**SOS 2201 SOIL FERTILITY AND PLANT NUTRITION**

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**Course Type**: **CORE (B.Sc. Agric. II, B.Sc. Hort II, B.Sc. LUM II)**

 **ELECTIVE (B.Sc. For II, B.Sc. Comm For II)**

**1. COURSE DESCRIPTION**

**Course Credits (CU)**: **3 CU**

**Course Duration**: **30 lecture hours and 15 contact practical hours**

**Pre-requisite:** An introduction Soil Science course equivalent to 3 C U

**COURSE DESCRIPTION**

Define soil fertility and plant nutrition. Factors controlling growth of plants. Plant nutrients and their categorisation. The organic and inorganic sources of plant nutrients. Nutrient functions and deficiency symptoms in plant. Factors and processes controlling availability of plant nutrients in soil. Soil-plant relations affecting nutrient up-take, distribution and assimilation. Soil fertility maintenance and nutrient requirements of various crops.

**2. COURSE OBJECTIVES**

**General**

To enable the students acquire knowledge and skills in soil fertility and plant nutrition as a requirement for subsequent soil fertility management courses.

Specific objectives

1. Students to appreciate soil fertility as a factor controlling plant growth
2. Students to know the sources and functions of the different nutrients
3. Students to gain skills to assess soil fertility status

**3. RECOMMENDED REFERENCES FOR READING**

**Bationo A. (ed.) 2004.** Managing nutrient cycles to sustain soil fertility in Sub Saharan Africa.

**Bationo, A., Waswa, B., Kihara, J., Kimetu, J. (2007).** Advances in integrated soil fertility management in sub-Saharan Africa: Challenges and Opportunities, pp 255 – 259, Springer

**Ebanyat, P. (2009). A road to food?** Efficacy of nutrient management options targeted to heterogeneous soilscapes in Teso farming systems, Uganda. A PhD Thesis, Wageningen University.

**Gichuru, M.P., Bationo, A., Bekunda, M.A., Goma, H.C., Mafongoya, P.L., Mugendi, D.N., Murwira, H.K., Nandwa, S.M., Nyathi, P., Swift, M.J. (eds.) 2003.** Soil fertility management in Africa: A regional perspective.

**Nkonya, E., Kaizzi, C., Pader, J., (2005).** Determinants of nutrient balances in eastern Uganda. Agricultural systems 85: 155 – 182.

**Prasad, R., Power, J.F. (1997).** Soil fertility management for sustainable agriculture. Lewis Publishers, New York.

**Sundberg C., 2005.** Improving Compost Process Efficiency by controlling Aeration, Temperature and pH. A Doctoral Thesis

**Tidsale S.L., Werner N.L., Beaton J.D., Havlin J.L. 1993.** Soil fertility and fertilizer; 5th Edition, Chapters 1 – 10, 12 and 13.

**4. COURSE CONTENT, METHODS OF INSTRUCTION, TOOLS AND EQUIPMENT REQUIRED**

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| **TOPIC** | **CONTENT** | **METHOD OF INSTRUCTION / Time allocated** | **TOOLS / EQUIPMENT NEEDED** |
|  **INTRODUCTION**  | * Definitions of soil fertility, productivity and plant nutrients
* History and status of soil fertility in the world with emphasis to Uganda
* Factors affecting plant growth
 | Interactive lectures (2 hours) | Chalk / BB or Markers / Flip charts |
| **Plant nutrients:**Functions and deficiency/toxicity indicators | * Plant nutrients
	+ - forms as taken up by plants
		- classification based on amount required by plants
		- functions to plants
		- deficiency and toxicity indicators
* Toxic elements to plants available in soil and the condition that lead to their uptake
 | Interactive lectures (5 hours)Field trip to assess nutrient deficiency/toxicity on plants (1.5 hours)Practical: determination of N in plant tissues (1.5 hours | Chalk / BB or Markers / Flip chartsComputer and projectTransport and practical handbookPlant samples, reagents for N analysis, laboratory space |
| Sources of plantNutrients | * Nutrient added in an agricultural system
* Organic Vs inorganic sources of plant nutrients
 | Interactive lectures (2 hours)Practical: Determination of N in soil (1.5 hours)Determination of available P (1.5 hours)Determination of cation exchange capacity (1.5 hours) | Chalk / BB or Markers / Flip chartsSoil samples, reagents for available P and CEC determination, laboratory space |
| Nutrient managementin soil | * Nutrient lost from agricultural system
* How to minimize loss for each nutrient
* Factors controlling availability of nutrients in soil
* Nutrient concentrations in soil and ground water in relation to environmental concerns
 | Interactive lectures (4 hours) | Chalk / BB or Markers / Flip charts |
| Nutrient uptake by plants | Mechanisms of nutrient uptake* + Diffusion
	+ Osmosis

Factors affecting uptake of nutrients by plants | Interactive lectures (3 hours) | Chalk / BB or Markers / Flip charts |
| Nutrient cycles | Cycles of major plant nutrients (carbon, nitrogen, phosphorus, potassium, sulphur, calcium and magnesium | Interactive lectures (2 hours) | Chalk / BB or Markers / Flip charts |
| Essential nutrient fordifferent plants | Plant nutrient requirements for each crop with special emphasis to major crops grown in Uganda (e.g. banana, maize, millet, beans, groundnuts, cassava, coffee, cotton  | Lecture (4 hours) |  |
| Soil organic matter as a sink for soil fertility in Sub Saharan Africa | Soil organic matter* + Sources of soil organic matter to soil
	+ Status of organic matter in soil with special emphasis to Uganda
	+ Nature and composition
	+ Effect on soil properties
	+ Effect of nutrient supply
	+ C:N ratio as a factor in soil organic matter mineralization and nutrient release
 | Interactive lectures (2 hours)Practical Determination of soil organic matter (wet method) (1.5 hours) | Chalk / BB or Markers / Flip chartsSoil samples and reagents for organic carbon determination |
| Factors controlling soil fertility |  | Interactive lectures (2 hrs)Practical on soil pH in water (1.5 hours) | Chalk / BB or Markers / Flip charts |
| Processes controlling soil fertility |  | Interactive lectures (2 hrs)Liming practical (1.5 hours)  | Chalk / BB or Markers / Flip charts |
| Composting | * Composting process
	+ Why compost?
	+ Factors that affect the process (e.g. C:N ratio, temperature, aeration, microorganisms, pH and moisture content)
	+ How would you tell mature/ ready compost?
	+ Composting in practice
		- Procedure
		- Materials
		- monitoring
 | Interactive Lectures (3 hr)Practical (3 hr) | Chalk / BB or Markers / Flip charts |

**5. SUMMARY OF TIME NEEDED**

Interactive lectures covering theory 30 hrs

Laboratory and field-based practicals 15 hrs

**6. OVERALL COURSE EVALUATION**

Three continuous assessment 20

Six practical reports 20

Final examination 60

Total 100