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IMPROVEMENT IN FOOD RESOURCES



We need to improve crops because as the population increases, the demand for food also increases. so, we need to improve crops by-

- Making crops pest resistant
- Making crops tolerant to environmental stresses

Blue Revolution	Yellow Revolution	White Revolution	Silver Revolution
To increase fish production	To increase oil production	To increase milk production	To increase egg production

Green revolution and its impacts

⇢ The introduction of high-yielding varieties of seeds after 1965 & increased use of fertilizers & irrigation are known collectively as green revolution.

⇢ Father of green revolution in India is M.S. Swaminathan.

Drawbacks:

⇢ The use of synthetic chemical pesticides and insecticides on a large scale, causing unimaginable damage to the fertility of the soil and destroying the micronutrients in it.

Challenges :

⇢ We should increase food production without degrading our environment and disturbing the natural balance.

⇢ Need of practising farming using principles of ecology.

⇢ We should adapt the sustainable agriculture practices.

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Objectives:

- Satisfy human food and fiber needs
- Make the most efficient use of nonrenewable resources and on-farm resources, natural biological cycles and controls.
- Farming methodology and equipments should be economical for the farmer.
- Enhance the quality of life for farmers and society as a whole.

Improvement in crop yields

Norman E Borlaug was an American agronomist led initiatives worldwide that contributed to extensive increase in agricultural production termed the green revolution.



Father of Green Revolution {World}

CROP

Plants of same kind which are grown and cultivated at one place on a large scale are known as crops.

Types of Crops

Cereal crops

They are rich in carbohydrate and thus provide energy. e.g. *Rice, Wheat, Maize, Sorghum, Barley, Millets.*



Rice

Pulses

They are rich in protein and thus helpful for body building. e.g. *Gram (Chana), Moong, Pea (Matar), Lentil (masoor), Urad, Pigeon pea (Arhar).*



Moong

Oil seed crops

They rich in oil and fatty acids. e.g. *Groundnut, Sunflower, Soyabean, Mustard, Sesame (til), linseed.*



Vegetable crops

These provide vitamins, minerals along with small quantities of carbohydrate, protein and oils.



Spices

They are used for enhancing palatability.
e.g. *Chilly, black pepper, ginger, turmeric.*



Fodder crops

These provide green fodder to the cattle.
e.g. *Berseem, sorghum, maize, oat, sudan grass, alfalfa.*



Crops are divided into two groups on the basis of growing season.

Kharif Crops

- These are autumn or monsoon crops. The sowing starts in rainy season.
- They are sown in June-July.
- They are harvested in Sept.-Oct.
- They require warm and wet weather.
- They need a lot of water.
- E.g. Rice, Cotton, Bajra, Jowar, Groundnut, Maize, Spinach, Soyabean pigeon pea etc.

Rabi Crops

- The sowing starts in winter season.
- They are sown in October- November.
- They are harvested in March-April.
- They require dry and cold weather.
- They do not need a lot of water.
- E.g. Wheat, Barley, Gram, Pea, Mustard, Linseed, Potato, Orange, Apple etc.

AGRICULTURE

It is an applied biological science which deals with the production of plants and raising of life stock for human use.

Agriculture

Agronomy

- Horticulture
  (production of fruits and vegetables)
- Olericulture
  (production of vegetables)
- Floriculture
  (production of flowers)

Animal Husbandry

- Cattle farming
- Poultry
- Pisciculture
- Apiculture

The major groups of activities for improving crop yields can be classified as:

1. Crop variety improvement (the choice of seed for planting).
2. Crop production management (the nurturing of the crop plant).
3. Crop protection management (the protection of the growing and harvested crops from loss)

Crop Variety improvement

Crop improvement simply means to develop crops with desired characters.

Plant Breeder :

The scientist who are concerned with the improvement of plants are called plant breeder.

- It aims towards development of superior variety involving various biotechnological methods including mutation, tissue culture, genetic engineering etc.

The various methods of crop improvement are:

Methods of crop improvement

- **By hybridization**
- **By genetic modification**

Hybridization

- The traditional method of crop improvement is by sexual hybridization, making crosses between two genetically dissimilar plants with desirable characteristics.
- At fertilization, the genetic information from each parent recombines, so characteristics from each parent are inherited to the offspring. However, many other features are also inherited, along with the desirable one.

