



# UNIVERSITÀ DEGLI STUDI DI PALERMO

<b>DEPARTMENT</b>	Scienze Agrarie, Alimentari e Forestali		
<b>ACADEMIC YEAR</b>	2018/2019		
<b>BACHELOR'S DEGREE (BSC)</b>	AGRICULTURAL SCIENCES AND TECHNOLOGIES		
<b>INTEGRATED COURSE</b>	SOIL FERTILITY - INTEGRATED COURSE		
<b>CODE</b>	18749		
<b>MODULES</b>	Yes		
<b>NUMBER OF MODULES</b>	2		
<b>SCIENTIFIC SECTOR(S)</b>	AGR/13, AGR/16		
<b>HEAD PROFESSOR(S)</b>	MOSCHETTI GIANCARLO	Professore Ordinario	Univ. di PALERMO
<b>OTHER PROFESSOR(S)</b>	LAUDICINA VITO ARMANDO	Professore Ordinario	Univ. di PALERMO
	MOSCHETTI GIANCARLO	Professore Ordinario	Univ. di PALERMO
<b>CREDITS</b>	9		
<b>PROPAEDEUTICAL SUBJECTS</b>	01933 - ORGANIC CHEMISTRY		
<b>MUTUALIZATION</b>			
<b>YEAR</b>	2		
<b>TERM (SEMESTER)</b>	1° semester		
<b>ATTENDANCE</b>	Not mandatory		
<b>EVALUATION</b>	Out of 30		
<b>TEACHER OFFICE HOURS</b>	<p><b>LAUDICINA VITO ARMANDO</b> Wednesday 11:00 14:00 Dip. SAAF, 1° piano, studio 142</p> <p><b>MOSCHETTI GIANCARLO</b> Monday 11:00 13:00 Palermo, Via delle Scienze, Edificio 5 primo piano Studio Prof. Giancarlo Moschetti Tuesday 11:00 12:00 Palermo, Via delle Scienze, Edificio 5 primo piano Studio Prof. Giancarlo Moschetti</p>		

DOCENTE: Prof. GIANCARLO MOSCHETTI

<b>PREREQUISITES</b>	Fundamentals of general and inorganic chemistry, and organic chemistry, basic knowledge
<b>LEARNING OUTCOMES</b>	<p>Knowledge and understanding skill</p> <p>Acquisition of cognitive bases on soil chemistry and microbiological fertility, and particularly on physico-chemical, biochemical and microbiological processes driving the availability of plant essential nutrients to root uptake.</p> <p>Skill to apply knowledge and understanding</p> <p>Ability to understand if and when an issue relative to soil fertility (physicochemical, biochemical and microbiological) is resolvable resorting to the knowledges acquired during the course. Skill to search information in foreign languages, their analysis and synthesis. Study capacity through English literature</p> <p>Judgement autonomy</p> <p>Formulation of one's own logical pathway of cause-effect on the origin of recognized issues about the soil fertility, in order to sustain one's own independent hypotheses to resolution</p> <p>Communication skills</p> <p>Presentation capacity, also to an incompetent audience and resorting to multimedia technology, of the techno-scientific explanations to the identified issues about soil fertility, as well as of the hypotheses for their resolution</p> <p>Learning skill</p> <p>Capacity to find the reliable information sources (textbooks but also specialized, scientific journals) for a one's own independent pathway to updating and technoscientific progress, together with the most shared and established national and international trends on issues about the soil fertility and sustainable agriculture</p>
<b>ASSESSMENT METHODS</b>	<p>The purpose of examination tests will be to verify the acquisition of cognitive bases on main soil physico-chemical, biochemical and microbiological properties, in order to understand peculiar subjects dealing with the physical, chemical and biological fertility of soils, and also properly using specific language and notions. In order to pass the whole examination, the student has to solve at least 2 questions each 3 CFU, i.e. 6 in total. The global assessment of the achieved learning will consist on a first oral ongoing test concerning 1/2 of subjects relative to both units ("Soil Fertility" (6 CFU).and "Soil Microbiology" (3 CFU)). The failed oral ongoing tests will be tackled during a single oral final test. The final examination grade will be the weighted average of all ongoing test grades, eventually the final oral test included.</p> <p>The final assessment, properly graded, will be formulated on the basis of the following conditions:</p> <p>a) Basic knowledge of soil chemistry and microbiology and limited ability to independently apply the concepts in new situations, sufficient capacity for analysis of the presented phenomena and the procedures followed exposure (18-21 rating);</p> <p>b) good knowledge of soil chemistry and microbiology studied and ability to apply it independently in situations similar to those studied, discrete analysis capabilities of the presented phenomena and the procedures followed exposure (22-25 rating);</p> <p>c) thorough knowledge of soil chemistry and microbiology studied and ability to apply it to any proposed biological phenomenon, but not always readily and following a linear approach, good analytical skills of the presented phenomena and the procedures followed exposure (26-28 rating);</p> <p>d) deep knowledge of soil chemistry and microbiology studied and ability to apply it promptly and properly to any proposed microbiological phenomenon, excellent analytical skills of the presented phenomena and excellent communication skills (29-30L vote).</p>
<b>TEACHING METHODS</b>	Lectures, laboratory tests, literature search

**MODULE  
SOIL MICROBIOLOGY**

*Prof. GIANCARLO MOSCHETTI*

**SUGGESTED BIBLIOGRAPHY**

-Appunti delle lezioni  
-Biovati B e Sorlini C (2007) Microbiologia generale ed agraria. Ambrosiana ed., Milano  
-Biovati B e Sorlini C (2008) Microbiologia agroambientale. Ambrosiana ed., Milano

<b>AMBIT</b>	10689-Attività formative affini o integrative
<b>INDIVIDUAL STUDY (Hrs)</b>	45
<b>COURSE ACTIVITY (Hrs)</b>	30

**EDUCATIONAL OBJECTIVES OF THE MODULE**

The course aims to provide knowledge on the origin, biology, ecology, metabolic activity and systematic of soil microorganisms, assessing their role and behavior in agricultural environments. The course also addresses the identification, assessment, monitoring and control of microorganisms of agricultural interest in order to increase knowledge on the role which they perform in the maintenance of the soil fertility. The exercises will provide knowledge on methods of numbering and identification of specific microorganisms or microbial groups in the soil.

