UNIVERSITATEA DE ŞTIINŢE AGRICOLE ŞI MEDICINĂ VETERINARĂ CLUJ-NAPOCA
Facultatea de Agricultură
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No._____of _____ **USAMV form 0102020108 (discipline code)**

SUBJECT OUTLINE

1. Information on the programme

1.1. Higher education institution	**University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca**
1.2. Faculty	**Agriculture**
1.3. Department	Technical Sciences and Soil Sciences
1.4. Field of study	Agronomy
1.5. Cycle of study[1]	Bachelor
1.6. Specialization/ Study programme	Montanology / 4 years
1.7. Form of education	Full-time

2. Information on the discipline

2.1. Discipline name	**AGROCHEMISTRY 1**							
2.2. Course coordinator				Prof. PhD Mărghitaş Marilena				
2.3. Seminar/ laboratory/ project coordinator				Lecturer PhD Pop Tiberia Ioana				
2.4. Year of study	II	2.5. Semester	I	2.6. Evaluation type	Summative (E)	2.7. Discipline status	Content[2]	DD
							Compulsoriness[3]	DI

3. Total estimated time (teaching hours per semester)

3.1. Hours per week – full time programme	**4**	**out of which: 3.2. lecture**	**2**	**3.3. seminar/ laboratory/ project**	**2**
3.4.Total number of hours in the curriculum	**56**	**out of which: 3.5. lecture**	**28**	**3.6.seminar/laboratory**	**28**

Distribution of the time allotted	hours
3.4.1. Study based on books, textbooks, bibliography and notes	20
3.4.2. Additional documentation in the library, electronic platforms and field experiences	15
3.4.3. Preparing seminars/ laboratories/ projects, subjects, reports, portfolios and essays	15
3.4.4. Tutorials	4
3.4.5. Examinations	15
3.4.6. Other activities	

3.7. Total hours of individual study	64
3.8. Total hours per semester	120
3.9. Number of credits[4]	4

4. Prerequisites (if applicable)

4.1. curriculum-related	Mathematics, Chemistry, Pedology, Botany, Biochemistry, Biophysics and Agrometeorology, Plant Physiology, Agrotechnology and Experimental Technique, Zootechnics
4.2. skills-related	The student must have theoretical knowledge regarding the agroecosystem, environmental factors and the measures exercised by humans on them, because the bioproductivity of agroecosystems depends on climatic, nutritional, biological and socio-economic factors (management).

5. Conditions (if applicable)

5.1. for the course	The course is interactive, students can ask questions about the content of the lecture. The university subject requires the observance of the starting and finishing time of the lecture. No other activities are tolerated during the lecture, the cell phones must be closed.
5.2. for the	During the practical laboratory work, the presence of the specialized teacher in the

seminar/ laboratory/ project	agrochemical field and her consultation during the agrochemical analysis is mandatory. Each student will carry out an individual activity with the laboratory materials provided and described in the procedures and laboratory guide. Academic discipline is imperative during the agrochemical laboratories and field work.

6. Cumulated specific competences

Professional competences	To know the agronomic and agrochemical language specific to the understanding of Agrochemistry; To know the characteristics and the functioning of the bioproductivity of ecosystems; To understand the theoretical principles and practical measures underlying the knowledge of agrochemical resources and the management of their use in agriculture and horticulture, under the conditions of agrochemical optimization of the soil-plant system and obtaining higher agricultural and horticultural products quantitatively and qualitatively, as well as their profitability; To acquire knowledge regarding the use of natural organic resources, land management and fertilization of agricultural and horticultural systems, good agricultural practices, respect for nature and biodiversity (ecological management, management of animal husbandry and maintenance) according to the proposed EU strategy for rural and urban space development; To understand the impact of anthropic activities on the environment and remedial measures to be taken; To be able to implement the measures of the development of the green spaces in the urban areas, the mountain areas, the strengthening of the specific management of the rural areas, the development of the villages and their evolution towards the modern civilization.
Transversal competences	To demonstrate the ability to characterize the main agrochemical indices underlying the rational fertilization of plants and the main natural and mineral organic resources applied in sustainable agriculture systems; To acquire the students' theoretical knowledge based on the use of fertilizers and amendments to agricultural and horticultural crops as well as the economic and ecological basis of fertilizer consumption in agriculture and horticulture for the sustainable increase of soil fertility and maintaining ecological balance in existing agroecosystems; To be able to monitor the main agrochemical factors of differentiation of nutrient doses for plants in order to achieve rational and efficient fertilization in increasing soil fertility and productivity and higher quality and quantitative plant productions that ensure food safety and security; To be able to determine the economic efficiency of the soil-plant-fertilizer system at different agricultural crops; To participate in the activities of agrochemical monitoring of soils and the research program of the nutrition of plant species and the management of nutrients and fertilizers of Agrochemistry.

