

IMPROVEMENT IN FOOD RESOURCES

To fulfil the need of food to geometrically growing population, the various practices involved in crop production should be more scientific. Till now following revolutions to increase food, fish, milk and oil production have been successful with due efforts made by scientist.

1. Green revolution: for increase in food grain production.
Father of green revolution –
Father of green revolution in India – Mr. M.S.Swaminathan
2. Blue revolution: for increase in fish production.
3. White revolution: for increase in milk production.
4. Yellow revolution: for increase in oil production.
5. Golden revolution: for increase in pulse production.

Different types of crop:

(A) on the basis of nutrients they provide:

- (i) **Cereals:** contain high amount of carbohydrate to provide energy.
e.g. – Wheat, Maize, Rice, Barley, Rye, Oats, Sorghum etc
- (ii) **Pulses:** are rich in protein.
e.g.- Gram (Chana), Black gram(Urad), Green gram(Moong), Pigeon gram(Arhar), Lantel(Massor)
- (iii) **Oil yielding plant:** provide fatty acid.
e.g. – Ground nut, Castor, Cotton, Sunflower, Coconut, Mustered, Sesame, Linseed, Niger.
- (iv) **Vegetable, Spices & Fruits:** are sources of vitamins, minerals, and small quantity of protein, carbohydrate and oil.
e.g. – Spices – Ginger, Turmeric, Cloves, Pepper, Fennel, Coriender, Cumin.
- (v) **Fibre yielding plant:** e.g.- Cotton, Jute.
- (vi) **Beverages:** have very little nutritive value but are very stimulating.
e.g.- Tea, Coffe
- (vii) **Fodder crop:** e.g. – Barsem, Sudan grass, Oat grasses

(B) On the basis of season in which they are grown:

- (i) **Kharif crop:** grown in rainy season (from June to October)
e.g. – Paddy, Soya bean, Arhar, Maize, Cotton, Urad, Moong etc.
- (ii) **Rabi crop:** grown in summer season (November to April)
e.g.- Wheat, Gram, Peas, Mustard, Linseed
“They are also called **“summer season crop”**.”

Since from 1960 – 2004 the total crop production has been increased by four times whereas only 25% increase in cultivated land has been seen. This can be made possible due to

1. Choice of good & healthy seed.
2. Supplying proper nutrition for crops.
3. Protecting growing and harvested crop.

To obtain higher yield from farmland following three systems are being used:

1. Crop variety improvement.
2. Crop production management.
3. Crop protection management.

1. CROP VARIETY IMPROVEMENT:

The first and foremost important step to improve the crop yield is to improve the variety of crop which has following characteristics i.e. crop variety improvement is done for the following purposes:

1. Higher yield.
2. Better quality.
3. Biotic & abiotic resistance i.e. disease, insects & pest resistance.
4. Desirable agronomic characters for specific crops like dwarfness, intensive branching, more tillering & increased fertiliser responsiveness.
5. Wider adaptability: developed improved crops help in stabilizing crop production under different climatic conditions.
6. Early maturation(ripening)
7. Better response to fertilisers.

Crop variety can be improved by plant breeding. Plant breeding can be done either by **selection** or **hybridisation**.

Hybridisation is the crossing of two plants differing from each other genetically in one or more characters.

By hybridisation it is possible to combine all the good characters in a single variety and to exploit & utilise the hybrid vigour.

Hybridisation or crossing over may be Intervarietal (between different varieties), Interspecific (between two different species of same genus) or Intergeneric (between different genera). The objective of hybridisation becomes more fulfilled by the genetic engineering. Nowadays the desired characters in plants can be obtained by introducing the gene of desired characters; such crops are called “Genetically modified crops” or GM Crops.

2. CROP PRODUCTION MANAGEMENT: Includes - Nutrients requirement, Irrigation & Cropping pattern.

(i) NUTRIENT REQUIREMENT: There are two types of nutrients required by the plants

(a) Macronutrients: needed by the plants in large amount. E.g.- N₂, P, K, Ca, Mg, S

(b) Micronutrients: needed by the plants in very small amount.e.g. - Fe, Cu, Zn, Bo, Mo, Cl.

