



1<sup>ST</sup> SEM. 2004/2005

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UNIVERSITY OF SWAZILAND

FINAL EXAMINATION PAPER

**PROGRAMME:** BACHELOR OF SCIENCE IN AGRICULTURE  
YEAR 5 (CROP PRODUCTION,  
HORTICULTURE AND LAND AND WATER  
MANAGEMENT OPTIONS) AND BACHELOR  
OF SCIENCE IN AGRICULTURAL EDUCATION  
YEAR 5

**COURSE CODE:** CP 502

**TITLE OF PAPER:** SOIL CHEMISTRY AND FERTILITY

**TIME ALLOWED:** TWO AND A HALF (2.5) HOURS

**INSTRUCTIONS:** ANSWER FOUR QUESTIONS, TWO (2)  
QUESTIONS FROM EACH SECTION

**DO NOT OPEN THIS PAPER UNTIL PERMISSION HAS BEEN GRANTED  
BY THE CHIEF INVIGILATOR**

**SECTION 1: SOIL CHEMISTRY****QUESTION 1**

Describe the dominant clay minerals in soils of your country and discuss the significance of clay minerals when soils are used for crop production or as a medium for the disposal of municipal waste. [25]

**QUESTION 2**

Discuss the interactions of sesquioxides with anions in tropical and subtropical soils and highlight the implications of these reactions in the mineral nutrition of plants [25]

**QUESTION 3**

- (a) Discuss the role of soil acidity in crop production [15]
- (b) What remedial actions would you recommend to improve crop yields in acid soils [4]
- (c) An acid soil was found to contain 5 me exch. Al/100g soil. Calculate the amount of limestone in metric tons/ha required to neutralize the exchangeable Al to a depth of 15cm. The soil has a bulk density of 1.2 g/cm<sup>3</sup> and the limestone has a neutralizing value of 90%. [6]

[25]

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**SECTION 2: SOIL FERTILITY**

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**QUESTION 4**

- (a) Discuss, briefly, the major soil fertility problems in soils of your country and suggest practical strategies to address such problems **[15]**
- (b) A fertilizer recommendation for maize in the middleveld of Swaziland showed that for optimum growth of this crop the following elements must be applied as follows:
- N - 60kg ha<sup>-1</sup>
- P - 55kg ha<sup>-1</sup>
- K - 40kg ha<sup>-1</sup>
- (i) Calculate the amount of the compound fertilizer, 2:3:2(38), that must be added to supply all the N required. **[6]**
- (ii) How much P and K would the quantity of 2:3:2(38), obtained in (i) above, supply to the maize plants? **[4]**
- [25]**

**QUESTION 5**

- (a) Describe the transformations of phosphorus in soils and highlight the implications of such reactions in the phosphorus nutrition of plants. [6]
- (b) Discuss the factors which influence the availability of phosphorus to plants in soils and indicate the strategies you would recommend to increase phosphorus availability to plants in soils. [15]
- (c) A soil has a phosphorus soil test of  $10\text{mg P kg}^{-1}$  soil and the sufficiency level for most crop plants in  $20\text{mg kg}^{-1}$  soil. The efficiency of conversion of fertilizer P to soil P is 20%. Calculate the amount of triple superphosphate (22%P) that is required to increase the soil test P to the sufficiency level. [4]

[25]

**QUESTION 6**

Suppose that you are a leader of a team that has been assigned the task of selecting an extractant for plant – available phosphorus in soils of a developing country. Describe in detail how you would accomplish this task.

[25]