# CROP PRODUCTION (1)
# Chapter 1
# Introduction

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# The grass family

Plants are either annuals, or perennials. Grasses are almost all herbaceous plants, usually with hollow cylindrical stems closed at the nodes. The stems are made of nodes and internodes. The leaves are two-ranked and parallel-veined. The roots are fibrous. The small greenish flowers are collected in a compact or open inflorescence, which is terminal on the stem. The flowers are usually perfect, small, and with no distinct perianth. The grain or caryopsis may be free, as in wheat, or permanently enclosed in the floral bracts as in oats.

# The legume family

**Legumes may be annuals, biennials or perennials. Leaves are alternate on the stems, stipulate with netted veins, and mostly compound. The flowers are almost always arranged in racemes as in the pea. The flowers of leguminous field crops are butterfly-like. The irregular flowers consist of five petals, a standard, two wings, and a keel that consists of two petals that are more or less united. The calyx is normally four- or five toothed. The fruit is a pod that contains one or several seeds. The root system is taproot. Often the roots have an abnormal growth called nodules caused by the activities of bacterium *Rhizobium.***

# Crop classification according purpose of it uses:

## i. Cereal or Grain crops

Cereals are grasses grown for their edible seeds, the term cereal being applied either to the grain or to the plant itself. Cereals include wheat, oats, barley, rye, rice, maize, sorghum, millets, etc.

## ii. Legumes

These include pea nuts, field beans, cowpeas, soybeans, lima beans, mug beans, chickpeas, pigeon peas, broad beans and lentils. They all belong to the family Leguminosae and are grown for their edible seeds.

## iii. Oil crops

The oil crops include soyabean, peanuts (groundnuts), sunflower, safflower, sesame, castor bean, mustard, cotton seed, corn and grain, sorghum, rape, flax and perilla, the seeds of which contain some useful oils.

## iv. Root and tuber crops

These include sugar beets, carrots, sweet potatoes, yams, cassava, potatoes and cocoyam.

## v. Fiber crops

These are grown for their fiber. They include cotton, jute, kenaf, hemp, ramie and sisal.

## vi. Sugar crops

These are crops that are grown for their sweet juice from which sucrose is extracted and crystallized. They include sugarcane and sugar beet.

## vii. Forage crops

These are vegetable matters fresh or preserved that are utilized as feeds for animals. They include grasses, legumes, crucifers and other cultivated crops.

## viii. Vegetable crops

This group includes potatoes, tomatoes and onions.

## ix. Rubber crops/latex crops

These crops which include Para rubber are grown for the milky sap, or latex which they produce.

## x. Beverage crops

These crops are also sources of stimulants. They include tea, coffee and cocoa.

# 2. Special-purpose Classification

## i. Cover crops

These are crops planted to provide a protection to the soil against direct beating of rainfall. When crops are turned under while still green, they are termed green manure crops. Important green manure crops include alfalfa, soyabeans, cowpeas, rye, and buckwheat.

## ii. Catch crops

Catch crops are substitute crops planted too late for regular crops or after the regular crop have failed. Short season crops such as millet and buckwheat are often used as catch crops.

## v. Companion crops

These are crops that are grown with a crop such as alfalfa or red clover in order to secure a return from the land in the first year of a new seeding. Grain crops and flax are often used for this purpose.

## vi. Trap crops

These are crops planted to attract certain insects or parasites. Trap crops are plowed under or destroyed once they have served their purpose.

## iii. Soiling crops

These are crops that are cut and fed green and may include legumes, grasses, kale, and maize.

## iv. Silage crops

Silage crops are those cut and preserved in succulent condition by partial fermentation. They include corn, sorghum, forage grasses and legumes.

# Select the most appropriate answer from the following questions.

1. The world cultivate Beverage crops such as

a) Wheat. b) Tea. c) Maize d) Field bean

2. Oil crops cultivated in the world is

a) Chickpea. b) Lentil. c) Corn. d) Alfalfa.

3. The crop not following leguminosae family is

a) Field bean. b) Alfalfa. c) Chickpea. d) Sorghum.

4- The activities of bacterium *Rhizobium* attacked roots of family plants of

a) Leguminosae. b) Linaceae. c) Chenopodiaceae. d) Compositae.

5- The stems are includes nodes and internodes in

a) Field bean. b) Rice. c) Chickpea. d) Egyptian clover.

6-Essential element for plant like

a)zinc. b) boron. c) nitrogen. d) iron.

7-When we found loss of green colour, yellow discoloration of leaves from tip backward, older leaves brown is deficiency symptoms of

a)phosphorus. b) potassium. c) nitrogen. d) sulphur.

8-When we found leaves show discoloration along outer margin from tips to base is deficiency symptoms of

a)phosphorus. b) potassium. c) nitrogen. d) sulphur.

9-Yung leaves turn yellowish to black and cured or cupped brown spots is deficiency symptoms of

a)boron. b) nitrogen. c) sulphur. d) calcium.

