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| **STUDY PROGRAMME:** | **Professional Undergraduate Study Programme Agriculture** Specific field of study: Plant production |
| **Course:** | **PLANT NUTRITION** |
| **Course code: 273283****Course status: compulsory** | **Semester: III** | **ECTS credits: 5,0** |
| **Course holder:**  | **Ivka Kvaternjak,** Ph.D., professor of professional studies |
| **Course associates:**  | **Filip Rutić**, MSc, assistent |
| **Modes of delivery:** | **Number of hours** |
| **Lectures** | 45 |
| **Excersises,** | 20  |
| **Seminars** | 10 |
| **Practical training** | 8 |

**Course objectives:** To train students to be able to plan the proper fertilization of plant crops in direct production, using the acquired knowledge of plant nutrition, to achieve satisfactory yields, with optimal utilization of the potential of plant fertility and soil fertility, to maximally preserve natural resources, healthy water, ecosystem biodiversity, and the fertility and productivity of land surfaces .

**Course content**

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|  | **Course units**  |  | **Modes of delivery:** | **Places of delivery** |
| L | E | S | PT |  |
| 1. | Introduction to plant nutrition as a scientific discipline, definitions, biogenic elements, division according to amounts needed for the plant and physiological functions | 3 | - | - | - | Lecture hall |
| 2. | Soil as a source of plant nutrients, soil features important for plant nutrition | 3 | - | 1 | - | Lecture hall |
| 3. | Forms of nutrients in the soil and their dynamics. Factors affecting nutrient intake.  | 3 | - | - | - |
| 4. | Receiving nutrients through roots and leaves, changes in nutrient content in the plant.  | 3 | - | 2 | - |
| 5. | Soil fertility, Knowledge test (1st colloquium) | 3 | - | 1 | - |
| 6. | Nitrogen - sources, soil and plant content, uptake, physiological role, biological fixation, losses from the soil, symptoms of deficiency and excess.  | 3 | - | 1 | - |
| 7. | Phosphorus - sources, content in soil and plant, intake, content, physiological role, losses from soil, symptoms of deficiency and excess. | 3 | - | - | - |
| 8. | Potassium - sources, average content in soil and plant, intake, physiological role, losses from soil, symptoms of deficiency and excess. | 3 | - | - | - |
| 9. | Calcium - sources, average content in soil and plant, intake, physiological role, losses from soil, symptoms of deficiency and excess  | 3 | - | 1 | - | Lecture hall |
| 10. | Sulfur and magnesium - sources, content in soil and plant, intake, physiological role, losses from soil, symptoms of deficiency and excess. | 3 | - | - | - |
| 11. | Knowledge test (II colloquium) | 3 | - | - | - |
| 12. | Iron, manganese and molybdenum - sources, intake, content in soil and plant, physiological role, losses from soil, symptoms of deficiency and excess.  | 3 | - | - | - |  |
| 13. | Zinc, copper and boron - sources, uptake, distribution and content in the soil and plant, physiological role, losses from the soil, symptoms of deficiency and excess. | 3 | - | - | - |  |
| 14. | Useful elements. Non-essential heavy metals in the soil: lead, cadmium, chromium, mercury, arsenic. | 3 | - | 2 | - |  |
| 15. | Mineral fertilizers: division of mineral fertilizers, nitrogen, phosphorus and potassium, complex mineral fertilizers, crystallons.  | 3 | - | 2 | - |  |
|  | Organic fertilizers: division, properties and application, bacterial fertilizers. Good agricultural practice in the use of fertilizers, Nitrate Directive, Knowledge test (III colloquium) |  |  |  |  |  |
| 1. | Exercises | - | 2 | - | - | Lecture hall |
| 2. | Soil fertility control: organization and implementation  | - | 2 | - | - | Lecture hall/field |
| 3. | Taking and preparing soil samples for analysis  | - | 2 | - | - | Laboratory |
| 4. | Determination of soil reactions: pH in water and 1M KCl, Hydrolytic acidity  | - | 2 | - | - |
| 5. | Determination of replaceable aluminum by the Sokolov method. Determination of the amount of total carbonates by Scheibler  | - | 2 | - | - | Laboratory |
| 6. | Determination of the amount of physiologically active lime according to Druineau-Galet. Determining the amount of humus by the bichromate method  | - | 2 | - | - |
| 7. | Determination of the amount of nitrogen in the soil: Total according to Kjeldahl and mineral.  | - | 2 | - | - |
| 8. | Spectrophotometry. Flame photometry, Atomic absorption spectrometry, determination of microelements in soil | - | 2 | - | - | Laboratory |
| 9. | Determination of plant-accessible phosphorus and potassium in the soil using the AL-method.  | - | 2 | - | - | Lecture hall |
| 10. | Interpretation of results and calculations  | - | 2 |  | - |
|  | **Professional practice: a research assignment** |  |
| 1. | Taking a soil sample and delivering it to the laboratory, drying it.  | - | - | - | 1 | Field |
| 2. | Soil sample preparation, Analytical procedures, basic analysis for fertilization planning. | - | - | - | 3 | Laboratory |
| 3. | Interpretation of results, instructions for writing a research paper | - | - | - | 2 | Lecture hall |
| 4. | Preparation of a report on the control of soil fertility on the family farm and fertilization planning for one crop | - | - | - | 2 | Lecture room, independent work |

L=Lectures, E=Excersises, S=Seminars, PT=Practical training

**Learning outcomes (LO)**

After passing the exam, the student will be able to:

LO 1. Classify plant nutrients according to amounts needed by plants and physiological functions

LO 2. Create favorable conditions in the soil for the growth and development of plant species

LO 3. Valorize the role of essential macro and micronutrients and the harmfulness of toxic elements

LO 4. Assess the symptoms of excess and deficiency of certain essential macro and micronutrients

LO 5. Rank fertilizers according to purpose, origin and harm to the environment

LO 6. Recommend rational fertilization based on soil analysis

**Course holder:**

Ivka Kvaternjak, Ph.D., professor of professional studies

Križevci, July 2024