UNIVERSITÀ DI PISA

USE AND RECYCLING OF BIOMASSES

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Anno accademico	2020/21
CdS	AGRIFOOD PRODUCTION AND AGROECOSYSTEM MANAGEMENT
Codice	080GG
CFU	6

Moduli	Settore/i	Tipo	Ore	Docente/i
USO E RICICLO DELLE BIOMASSE	AGR/13	LEZIONI	64	ROBERTO CARDELLI MARCO LANDI

Learning outcomes

Knowledge
The student will acquire the necessary knowledge to understand the phases of production, transformation and recycling of waste biomasses.

Assessment criteria of knowledge
An oral exam is necessary for the assessment of the acquired knowledge.

Skills
The student will acquire knowledge of the physical, chemical and biological properties of various types of residual biomass, the actual maturation stage of the organic fraction, as well as the concentration in the biomass of the most important organic and mineral pollutants. In particular, he will have acquired knowledge of the chemical and biological processes that occur in soil amended with materials.

Assessment criteria of skills
At the end of the course, tests are carried out during which the student must demonstrate that she/he has acquired the skills to evaluate the options for the possible destinies of the residual biomasses also through the presentation of original research on topics of the program, accompanied by illustrations of cases of study.

Behaviors
At the end of the course, the student will acquire and develop the ability to evaluate the characteristics and the possibilities of the use of residual biomasses and address issues related to biomasses as a source of support for soil fertility and their characteristics in relation to environmental impact.

Assessment criteria of behaviors
Behaviors will be checked:
- during the assessment, where tests aimed at assessing the student's behaviour in the face of the problems will be provided by the professor;
- during the course, when the degree of accuracy of the activities carried out will be assessed.

Prerequisites
To deal with the teaching of "Use and recycling of biomass", is essential the basic knowledge of:
- inorganic chemistry (in particular chemical bonds, chemical equilibrium, chemical reactions in aqueous solution, the solubility of ionic compounds in water, precipitation and redox reactions)
- soil chemistry

- agricultural microbiology

Teaching methods
The lectures are held with the help of slides.
The E-learning site of the CdS is used where the teaching material used in the frontal lessons is provided but also for communications of any kind with the students.
The interaction between professor and students also takes place through receptions, e-mails and student counsellors

Syllabus

1. Introduction. Definition of biomass. The concepts of waste and residue. Present situation and perspectives of biomass recovery: the dimensions of the problem. Quantitative and economic aspects of the use and recycling of urban, industrial, agricultural, agro-food biomasses. Disposal and recycling techniques.

2. The disposal of biomasses in the field. Pedo-climatic factors that influence the fate of biomasses in the soil. The decomposition process of the organic matter from biomasses in the soil: forecasting models. The main polluting compounds in biomass. Organic pollutants. Inorganic pollutants (heavy metals): short and long term environmental contamination risks.

3. Urban waste. Urban liquid residues (sewage sludge). Disposal in the agricultural sector: the legislation. The application of sludges to the soil in relation to the physico-chemical characteristics. Sanitary aspects. Urban solid waste (MSW). Legislative aspects and guidelines of the European community. Chemical-physical composition. Composting: state of the art on process technologies. Choice of materials to be composted. Description of the process: variations in physical, chemical and biological parameters. Evaluation of the maturity of the product for agricultural use. Economic evaluations on the use of compost. Home-made compost.

4. Residues from livestock farming. Problems on the use of livestock manure in agriculture. Manure, droppings, pig residues. Chemical-physical characteristics: macro and microelements, fresh and humified organic substance.

5. Residues from the agro-food industry. Residues from the dairy, sugar beet and wine industries. The oil industry. The agricultural use of vegetation waters. The agricultural use of wet pomace and wet husks.

Presentation of cases of study

Bibliography
Rechcigl J.E. - (1995) Soil amendments and environmental quality. CRC, Lewis, New York.
FAO - (1991) Recent developments in animal waste utilization. REUR Technical series 17.
Cesena Agri-environmental Observatory. - (1995) Recovery and use of organic waste in agriculture.

Non-attending students info
Non-attending students can follow the progress of the lessons using the teaching material made available by the professor before the start of the course on the E-learning website of the CdS.

Assessment methods
Final oral examination (18/30 at least)

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