CROP PRODUCTION AND MANAGEMENT

- Agriculture research institutions are developing new technologies to help the farmers to increase productivity both in terms of quality or quantity.

Agricultural Practices

- Agriculture has always been the backbone of our country's economy.
- **Kharif Crops:** The crops which are sown in the rainy season (i.e., from June to
- September) are called kharif crops.
- Paddy, maize, soya bean, groundnut, cotton etc., are kharif crops.
- **Rabi Crops:** The crops grown in winter season (i.e., from October to March) are called rabi crops.
- Examples of rabi crops are wheat, gram, pea, mustard, linseed.
- **Zaid Crops (Summer Crops):** The crops which are grown in summer season are called zaid crops.
- Muskmelon, watermelon and cucumber are examples for zaid crops.
- According to utility.
- **Food crops** – Paddy and maize are cultivated for human consumption.
- **Fodder crops** – These are useful for livestock consumption. E.g. Sorghum, millets
- **Fabre crops** - These crops are used for cordage and textile. E.g. Cotton, hemp
- **Oil crops** - Oil crops are useful in a large scale for consumption or industrial uses. E.g. Ground nut, sesame.
- **Ornamental crops** - These are utilized for landscape gardening. E.g.- Croton, Euphorbia.
- Our country is the largest producer of bananas and mangoes in the world.

- It is also the second largest producer of wheat and rice.

Basic Practices of Crop Production

- Different activities in crop production are ploughing, sowing, applying fertilizers, harvesting and seed storage.

Soil preparation

- Soil preparation is the first step in the crop production practice.
- Is to loosen the topsoil.
- Helps in the growth of earthworm and soil microbes.
- These organisms add humus to the soil and are friendly to farmers.
- The soil is prepared by the following methods.
- a. Ploughing
- b. Levelling
- c. Basal manuring

Ploughing

- Ploughing or tilling is the process of loosening and turning the soil up and down to facilitate the availability of nutrients in the root zone of the cultivating crop.
- Agricultural implements generally used in the field preparation.

Plough

- Plough is mainly used for tilling the soil, to add fertilisers to the crop, remove weeds and other waste materials from the field and also to turn the soil.
- A plough is made of wood and is drawn by a pair of bulls or horses.
- It contains a strong and a sharp triangular iron strip known as ploughshare.
- The main part of the plough is a long log of wood which is called plough shaft.
- The other end is attached to a beam which is placed on the bull's neck.

Hoe

- It is a simple agricultural tool which is used to till the land, remove weeds and dig up soil.

- It has a long wooden rod with a bent iron plate at one end.
- The other end may be attached to an animal.

Cultivator

- It involves the use of a tractor to drive the cultivator.
- Cultivators also kill weeds and dig up unwanted vegetation available in the field.
- Nowadays ploughing tractor-driven cultivator.
- The use of cultivator saves labour and time.

Levelling

- Once the field is ploughed, the topsoil is quite loose.
- The levelling of soil is done with an implement called the leveller, which is a heavy wooden or iron plank.
- Levelling of the field also helps in uniform distribution of water during irrigation.

Basal Manuring

- Manuring means adding manure to the soil.
- Manure contains many nutrients required for the growth of crop plants.
- To increase the fertility of the soil, we add manure to the soil even before we begin the sowing because it gets properly incorporated into the soil.
- Application of green manure and farm yard manure will always enhance the growth and yield of the crops.

Sowing of Seeds

- This is the second step in crop production.
- Sowing is the actual process of planting the seeds in the soil.
- The seeds that are sown have to be selected very carefully to have high quality.
- Various methods are followed for sowing the seeds.

Sowing by hand

- The scattering of seeds by hand is the simplest method of sowing seeds.
- This is the most economical method of sowing seed.

Seed Drill

- This is a modern method of sowing seeds.
- It is a better and more efficient method than sowing by hand.
- It is usually done by attaching iron drills to a tractor.
- Ensure that the seeds are planted at equal intervals and at the correct depth in the soil.