7. Discipline objectives (based on the cumulated specific competences)

7.1. General objective	To acquire the knowledge regarding the role of nutrients in plants life and the need of plants for nutrients. To acquire the efficiency and optimization of fertilization systems for the main plant species. To obtain higher agricultural and horticultural productions quantitatively and qualitatively with maintaining and increasing soil fertility and implicitly the real protection of agro-ecosystems for sustainable agriculture and a clean and healthy environment.
7.2. Specific objectives	To know the chemical composition of the plant and the specific and global nutrient consumption of each plant in order to correctly determine the optimal economic doses of fertilizers in agro-ecosystems and ecosystems; To know the main agrochemical indices of soils that underlie the calculation of optimum economic doses of fertilizers for plants and the landscapes for obtaining quality crops and organizing the green spaces with diversified species; To know the main characteristics of the natural organic and mineral agrochemical resources used in agricultural and horticultural works; To acquire practical and decisional skills in the field.

8. Content

8.1. COURSE **Number of hours –28**	Teaching methods	Observation
Chapter 1. Agrochemistry - interdisciplinary science 1.1. Definition, object and brief history of agrochemistry; 1.2. Agrochemical laws, principles, concepts and theories over time; 1.3. Chemistry in the context of agricultural systems.	Lecture	1 lecture = 2 hours
Chapter 2. The agrochemical basis of fertilization in relation to the role and requirements of nutrients in plants 2.1. Chemical and elemental composition of plants; 2.2. Classification of the elements involved in plant nutrition and crop	Lecture	3 lectures = 6 hours

fertilization; 2.3. The nutrient supply states of plants; 2.4. Nutrient requirements of plants; 2.5. Diagnosis of negative vegetation states caused by insufficient or excessive nutrients. **Chapter 3. Soil as a mean of plant nutrition and application of fertilizers and amendments** 3.1. Soil as a polydisperse system. Component phases; 3.2. The role of clay minerals and humus in soil chemistry, physics and biology; 3.3. Forms of mineral elements in soils; 3.4. Soil fertility - specific and fundamental trait - Relevant agrochemical indicators of soil fertility. **Chapter 4. Correction of the reaction, improvement of the ionic composition and fertility of the acidic and saline-alkaline soils** 4.1. Correction of acid reaction of soils: 4.1.1. Criteria and agrochemical indices used in the quantitative determination of acid soil improvement parameters; 4.1.2. Plants requirements depending on soil reaction. Plant sensitivity to aluminum toxicity; 4.1.3. Amendments for acid soils. Calculation of amendments doses; 4.1.4. The complex program for acid soil improvement. 4.2. Correction of alkaline reaction and soil salinity: 4.2.1. Criteria and agrochemical indices used in the initial and quantitative determination of parameters for improving saline-alkaline soils; 4.2.2. Plant tolerance to salinity; 4.2.3. Amendments for saline-alkaline soils. Calculation of amendments doses; 4.2.4. The complex program for saline and alkaline soils improvement. **Chapter 5. Fertilizers - means of quantitative and qualitative increase of plant production and soil fertility.** 5.1. Definition of fertilizers and their classification; 5.2. Physical and chemical indicators for the characterization of fertilizer quality; 5.3. Chemical (mineral) fertilizers with primary macroelements (N, P, K): 5.3.1. Simple nitrogen fertilizers: Nitrogen in soil-plant; Classification and types of nitrogen fertilizers (ammoniacal, nitric, nitric and ammoniacal, amidic, slowly soluble amidic, nitrogenous liquids); Efficiency conditions for nitrogen fertilizers. 5.3.2. Simple fertilizers with phosphorus: Phosphorus in soil-plant; Classification and types of phosphorus fertilizers (soluble in water, in conventional reagents and in strong acids); Efficiency conditions for phosphorus fertilizers. 5.3.3. Simple fertilizers with potassium: Potassium in soil-plant; Classification and types of potassium fertilizers (raw potassium salts, soluble potassium salts, other potassium resources); Efficiency conditions for potassium fertilizers.	Lecture Lecture Lecture	2 lectures = 4 hours 3 lectures = 6 hours 5 lectures = 10 hours