Some hybrid/Genetically modified seeds	
Wheat	Kalyan, sarbati sonara, sonalika
Maize	Ganga, ambar, jawahar
Rice	Jaya, padma, pusa basmati, IR8
Cotton	G-57, Bt (GM)

Hybridization may be of three types

- **Inter Varietal** — Between the two varieties of the same species
- **Interspecific** — Between the different species of the same genus.
- **Intergeneric** — Between two different genera.

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Note

Plant breeding is a branch of science concerned with producing improved varieties of crop plants by introducing several desired characteristics into them.

By Genetic Modifications/Plant Transformation

In this crop is improved by introducing a gene that would provide the desired characteristics.

Transgenic Plants :

The plant in which the foreign gene has been introduced is called transgenic plant or genetically modified plant.

Example :

Bt cotton is a genetically modified crop which carries bacterial genes that protect the crop from insects.

The various aspects for which crop variety improvement is carried out are

- Higher yield
- Better quality
- Biotic and abiotic resistance
- Change in maturity duration
- Wider adaptability
- Desirable agronomic characteristic

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Crop Production Management

Plant responses to soil conditions and atmospheric environment must be exploited to the maximum to produce a high yield per unit area of land.

Few factors that if managed well will help increasing crop production.

1. Nutrient management
2. Irrigation
3. Cropping patterns

1. Nutrient management

- Controlling the selection, timing and amount of nutrient supply to the crops.
- Plant nutrients are inorganic raw materials that the plant absorb from their surroundings and utilize the same in building up their organic matter.
- There are essential elements for growth and development of plants. They are classified into two groups :

Macronutrients

The essential elements utilized by plants in relatively large quantities are called major nutrients or macronutrients.

Micronutrients

The essential element utilized by plants in relatively small quantities or traces are called micronutrients.

Sources of Nutrients

S. No.	Sources	Nutrients	Types
1.	Air	Carbon, Oxygen	Macro nutrients
2.	Water	Hydrogen	Macro nutrients
3.	Soil	Nitrogen, Phosphorus, Potassium, Sulphur, Calcium, Magnesium	Macro nutrients
		Iron, Manganese, Boron, Zinc, Copper, Molybdenum, Chlorine, Nickle	Micro nutrients

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Differences between Manures and Fertilizers

Manures	Fertilizers
These are organic substances obtained by the decomposition of plant and animal wastes.	These are artificial inorganic salts.
They are rich in organic nutrients, not rich in (NPK).	They are rich in Nitrogen, Phosphorus and Potassium (NPK).
They are not nutrient specific.	They are nutrient specific.
They are not soluble in water so absorbed slowly by plants.	They are soluble in water and absorbed quickly.
They are not harmful to the environment.	They are harmful to the environment.
They have nutrients in small quantity so needed in large quantity.	They have higher amount of nutrients so required in very small quantity.
They are bulky substances so difficult to store and transport.	They are in concentrated form and easy to transport and store.
They are prepared in field.	They are prepared in factories.

Note

⇢ **Compost** is a type of manure which is produced from the plant and animal wastes by the action of microbes.

⇢ **Vermicompost** process is the type of manure which is produced by the degradation of organic wastes through consumption by the earthworms.

⇢ **Green manure** is a type of manure which is produced by the sowing and back ploughing of fast growing crops. e.g. Cowpea, Lentil, Sunn Hemp, Dhaincha.

2. Irrigation

⇢ Process of artificial supplying of water to the crop.

⇢ Different sources of irrigation: well, tube well, ponds, lakes, river, canal and dams.

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Irrigation systems in India:

- Canal system
- Tanks
- Wells (Dug well & Tube well)
- River valley system
- River lift system

Note

Wells and tube wells are successful in those areas where underground water is not saline whereas in those areas where underground water is saline, canal water is used for irrigation.

Modern Methods of Irrigation:

Sprinkler System

- Spread water uniformly over crop plants and field.
- Useful for sandy soil and uneven land.
- An efficient system in the canal irrigated area of Haryana and Rajasthan.



Drip System (Trickle system)

- Water is not wasted at all.
- Boon in poor water regions.
- Best irrigation technique for fruit crops, garden and trees.



Water augmentation:

Water availability for irrigation can be assured by augmenting ground water. It is carried out by two methods-

(i) Rainwater harvesting

(ii) Watershed management

(3) Cropping patterns

- There are models of raising crops which help in obtaining maximum benefit from the same piece of land, reduce risk of crop failure, disease and infestation.
- Three common types of cropping patterns are mixed cropping, intercropping and crop rotation.

