SUBJECT: CROP PRODUCTION: 3rd Sem. Agriculture Engineering.

MAJOR CROPS OF INDIA

Video

https://www.youtube.com/watch?v=IrwRM244lPQ

SOIL TILLAGE

PDF

http://eagri.org/eagri50/AGRO101/lec10.pdf

CROPPING SYSTEMS

PDF

http://eagri.org/eagri50/AGRO101/lec15.pdf

IMPROVEMENT IN FOOD RESOURCES

PDF

http://ncert.nic.in/ncerts/l/iesc115.pdf

PDF

SEEDS & SOWING METHODS

PDF

http://eagri.org/eagri50/AGRO101/lec11.pdf

VERMICOMPOSTING & VERMICOMPOST PRODUCTION

PDF

http://www.hillagric.ac.in/edu/coa/agronomy/lect/agron-3610/Lecture-10-BINM-Vermicompost.pdf

https://kvk.icar.gov.in/API/Content/PPupload/k0196_88.pdf

Video

https://www.youtube.com/watch?v=TCQfBMy-55E

WEED MANAGEMENT & INTEGERATED WEED MANAGEMENT

PPT

https://www.slideshare.net/rajendra750/integrated-weed-management

HTML

http://www.agriinfo.in/default.aspx?page=topiclist&superid=1&catid=67

PEST MANAGEMENT & INTEGERATED PEST MANAGEMENT

PPT

https://www.slideshare.net/sakeenagilani/integrated-pest-management-34456850

PDF

http://www.hillagric.ac.in/edu/coa/agronomy/lect/agron-3610/Lecture-17-and-18-IPM.pdf

FARMERS'HANDBOOK FOR AGRICULTURE

PDF

www.manage.gov.in/publications/farmerbook.pdf

GENERAL /USEFUL LINKS FOR THE "CROP PRODUCTION"

https://www.agrifarming.in/

http://vikaspedia.in/agriculture/crop-production/

http://www.agriinfo.in/

SOIL FERTILITY & NUTRIENT ELEMENTS

What is Soil Productivity?

- Soil productivity means the crop producing capacity of a soil which is measured in terms of yield (bio-mass). Productivity is a very broad term and fertility is only one of the factors that determine the crop yields. Soil, climate, pests, disease, genetic potential of crop and man's management are the main factors governing land productivity, as measured by the yield of crop. To be productive, soil must contain all the 13 essential nutrients required by the plants.
- The total quantity of nutrients is not only being sufficient but they should also be present in an easily "available" form and in "balanced" proportions. Over and above fertility, there are other factors deciding productivity.

What is Soil fertility?

It is defined as the inherent capacity of a soil to supply available nutrients to plants in an adequate amount and in suitable proportions to maintain growth and development. It is measure of nutrient status of soil which decides growth and yield of corp.

Factors affecting soil fertility

I. Natural factors or Pedogenic factors

II. Edaphic factors or Soil management factors

Importance of Soil fertility

- Soil fertility is a key factor for successful crop production and it is a measure of capacity of soil to supply plant nutrients. Soil fertility and fertilizers are very much closely related terms. Soil fertility acts as a 'SINK' where in plants can draw nutrients for maximum yield, where as fertilizer, acts as a 'SOURCE' wherein we can draw continuously different nutrients and also add to the sink. The importance of soil fertility and fertilizer management is being increasingly recognized in all countries recently to meet the demand for food and other agricultural raw materials.
- Intensive use of fertilizer, intensive cropping with high yielding varieties have no doubt increased the food production and reduced the food shortage but it has also brought in numerous problems of soil fertility, soil and water pollution. On the other hand, fast depletion of nutrients due to over exploitation, a wide spread deficiency of N, P, K and S coupled with micro nutrients deficiencies especially Zn and boron has been noticed in many soils.
- Further deforestation, shifting cultivation, burning of trees, bushes, grasses and cow dung, soil erosion, soil degradation, nutrient losses, excessive fertilizer application, leaching losses etc., have aggravated the depletion of soil fertility status. It is being realized that the future of Indian agriculture is closely related to scientific management of soil fertility along with judicious and efficient use of fertilizers.
- Soil fertility problems cannot be solved by mere supply of plant food nutrients, but their efficient management is also very important aspect since the fertilizer is one of the costliest inputs. It requires a well balanced scheduling of fertilizers to get maximum returns with minimum investment. Apart from fertilizers, due to lack of biomass resources, farmers are not in a position to apply sufficient organic manures also.

