ST. JOSEPH’S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

III SEMESTER **AGRICULTURE AND RURAL DEVELOPMENT** Time:3hrs/week

SSAC 221(2) **MANURES, FERTILIZERS AND SOIL FERTILITY MANAGEMENT** Marks:60

w.e.f AJ 2022-2023 **SYLLABUS**

**Objectives**

* To Estimate available N in soils
* To Estimate of K & S in plant samples
* To Identify acid radicals in fertilizers /salts
* To Identify basic radicals in fertilizer /salt Determination of most

profitable level of capital use.

**Course Outcomes**

At the end of the course, students will be able to

**CO1:**Discuss the conceptual framework of soil fertility and plant nutrition.

**CO2:**Classify plant nutrients and explain nutrient cycles.

**CO3:**Summarize the deficiency and toxicity symptoms in plants and corrective measures.

**CO4:**Discuss the methods of soil fertility evaluation and plant analysis.

**CO5:**Explain the use and control of natural, chemical and mixed fertilizers in agriculture.

**THEORY**

**UNIT-1 (6 Hours)**

1. Introduction - History of soil fertility and plant nutrition - Concepts of soil fertility, soil productivity, Navadhanya and Annapurna concepts in relation to soil fertilitySoil as a source of plant nutrients - Nutrient Elements - Arnon’s criteria of essentiality – Essential, functional and beneficial elements.

2. Scientists responsible for the essentiality of nutrients -Ionic forms of plant nutrients in soil – Mechanism of nutrient transport - Movement of ions from soils to roots – Mass flow, diffusion, root interception and contact exchange.

3. Essential nutrients – Classification and their functions in plants.

4. Deficiency symptoms of nutrients - Corrective measures – Toxicity symptoms of different nutrients.

5. Nitrogen - Occurrence, content and distribution - Factors influencing the content of nitrogen in soil. Forms of soil nitrogen - Nitrogen Cycle – Transformations in soils – Mineralization (aminisation and ammonification) - Fate of released ammonia – Factors affecting ammonium fixation - Nitrification – Factors affecting nitrification – Fate of released nitrate nitrogen.

6. Leaching losses of nitrate nitrogen – Nitrification inhibitors-Denitrification – Immobilization, Nitrogen fixation - Different types – Biological fixation of nitrogen – Symbiotic and non symbiotic – Nitrogen balance sheet – Gains and losses.

**UNIT -II (6 Hours)**

1Phosphorus - P – Cycle – Content in soils – Forms of phosphorus in soil - Inorganic and organic phosphorus compounds – Phosphorus fixation – Mechanisms of phosphate fixation -Factors affecting phosphate fixation in soil - Quantity and intensity parameters.

2. Potassium - Content in soil – Source – Forms of soil potassium - Potassium fixation Factors affecting potassium fixation – Quantity and Intensity parameters – Luxury consumption.

3.Calcium - Sources and content – Forms of calcium in soil, factors affecting the availability of calcium in soil –Magnesium - Sources – Content – Forms of magnesium in soils - Factors affecting availability of magnesium - Functions.

4. Sulphur - S – Cycle – Occurrence – Forms of Sulphur in soil - Sulphur transformation in soils – Mineralization and immobilization - Sulphur Oxidation – Factors affecting oxidation in soils - Sulphide injury – Causes, symptoms and remedial measures.

5. Micronutrient - Sources – Forms in soil solution – Pools of micronutrients – Predisposing factors for occurrence of micronutrient deficiencies in soil and plants

6. Zn and Mn - Content – Forms in soils – Critical limits in soils and plants - Factors affecting their availability.

7. Fe and Cu - Content – Forms in soils – Critical limits in soils and plants. Factors affecting their availability.

**UNIT- III (6 Hours)**

1. Boron and Molybdenum - Content – Forms in soil - Critical limits in soils and plants. Factors affecting their availability.

2. Chlorine - Content – Forms in soils – Critical limits in soils and plants. Factors affecting its availability – Beneficial Elements- Sodium, Cobalt, Vanadium and Silicon

3. Soil fertility Evaluation: - Approaches – Soil testing – Objectives of soil testing – Chemical methods for estimating available nutrients. 4.Plant analysis – Rapid tissue tests – Indicator plants - Biological methods of soil fertility evaluation, A- value – Microbiological methods – Sackett and Stewart techniques – Mehlich technique – Cunninghamella plaque method – Mulder’s Aspergillusniger technique – Mistcherlich’s pot culture method.

5. Soil test-based fertilizers recommendation: - Critical nutrient concept (Cate and Nelson) – Critical levels of nutrients in soils - General recommendations Use of empirical equations for scheduling fertilizer doses - Targeted yield approach

6. Nutrient use efficiency: - Soil, plant and management factors influencing Nutrient use efficiency in respect of N, P, K, S, Fe and Zn fertilizers – Foliar application – Fertigation – Liquid fertilizers.

7.Methods of application of nutrients under rainfed and irrigated conditions

**UNIT –IV (6 Hours)**

1. Introduction and importance of organic manures - Definition and difference between manures and fertilizers-Classification of manures (Bulky & Concentrated) with suitable examples. Importance of manures in soil fertility management.

2. Bulky organic manures – Preparation of FYM – Methods of collection and storage. Losses of nutrients from FYM during collection and storage -Ways to minimize these losses.

3. Compost and composting – Different methods of composting including the starters and raw materials

4. Methods of preparation of rural and urban compost. Mechanical compost plants – Their advantages over conventional composting –Vermi-composting

5. Green manures – Classification with examples. Advantages and limitations of green manuring and green leaf manuring. Biogas plant – Principles of operation and its advantages.

6. Definitions of penning, sewage, sewerage, sullage, pouderette, Activated compost process. Concentrated organic manures – Oil cakes, blood meal, bone meal, horn meal, fish meal, meat meal and guano.

**UNIT –V ( 6 Hours)**

1. Chemical fertilizers – Classification with examples – Nitrogenous fertilizers – composition and properties of major nitrogenous fertilizers viz., Ammonium sulphate, urea and calcium ammonium nitrate.

2. Phosphatic fertilizers – Composition of Rock phosphate – Occurrence, types and properties- properties of SSP, TSP and basic slag – Potassic fertilizers –MOP, SOP properties.

3. Secondary and micronutrient fertilizers – Different sources of these nutrients and their contents - Conditions leading to their deficiency - Methods of application and mode of action of NPK fertilizers in soils.

4. Amendments – Role of important organic and inorganic amendments and synthetic conditioners as amendments - Complex fertilizers – Types, composition of DAP, MAP, UAP, important nitrophosphates.

5. Mixed fertilizers – Advantages and disadvantages over straight fertilizers - Nanofertilizers- Fertilizer grade – Fertilizer ratio – unit value of fertilizers – Problems - INM - Components - Advantages.

6. Fertilizer Control Order (FCO) – Its importance and regulations - Specifications for important fertilizers - Fertilizer storage – Specifications - Problems during storage.

**References text book**

1. Indian Society of Soil Science.2012. Fundamentals of Soil Science. IARI, New Delhi.

2. Yawalkar K.S, Agarwal, T.P and Bokde, S 1995. Manures and Fertilisers. Agril. Publishing House, Nagpur

3. Samuel Tisdale, Nelson Werner L, Beaton James D and Havlin John L. 2005.

Soil Fertility and Fertilizers: An Introduction to Nutrient Management, Macmillian Publishing Co., New York. 4. D. K .Das 2014. Introductory Soil Science. Kalyani Publishers, New Delhi

**\*\*\* \*\*\* \*\*\***