



COLLEGE OF HEALTH, AGRICULTURE & NATURAL SCIENCES

NACP 507: ADVANCED SOIL FERTILITY MANAGEMENT

END OF SECOND SEMESTER FINAL EXAMINATIONS

APRIL/MAY 2023

LECTURER: PROF. F. MAPANDA

DURATION: 3 HOURS

INSTRUCTION

This paper has **two (2)** sections.

A) Answer **both** questions in **Section A**, and

B) Answer any **three** Questions from **Section B**

NACP507: Advanced Soil Fertility Management

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SECTION A – Answer all questions in this section (40 marks)

1. a) Convert the following expressions of concentration into stated units given the relative atomic masses: C=12; Ca=40.
 - (i) 1.5% soil organic carbon (C) into mg/kg [2]
 - (ii) 2.5 meq/100 g calcium (Ca) into parts per million (ppm) [3]
 - b) Given that 100 g of a soil are holding 15 mg Ca, 28 mg potassium (K) and 16 mg of sodium (Na) on its colloids, calculate the theoretical charge contribution of this soil in cmol_c/kg. Atomic weight: Ca=40, K=39, Na=23 [3]
 - c) A farmer applied 60 kg of ammonium nitrate (NH₄NO₃) (34.5% N) on 0.2 ha, and 5% of the applied N was lost by denitrification.
 - (i) What is denitrification? [2]
 - (ii) Calculate the mass of N lost. [3]
 - (iii) How can this loss be minimized? [3]
 - d) Explain why secondary minerals are more influential to soil fertility than primary minerals. [4]
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2. a) Soil organic matter (SOC) decreases when soils are first cropped and the rate of decline is affected by management.
 - (i) State four (4) reasons why SOC decreases on first cropping [4]
 - (ii) Explain two (2) management options that minimize this loss. [4]
 - b) State three (3) conditions under which foliar fertilizer application becomes the most recommended method of nourishing crops. [6]

- c) Define Crop Nutrient Requirement (CNR) and briefly explain how this parameter is derived. **[6]**

SECTION B - Answer any three (3) questions in this section (60 marks)

3. Discuss the Exchangeable Al method of determining lime requirement of a soil, indicating the conditions under which this method is normally applied. **[20]**
4. Using clear examples, describe the indices that are used to assess fertilizer use efficiency in agronomy under the following headings.
- a) Apparent crop recovery efficiency **[7]**
 - b) Physiological efficiency **[7]**
 - c) Internal Utilization efficiency **[6]**
5. The efficiency of nutrient release to the plant can be manipulated by varying the quality and quantity of organic material, and the time when it is applied, in relation to the onset of rain. Discuss this statement, making reference to different soil types. **[20]**
6. Discuss the diagnosis, causes, effects and reclamation of the following problem soils.
- a) Sodic soil **[10]**
 - b) Saline soil **[10]**
7. Using any set of soil fertility management technologies, clearly describe how you would implement an Integrated Soil Fertility Management (ISFM) in the smallholder farming community where soil productivity is declining. **[20]**

END OF EXAMINATION PAPER