Differences between mixed cropping and intercropping

Mixed cropping	Intercropping
Seeds of different crops are mixed before sowing.	Seeds of different crops are not mixed. They are sown separately.
There is no pattern of sowing.	The different crops are sown in separate rows or strips.
It minimizes the risk of crop failure.	It increases crop productivity per unit area.
Only a common type of fertilizer can be added.	Specific fertilizers can be provided to each crop.
Crop specific pesticides cannot be sprayed.	Crop specific pesticides can be sprayed without difficulty.
Harvesting of early maturing crop provides a lot of difficulty.	There is little difficulty in harvesting individual crops.
Lesser inputs of irrigation and nutrients are required.	Requirement of inputs is comparatively more.

Crop rotation

- It is the successive planting of different type of crops on the same land in a sequential manner.
- A common crop rotation is growing of leguminous plants like peas, pulses, beans etc alternately with cereal crops like rice, wheat and maize.
- Crop rotation reduces the use of chemical fertilizers and constant infestation of crops by pests and diseases.

Crop protection management

Crops can be protected by the following methods:

- Use of pesticides
- Use of resistant varieties
- Crop rotation and other cropping systems
- Summer ploughing

Pest : Any destructive organism that causes great economic damage or destroying crop plants are called pests.

e.g. weeds, insects, mites, nematodes.

Pesticide/biocide

A chemical that is used to kill a pest organism which includes insecticides (for killing the insects), weedicides (for killing the weeds), fungicides (for killing the fungi), nematocides (for killing nematodes) and rodenticides (for killing rodents).

S.No.	Pesticide	Affected organism	Example
1	Weedicide	Weeds	2,4-D, Isoproturon
2	Insecticide	Insect	DDT, Malathion
3	Fungicide	Fungal pathogen	Bordeaux mixture
4	Algicide	Algal pathogen	$CuSO_4$
5	Rodenticide	Rodents (rat, moles)	$ZnSO_4$
6	Nematocide	Nematode	Methyl bromide

Weed :

The small-sized unwanted plants which grow along with a cultivated crop in a field. Weeds can severely reduce crop yields by competing for light, water and nutrients.

Some common weeds: Xanthium (Gokhroo), Parthenium (Gajar grass), Convolvulus, Cyprinus rotundus (Motha), Amaranthus (Chaulai), Chenopodium (bathua).

Methods of weed control :

- Mechanical method : Uprooting, ploughing, burning and flooding.
- Biological method : e.g. Prickly-pear cactus (Opuntia) is controlled by Cochineal insect and aquatic weeds (Hydrilla) are controlled by Carp fish.
- Chemical control : e.g. Isoproturon, 2,4-D, MCPA, Atrazine.

Crop disease are of following types :

- Seed borne: e.g. Ergot of bajra and leaf spot of paddy.
- Soil borne: e.g. Smut of bajra and Tikka of ground nut.
- Air borne: e.g. Rust of wheat.

Storage of grains


Silose

Storage losses in agricultural produce can be very high. Factors responsible for such losses are biotic and abiotic factors. Preventive measures are-

(i) Spraying: Malathion and pyrethrum are commonly used by spraying.

(ii) Fumigants: Volatile pesticides are called fumigants.

Ethylene dibromide (EDB), Aluminium phosphide, Celphos, CH_3Br, Zinc phosphide.

ANIMAL HUSBANDRY

The scientific management of livestock which deals with the feeding, caring and breeding of domesticated animals is called animal husbandry.

Utility of domestic animals	Examples
1. Milch (Milk-yielding)	Cow, Buffalo, Goat
2. Meat & Egg yielding	Goat, Sheep, Fish, Chicken
3. Draught Animals	Horse, Donkey, Mule, Bullock
4. Hair & Skin yielding	Sheep, Goat, Rabbit, Cow

Cattle farming

- Cattle husbandry or cattle farming is carried out primarily for two reasons:
  - Milk production
  - Agricultural work
- Indian cattle mainly include cows (*Bos indicus*) and buffaloes (*Bos bubalis*).
- Cows are adapted to drier regions of the country, while buffaloes are well adapted to wet areas and river beds.
- The milk produced by buffaloes is rich in nutrients than that produced by cows.

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Note

- Milk production besides other factors, also depends upon the duration of lactation period, i.e. the period of milk production after the birth of calf.
- Therefore, the milk production can be increased by increasing the lactation period.
- Sahiwal and Red Sindhi are milch breeds i.e., good milk producing breeds, while Tharparker is a dual purpose breed, i.e. good for both milk and draught.