Sources of plant nutrients:

Air – Carbon, Oxygen

Water – Hydrogen

Soil – N₂, P, K, Ca, Mg, S, Fe, Mn, Bo, Zn, Co, Mo, Cl

“Most important nutrients needed for growth of plants are N₂, P, and K”.

Differences between Manures & Fertilisers:

Manure	Fertilisers
1. Are partially decayed wastes and animal residue by microbes.	1. Is a salt or Organic compound containing essential part of nutrients.
2. It is not nutrient specific and tends to remove general deficiency of the soil.	2. It is nutrient specific i.e. it contain much higher amount of particular nutrients and are used to remove particular deficiency of the soil.
3. It adds humus to the soil.	3. It does not add any humus to the soil.
4. Nutrients present in the manure are absorbed slowly by the crop since it is not soluble in water.	5. Since it is soluble in water it is readily absorbed by plants.
6. It is voluminous and bulky so it is inconvenient to store, transport, handle and apply to the crop.	6. It is compact so it is easy to store, transport and apply to crops.

Disadvantages of fertilisers:

1. They are expensive.
2. It does not add any humus to the soil.
3. In a long run it destroys the soil texture making it infertile.

Types of manure:

1. Farm-yard manure (FYM): Consists of rotted vegetable and animal refuse.
2. Compost manure: It mainly consists of rotted vegetable and animal refuse.
3. Green manure: In preparing green manure a quick growing crop is cultivated and ploughed under to incorporate into the soil. E.g.- Sunhemp, Dhaincha, Gur etc.

Advantages of manure:

1. It enriches soil with nutrients.
2. It adds organic matter to the soil which improves the texture and increase water holding capacity of the soil.
3. It provides food for soil organisms.

Limitations of manure:

1. It is voluminous and bulky so it is inconvenient to store, transport, handle and apply to the crop.
2. The nutrients of manure are released slowly.
3. They are not nutrient specific.

BIO-FERTILISERS: Living beings used to increase the soil fertility are called bio-fertilisers. e.g.- Anabaena, Nostoc, Rhizobium, Blue-green algae, Azollaetc etc.

(ii) IRRIGATION:

The technique of providing water to the crops in the fields by means of Canals, Reservoir, Wells and Tube-wells etc is called irrigation.

Importance of irrigation:

1. Irrigation water supplies two essential elements to crops i.e. Hydrogen and Oxygen.
2. Moisture available in the soil leads to germination of seeds.
3. Water made available to field by the process of irrigation helps in absorption of nutrients by plants from the soil.

Irrigation System: The design equipment and technique of replenishing the soil water deficit by applying irrigation water is referred to as irrigation system.

Requirement of good irrigation system:

1. There should be minimum or no wastage of water.
2. It should be inexpensive and economically justifiable.

Types of irrigation system: Canal system, Tanks, Wells, River valley system.

(iii) CROPPING PATTERN: Following ways of growing crops can be used to give maximum benefits

1. Mixed cropping
2. Inter cropping
3. Crop rotation

Mixed Cropping: The process of growing two or more different crops together in the same piece of land is called mixed or multiple cropping.

e.g. - Cotton & ground nut, Maize & Urad, Rice with Jowar or Maize, Cotton with Jowar or Red gram or Coriander etc, Wheat with Mustard.

“While doing mixed cropping it is ensured that different crops may mature at different times:.

Advantages of mixed cropping:

1. Multiple cropping saves time and labour of farmers.
2. It helps in optimum utilisation of the soil.
3. It avoids depletion of soil nutrients due to different nutrient requirement of different crops in the same field.
4. The waste material and product released by one crop may be beneficial to the other crop in mixed cropping.
5. When two crops of different nature are grown simultaneously, risk of total crop failure is minimised due to uncertainty in monsoon.
6. It results in increase in yield because growing of legume crop along with cereals will increase the yield of cereals due to coverage of nitrogen deficiency in soil.
7. Minimise pest damage because a particular type of plant is infected by a particular type of pest.