Dibbling

- It is the placement of seed material in a furrow, pit or hole at predetermined spacing with a dibble, more commonly by hand.
- Soil around the hole is pressed with hand or leg for moist soil contact.
- Sowing seeds is essentially the most important part of crop production.
- Precautions while sowing seeds.
- Seeds must be sown in proper distance and the distance is varied from one crop to other crop.
- This is to ensure that all plants get their fair share of light, water and nutrients for the growth and development.
- Have been proved to increase the yield of the farm.
- Transplanting is removal of an actively growing seedling from one place (usually nursery bed) and planting it in the main field for further growth till harvest.
- Transplanting makes use of pre grown plants, seedlings or vegetative propagated clones.
- If seeds are simply scattered on the top they are likely to be blown away or eaten by animals or birds.
- At the same time, if we sow them too deep into the ground, they will not germinate due to lack of air.
- So, seeds must be sown at the correct depth in the soil.
- The seeds that are sown should be of the highest quality.
- They should be free from all diseases.

Adding Manure and Fertilisers

- The substances which are added to the soil in the form of nutrients to enhance the growth of plants are called manure and fertilisers.

- The term fertility refers to the inherent capacity of a soil to supply nutrients to crop plants in adequate amounts and in suitable proportions.
- These nutrients are essential for the growth of plants.
- Manure is an organic substance obtained from the decomposition of plants or animal wastes.
- Farmers dump plant and animal waste in pits at open places and allow it to decompose.
- The decomposed matter is used as organic manure.
- Regular addition of organic manures helps to maintain the soil fertility, protecting them from wind and water erosion and preventing nutrient losses through runoff and leaching.
- This also increases water-holding capacity, soil aggregation, soil aeration and permeability.
- Fertilizer is a substance which is added to the soil to improve plants' growth and yield.
- Composed mainly of urea, ammonium sulphate, super phosphate, potash, NPK (Nitrogen, Phosphorus, Potassium).
- Use of synthetic fertilizers has significantly improved the quality and quantity of the food their long-term use is debated by environmentalists.

Irrigation

- Water is important for the proper growth and development of plants.
- The supply of water to crops at regular intervals is called irrigation.
- The time and frequency of irrigation varies from crop to crop, soil to soil and season to season.
- Fertilizers can also be applied through the irrigation.
- The various sources of irrigation are wells, tube wells, ponds, lakes, rivers, dams and canal.
- Effective irrigation is the controlled and uniform supply to water to crops in the required amount at the right time with the minimum expenditure.
- a. Traditional Methods
- b. Modern Methods

a. Traditional Methods

- Irrigation is done manually.
- Here, a farmer pulls out water from wells or canals by himself or using cattle and carries to farming fields.
- Pumps are also commonly used for lifting water from various sources.
- Diesel, biogas, electricity and solar energy are the few important sources of energy needed to run these pumps.
- The method of pulling water may vary from one place to other place.
- The main advantage of this method is that it is cheaper.
- But its efficiency is poor because of the uneven distribution of water.
- It also leads to heavy water loss.

b. Modern Methods

- The modern irrigation methods help to overcome the problems exist in the traditional methods.
- It also facilitates the even distribution of moisture in the field.
- The modern methods involve two systems.
- Sprinkler system
- Drip system

Sprinkler System

- A sprinkler system, as its name suggests, sprinkles water over the crop and helps in an even distribution of water.
- Much advisable in areas facing water scarcity.
- Water is sprinkled through the fine nozzles of pipes.

Drip System

- In drip system, water is released drop by drop exactly at the root zone using a hose or pipe.
- This method is considered as the effective one in regions where the availability of water is less.
- The global population is expected to be 9 billion by the year 2050.
- So, efficient and sustainable water use is needed for our own generation and future generations.
- Agriculture activities alone utilize 70% of the available fresh water resources.
- So, drip irrigation is a better solution for economical use of water.

Weeding

- Undesirable plants are called weeds.
- The removal of weeds is called weeding.
- Weeds compete with the crop plants for the nutrients, sunlight, water, space and other resources.
- It results in the undernourishment of crops and leads to low yield.
- Farmers adopt many ways to remove weeds and control their growth.

Mechanical methods

- This is the most common method in which weeds are destroyed physically.
- Hand pulling or weeding with the help of weeding hole is the oldest and most efficient method.