- So with all these conditions soils become deficient and very “hungry” for the need of nutrients day by day. It is therefore, imperative that sound soil and crop management practices, Judicious use of fertilizers and Integrated nutrient management practices must be adapted to improve and maintain good soil fertility and better soil physical condition for the purpose of sustained crop production.

Nutrient: *Nutrients are substances required by an organism for their normal growth and reproduction.*

Plant Nutrient: *The plant nutrient is a “food” which is composed of certain chemical elements often referred to as ‘plant nutrient’ or plant food elements considered very essential for growth and development of plants.*

Nutrition: *The supply and absorption of chemical compounds needed for growth and metabolism of an organism.*

Types of nutrient elements

- Plant nutrient elements are broadly grouped in to two types.

  A. Essential Nutrients/ Elements

  B. Beneficial Nutrients/Elements

A. Essential Nutrients/elements

The elements needed by the plant without which the plant is not able to survive and complete its life cycle are called essential nutrient

or

An essential nutrient element is the one which is required for the normal life cycle of an organism and where functions cannot be substituted by any other chemical compound.

- Plants absorb or utilize more than 90 nutrient elements from the soil and other sources during their growth and development and about 64 nutrients have been identified in plants by their tissue analysis.
- But all are not essential for their growth and development. They require only 17 elements/nutrients. These 17 have been recognized as essential elements. They are;

1. Carbon (C)	10. Iron (Fe)
2. Hydrogen (H)	11. Manganese (Mn)
3. Oxygen (O)	12. Zinc(Zn)
4. Nitrogen (N)	13. Copper (Cu)
5. Phosphorous (P)	14. Boron(B)
6. Potassium (K)	15. Molybdenum (Mo)
7. Calcium (Ca)	16. Chlorine (Cl)
8. Magnesium (Mg),	17. Nickel (Ni)
9. Sulphur (S)	

Of these element C,H,O together constitute 95-96% (C-45%, O-45%,H-6%). Subsequently N, P and K constitute 2.7% in plants. The other elements constitute only 1.3-1.4%. But all have definite roles to play in the growth and development. Among these Nickel is the latest nutrient addition to the list in 1987.

Classification of essential nutrients

- Essential nutrients are classified in to two major groups based on relative utilization or absorption by the plants and also based on their biochemical behavior and physiological functions.

  I. Based on relative utilization or absorption by the plants;

A. Macro or Major Nutrients

B. Micro nutrients

- rther Macronutrients are classified into two types

1. Primary Nutrient: Nitrogen, Phosphorus and Potassium. These three elements are also called as *fertilizer elements*.

2. Secondary Nutrients: Calcium, Magnesium and Sulphur. .

II. Classification based on their biochemical behavior and physiological functions.

Group	**Nutrient elements**	**Biochemical Functions**
Group I	C,H,O, Ca	**They are basic structural elements.** They are Major constituent of plants (carbohydrates, proteins and fats) and organic matter. These elements are also involved in enzymes process. They provide energy for growth and development by oxidative break down.
Group-II	N,P & S	**Accessory structural elements** of the more active and vital living tissues. Essential component of metabolically active compounds like

		amino acids, proteins, enzymes and non-proteinaceous compounds. They involve in energy storage (ATP & ADP) and transfer (Phosphate esters).
Group-III	K, Ca, Mg	**Regulators & carriers** for the most part of plant metabolism. They involve in synthesis and translocation of carbohydrates, maintain ionic charge balance and induce enzyme activation.
Group-IV	Fe, Mn, Zn, Cu, B, Mo, Cl.	**Catalysts and activators**. These elements Involve in oxidation-reduction reactions, chlorophyll synthesis and also exists in organic combinations.