Disadvantages of mixed cropping:

1. It is impossible to use any labour saving equipment or machinery on the field.

Inter Cropping: is the growing of two or more crops simultaneously in the same field in definite row pattern.

A few rows of one crop alternate with a few rows of a second crop. Crops are selected in a fashion that their nutrients needs differ. E.g. - Soyabean + Maize, or Bajra + Lobia(Cow pea)

Advantages of inter cropping:

1. It ensures maximum utilization of nutrients.
2. It checks spreading of pests and disease to all plants.
3. Both crops can give better returns.

Crop rotation: the process in which different types of crops are grown alternately in the same field is called crop rotation.

Advantages of crop rotation:

1. Improves the fertility of the soil and results in the increase in the food production.
2. It helps in pest control.
3. It improves crop quality.
4. It keeps the land occupied with greater part of time with crops.

Mixed cropping	Inter cropping
1. It has the target to minimize total crop failure	1. It has the target to improve productivity`
2. Seeds of two crops are mixed before sowing	2. Seeds of two crops are not mixed
3. It involves no set pattern of rows of crops	3. It involves set pattern of rows of crops
4. In this method there is a difficulty of fertilizer application to individual crop.	4. In this method fertilizer can be applied as per need of the crops
5. Harvesting and threshing of crops separately is not possible, thus marketing & consumption of only mixed produce is possible	5. Both crops can be easily harvested & threshed separately thus each crop can be marketed & consumed separately.

3. CROP PROTECTION MANAGEMENT: It includes **protection of the growing crops and harvested crops.**

Weeds, insects, pests and diseases infest the field crops. It can be controlled by adopting following methods:-

1. To grow resistant varieties.
2. Optimum time of sowing the crops.
3. Crop rotation and cropping systems.
4. Deep ploughing in summers to kill weeds, pathogen etc. i.e. summer ploughing.

Weed control:

Weeds are unwanted plants which grow of their own along with crop plants.

e.g. - Xanthium (gokhroo), Parthenium (gajar ghas), Cyprinus rotundus (motha), Opuntia etc.

The growth of weeds is harmful because of the following reasons:

1. The weeds consume a lot of nutrients, sunlight, water and fertilizers thereby reducing crop production.
2. It occupies space meant for crop thereby reducing crop yield and lower the quality of food grain.
3. The weeds spread very fast because they produce a large quantity of seeds.

Weeding: The process of removing weeds from a crop field is called weeding. It can be done by following methods:

1. Removal by hands.
2. Removal by instruments like trowel (khurpa)
3. By using chemicals called weedicides. Eg-2,4-D (2,4-Dichlorophenoxy acetic acid), Butachlor, Atrazine, Isoproturon, Fluchloralin etc.
4. Control of weed by biological methods: in this method some selective insects or other organisms are put into the crop field having weeds. These insects or organisms selectively destroy the weed plants without harming the crop plants. Eg- Cochineal insects are used to remove weeds called Opuntia.

Cultural methods: Proper seed bed preparation , timely sowing of crops, inter cropping & crop rotation control the weeds growth.

Insect's pests control:

Usually the insect's pests attack the plants by producing following three types of symptoms:

1. By cutting plants like roots stem and leaves.
2. By sucking sell sap from various plants parts.
3. They bore into stem and fruits.

Pesticides: chemicals which can kill or destroy the pests are called pesticides.eg- Bordeaux mixture (mixture of copper sulphate and Lime in a 4:4 ratio). Pesticides are of several types depending on the types of pests killed or controlled. Thus they may be:

(i) **Fungicides:** kill fungi

(ii) **Insecticides:** kill insects

(iii) **Nematicides:** kill nematodes

(iv) **Rodenticides:** kill rodents

(v) **Herbisides:** kills herbs.

Plant disease:

e.g. - black stem Rust of wheat, loose smut of wheat, Late blight of potato, Yellow vein mosaic of Lady's finger.