Tillage methods

- one of the practical methods of
- destroying weeds of all categories. Weeds are
- buried in the soil and also exposed to sun heat
- by deep ploughing.
- Crop rotation
- In this method, proper rotation of crops
- is followed for controlling crop associated and
- parasitic weeds.
- Summer tillage
- Deep ploughing after harvest of Rabi crop
- and exposing underground parts of weeds to strong sunlight during summer months is useful for destroying many annual and perennial weeds.

Biological weed control

- In this method, bio agents like insects and pathogens are used to control weeds.
- The objectives of biological control are not eradication, but reduction and regulation of the weed population.

Chemical methods

- Chemical methods are very effective in certain cases and have great scope in weed control.
- The chemicals used for killing the weeds or inhibiting their growth are called herbicides.
- These chemicals are mixed with water and sprayed over the crops.

Integrated weed management

- Integrated weed management combines different agronomic practices and herbicides use to manage weeds, so that the reliance on any one weed control technique is reduced.
- There are over 30000 species of weeds around the world.
- Out of these 18000 species cause serious losses to crops.
- The continuous use of the same method leads to building up of tolerant species.
- Therefore, a suitable combination of different methods of weed control should be practiced for minimizing the losses caused by weeds in different crops and also for preventing environmental pollution.
- Mechanical, biological, cultural and chemical methods are included in integrated weed managements.

Harvesting of Crops

- The process of cutting and gathering a crop is called harvesting.

Manual harvesting

- This is the major method of harvest in India.
- Certain crops are harvested without using tools.
- Ground nut crop can be harvested by uprooting with hand, provided soil moisture is adequate for hand pulling.
- The same method is used in the case of green gram, black gram and horse gram.

Mechanical method

- Harvesting in our country is generally done by employing the labours with the help of farm instruments like sickle.
- This method is a laborious and time-consuming one and it is suitable for small-sized farms only.

Machine harvesting

- This harvesting method is used in large sized agriculture fields.
- The term harvesting also includes the immediate post-harvest practices such as threshing and winnowing.
- **Threshing:** The process of separating the grains from their chaffs or pods is threshing.
- **Winnowing:** After threshing, we must separate the grains from the chaffs.
- Winnowing is the process of separating the grains.
- The crops need close examination to ensure that harvesting is not premature.
- Premature harvesting leads to shedding of seeds and loss of crop.
- And if the crops are over ripened, they lose their value in the market and it becomes inconsumable in certain cases.

Storage

- Storage is an important aspect of post- harvest technology, because the crop is seasonally produced but consumed through out the year.
- Before storing, harvested grains should be made free from moisture.
- Any moisture in the stored grins will lead to the growth of microorganism.
- Need to be dried in the sun before storing.
- Food grains are collected in gunny bags and then stored in godowns.
- Silos and granaries are used for the storage of grains on large scale.
- Chemical vapors are sprayed to minimize pest and insets in godowns.
- This is called fumigation. The stored grains are
- Food Corporation of India (FCI) was set up on 14th January 1965 at Chennai with the objective of distribution of food grains throughout the country for Public Distribution System (PDS) and maintaining a satisfactory level of operational and buffer stocks of food grains to ensure National Food Security. Its capital is in New Delhi now.
- Inspected from time to time to make sure that they are free from diseases and pests.
- Stored on a large scale in government-owned godowns.
- Categories of agricultural produce needing storage are food grains, oil seeds, seeds and folder.

- Crop rotation is planting a series of different crops in the same field following a defined order.
- Mono cropping and mixed cropping are the two methods used in crop production.
- Mono cropping is the repeated planting of the same crop in the same field year after year.
- Mixed cropping is the cultivation of two or more than two crops simultaneously on the same land without any pattern.
- Crop rotation has many advantages.
- Many crops like legumes may have positive effects on succeeding crops in the rotation, leading to greater production over all.
- A shallow rooted grain crop, deep rooted cash crop and restorative crop (legume crop) should be included in the rotation for maintaining soil productivity.
- The leguminous crops should follow non leguminous crops to have atmospheric nitrogen to succeeding crops.
- It helps in maintaining a better balance of nutrients in the soil.
- Weed problem is less in intercropping system compared to their sole crops.
- Leguminous plants have symbiotic relation with the
- Rhizobium bacteria found in the root nodules of these plants.
- These plants have the ability to fix atmospheric nitrogen in their roots with the help of these bacteria.
- The fruits of this plant are called legumes.
- Examples of legumes include alfalfa, clover, peas, beans, lentils, lupins, mesquite, carob, soy, and peanuts.
- These plants are used in crop rotation to multiply soil nitrogen.