10-Leaves frequently misshapen and crinkled, thick and brittle, white, irregular spots between veins is deficiency symptoms of

a) boron. b) zinc. c) iron. d) manganese.

# Essential Elements for Plant Growth

- **Macronutrients are needed by the plants in large amount, and large quantities have to be applied if the soil is deficient in one or more of them. Within the group of macronutrients, which are needed for plant growth in large amounts, the primary nutrient such as nitrogen, phosphorus and potassium. While calcium, magnesium and sulphur are sometimes called secondary nutrients due to their secondary importance in plant nutrition.**

# Functions of Nitrogen (N)

1. Nitrogen is the motor of plant growth. It makes up to 1 to 4 percent of dry matter of the plant. It is taken up from the soil in the form of nitrate ($NO_3^-$) or ammonium ($NH_4^+$).
2. In the plant it combines with compounds produced by carbohydrate metabolism to form amino acids and proteins.
3. Being the essential constituent of proteins, it is involved in all the major process of plant development and yield formation.
4. A good supply of nitrogen for the plant is important also for the uptake of the other nutrients

# Functions of Phosphorus (P)

1. It constitutes 0.1 to 0.4 percent of dry matter of the plant.
2. It plays a key role in the transfer of energy.
3. It is essential for photosynthesis and other chemical-physiological process in the plant.
4. It is indispensable for cell differentiation and for the development of the tissues, which form the growing points of the plant

# Functions of Potassium (K)

1. Potassium makes up 1 to 4 percent of the dry matter of the plant.
2. It activates more than 60 enzymes.
3. It plays a vital part in carbohydrate and protein synthesis.
4. Potassium improves the water regime of the plant and increases its tolerance to drought, frost and salinity.
5. Plants well supplied with K are also less affected by diseases

## Functions of Magnesium (Mg)

1. It is a central constituent of chlorophyll, the green pigment of the leaves which functions as acceptor of the energy from the sun, thus, 15 to 20 percent of the magnesium found in plant is contained in the leaves.
2. Mg is also involved in enzyme reactions related to the energy transfer of the plant.

## Functions of Sulphur (S)

1. It is an essential constituent of protein and also involved in the formation of chlorophyll.
2. In most plants it makes up to 0.2 to 0.3 percent of dry matter.

## Functions of Calcium (Ca)

1. Calcium is essential for root growth
2. It is a constituent of cell wall materials

## Micronutrients or Trace Elements

These are iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), molybdenum (Mo), chlorine (Cl) and boron (B). They are part of the key substances in plant growth and are comparable with vitamins in human nutrition. Being taken up in minute amounts, their range of optimal supply is very small.

# Chemical Fertilizers
# a. Nitrogenous Fertilizers

- The nitrogen in many straight and compound fertilizers is in the ammonium ($NH_4$ ions) form, but this is quickly changed by the bacteria in the soil to the nitrate ($NO_3$ ions) form. Most crop plants such as cereals take up and respond to the $NO_3$ ions faster than to the $NH_4$ ions, but some crops, such as rice, potatoes and grasses, are equally responsive to both forms.

# i. Nitrate Fertilizers

In these fertilizers, nitrogen is combined in nitrate ($NO_3$) form with other elements. Such fertilizers are sodium nitrate ($NaNo_3$), having 16 percent N, calcium nitrate [$Ca(NO_3)_2$], having 15.5% N, and potassium nitrate ($KNO_3$), having 13.4% N and 44% K.

Nitrate fertilizers are quickly dissociated in the soil, releasing the nitrate ion for plant absorption. As such they are readily absorbed and utilized by the plants. The great mobility of the nitrate ions in the soil has the advantage that, even when applied to the surface of the soil, the nitrogen quickly reaches the root zone. They are therefore very often used as side and top dressings.

# ii Ammonium Fertilizers

In these fertilizers, nitrogen is combined in ammonium ($NH_4^+$) form with other elements examples of such fertilizers:

1. Ammonium sulphate [$(NH_4)_2SO_4$ ], having 20% N,
2. Ammonium phosphate ($NH_4H_2PO_4$) having 20% N and 20% P or 16% N and 20% P;
3. Ammonium chloride ($NH_4Cl$), having 24-26% N,
4. Anhydrous ammonia, having 82% N and
5. Aqueous ammonia having 28% N.

When added to the soil, the ammonium ion is temporarily retained by the colloidal fraction of the soil until it is nitrified.

# iii. Nitrate and Ammonium Fertilizers

- These are fertilizers that contain nitrogen in both ammonium and nitrate forms. Examples of such fertilizers:
- 1. Ammonium nitrate ($NH_4NO_3$), having 32.5% N,
- 2. Ammonium sulphate nitrate (ASN)[ $(NH_4)_2SO_4.NH_4NO_3$], having 26% N,
- 3. Calcium ammonium nitrate (CAN) [$Ca(NH_4NO_3)_2$ ], having 25% N.
- These fertilizers are readily soluble in water and suitable for use under variety of soils and cropping conditions. The nitrate nitrogen of these fertilizers are readily available to plants for rapid growth and the ammonium nitrogen resists leaching losses and can be utilized by the plants at a later stage. These fertilizers are acidic in their residual effect on the soils.