8.2. PRACTICAL WORKS **Number of hours – 28**	Teaching methods	Observation
1. Labor protection training. Introduction to the agrochemical soil analysis laboratory. Visiting the profile laboratories (OSPA).	Laboratory	1 lab = 2 hours
2. Control of soil fertility by soil analysis and plant analysis.	Laboratory	1 lab = 2 hours
3. Determination of humidity, dry matter, methods of mineralization of plant material.	Laboratory	1 lab = 2 hours
4. Determination of soil pH and conductivity.	Laboratory	1 lab = 2 hours
5. Determination of humus (C-organic) from the soil, calculation of the nitrogen index (IN) for interpreting nitrogen supply status of the soil.	Laboratory	1 lab = 2 hours
6. Determination of mineral forms of nitrogen (nitric and ammoniacal) in soil.	Laboratory	1 lab = 2 hours
7. Determination of mobile phosphorus - assimilable from soil.	Laboratory	1 lab = 2 hours
8. Determination of mobile potassium - assimilable from the soil.	Laboratory	1 lab = 2 hours
9. Determination of calcareous amendments doses in acidic soils (according to relevant acidity indexes - pH, V%, Ah, Al mobile, PNA).	Laboratory	1 lab = 2 hours
10. Determination of gypsum dose amendments for saline-alkaline soils (after exchangeable Na content, PSA).	Laboratory	1 lab = 2 hours
11. Determination of iron (Fe^{2+} and Fe^{3+}) in soil and interpretation of results in relation to chlorinated power indices (CPI).	Laboratory	1 lab = 2 hours

12. Determination of the active CaCO3 in soil and calculation and interpretation of the chlorinating power indices (CPI).	Laboratory	1 lab = 2 hours
13. Determination of heavy metals in soil (copper, lead, zinc, cadmium, cobalt, manganese).	Laboratory	1 lab = 2 hours
14. Knowledge checking.	Laboratory	1 lab = 2 hours

Compulsory bibliography:

1. Avarvarei I. şi colab., 1997, Agrochimie., Ed Sitech, Craiova ;
2. Rusu M.,1992,1993, Agrochimie,(vol, I, II),Tipo Agronomia, Cluj-Napoca ;
3. Marilena Mărghitaş, Cătălin Băluţiu, 1996, Agrochimie – Lucrări practice, Tipo Agronomia, Cluj-Napoca ;
4. Marilena Mărghitaş, 2003, Agrochimie, Ed. AcademicPres, Cluj-Napoca ;
5. Rusu Mihai, Marilena Mărghitaş, Tania Mihăiescu, I.Oroian, Adelina Dumitraş, 2005, Tratat de Agrochimie, Ed. Ceres, Bucureşti ;
6. Marilena Mărghitaş, M. Rusu, Tania Mihăiescu, 2005, Fertilizarea plantelor agricole şi horticole, Ed. AcademicPres, Cluj-Napoca ;
7. Mihai Rusu, Marilena Mărghitaş şi colab., 2010, Cartarea agrochimică - Studiu agrochimic al solurilor - Ed. AcademicPres, Cluj-Napoca ;
8. Marilena Mărghitaş şi colab., 2011, Manual de bune practici în tehnologia fertilizării plantelor agricole, Ed. AcademicPres, Cluj-Napoca ;

