UNIVERSITATEA DE ŞTIINŢE AGRICOLE ŞI MEDICINĂ VETERINARĂ CLUJ-NAPOCA
Facultatea de Agricultură
Calea Mănăştur 3-5, 400372, Cluj-Napoca, România
Tel: 0264-596.384, Fax: 0264-593.792
www.usamvcluj.ro

No._____of _____ USAMV form 0102020109 (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 2**							
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	II	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	10
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	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 5 (continuation of fertilizers from sem 1) 5.4. Chemical (mineral) fertilizers with secondary macroelements (S, Ca, Mg): 5.4.1. Simple sulfur fertilizers: Sulfur in soil-plant; Classification and types of sulfur fertilizer resources (amendments, mineral fertilizers with other elements, other resources); Conditions for the efficient application of sulfur fertilizers. 5.4.2. Fertilizers and other resources with calcium: Calcium in soil-plant; Classification of calcium fertilizer resources (amendments to acidic soils, amendments to alkaline soils, fertilizers with other elements); Conditions for the	Lecture	8 lectures = 16 hours

efficient application of calcium fertilizer resources. 5.4.3. Fertilizers with magnesium: Magnesium in soil-plant; Classification of magnesium fertilizing resources (mineral salts and natural rocks); Conditions for the efficient application of magnesium fertilizer resources. 5.5. Fertilizers with microelements (Fe, Mn, Cu, Zn, B, Mo): 5.5.1. Iron fertilizers: Iron in soil-plant; Chloride power indices; Classification of iron fertilizers (mineral salts and iron chelates); Conditions for the efficient application of iron fertilizers. 5.5.2. Manganese fertilizers: Manganese in soil-plant; Classification of manganese fertilizers (mineral salts and manganese chelates); Conditions for the efficient application of manganese fertilizers. 5.5.3. Copper fertilizers: Copper in soil-plant; Classification of copper fertilizers (mineral salts and copper chelates); Conditions for the efficient application of copper fertilizers. 5.5.4. Zinc fertilizers: Zinc in soil-plant; Zinc fertilizers (mineral salts and zinc chelates); Conditions for the efficient application of zinc fertilizers. 5.5.5. Fertilizers with boron: Boron in soil-plant; Boron fertilizers (boron mineral compounds); Conditions for efficient application of boron fertilizers. 5.5.6. Fertilizers with molybdenum: Molybdenum in soil-plant; Fertilizers with molybdenum (mineral salts); Conditions for efficient application of molybdenum fertilizers. 5.6. Complex and mixed (compound) mineral fertilizers with 2-3 and more fertilizing elements. Classification, trends and the role of fertilization with compound fertilizers in agricultural and horticultural technologies, perspectives: 5.6.1. Solid complex fertilizers (binary and ternary); 5.6.2. Complex liquid fertilizers (soil, crystalline and foliar solutions); 5.6.3. Mixed fertilizers; 5.6.4. Ionic fertilizers (organo-minerals); 5.7. Natural organic fertilizers: Classification, advantages of use; Organic fertilizer types (manure, semi-liquid manure, poultry manure, sewage sludge-settling, vegetable and household residues, peat, compost, green manure); Conditions for the efficient application of organic fertilizers. 5.8. Fertilizer storage, handling and application: Fertilizer storage; Methods of application of fertilizers.		
Chapter 6. Determination of fertilizer doses 6.1. Agrochemical, economic and technical doses used in fertilization; 6.2. Determination of doses of organic fertilizers; 6.3. Establishing the doses of mineral fertilizers according to the nutritional factors of plants, soil and economics; 6.4. Establishing fertilizer doses for crops in protected areas; 6.5. Preparation of the fertilization program.	Lecture	1 lecture=2 hours
Chapter 7. Soil fertility control by agrochemical methods 7.1. Generalities, definitions, history, perspectives; 7.2. Agrochemical methods for soil fertility control: Soil analysis; Plant analysis; Experiences with fertilizers and production curves; Agrochemical mapping; 7.3. Monitoring of soil quality status.	Lecture	1 lecture=2 hours
Chapter 8. Fertilizers and crop quality 8.1. The effect of macro- and microelements on crop quality; 8.2. Principles related to quality indicators and safety - food security.	Lecture	1 lecture=2 hours
Chapter 9. Principles and methods of rational use of fertilizers in agricultural and horticultural crops: 9.1. Factors and methods that condition the effect of fertilizers; 9.2. Principles of fertilizer application in agricultural crops; 9.3. Principles of fertilizer application in natural and sown meadows; 9.4. Principles of fertilizer application in field grown vegetables; 9.5. Principles of fertilizer application in vegetables grown in greenhouses and solariums; 9.6. Principles of fertilizer application in vineyards; 9.7. Principles of fertilizer application in apple orchards; 9.8. Principles of fertilizer application in floricultural, ornamental and dendrological crops.	Lecture	2 lectures=4 hours
Chapter 10. Protection of agroecosystems in the context of the use of fertilizers and amendments 10.1. Pollution of soil and plant products. Prevention and pollution measures; 10.2. Resources of conventional and unconventional nature effective in	Lecture	1 lecture= 2hours