Seed Bank

- Seed bank is a place where seeds are stored in order to preserve genetic diversity.
- Seeds may be viable for hundreds and even thousands of years.
- Seed banks are like seed libraries that contains valuable information about evolution strategies of plants.
- The Royal Botanical Gardens located in Kolkatta first started collecting seeds formally as seed bank.

- Created to store native varieties of seeds.
- Farmers have started preserving indigenous seeds.
- The simple and healthiest method of seed storage is in the air tight earthen pots.
- Navadanya seed bank, a nongovernmental organization located in New Delhi conserve around 50,000 crop varieties, with the primary focus on preservation of grain species.
- Acharya Jagadish Chandra Bose Indian Botanic Garden located in Kolkatta was earlier called Royal Botanic Garden.
- This garden exhibits a wide variety of rare plants and a total collection of over 12,000 specimens.
- The area of this garden spreads over 109 hectares.

Seed balls

- Seed balls are a mixture of soil, compost and plant seeds.
- These balls are thrown into land areas.
- With the monsoon set in, these planted seed balls will germinate into seedling.
- Seed balls are prepared by non-government organization and enthusiastic school Children.
- The concept of seed ball has potential to increase tree cover and also to improve the awareness among the people about conserving plants.

Heirloom seed

- An heirloom seed is the seed of plant that has been carefully cultivated and passed down through many generations.
- Heirloom seeds are also called organic seeds.
- The goal of preserving heirloom seed is to prevent any type of change due to outside influence.
- Some vegetable varieties are self-pollinated and are grown with virtually no danger of crossing.
- Synthetic fertilizers, herbicides or pesticides are not used for organic seeds but conventional fertilizer, herbicides and pesticides are used.

Bio-Indicators

- Bioindicator or biological indicator is any species or group of species whose function or status reveals the qualitative status of the environment.
- Biological indicators are used to document and understand changes in earth's living systems especially changes caused by the activities of an expanding human population.
- Give us information about soil structure, development, nutrient storage and biological activities.
- Lichen is a natural bio-indicator of climate change and air pollution effect.
- It is a combination of an alga and a fungus which live together in symbiotic association.
- Lichen is a sensitive environmental parameter like temperature humidity, wind and air pollutants.
- It gives information about changes in climate, air quality and biological process.

Agriculture Research Institutions

- Agricultural research institutions formulate the agricultural practices based on recent research results and farmers' needs.
- Indian Agricultural Research Institute and Indian Council of Agricultural Research are some of the institutions.

Indian Agricultural Research Institute (IARI)

- The Indian Agricultural Research Institute is a national institute for agricultural research, education and extension.
- IARI is commonly known as the Pusa Institute.
- It is financed and administrated by the ICAR (Indian Council of Agricultural Research).
- This was responsible for research leading to the green revolution in India during 1970s.

Indian Council of Agricultural Research (ICAR)

- The Indian Council of Agricultural Research is an autonomous body responsible for co-ordinating agricultural education and research in India.

- The union minister of agriculture serves as its president.
- Under the Department of Agricultural Research and Education, Ministry of Agriculture.
- It is the largest network of agricultural research and education institutes in the world.

Krishi Vigyon Kendra

- Krishi Vigyan Kendra is a farm science centre.
- These centres serve as the ultimate link between ICAR (Indian council of Agricultural research) and farmers.
- The first KVK was established in 1974 in Pondicherry.
- Since then, KVKs have been established in all states and the number continues to grow.
- KVKs can be formed under a variety of host institutions, including agricultural universities, state departments, ICAR institutes, other educational institutions or non government organisations.

Responsibilities of KVK

- Each KVK operates a small farm to test new technologies, such as seed varieties or innovative farming methods developed by ICAR institutes.
- KVKs organise workshops.
- KVKs provide advisory service to the farmers about weather and market pricing through radio and mobile phones.