B. Beneficial Nutrients/Elements

Beneficial elements are the mineral elements which stimulate the growth and have beneficial effects even at very low concentration. They are not essential or essential only for certain plant species under specific conditions. They are also known as 'potential micro-nutrients'.

- These elements have been found to affect the uptake, translocation and utilization of other essential elements, help in production of essential metabolite by activating

enzymatic system/action and also counteract the toxic effects of some other elements or anti metabolites.

- Eg: Silicon (Si) for rice, Sodium (Na), Aluminum (Al), Cobalt (Co), Selenium (Se), Iodine (I), Gallium (Ga) and Vanadium (Va).

Definitions

- **Macro or Major Nutrients**: They are the nutrients utilized by the plants in relatively large amounts (quantity) for their growth and development.

Eg: C, H. O. N, P, K, Ca, Mg and S (C, H and O are abundantly present in the atmosphere and need not be applied through fertilizers).

Primary nutrients: are those nutrients required relatively in large quantities by the plants for their growth and development. These are also designated as 'fertilizer elements' because, deficiency of these elements is corrected by application through fertilizers.

Eg: N, P and K

Criteria of Essentiality of Nutrients

- This concept was propounded by Arnon and Stout (1939) and they considered 16 elements essential for plant nutrition. For an element be regarded as an essential nutrient, it must satisfy the following criteria;

1. A deficiency of an essential nutrient element makes it impossible for the plant to complete the vegetative or reproductive stage of its life cycle. 2. The deficiency of an element is very specific to the element in question and deficiency can be corrected /prevented only by supplying that particular

element.

3. The element must directly be involved in the nutrition and metabolism of the plant and have a direct influence on plant apart from its possible effects in correcting some micro-biological or chemical conditions of the soil or other culture medium.

Organic matter and its composition

Soil organic matter is a complex matter obtained from the plants and animal residues containing both organic and inorganic chemical compounds.

Composition of Organic matter

A. Organic compounds

1. Nitrogenous compounds

eg: Amine, amide compounds and amino acids (water soluble) proteins (simple, combined, derived), peptone, purine, peptide, nucleoprotein, protease, pyridine, alkaloid, pirimidin.

2. Non nitrogenous compounds

Eg : -Carbohydrates (mono, di, poly and oligosaccharides, amino sugars, sugar acids, sugar alcohol),lignin (aliphatic hydroxyl and carbonyl group found), Cellulose and hemicelluloses, tannin, fat, wax and resin, pigments, organic acids (acetic, oxalic, saccharic, propionic, benzoic, pomitic), organic phosphorus compounds (nucleic acids, phospholipids, inositol phosphate) and organic sulphur compounds (cystein, cystine, methionine).

B. Inorganic compounds

Organic matter contains several inorganic elements such as H, O, N, P, Ca, Mg, S, Na, K, Fe, Al, Mn, Zn, Mo, Si, B, Co, Cl etc. All these are in metallic complex form hence organic matter is water insoluble and do not destroy by leaching.

Secondary nutrients: are those nutrients which are required by plants in moderate amounts. They are called secondary because they are unknowingly supplied through fertilizers and other amendments. However their role in nutrition is not secondary but they are given secondary importance in its supply and management.

Eg: Ca, Mg & S

Ex: When SSP is applied as a fertilizer for P it supply Ca and S Dolomite applied as a liming material supply Ca and Mg. Ammonium Sulphate added as N fertilizer will supply S

Micronutrients: The nutrients which are required by plants in relatively smaller quantities for their growth and development, but these are equally important and essential to plants as macronutrients. They are also called as trace/rare/nano elements.

These include Fe, Mn, Zn, Cu, B, Mo, Cl and Ni.