Sveučilište u Zagrebu Agronomski fakultet
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Rhizosphere ecology (146043)

Nositelj kolegija

izv. prof. dr. sc. Boris Lazarević

Opis kolegija

Rhizosphere ecology is module which provides physiological viewing of the role of plant root in interaction with environment. At the beginning, module is concerning about the soil structure and function, as the medium in which root grows and develops; afterwards structure and function of root parts, root surface and its role in interaction with soil. The physiological aspects of root growth, respiration and metabolism of carbon and intercellular transport of water and mineral substances throughout the roots are the basic meaning of root metabolism. The multiple symbiosis in function of optimization in receiving nutrients in different environmental conditions are reviewed, as well as specific role of root exudates in microbiological activities. In degraded soils metabolism of root (excrete of plant sap, phytosiderophores, hydrogen ion, phosphatase) is reviewed with the respect of physiological processes responsible for plant adjustment to take over the stress of nutrient deficiency, salt, heavy metal, aluminium toxicity and low or too high pH.

ECTS: **3.00**

E-učenje: **R1**

Sati nastave: 30
Predavanja: 25
Seminar: 5

Izvođač predavanja

- izv. prof. dr. sc. Boris Lazarević

Izvođač seminara

- izv. prof. dr. sc. Boris Lazarević

Ocjenjivanje

Dovoljan (2): 60-70 %
Dobar (3): 71-80 %
Vrlo dobar (4): 81-90 %
Izvrstan (5): 91-100 %

Vrsta kolegija

- Graduate studies / Environment, agriculture and resource management (Obvezni kolegij, 3. semestar, 2. godina)

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Opće kompetencije

At the end of this course the student is expected to be able to:
- define and characterize the three phase soil system,
- explain the processes and factors determining bioavailability of nutrients in the soil, processes and factors determining uptake of water and nutrients and of losses of nutrients from the soil;
- appreciate the importance of rhizosphere processes in plant nutrition, pollutant uptake and ecotoxicology;
- understand root growth, root distribution and root functioning in relation to abiotic factors in the biosphere;
- explain the basic principles of the ecology of the rhizosphere;
- understand the and the interactions between plants and microbes;
- use some basic methods frequently used in rhizosphere research.

Oblici nastave

- Lectures
- Seminars
  Groups (2-3 students) independently prepare and present the lecture using recent scientific and professional literature related to the topic of rhizosphere ecology.

Ishodi učenja i način provjere

Ishod učenja	Način provjere
Understanding of the root importance in plant growth and productivity.	Participating in the discussions, work tasks during classes - analysis of case studies, seminars, written exam
Understanding of the mechanisms of root growth and development.	Participating in the discussions, work tasks during classes - analysis of case studies, seminars, written exam
Understanding the factors which have influence on root growth, development and morphology.	Participating in the discussions, work tasks during classes - analysis of case studies, seminars, written exam
Understanding of physiological processes in the root (respiration, storage capacity), mechanisms of water and nutrient uptake and translocation. Types and role of the plant root exudates.	Participating in the discussions, work tasks during classes - analysis of case studies, seminars, written exam
Knowledge of nutrient cycles (C, P, N, S etc.)	Participating in the discussions, work tasks during classes - analysis of case studies, seminars, written exam
Understanding of plant adaptations to degraded soils (acid, alkaline soils), plant reaction to toxicity of heavy metals, acidity and salts.	Participating in the discussions, work tasks during classes - analysis of case studies, seminars, written exam
Understanding the principles and mechanisms of phytoremediation.	Participating in the discussions, work tasks during classes - analysis of case studies, seminars, written exam
The importance of soil biogenity preservation and importance of symbiosis and mycorrhiza in nutrient acquisition and uptake.	Participating in the discussions, work tasks during classes - analysis of case studies, seminars, written exam

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Način rada

Obveze nastavnika

Teaching (lectures and seminars), maintaining consultation, provision of teaching materials; help with creating seminars; organization and conduct examinations

Obveze studenta

Class attendance; writing essays; literature search and interpretation of scientific papers; presentation of seminar papers; exam

