ACHARYA N.G.RANGA AGRICULTURAL UNIVERSITY RAJENDRA NAGAR, HYDERABAD



Soil Fertility, Soil Chemistry and Nutrient Management

C.No. SSAC 221 Credits: 2 + 1 = 3

Dr Sailaja V Assistant Professor

Dr. P. Kavitha Assistant Professor

Dr P R K Prasad Professor & Head Agril. College, Bapatla

Department of Soil Science and Agril. Chemistry

College of Agriculture, Rajendranagar, Hyderabad – 30.

May 2011

Lecture outlines

Lec.No	Торіс	Page
1	Introduction:- Importance of soil chemistry and soil fertility in crop production. Concepts of soil fertility and soil productivity. Definitions and differences. Soil as a source of plant nutrients.	1
2	Nutrient Elements:- Arnon's criteria of essentiality – Essential. Functional and Beneficial elements. Scientists responsible for the essentiality of individual nutrient elements. Classification of essential nutrients. Ionic forms of plant nutrients in soil. Beneficial elements.	3
3	Movement of ions from soils to roots – Mass flow, diffusion, root interception and contact exchange.	9
4	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.	12
5	Nitrification – Factors affecting nitrification – Fate of nitrate nitrogen – Leaching losses of nitrate nitrogen – Denitrification – Nitrification inhibitors. Immobilization	15
6	Nitrogen fixation:- Different types - Biological fixation of nitrogen - Symbiotic and non symbiotic - Nitrogen balance sheet - Gains and losses - Functions - Deficiency symptoms - Corrective measures - Toxicity symptoms	18
7	Phosphorus:- P – cycle – content in soils – forms of phosphorus in soil - Inorganic and organic phosphorus compounds – Phosphorus fixation – Mechanisms of phosphate fixation	23
8	Factors affecting phosphate fixation in soil – Methods to reduce phosphate fixation. (Organic matter additions and Placement of P fertilizers etc.) – Quantity and intensity parameters – Functions – deficiency symptoms – Corrective measures – Toxicity symptoms.	27
9	Potassium:- content in soil – Source – forms of soil potassium - Potassium fixation.	31
10	Factors affecting potassium fixation – Quantity and intensity parameters – Luxury consumption – Functions and deficiency symptoms – corrective measures.	34
11	Calcium - sources and content - forms of calcium in soil, factors affecting the availability of calcium in soil - Functions - Deficiency symptoms - Corrective measures	38
12	Magnesium - Sources - Content - Forms of magnesium in soils. Factors affecting availability of magnesium. Functions - Deficiency symptoms - Corrective measures.	42
13	Sulphur:- S - Cycle - Occurrence - Forms of Sulphur in soil. Sulphur transformation in soils - Mineralization and immobilization.	45
14	Sulphur Oxidation – Factors affecting oxidation in soils. Sulphide injury – Causes, symptoms and remedial measures - Functions – Deficiency symptoms and corrective measures	47

15	Micronutrient:-Sources – Forms in soil solution – Pools of micronutrients – Predisposing factors for occurrence of micronutrient deficiencies in soil and plants	51
16	Zinc: - Content – Forms in soils – Critical limits in soils and plants. Factors affecting availability of zinc – Functions – Deficiency symptoms corrective measures	54
17	Copper and Iron - Content - Forms in soils - Critical limits in soils and plants. Factors affecting its availability -Functions - Deficiency symptoms - Corrective measures. Toxicity symptoms.	59
18	Manganese: - Content - Forms in soils - Critical limits in soils and plants. Factors affecting its availability - Functions - Deficiency symptoms - Corrective measures. Toxicity symptoms.	68
19	Boron: - Content – forms in soil - Critical limits in soils and plants. Factors affecting its availability – Functions – Deficiency symptoms – Corrective measures	72
20	Molybdenum and Chlorine - Content - Forms in soils - Critical limits in soils and plants. Factors affecting their availability - Functions - Deficiency symptoms - Corrective measures. Toxicity symptoms.	75
21	Soil pH – pH scale – Active and potential acidity-Factors affecting soil pH – Problems on soil pH.	79
22	Importance of soil pH on nutrient availability of plant nutrients – Buffering capacity of soils.	84
23	Problem soils: Definition – Classification - Acid, Saline, Saline Sodic, Sodic and Calcareous soils - characteristics – Formation and Nutrient availability in problem soils.	86
24	Reclamation of problematic soils – Mechanical, Chemical and Biological methods. Lime requirement – Different liming materials - Organic amendments – FYM, compost, pressmud, green manures - Green leaf manures, problems associated with over liming. Gypsum requirement – Classification of crops based on their tolerance to salts.	92
25	Irrigation water:- Quality of irrigation water – Classification based on EC, SAR, RSC and Boron content. Indian standards for water quality. Use of saline waters in agriculture	96
26	Soil fertility Evaluation: - Approaches – Nutrient deficiency symptoms. Soil testing – Objectives of soil testing – Chemical methods for estimating available nutrients	101
27	Plant analysis – Rapid tissue tests – DRIS – Indicator plants.	103
28	Biological methods of soil fertility evaluation:- Microbiological methods – Sackett and Stewart Techniques, Mehlich technique – Cunninghamella plaque method and Mulder's Asppergillus niger test	108
29	Pot culture test:- Mitscherlich's pot culture method - Jenny's pot culture test. Neubauer's seedling method. Sunflower pot culture technique for Boron. A – Value	110
30	Soil test based fertilizers recommendation:- Critical nutrient concept (Cate and Nelson) – Critical levels of nutrients in soils. Use of empirical equations for scheduling fertilizers P dosage to crops	112
31	Nutrient use efficiency:- Soil, plant and management factors influencing Nutrient use efficiency in respect of N, P, K, S, Fe and Zn fertilizers	114

4 /	Use of fertilizers and insecticides in agriculture - trends in their use,	116
	effects of excess use of these chemicals on soil, water and air	

Text books for reference

- 1. Diagnosis and improvement of saline and alkali soils (USDA Hand book No.60) Richards L.A., 1954, Oxford &IBH Publishing Co., New Delhi
- 2. Soil Fertility Theory and Practices. Kanwar J.S.(Ed.), 1976, ICAR, N.D
- **3.** Soil Fertility and Fertilizers. Tisdale S.L., Nelson W.L., Beaton J.D., and Havlin J.L. 1995. Macmillion Publishing Co.
- 4. Fundamentals of Soil Science. 1998. Published by ISSS, New Delhi
- 5. Chemistry of the Soil. 1964. Bear F.E. Oxford & IBH Publishing Co., ND
- **6.** Nature and Properties of Soils. 2005. Brady N.C.and Ray Well. Saurabh Printers Private Ltd., ND.
- 7. Introduction to soil Science. Dilip Kumar Das. 2010. Kalayani Publishers New Delhi.
- **8.** Manures and fertilisers. Yawalkar K.S, Agarwal, T.P and Bokde, S 1995. Agril. Publishing House, Nagpur
- 9. Soils of Andhra Pradesh. ANGR Agril. University, Hyderabad (1995)