Optional bibliography:

1.Hera C., Z. Borlan, 1980, Ghid pentru alcătuirea planurilor de fertilizare, Ed. Ceres, Bucureşti ;
2.Borlan Z., C. Hera, 1982, Tabele şi nomograme agrochimice, Ed. Ceres, Bucureşti ;
3.Borlan Z. şi colab., 1994, Compendiu de Agrochimie, Ed.Ceres, Bucureşti ;
4.Velicica Davidescu, D. Davidescu, 2002, Compendiu agrochimic, Ed. Academiei, Bucureşti ;
5.Marilena Mărghitaş, Mihai Rusu, 2003, Utilizarea îngrăşămintelor şi amendamentelor în agricultură, Ed. AcademicPres, Cluj-Napoca ;

9. Corroborating the discipline content with the expectations of the epistemic community representatives, of the professional associations and of the relevant employers in the corresponding field

In order to identify ways of modernizing and continuously improving the teaching and the content of the courses, with the most current topics and practical problems, the teacher and students participate in the annual symposium of the USAMV Cluj-Napoca, the Agriculture and Horticulture section and the annual SNRSS Conference where current issues of Agrochemistry and the management of the use of fertilizers and nutrients in Agriculture are discussed.

10. Evaluation

Type of activity	10.1. Evaluation criteria	10.2. Evaluation type	10.3. Percentage of the final grade
10.4. Course	Definition, object and brief history of agrochemistry; The importance of agriculture in the sustainable development of economy; Chemical and elemental composition of plants; The role of nutrients in plant life; Nutritional disorders in plant nutrition; Soil as a nutrition medium for plants and application of fertilizers and amendments; Agrochemical resources used as amendments for acid and alkaline soils; Agrochemical resources used as fertilizers in agriculture - Fertilizers, definition, classification, efficiency conditions; The main chemical fertilizers (minerals) with primary macroelements (N, P, K) used as fertilizers in agricultural and horticultural plants.	summative(E)	70%
10.5. Seminar/Laboratory	Working methodologies used in soil and plant sampling for the control and evaluation of soil fertility status through soil analysis, plant and agrochemical mapping; Determination of the main agrochemical indices of soil that underlie the characterization of the regime of humic organic matter (humus), nitrogen, phosphorus, potassium, iron and CaCO3 active in the	A brief check is given at the beginning of each laboratory and the final grade by practical exam at the end of the semester	30%

	soil; Determination of agrochemical indices specific to acidic and saline-alkaline soils in order to establish the correct dosage of limestone and gypsum amendments; Determination of heavy metals (Cu, Pb, Zn, Cd, Mn) from soil.		

10.6. Minimum performance standards

Mastering of scientific information transmitted through lectures and laboratories at an acceptable level. Obtaining a passing grade for practical laboratories and lectures is a condition of passing the exam.

1 Cycle of studies - choose one of the three options: Bachelor/Master/Ph.D.

2 according to the educational plan

3 Discipline status (compulsoriness) - choose one of the options – **DI** (compulsory discipline) **DO** (optional discipline) **DFac** (facultative discipline).

4 One credit is equivalent to 25-30 hours of study (teaching activities and individual study).

Filled in on
04.09.2019

Course coordinator
Prof. PhD Mărghitaș Marilena

Laboratory work/seminar coordinator
Lecturer Phd Pop Tiberia Ioana

Approved by the department on
05.09.2019

Head of the Department
Assoc. Prof. PhD. Ranta Ovidiu