**SYLLABUS**

<b>Hrs</b>	<b>Frontal teaching</b>
1	Mode of the course and examination. Objectives of the discipline and its subdivision, History of Microbiology
2	The characteristics that allow you to describe, identify, recognize, classify a microorganism.
2	The micro and macro morphology of the bacterial cell (prokaryote). Structure, chemical composition and functions of the capsule, cell wall, cell membrane, ribosomes, the genome of the plasmids, the inclusions, the appendices and the endospores.
2	Energy metabolism and relationships with oxygen. The diverse nature of the processes and the different types and their discriminant value. nutritional and cultural needs and habitats.
2	The microbial growth. The curve of the bacterial growth; factors affecting microbial growth
3	The soil as a habitat for the life of microorganisms. Role of microorganisms in the soil formation, structuring and soil fertility.
1	Ecology of soil microbial populations: the native and not-resident microflora. Characterization and role of the major functional microbial groups. of the soil.
2	Interactions between plants, microorganisms and soil: the rhizosphere and rhizosphere effect; the Plant Growth Promoting Rhizobacteria: main mechanisms (production of IAA, siderophores, antibiotics and antifungals); the main bacteria PGPR.
2	The spread of the nitrogen fixation among prokaryotes. The main nitrogen-fixing microorganisms: Bradyrhizobium and Rhizobium; Azospirillum; Azotobacter, Frankia
3	The composting process in the management of an organic farm
<b>Hrs</b>	<b>Workshops</b>
10	Isolation, counts and identification of soil and rhizospheric microorganisms.

## MODULE SOIL FERTILITY

*Prof. VITO ARMANDO LAUDICINA*

### SUGGESTED BIBLIOGRAPHY

Fondamenti di chimica del suolo (Sequi P., Ciavatta C., Miano T.). Patron Editore, Bologna, 2017  
Chimica e fertilita' del suolo (P. Violante). Edagricole, Milano, 2013.

<b>AMBIT</b>	50125-Discipline della produzione vegetale
<b>INDIVIDUAL STUDY (Hrs)</b>	90
<b>COURSE ACTIVITY (Hrs)</b>	60

### EDUCATIONAL OBJECTIVES OF THE MODULE

The course aims to provide students with cognitive bases for understanding fundamentals of soil chemistry and fertility, particularly the physico-chemical, biochemical and biological processes driving the availability of essential nutrients to plant root uptake. The course leitmotiv will consist in emphasizing the advantages, with regard to environmental sustainability, of the soil biological management (conservative) compared to the traditional (intensive) one. In other words, it will be underlined that the importance of the soil resource, as constitutively renewable only after millennia, goes well beyond a simple support for crop yield.

## SYLLABUS

Hrs	Frontal teaching
1	Introduction to the Soil Science: Soil as a natural resource - Different concepts of soil - Different constituents of soil.
4	The mineral constituents of soil: Minerals and constituents of rocks and soil - Dimensional scale - Mineralogy of sand and silt fractions - Mineralogy of clay fraction - Surface area and surface charge
2	Physico-mechanical properties of soil: The colloidal state - Soil texture - Soil structure - Importance of soil structure - The porosity - The colour
8	Soil organisms and organic matter: Organic constituents of soil - Origin of soil organic matter - Organisms living within soil - Transformations of crop residues after soil biological activity - Soil organic matter properties - Factors affecting the decomposition rate of soil organic matter
5	Surface reactions and adsorbing capacity of soil: Physical adsorption - Chemical adsorption - Chemico-physical adsorption - Charge origin on soil particles - Cationic exchange - Anionic exchange - Interactions among colloidal soil components.
6	pH reaction in soil - Forms of soil acidity - Degree of base saturation - Soil buffer capacity - Causes of soil acidification - Alkaline soils - Salt-affected soils - Corrections of pH anomalies in soil
3	Water and air in soil: interactions between water and soil solids - Salinity and hardness of irrigation water - Sodium Adsorption Ratio - Air in soil - Soil respiration - Mechanisms of gas exchange - Effects of scanty aeration on microbial and root activities - Chemistry of flooded soils- Redox reactions in soil.
6	Nutrient cycles: Nutrients for plant growth - Processes of mineralization and immobilization of Nitrogen - The Nitrogen cycle - Transformations of phosphorus and sulphur Potassium, calcium and magnesium - Trace nutrients
3	Assessment of soil fertility. Symptoms of plant nutrient deficiency. Plant tissue analyses. Analyses of soil available nutrients. Interpretation of results and assessment of crop nutrient needs.
2	Soil quality and sustainable agriculture. Bioindicators of soil quality
Hrs	Practice
2	Fertilizers, amenders, correctives. N, P, K fertilizers. Organo-mineral fertilizers.
8	Techniques for assessing the major soil quality bioindicators. C and N held within soil microbial biomass. Soil metabolic activities: respiration, enzyme activities. Soil microbial community structure.
Hrs	Workshops
4	Determination of soil organic C and total N
6	Assessment of soil actual and potential acidity - Determination of total and active carbonates - Determination of cation exchange capacity