# iv. Amide fertilizers

**These fertilizers are carbon compounds, and so are called organic fertilizers. Important fertilizers in this group are:**

**1. Urea [Ca(NH2)2], having 46% N and**

**2. Calcium cyanamide (CaCN2), having 22% N**

**These fertilizers are readily soluble in water and easily decomposed by micro-organisms in the soil. In the soil they are quickly changed into ammonical nitrogen and then to nitrate form.**

# b. Phosphorus fertilizers

- Crop plants absorb phosphorus in the form of negatively charged ions such as or $H_2PO_4^-$
- Phosphorus fertilizers can be classified into three groups depending on the form in which phosphoric acid is combined with calcium.
- Phosphorus fertilizers containing water-soluble phosphoric acid or monocalcium phosphate [$Ca(H_2PO_4)_2$]: such fertilizers are super phosphate, ordinary or single, having 16-18% $P_2O_5$; double super phosphate, having 32% $P_2O_5$; triple super phosphate, having 46-48% $P_2O_5$ and ammonium phosphate, having 20% N and 20% $P_2O_5$ or 16% N and 20% $P_2O_5$.
- These fertilizers are quickly absorbed by the plants, since plants absorb phosphorus as $H_2PO_4$ ions.

# c. Potassium fertilizers

All potassium fertilizers consist essentially of potassium in combination with chloride, sulphate, or nitrate. Almost all potassium fertilizers are water soluble. The following are examples of potassium fertilizers:

a) Potassium chloride [KCl] or muriate of potash, having 60-63% $K_2O$

b) Potassium sulphate [$K_2SO_4$ ], having 50 – 53 % $K_2O_5$ and 18% of sulphur

c) Potassium-magnesium sulphate [$K_2SO_4$. $MgSO_4$] having 22% $K_2O_5$

d) Potassium nitrate [$KNO_3$], having 13% nitrogen and 44% $K_2O_5$

e) Potassium metaphosphate [$KPO_3$] having 40% $K_2O$ and 60% $P_2O_5$

# Time of applying nitrogen fertilizers

Since nitrogen is required throughout the growth period and nitrogenous fertilizer are lost through leaching, it is better not to apply too much nitrogen at one time. The split application of nitrogen throughout the growing period will ensure greater efficiency and plants would not suffer from nitrogen deficiency.

1- Row or Band Placement

2- row placement

3- hill placement

4- Top dressing

5- Side dressing

# Nitrogen deficiency symptoms

1. stunted growth
2. Loss of green colour, yellow discoloration of leaves from tip backward, older leaves brown.
3. Lower leaves may die premature while the top of the plant remains green

# Phosphorus deficiency symptoms

1. Stunted growth.
2. Leaves turn dark bluish green, purpling and browning from tip backward.
3. Plants slow to ripen, remaining green.
4. Fruits may be misshapen, grain is poorly filled

# Potassium deficiency symptoms

1. Stunted growth.
2. Leaves show discolouration along outer margin from tip to base.
3. Outer edges of leaves yellow or reddish, becoming brownish or scorched and dead; leaves wilted.
4. Lodging.
5. Tree leaves are yellowish, reddish, pinched, cupped or curved.
6. Fruit is small, may have lesions or injured sport, poor storage and keeping quality.

## Magnesium deficiency symptoms

Yellowish discolouration between Greenleaf veins, followed by blotching and necrosis (death of tissue), starting at lower older leaves.

## Sulphur deficiency symptoms

1. Whole plant is yellowish (often mistaken as N deficiency).
2. Yellowish of upper leaves, even on newest growth.
3. Delayed crop maturity.

# Calcium deficiency symptoms

1. Young leaves turn yellowish to black and curved or cupped (brown spot).
2. Plants appear to wilt.
3. Fruits may appear rotten.
4. Roots are malformed.

# Boron deficiency symptoms

1. Leaves frequently misshapen and crinkled, thick and brittle, white, irregular spots between veins.
2. Growing tips of buds die, with bushy growth near tips extension growth inhibited with shortened internodes.
3. Water-soaked, necrotic spots or cavities in beet and other root crops and in the pith of stems.
4. Fruit small and poorly formed, often with corky nodules and lesions.
5. Low seed production due to incomplete fertilization.

# Zinc deficiency symptoms

1. Stunted growth of leaves.
2. Fruit trees with typical shortened bushy shoots.
3. Chlorotic stripes (white bleached bands) between the leaf veins in lower part of leaf.
4. In some cases leaves have an olive green or grayish green color (very similar to P deficiency).