cotton or maize.

Silage crops

These crops are preserved in a succulent condition by partial fermentation in a tight receptacle. They include corn, sorghum, forage grasses and legumes.



Based on root depth

Hallow root crops

The root system of these crops extends in the soil to a depth of one meter such as wheat, barley and rice.

Intermediate crops

The depth of the root system of these crops ranges from 1- 1.5 meter in the case of faba bean and sugar beet.

Deep root crops

The root system of these plants extends in the soil to a depth more than 1.5 meter as in alfalfa.



Based on CO₂ fixation

C3 Plants: Net assimilation rate in these plants is low but compensation point is high. Stomata are open during the day. Photo respiration is high in these plants C3 Plants have lower water use efficiency. The initial product of C assimilation is the three 'C' compounds. Example, rice, soybeans, wheat, barley cottons, potato. C3 plants include more than 95 percent of the plant species on earth.

C4 plants: Net assimilation rate in these plants is high but compensation point is low. Stomata are open during the day. The primary product of C fixation is four carbon compounds which may be malice acid or acerbic acid. The enzymes responsible for carboxylation are Phosphoenol Pyruvic acid carboxylose which has high affinity for CO₂ and capable of assimilation CO₂ event at lower concentration, photorespiration is negligible. C4 plants translate photosynthates rapidly. Example, sorghum, maize, sesame, millets.

CAM plants: (CAM stands for Crassulacean Acid Metabolism) the stomata open at night and large amount of CO₂ is fixed as a malice acid which is stored in vacuoles. During day stomata are closed. There is no possibility of CO₂ entry. CO₂ which is stored as malice acid is broken down & released as CO₂. In these plants there is negligible transpiration. C4 & cam plant have high water use efficiency. These are highly drought resistant. Example of CAM plants are pineapple, sisal and agave.



Based on mode of pollination

Naturally self-pollinated crops

the predominant mode of pollination in these plants is self-pollination in which both pollen and embryo sac are produced in the same floral structure or in different flowers but within the same plant. Examples: rice, most pulses, okra, tobacco, tomato.

Naturally cross-pollinated crops

Pollen transfer in these plants is from the anther of one flower to the stigma of another flower in a separate plant, although self-pollination may reach 5 percent or more. Examples: corn and many grasses, avocado, grape, mango, many plants with unisexual or imperfect flowers.

Both self- and cross-pollinated crops

These plants are largely self-pollinated but varying amounts of cross-pollination occur. Examples: cotton and sorghum.



Based on leaf morphology

Broad leaved: Mustard, pea, potato, tobacco.

Narrow leaved: Rice, wheat, sugarcane, onion, ginger, finger millet.

Based on topo-sequence

Crops grown on upland: Redgram, maize, jower.

Crops grown on medium land: Jute, potato, sugarcane, wheat.

Crops grown on low land: Rice, para grass.

Based on suitability of the textural group of soils

Sandy to sandy loam soil (light textured): Potato, sweet potato, sugarbeet, onion.

Silty to silty loam soil (medium textured): Jute, sugarcane, maize, cotton.

Clay to clay loam soil (heavy textured): Rice, wheat, lentil, para grass guinea grass.



Based on tolerance to the problematic soil

Tolerant to acidic soil: Potato, mustard, wet rice.

Tolerant to saline soil: Chillies, sugar beet, beet, sunflower, barseem.

Tolerant to alkaline soil: Barley, cotton, pea, barseem.

Tolerant to water logged soil: Rice, para grass, napier, job's tier

Tolerant to soil erosion: Vetiver, moth bean, marvel grass.

Based on tolerance to hazardous weather conditions

Frost tolerant: Sugar beet, beet.

Cold tolerant: Potato, cabbage, mustard.

Drought tolerant: Millets, barley, safflower, castor.



Based on water supply

Irrigated crop: Boro rice, potato, tobacco.

Rainfed crop: Millets, upland rice, jute, castor, Dinanath grass.

Rainfed, but partially irrigated: Chick pea, mustard, maize.

Residual soil moisture crops: Tori, lathyrus

Rainfed flooded crops: Deep water rice, makhana, water chestnut.

Based on method of sowing / planting

Direct seeded: Upland rice, mustard, chick pea, lentil.

Planted: Potato, napier, citronella.

Transplanted: Transplanted rice, tobacco, onion.



According to requirement of inter-tillage and earthing-up

Intertilled crops: Potato, sweet potato, sugar beet.

Non-intertilled crops: Lentil, oats, chick pea, linseed.

According to crop duration

Very short (upto 75 days): Greengram, spinach.

Short (76-100 days): Upland rice, early potato.

Medium (101-125 days): Wheat, jower, bajra, barley.

Long (126-150 days): Tobacco, barseem.

Very long (>150 days): Sugarcane, red gram.



According to method of harvest

Reaping: Rice, wheat, mustard.

Uprooting by pulling: Linseed, radish, beet.

Uprooting by digging: Potato, sweet potato.

Picking: Cotton, maize, okra.

Cutting: Barseem, napier.

Grazing: Para grass, pasture grasses.

According to post-harvest operation required

Curing: Tobacco.

Stripping: Jute, mesta, sunhemp.

Shelling: Groundnut, maize.

Ginning: Cotton.



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