



UNIVERSITATEA DE ȘTIINȚE AGRICOLE ȘI MEDICINĂ VETERINARĂ CLUJ-NAPOCA

Facultatea de Agricultură

Calea Mănăstur 3-5, 400372, Cluj-Napoca, România

Tel: 0264-596.384, Fax: 0264-593.792

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No. _____ of _____

USAMV form 0101020109 (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	Agriculture / 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 Mărghitaș 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.
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6. Cumulated specific competences

Professional competences	<p>To know the agronomic and agrochemical language specific to the understanding of Agrochemistry;</p> <p>To know the characteristics and the functioning of the bioproductivity of ecosystems;</p> <p>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;</p> <p>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;</p> <p>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.</p>
Transversal competences	<p>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;</p> <p>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;</p> <p>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;</p> <p>To be able to determine the economic efficiency of the soil-plant-fertilizer system at different agricultural crops;</p> <p>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.</p>

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	<p>To know the types of simple and compound chemical (mineral) fertilizers as well as the natural organic resources needed in the fertilization programs of agricultural and horticultural plants;</p> <p>To know the main agrochemical indices of the soils that are the basis of the correct calculation of the optimum economic doses of fertilizers in the main plant species of cultivated plants for obtaining quality crops;</p> <p>To know the agrochemical methods for controlling the soil fertility status: Soil analysis; Plant analysis; Experiences with fertilizers and production curves; Agrochemical mapping;</p> <p>To know the principles and methods of rational use of fertilizers in horticultural crops in the context of the real protection of agroecosystems;</p> <p>To acquire practical and decisional skills in the field.</p>

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;	Lecture	8 lectures = 16 hours

<p>Classification of calcium fertilizer resources (amendments to acidic soils, amendments to alkaline soils, fertilizers with other elements); Conditions for the efficient application of calcium fertilizer resources.</p> <p>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.</p> <p>5.5. Fertilizers with microelements (Fe, Mn, Cu, Zn, B, Mo):</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>5.5.4. Zinc fertilizers: Zinc in soil-plant; Zinc fertilizers (mineral salts and zinc chelates); Conditions for the efficient application of zinc fertilizers.</p> <p>5.5.5. Fertilizers with boron: Boron in soil-plant; Boron fertilizers (boron mineral compounds); Conditions for efficient application of boron fertilizers.</p> <p>5.5.6. Fertilizers with molybdenum: Molybdenum in soil-plant; Fertilizers with molybdenum (mineral salts); Conditions for efficient application of molybdenum fertilizers.</p> <p>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:</p> <p>5.6.1. Solid complex fertilizers (binary and ternary);</p> <p>5.6.2. Complex liquid fertilizers (soil, crystalline and foliar solutions);</p> <p>5.6.3. Mixed fertilizers;</p> <p>5.6.4. Ionic fertilizers (organo-minerals);</p> <p>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.</p> <p>5.8. Fertilizer storage, handling and application: Fertilizer storage; Methods of application of fertilizers.</p> <p>Chapter 6. Determination of fertilizer doses</p> <p>6.1. Agrochemical, economic and technical doses used in fertilization;</p> <p>6.2. Determination of doses of organic fertilizers;</p> <p>6.3. Establishing the doses of mineral fertilizers according to the nutritional factors of plants, soil and economics;</p> <p>6.4. Establishing fertilizer doses for crops in protected areas;</p> <p>6.5. Preparation of the fertilization program.</p> <p>Chapter 7. Soil fertility control by agrochemical methods</p> <p>7.1. Generalities, definitions, history, perspectives;</p> <p>7.2. Agrochemical methods for soil fertility control: Soil analysis; Plant analysis; Experiences with fertilizers and production curves; Agrochemical mapping;</p> <p>7.3. Monitoring of soil quality status.</p> <p>Chapter 8. Fertilizers and crop quality</p> <p>8.1. The effect of macro- and microelements on crop quality;</p> <p>8.2. Principles related to quality indicators and safety - food security.</p> <p>Chapter 9. Principles and methods of rational use of fertilizers in agricultural and horticultural crops:</p> <p>9.1. Factors and methods that condition the effect of fertilizers;</p> <p>9.2. Principles of fertilizer application in agricultural crops;</p> <p>9.3. Principles of fertilizer application in natural and sown meadows;</p> <p>9.4. Principles of fertilizer application in field grown vegetables;</p> <p>9.5. Principles of fertilizer application in vegetables grown in greenhouses and solariums;</p> <p>9.6. Principles of fertilizer application in vineyards;</p> <p>9.7. Principles of fertilizer application in orchards;</p> <p>9.8. Principles of fertilizer application in floricultural, ornamental and dendrological crops.</p> <p>Chapter 10. Protection of agroecosystems in the context of the use of fertilizers and amendments</p>	<p>Lecture</p> <p>Lecture</p> <p>Lecture</p> <p>Lecture</p> <p>Lecture</p>	<p>1 lecture=2 hours</p> <p>1 lecture=2 hours</p> <p>1 lecture=2 hours</p> <p>2 lectures=4 hours</p> <p>1 lecture= 2hours</p>
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10.1. Pollution of soil and plant products. Prevention and pollution measures; 10.2. Resources of conventional and unconventional nature effective in fertilization.		
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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 CaCO ₃ 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
<i>Compulsory bibliography:</i>		
1. Avarvarei I. și colab., 1997, Agrochimie., Ed Sitech, Craiova ;		
2. Rusu M.,1992,1993, Agrochimie,(vol, I, II),Tîpo Agronomia, Cluj-Napoca ;		
3. Marilena Mărghitaș, Cătălin Băluțu, 1996, Agrochimie - Lucrări practice, Tîpo Agronomia, Cluj-Napoca ;		
4. Marilena Mărghitaș, 2003, Agrochimie, Ed. AcademicPres, Cluj-Napoca ;		
5. Rusu Mihai, Marilena Mărghitaș, Tania Mihăiescu, I.Oroian, Adelina Dumitraș, 2005, Tratat de Agrochimie, Ed. Ceres, București ;		
6. Marilena Mărghitaș, M. Rusu, Tania Mihăiescu, 2005, Fertilizarea plantelor agricole și horticole, Ed. AcademicPres, Cluj-Napoca ;		
7. Mihai Rusu, Marilena Mărghitaș și colab., 2010, Cartarea agrochimică - Studiu agrochimic al solurilor - Ed. AcademicPres, Cluj-Napoca ;		
8. Marilena Mărghitaș și colab., 2011, Manual de bune practici în tehnologia fertilizării plantelor agricole, Ed. AcademicPres, Cluj-Napoca		
<i>Optional bibliography:</i>		
1.Hera C., Z. Borlan, 1980, Ghid pentru alcătuirea planurilor de fertilizare, Ed. Ceres, București ;		
2.Borlan Z., C. Hera, 1982, Tabele și nomograme agrochimice, Ed. Ceres, București ;		
3.Borlan Z. și colab., 1994, Compendiu de Agrochimie, Ed.Ceres, București ;		
4.Velicica Davidescu, D. Davidescu, 2002, Compendiu agrochimic, Ed. Academiei, București ;		
5.Marilena Mărghitaș, Mihai Rusu, 2003, Utilizarea îngrășămintelor și 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
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			grade
10.4. Course	<p>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.</p>	summative(E)	70%
10.5. Seminar/Laboratory	<p>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 CaCO₃ 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.</p>	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 Mărghită 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