Breeding in cattle

Indigenous breeds of cows	Exotic breeds of cows	Cross breeds of cows
• Red Sindhi • Sahiwal (show excellent resistance to diseases).	• Jersey • Brown Swiss • Holstein friesian (Have a long lactation period)	• Karan fries • **Friesian**

Farm management practices

Farm management practices are aimed at analysis of on farm resources providing the appropriate living space to the livestock.

(A) Grooming

(B) Shelter

(C) Feeding

(D) Health care

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Improved Indian breeds of dairy cows are:

Karan-Swiss (crossbreed of exotic Brown Swiss and Indian Sahiwal)

Karan-Fries (crossbreed of exotic Holstein-Friesian and Indian Tharparkar)

Poultry Farming

The breeding of fowls for egg production and meat which are the best sources of proteins and fats.

Layer: The birds reared for egg production are called eggers or layers

Broilers : The birds reared for meat purpose are called broilers.

Indigenous breeds of hen	Exotic breeds of hen
• Aseel • Bursa	• White Leghorn • Rhode Island Red

Cross breeds

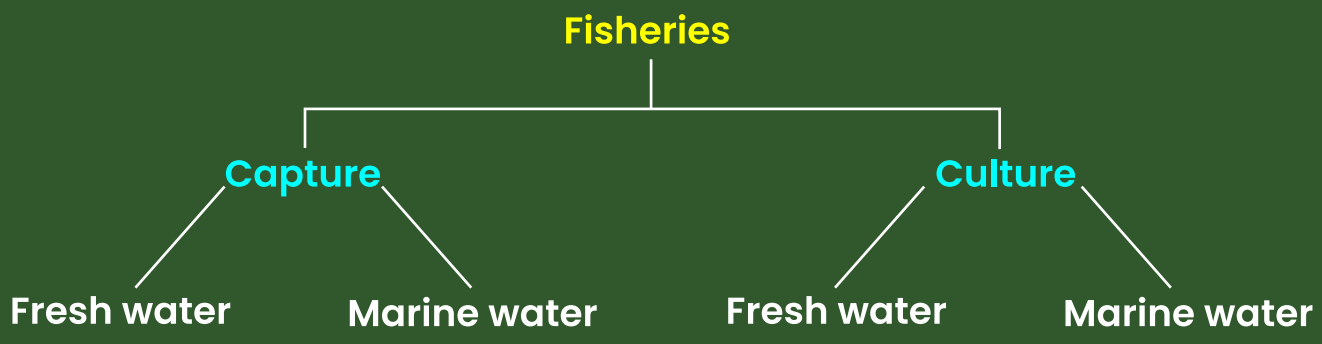
The desirable traits which can be achieved by cross breeding are

- Increased fertility and fecundity (egg laying capacity) of the fowl.
- Large sized eggs.
- Increased meat yield.
- Low maintenance requirements.
- Less diet requirements.
- Rise in number and quality of chicks.
- Increase in tolerance to high temperature or summer adaptation capacity.
- Reduced size of layers with ability to utilize more fibrous and cheaper diets made by using agricultural by-products.

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Fisheries

Fisheries are establishments connected with capture, prevention, exploitation and utilization of various types of fish, prawn, lobsters, oysters etc.



- The rearing of fish on a large scale is called pisciculture.
- Fish is a rich source of proteins and oils. These are a good source of vitamin A and vitamin D.
- Fresh water fishes :Catla, Rohu and Mrigal.
- Marine fishes : Tuna, Cod and Pomfret.
- The fish eggs are introduced into small ponds called hatcheries
- Composite Fish Farming is intensive fish farming of five or six fish species, with different food habits in a single fishpond.
- Surface feeder- Catla and silver carps.
- Intermediate Feeder- Rohu
- Bottom Feeder - Mrigal and the common carp.

Bee keeping

- The rearing of honey bees for a large scale production of honey and bee wax, is known as apiculture.
- Bees are reared in wooden boxes for commercial production of honey called apiaries.

Honey bee colony and social organization

In a colony, there are three types of bees which are structurally and functionally different from one another, so polymorphism is associated with division of labour. These types are :

(i) Queen bee : Queen bee lays eggs which hatch into larvae, which grows into pupae.

(ii) Drone bee : Drones are smaller in size than the queen, and their function is to fertilize the queen.

(iii) Worker bee : Worker bees look after young ones, collect nectar and pollen from flowers and make honey.

