

National University of Lesotho

Faculty of Agriculture

BSc Crop Science

CPS 4508: Crop Physiology

Date: June 2023

Final Examinations

Total time 3hrs

Total Marks: 100

Instructions to candidate

- a) Answer **ANY FOUR** Questions.
- b) Each Question Carries **25 Marks**.

-----GOODLUCK!!-----

QUESTION 1 (25 Marks)

1.1. In plant water relations, **contrast how** bulk flow differs from diffusion using equations. [10]

1.2. **Explain** the concept of plant-water relations and how it represents a compromise. [5]

1.3 Identify and describe two main pathways by which water can move from the soil to the roots or from cell to cell everywhere in the plant. [10]

QUESTION 2 (25 Marks)

2.1a. Irradiance impinging upon a surface depends on 4 parameters. **List** and **show** how they influence RUE and later Crop Productivity? [20]

2.2. In Lesotho, new agricultural policies, encourages **commercial farming**, therefore if followed, and right agronomic practices practiced, **commercial yield** is inevitable. **Crop productivity** depends on all the terms at the right of the equation of **commercial yield**.

$$Y_c = (Q_i \times \Phi \times \epsilon - R) \text{ HI}$$

Where Y_c is commercial yield

Y = total biomass yield

Q_i = incident PAR

Φ = proportion of Q_i absorbed by the crop

ϵ = conversion efficiency of absorbed PAR in biomass (RUE = radiation use efficiency)

R = respiration loss/cost

2.2a. **Explain clearly** how these agronomic practices can influence RUE and later Y_c for wheat winter cropping at **Leribe, Kolonyama Ha Manama**. [5]

QUESTION 3 (25 Marks)

3.1. Give the formulae and abbreviations of the following indices and explain how growth measurements is done using each of them.

- a) Crop Growth Rate [5]
- b) Relative Growth Rate [5]
- c) Leaf Area Ratio [5]
- d) Net Assimilation Rate [5]
- e) Dry Matter Efficiency [5]

QUESTION 4 (25 Marks)

4.1 Explain why the growth curve typically makes a transition from exponential to linear dry matter accumulation early in the season (i.e., what is physically happening with respect to canopy structure and activity that causes the curve to have this shape?). **[8]**

4.2 Why does the rate of crop dry matter accumulation decline near the end of the season, even if canopy interceptions of incident PAR remain high? **[6]**

4.3. Define the concept of an Ideotype crop. **[5]**

4.4 Why a crop ideotype development must consider genotype by environment interaction formula? **[6]**

QUESTION 5 (25 Marks)

5.1 Define the following phrases as used in Crop Physiology

a) Photosynthetic efficiency. **[5]**

b) Photosynthetically Active Radiation. **[5]**

c) Radiation Use Efficiency **[5]**

d) Leaf boundary layer resistance **[5]**

e) Plant Canopy architecture and Photosynthesis **[5]**

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