Storage of grains:

Need for safe storage:

1. Ensures availability of grains throughout the years.
2. It facilitates distribution to far away places of a country.
3. Grains are harvested once in a year, however due to fixed eating habits they are needed regularly throughout the year.
4. It helps in making buffer stocks for emergency periods.
5. For surplus food, if available , storage is required.

Modes of storing of grains:

1. Perishable food material: the food material which gets spoiled easily on keeping for some time at room temperature is called Perishable food. E.g.- fruits, vegetables, fish, meat, milk, etc. they can be stored in cold-storage.
2. Non- Perishable food material: The food materials which don't get spoiled even on keeping for long time at room temperature are called Non- Perishable food material. These contain very less amount of water and are also called dry food. E.g. - foodgrains, wheat-flour, sugar, spices, etc. they can be stored by dry storage methods.

Non-perishable food materials are stored on a commercial scale in gunny bags or in grain silos.

The stored food grains are generally attacked and damaged by pests such as insects and rodents. Therefore the stored food grains should be regularly checked to detect any infestation. While storing the grains application of pesticides - by either spraying (like Malathion, Pyrethrum, D.D.T.) or Fumigation of fumigants (volatile pesticides are called fumigants like Ethylene dibromide, Aluminium phosphide/celphos, Methyl bromide); Rat poison/ Rodenticides like Zinc phosphide should be done at regular intervals.

ORGANIC FARMING: Organic farming avoids the use of synthetically compound fertilizers, pesticides. Organic farming rely upon crop rotation, crop residues, animal manures, legumes, green manures, off farm organic wastes, biological pest control.

Objective of organic farming:

1. To develop sustainable agriculture system
2. To develop an alternative strategy over chemical farming.
3. This system rely upon recourses within own recourses.

ANIMAL HUSBANDRY

The science of rearing, feeding, caring, breeding and disease control of animals is called animal husbandry. Main elements of animal husbandry are:

1. Proper feeding of animals.
2. Providing fresh water and good shelter to animals.
3. Proper health and protection against diseases.
4. Proper breeding of animals.

Need for animal husbandry: To ensure proper nutrition to our growing population

Advantages of animal husbandry:

1. Increased milk production through cattle farming.
2. Increased egg production through cattle farming.
3. Improvement of quality of meat through fish farming, pig farming, goat farming etc.
4. Proper utilization of animal waste.
5. To produce more honey and bees wax through bee keeping.

On the basis of utility animals have been categorized into following four types:

1. **Milch (milk-yielding) animals:** e.g.- cow, buffalo, goat
2. **Meat and Egg-yielding animals:** e.g.- goat, sheep, pig, fish, chicken, duck, etc
3. **Draught (working) animals:** e.g.- horse, bullock, camel, donkey, mule, elephant
4. **Hair and skin:** yielding animals; e.g.- sheep, goat, rabbit, cow, buffalo etc.

CATTLE FARMING

Cattle farming is done for two purposes: - milk production and bullock labour (e.g.- tilling, irrigation, and carting).

Breeds of cattle:

Indigenous breed:

Milch breed: e.g. - Gir, Sahibal, Red Sindhi, Deoni etc.

Draught breed: e.g. - Nageri, Hallikar, Malvi etc.

Dual purpose breed: e.g. - Deoni, Sahibal, Kankrej, tharparkar, Dangi etc.

Breeds of Indian buffalo: e.g. - Murrah, Nagpuri, Mehsana, Jaffrabadi, Surti, Bhadawari, Nilli, Ravi etc.

Exotic breed of milch cow: eg- Holstein-Friesien(Holland), Jersey(Island of Jersey of England), Ayrshire (Scotland), Brown-Swiss(Switzerland), Red Dane(Denmark), etc.

Cross breeds of cow:- eg- Karan-Swiss, Karan-Fries, Frieswal, Brown Swiss-Sahiwal, Jersey-Sindhi, Ayrshire-Sahiwal, Karan-Swiss etc.

Feeding of cattle:

The foods given to animals are called Feed. Feeding requires balanced ration in correct quantities to each animal proportionate to their body requirements and productive capacity. Both over feeding and under feeding should be avoided. Feed constitutes two main components i.e. roughage & Concentrate.

