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UNIVERSITY OF SWAZILAND

MAIN EXAMINATION PAPER

PROGRAMME: B. SC. AGRICULTURAL EDUCATION, YEAR 3

B. SC. AGRONOMY, YEAR 3

B. SC. HORTICULTURE, YEAR 3

COURSE CODE: CP302/CPR301

TITLE OF PAPER: CROP NUTRITION

TIME ALLOWED: 3 HOURS

INSTRUCTIONS: ANSWER ALL QUESTIONS

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

QUESTION 1:

(a) What are essential nutrient elements?

(b) Mention three criteria for determining essentiality of nutrient elements.

(c) What is Diagnosis Recommendation Integrated Systems (DRIS).

(d). Briefly describe the advantages of DRIS over conventional methods of interpreting tissue nutrient analysis

                                                            20 Marks

QUESTION 2:

Write short notes on the following:
  a. Tissue Testing for Crop Nutrition
  b. Soil Sampling for nutrient diagnosis
  c. Visual diagnosis of nutrient status in crop plants
  d. Nutrient Diffusion in soils

                                                            20 Marks

QUESTION 3:

3a. The diagram below (Fig 1) showed the relationship between concentration of nutrients (mg/kg) in maize plant and the crop yield (kg/ha). Define and explain the following terms: (i) deficiency zone, (ii) marginal zones (iii) adequate zone, (vi) toxic zone, (v) critical concentrations (**10 Marks**).
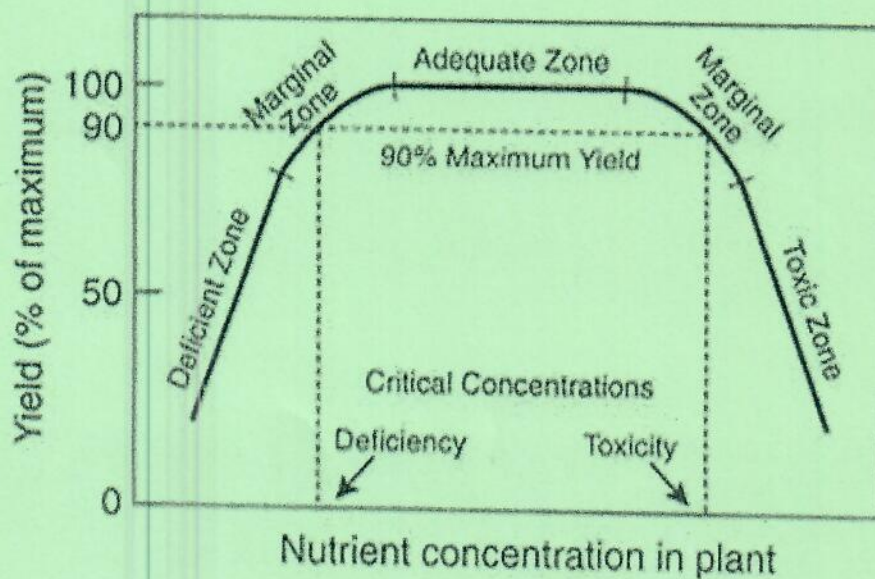

Fig 1: The relationship between nutrient concentrations in plants and yield

3b. Given the data below, on the effect of Phosphorus, N+P+K fertilizer and a control on the tissue Fe contents in two rice cultivars (ITA 212 and Suakoko 8) on two soil types across two years (2016 and 2017 cropping seasons). Briefly interpret the data given using the critical range of Fe of between $70 - 300$ mg kg^{-1}. **(10 Marks)**.

Total 20 Marks

Table 1. Contents of Fe (mg kg^{-1}) in tissues of two maize cultivars Suakoko 8 and ITA 212 on two soil types

Treatments	--- Inceptisols------		------- Alfisols -----	
	2016 season	2016 season	2017 season	2017 season
		---------------- Suakoko 8 -----------------		
Control	471a‡	562a	545a	1025a
P	475a	796a	1113b	493b
N+P+K	683a	775a	719a	1637c
		----------------- ITA 212 --------------------		
Control	697a	1053b	478a	253a
P	586a	943ab	1669b	512a
N+P+K	409a	863a	683a	565a
Critical range†	70 – 300 mg kg^{-1}			

† Fageria et al., 1991.; ‡ means with same letter ins same columns are not significantly different at 5% (Duncan Multiple Range Test). P, N+P+K fertilizers were applied at the recommended rates.

QUESTION 4:

4a. Data presented in Table 2 show the results of selected chemical properties of three soil types at Luyengo campus, Swaziland. From the data given, calculate the following: (i) ΔpH, (ii) SOM(%), (iii) ECEC (cmol/kg), (iv) B Sat (%) **(10 Marks)**.

4b. Given that critical levels for sustained and a continuous growth of maize were : pH = 6.0-6.5, exchangeable K = 0.6-0.8 cmol/kg, CEC = 17-20 cmol/kg and available P = 10-16mg/kg. Would you recommend these soils for maize cultivation? If yes, why? Give reasons. If no, please, give reasons. **(10 Marks)**.

Total 20 Marks

Table 2: Soil chemical properties of three soil types at Experimental Farm Land at Luyengo Campus, University of Swaziland

Depth	Org C (%)	pHw	pHKCl	c mol/kg						Av. P (mg/kg)	ΔpH	SOM(%)	ECEC (cmol/kg)	B. Sat (%)
				Ca	Mg	K	Na	CEC♣	Exc. Ac*					
							Soil Type 1							
0-12	1.15	5.10	3.96	1.65	0.98	0.51	0.28	11.44	0.62	23.1				
12-37	1.10	4.95	3.88	1.35	0.67	0.32	0.17	9.12	0.65	10.21				
37-53	0.441	4.86	3.84	1.23	0.27	0.17	0.06	9.37	0.66	12.23				
53-90	0.26	4.56	3.57	0.98	0.19	0.53	0.07	11.9	0.54	4.56				
							Soil Type II							
0-14	1.54	5.16	4.15	1.89	1.12	0.44	0.32	11.20	0.59	12.56				
14-31	1.31	5.11	4.12	1.53	0.89	0.21	0.26	10.17	0.61	14.85				
31-72	0.54	4.91	4.10	1.43	0.34	0.30	0.22	9.54	0.62	13.56				
72-85	0.33	4.68	3.82	1.20	0.30	0.23	0.19	12.20	0.56	4.56				
							Soil Type III							
0-16	1.61	5.20	4.23	1.66	1.20	0.45	0.30	10.80	0.48	12.10				
16-48	1.36	5.12	4.59	1.64	0.57	0.39	0.28	9.67	0.52	2.30				
48-100	0.41	5.23	4.13	1.30	0.34	0.29	0.22	9.30	0.51	10.12				
Critical levels		6-6.5						0.6-0.8		17-20			10-16	

♣CEC= Cation Exchange Capacity; Av.P= Available P; SOM= Soil Organic Matter; *ECEC= Effective Cation Exchange Capacity; B.Sat= Base Saturation