fertilization.		

8.2. PRACTICAL WORKS Number of hours – 28	Teaching methods	Observation
1. Identification and quality control of fertilizers and amendments-generalities, classification;	Laboratory	1 lab=2 hours
2. Collecting and preparing fertilizer samples for analysis;	Laboratory	1 lab=2 hours
3. Classical methods of fertilizer identification through preliminary analyzes (indicative analysis, coal burning and flame burning);	Laboratory	1 lab=2 hours
4. Qualitative study and identification of nitrogen fertilizers used in agricultural practice;	Laboratory	1 lab=2 hours
5. Qualitative study and identification of phosphorus fertilizers used in agricultural practice;	Laboratory	1 lab=2 hours
6. Qualitative study and identification of potassium fertilizers used in agricultural practice;	Laboratory	1 lab=2 hours
7. Qualitative study and recognition of the main complex and mixed (compound) fertilizers used in agricultural practice;	Laboratory	1 lab=2 hours
8. Qualitative study and recognition of the main natural organic fertilizers used in agricultural practice;	Laboratory	1 lab=2 hours
9. Determination of the active substance content of nitrogen fertilizers (calculation of the s.a. content and establishing the s.b./ha dose);	Laboratory	1 lab=2 hours
10. Determination of the active substance content of phosphorus fertilizers (calculation of s.a. content and determination of s.b./ha dose);	Laboratory	1 lab=2 hours
11. Determination of the active substance content of the potassium fertilizers (calculation of the s.a. content and establishing the s.b./ha dose);	Laboratory	1 lab=2 hours
12. Determining the CaCO3 content of the amendments and establishing their neutralization power (NAP);	Laboratory	1 lab=2 hours
13. Recognition of the main pesticides used for chemical protection in agriculture;	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	Chemical (mineral) fertilizers with secondary macroelements (S, Ca, Mg); Fertilizers with microelements (Fe, Mn, Cu, Zn, B, Mo); Complex and mixed (compound) mineral fertilizers with 2-3 and more fertilizing elements. Classification, trends and the role of fertilization with compound fertilizers in agricultural and horticultural technologies, perspectives; Natural organic fertilizers: Classification, advantages of use; Organic fertilizer types; Fertilizer storage, handling and application: Fertilizer storage; Methods of fertilizer application; Establishing fertilizer doses and harvest quality; Agrochemical methods of soil fertility control; Principles and methods of rational use of fertilizers in the main agricultural and horticultural crops; Protection of agroecosystems in the context of the use of fertilizers and amendments.	summative(E)	70%
10.5. Seminar/Laboratory	Working methodologies used in the sampling of fertilizers for the qualitative and quantitative analysis; Classical methods of fertilizer identification through preliminary analysis (indicative analysis, coal burning and flame burning); Qualitative study and identification of fertilizers with nitrogen, phosphorus, potassium, of complex and mixed fertilizers and natural organic used in agricultural practice; Qualitative study of the main fertilizers with nitrogen, phosphorus and potassium used in agriculture by determining their active substance content and determining the doses of s.b./ha (commercial substance/ha); Qualitative study of calcareous amendments used in agriculture by determining the $CaCO_3$ content and establishing the neutralization power of the amendment (NAP); Recognition of the main pesticides used for chemical protection in agriculture. Solved agrochemical problems and interpretation of agrochemical mapping.	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%
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 PhDPop Tiberia Ioana

Approved by the department on 05.09.2019

Head of the Department
Assoc. Prof. PhD Ranta Ovidiu