The animal feed is of two types:

Roughage: contains large amount of fibres with low nutrition. Eg- hay, fodder, silage, legumes like barseem, lucrene, cowpea; etc. it also includes fodder grasses, like Napier grass, Guinea grass and Elephant grass.

Concentrate: They are rich in protein and other nutrients. It contains mixture of cereals, like maize, jowar, broken grass, rice polish, cotton seed, molasses, oilseed cake etc.

The animal food requirement is divided into two categories:

1. Maintenance requirement: which supports the basic function of the life?
2. Milk- producing requirement: which increase the milk production.

Farm management practice:

A good animal shelter is also important aspects of animal husbandary.a good animal shelter should have following characteristics:

1. It should protect the animals from heat, cold, and rain and also from other animals.
2. It should be clean, dry, airy, and well ventilated.
3. It should have proper sunlight during the day.
4. It should have proper arrangement for clean drinking water.
5. It should be spacious so as to provide enough space for each animal to stay comfortably.
6. It should have a sloping floor for the hygienic disposal of animal excreta.
7. Regular brushing of animals to remove dirt and loose hair.

BREED IMPROVEMENT: The breeding of cattle is done by two methods:-

1. **Natural breeding:** It is further of two types:-
 - a) Random breeding: here pedigree bulls are kept along with grazing cows.
 - b) Controlled cross breeding: in this type of breeding native cows are crossed with exotic bulls of superior quality in natural breeding.
2. **Artificial breeding:** in this, semen of bull of good breed is collected and stored at freezing temperature. The introduction of semen of high quality bull in the body (vagina) of healthy females by artificial means during heat period or oestrous (fertility) period is called **artificial insemination**. This method is comparatively better and economical and has following advantages:
 - Several cows can be inseminated by semen of a single bull.
 - It ensures progeny of good quality and also avoids the transportation of animals.
 - Sperms can be stored for long at freezing temperature.

Some common animal disease:

- **Bacterial:** Anthrax, Tuberculosis, Rinderpest.
- **Viral:** Rabies, Cowpox, Encephalitis, Foot & mouth disease.
- **Fungal:** Ring worm
- **Worms:** Ascariasis.

POULTRY FARMING

Poultry is the branch of animal husbandry concerned with rearing of birds for eggs and meat. Egg laying birds are called LAYERS while meat-yielding birds are called BROILERS. It includes chickens (fowls), ducks, turkeys, pigeons etc. among these fowls are most widely domesticated birds in India.

Poultry breeds:

Indigenous: Assel-has four popular breed Peela, Yakub, Nurie, & Kajal, Ghagus, Basara, Chittagong

Exotic: white leghorn cock, white leghorn hen, rhode island red hen,

Cross breed: IBL-80, B-77, HH-260, etc.

Desired traits for improved varieties:

1. Quality and quantity of chicks.
2. Dwarf broiler parent for commercial chick production.
3. Summer adaptability capacity / tolerance to high temperature.
4. Low maintenance requirement.
5. Reduction in size of egg laying birds.

Care should be taken to avoid mortality and to maintain feathering & carcass quality. **To prevent poultry from diseases following measures should be taken.**

1. They should be kept in spacious, airy, and ventilated shelter.
2. The shelter should be clean properly and regularly.
3. Quick and hygienic disposal of excreta should be ensured.
4. Disinfectant should be sprayed regularly.
5. Animal should be vaccinated at regular interval to minimize it from common infection and disease.

FISH FARMING (PISCICULTURE)

Pisciculture or fishery or fish farming involves the rearing and breeding of fish scientifically by man in ponds, tanks, etc.

TYPE OF FISH FARMING:

On the basis of nature of source of fishes:

1. **Capture fisheries:** fish caught directly from their natural resources.
2. **Culture fisheries:** fish is cultivated in artificial water bodies called breeding ponds.

On the basis of nature of water sources:

1. **Marine fisheries:** it involves fish production in marine waters.
2. **Inland fisheries:** it involves fish production in fresh water systems and brackish waters like estuaries and lagoons.