Foliar Sprays

- Foliar feeding is a technique of feeding plants by applying liquid fertilizer directly to their leaves.
- Plants are able to absorb essential elements through the stomata in their leaves.
- But total absorption takes place through epidermis.
- Sea-based plant mixes from kelp contains trace nutrients and some hormones which are useful for the development of plant leaves, flowers and fruit.
- Foliar feeding is generally done in the early morning or late evening.
- Plant shows quick response to the nutrients applied by foliar feedings.

- The efficiency of nutrients uptake is considered to be 8-9 folds higher when nutrients are applied to the leaves, when compared with nutrients applied to soil.
- A foliar feeding is recommended when environmental conditions limit the uptake of nutrients by roots.

EM (Effective Microorganisms) Technology

- Effective microorganisms are a culture of different effective microbes, commonly occurring in nature.
- Nitrogen fixers, phosphate stabilizers, photosynthetic micro organisms, lactic acid bacteria, yeast, Rhizo bacteria and various fungi and actinomycetes are used as effective microorganisms.
- In this consortium, each mocro organisms has its own beneficial role in nutrient recycling, plant protection and soil health and fertility enrichment.

Vermiwash

- Vermiwash is a liquid that is collected aft er the passage of water though a column of worm action.
- It is a collection of excretory product and mucus secretion of earthworms along with micronutrients from the soil organic molecules.
- Vermiwash is used as a foliar spray for crops.

Panchgavya

- Panchgavya is a promoter with a combination of fi ve products obtained from the cow, which includes cow dung, cow's urine, milk, curd and ghee.
- All the fi ve products are collectively termed as panchgavya.
- Has the potential to play the role of promoting growth and providing immunity booster.
- Provides resistance to pests and increases the overall yield.
- Pachgavya can be used for seed treatment also.
- For this, seeds are soaked for 20 minutes before sowing.
- The present form of panchgavya is a single organic input which can act as a potentialator.

- The products of local breed of cow is said to have more potency than the products of exotic breeds.

Biocontrol Methods

- Bio-control or biological control is a method of controlling pests such as insects, mites, weed and plant diseases using other organisms.
- Bio predators, bio-pesticides, bio-repellents' and bio-fertilizers.

Bio-predators

- These are naturally occurring insects that use pests for feeding or multiplication.
- By introducing large numbers of predators in a greenhouse we can destroy the pest.
- Predators like Chrysopa spp. and Menochilus spp. are highly useful in controlling a wide variety of pests like aphids, white flies, cotton bollworms, leaf insects etc.
- The black kneel capsid is an insect found on fruit trees.
- It eats more than 1000 fruit tree red spider mites per year.

Bio-pesticide

- Bio-pesticides are living organism or their derived parts which are used as bio-control agents to protect crops against insect pests.
- Entomopathegenic viruses, bacteria insecticides, particularly bacillus thuringiensis, entamofungal pathogens, protozoans and insect parasitic nematodes have been found to control important pests which affect crops.
- **Fungal bio-pesticides:** Trichodermaviride is a fungus used as a biological pesticide.
- To control various disease caused by fungi such as wilt, rusting of leaves and root disease.
- **Bacterial bio pesticide:** A culture of bacillus thuringiensis bacteria is effectively used to control the pest Lepidoptera that attack cotton, maize plants.
- Panchagavya and leaves decoction of some plants are also used as bio-pesticides.

Bio - repellant

- Compound Azadiractin obtained from seeds of neem serves as a good insect-repellant.
- One of the earliest pesticides used by man was margosa leaves.
- The dried leaves repel the pests from stored grains.

Bio-fertilizer

- Bio fertilizers are organisms which can bring about soil nutrient enrichment.
- Nitrogen fixing microorganisms have the capability of converting free nitrogen into nitrogenous compounds and make the soil fertile.
- The main source of bio-fertilizers is cyano bacteria and certain fungi.
- Free living bacteria live freely in the soil and fix atmospheric nitrogen and make it available to the crops like cereals, millets, fruits and vegetables. E.g. Azosprillum.
- Free living cyano bacterium involves in nitrogen fixation along with photosynthesis.
- E.g. Anabeana, Nostoc.
- Symbiotic bacteria fix atmospheric nitrogen. E.g.
- Rhizobium leguminous plant like pea there are any nodes.
- Rhizobium bacteria live in such nodes.