Polaganje ispita

Elementi praćenja	Maksimalno bodova ili udio u ocjeni	Bodovna skala ocjena	Ocjena	Broj sati izravne nastave	Ukupni broj sati rada prosječnog studenta	ECTS bodovi
Attending classes				25	30	1
Seminar work	25			5	30	1
Written exam	75	<60% 60-70% 71-80% 81-90% 91-100%	Nedovoljan (1) Dovoljan (2) Dobar (3) Vrlo dobar (4) Izvrstan (5)		30	1
Total	100			30	90	3

Elementi praćenja	Opis	Rok	Nadoknada
Written exam	The written exam consists of 50 short questions.	Two days before the exam, students have to log in ISVU system to apply for the exam	

Tjedni plan nastave

1. Introduction L - Introduction, module description, definition of the rhizosphere, rhizosphere investigation importance.
2. Root system: anatomy, and morphology L - Anatomical and morphological characteristics of plant root system as a background for the understanding of different types of root systems and their physiological functions.
3. Root system: anatomy, and morphology; Root system: growth and development L - Anatomical and morphological characteristics of plant root system as a background for the understanding of different types of root systems and their physiological functions. Growth and development of the root syste, factors influencing root growth and development, dry matter accumulation and alocation, root - shoot communication.
4. Functions of the root system L - Root has to perform several functions simultanuously (plant ancourage, water and nutrien acquisition, dry metter accumulation...). The successful

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functioning of root systems has ecological significance in terms of the competitive advantage of individual species in mixed communities but is also economically important in the plant-based industries of agriculture, horticulture and forestry.

5. Root system. Physiological processes L - Explanation of the physiological processes as respiration, starch accumulation, synthesis of the specific enzymes, membrane proteins and different organic compounds that have influence on nutrient mobilisation and acquisition.
6. Root system. Physiological processes L - Explanation of the physiological processes as respiration, starch accumulation, synthesis of the specific enzymes, membrane proteins and different organic compounds that have influence on nutrient mobilisation and acquisition.
7. Root system. Physiological processes L - Explanation of the physiological processes as respiration, starch accumulation, synthesis of the specific enzymes, membrane proteins and different organic compounds that have influence on nutrient mobilisation and acquisition.
8. Root/Soli interactions L - Root can influence the properties of soils and soil type can, in turn, influence the type of root growth. This knowledge of plant/soil interactions has been put to use by humans in their agriculture and horticulture.
9. Root exsudates and their function L - Discussion about types of root exudates, their synthesis, efflux into the soil and function in the nutrient mobilization and acquisition, as well as external detoksificatin of aluminium and heavy metals, influence on the microorganism populations, etc. Root exudates are great source of the C, N, S, P and have inportant role in their cycle.
10. Root and soil organisms L - The increased amounts of microbial biomass and activity in the rhizosphere have effects on the mineralization and availability of many plant nutrients. The effects of the plant, then, on the microbial community are far-reaching, but the microbes that colonize the rhizosphere also have an impact on plants via their interaction with roots. Some microbes are plant pathogens whereas others contribute beneficial effects.
11. Abiotic stress and plant adaptation to abiotic stresses L - Chemical and physical soil characteristics have great influence on the root growth and development. Abiotic stress factors causes disrubtion of the normal root growth and metabolism. Lectures will provide reviews of the main abiotic stresses in plant production (soil compactness, drought, flood, soil acidity, salinity, aluminium and heavy metal toxicity), plant reaction and adaptation to abiotic stresses.
12. Abiotic stress and plant adaptation to abiotic stresss L - Chemical and physical soil characteristics have great influence on the root growth and development. Abiotic stress factors causes disruption of the normal root growth and metabolism. Lectures will provide reviews of the main abiotic stresses in plant production (soil compactness, drought, flood, soil acidity, salinity, aluminium and heavy metal toxicity), plant reaction and adaptation to abiotic stresses.
13. Phytoremediation L - The definition of phytoremediation, forms, and physiological mechanisms of phytoremediation, the practical use of the plant species suitable for phytoremediation will be discussed.
14. Seminars S - Written/ oral presentation of new findings in rhizosphere ecology research.
15. Seminars S - