

Course Unit	Physiology and Nutrition Vine		Field of study	Biology and Biochemistry	
Bachelor in	Oenology		School	School of Agriculture	
Academic Year	2023/2024	Year of study	1	Level	1-1
Type	Semestral	Semester	2	Code	9998-705-1202-00-23
Workload (hours)	175,5	Contact hours	T 30	TP -	PL 30
			TC -	S -	E -
			OT 4	O -	

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) Ana Maria Antão Gerales, Zulimar Hernández Hernández

### Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. To know the biochemical and biophysical processes of plants. Studying these processes linking them to the water, nutrient and energetic relationships.
2. Understand the processes of plant growth and development and the production of secondary metabolites. To know the essential nutrients to plants and its dynamics in soils .
3. Knowing the factors that influence the bioavailability of the nutrients in the soil and types of interventions that alter the bioavailability.
4. To Know the main types of fertilizers in the market and how to use them. The main techniques to know the soil fertility and the tissue nutrient concentrations.

### Prerequisites

Before the course unit the learner is expected to be able to:

Students must have prior knowledge in Biology, Chemistry, Biochemistry and Physics.

### Course contents

Water relations. Transpiration. Nutrition. Photosynthesis. Photorespiration. Plant Growth and development. Plant secondary metabolism. Structural and functional mechanisms of plant response to stress. Physiological response of plants with special focus on the grapevine. Basics of Vegetable Production. Basic soil-plant relationships. Elements essential to plant nutrition. Introduction to fertilizers. Evaluation of soil fertility and nutritional status of plants.

### Course contents (extended version)

1. Water in plants
  - Water potential. Soil-plant-atmosphere system. Water absorption by the plant. Water in xylem.
  - Factors that affect the availability of water in the grapevine.
2. Transpiration
  - Transpiration. Stomata physiology. Environmental /physiological control of stomata functioning.
  - Physiological/ environmental factors influencing transpiration. Photosynthesis/transpiration ratio
3. Transport in phloem: structure and transport mechanisms.
4. Photosynthesis. Structure of Photosynthetic system. Regulation of Photosynthetic Process.
  - Plantas C3, C4, CAM. RubisCO: estrutura e regulação. Fotorespiração.
  - Factors affecting photosynthesis : Light, Temperature, CO2 and water availability.
  - Shade/Sun plants. Responses of C3, C4 and CAM plants to light, temperature CO2 and to water amounts
  - Photosynthesis and productivity of the grapevine.
5. Plant Growth and development.
  - Phytohormones: Physiological role. How environment influences phytohormones action.
  - Biological and physiological functions of the plant phytochrome
  - Plant Secondary metabolites: characteristics and functions
  - Commercial use of phytohormones in the grapevine.
6. Physiological stress. Structural and functional mechanisms of plant response to stressors.
  - How environment affect the physiological response of plants with special focus on the grapevine
7. Notions of Vegetable Production
  - Growth rate and cultural cycle. The conditioning factors of plant production
  - Environmental factors. Genetic factors. Socio-economic factors
  - Relationships between environmental factors and plant growth.
  - Principles and Laws of Plant Nutrition. Law of the minimum. Limiting factor concept.
  - Law of decreasing increases. Production equations.
8. Availability of nutrients in the soil solution and absorption by the plant.
  - Activity of nutrients in the soil solution.
  - Concept of nutrient availability and bioavailability
  - Mobility of nutrients. Root interception. Mass flow. Diffusion
  - Depletion layer (soil and plant factors)
  - The role of the root in the absorption of nutrients. Morphological structure of the root.
  - The root as an absorption organ. Transportation to the aerial part. Aluminum toxicity.
  - nutritional and biological interactions (ion synergism / antagonism phenomena)
  - The leaf as an absorption organ.
9. Essential elements for plant nutrition.
  - General classification of nutrients. Essential nutrient concept.
  - Macronutrients. Functions in the plant. Visual symptoms of deficiency.
  - Behavior in soil. Micronutrients. Functions in the plant
  - Visual symptoms of deficiency. Behavior in soil.
10. Introduction to fertilizers. Classification of fertilizers.
  - Fertilizers. Chemical / physiological characteristics of fertilizers. Elementary fertilizers.
  - Compost fertilizers. Main features. Preferential times of application.
  - Gradual release fertilizers. Advantages and drawbacks.
  - Organic correctives. Features. Effects on the soil.
  - Mineral corrective (acidifying and alkalizing). Causes of soil acidification.
  - Characteristics of acidifying mineral correctives. Selection criteria.
  - Fertilizer application techniques.
11. Assessment of soil fertility
  - Biological methods. Chemical methods.
  - Soil analysis (sampling; analytical methods; interpretation of results).
  - Analysis of plants (sampling: type of organ, time of year).
  - Concepts of deficiency, sufficiency, excess and toxicity.
  - Advantages and limitations associated with soil fertility assessment methods.

**Recommended reading**

1. RAVEN PH, EVERT RFC & EICHHORN SE (2012). Biology of Plants. 8th ed. , W. H. Freeman and Company. New York
2. KELLER, M (2015). The Science of the grapevines: anatomy and physiology. 2th ed. Elsevier.
3. JAIN, V K (2022) Fundamentals Of Plant Physiology (20th Edition) S. CHAND PUBLISHING
4. SANTOS, J. Q. (2015) Fertilização. Fundamentos agroambientais da utilização dos adubos e corretivos. Publindústria.
5. Havlin, J. L. , Beaton, J. D. , Tisdale, S. L. , & Nelson, W. L. , (2014). Soil Fertility and Fertilizers: An Introduction to Nutrient Management, 8th ed. Pearson

**Teaching and learning methods**

Theoretical lectures with expositive methods, utilization of audio-visual resources. Laboratorial practical exercises

**Assessment methods**

1. Coursework (ordinary students) - (Regular) (Final)
  - Final Written Exam - 45% (practical examination (both components) The final mark must be 9. 5.)
  - Final Written Exam - 55% (Final written exam (theoretical) The final classification must be 9. 5.)
2. Worker Student - (Student Worker) (Final)
  - Final Written Exam - 45% (Final practical written exam The final classification must be 9. 5.)
  - Final Written Exam - 55% (Final written exam The final classification must be 9. 5.)
3. Supplementary exams - (Regular) (Supplementary, Special)
  - Final Written Exam - 45% (Final practical written exam The final classification must be 9. 5.)
  - Final Written Exam - 55% (Final written exam (theoretical) The final classification must be 9. 5.)

**Language of instruction**

Portuguese

**Electronic validation**

Ana Maria Antão Gerales, Zulimar Hernández Hernández	Margarida Maria Pereira Arrobas Rodrigues	António Castro Ribeiro	Maria Sameiro Ferreira Patrício
21-01-2024	22-01-2024	27-01-2024	29-01-2024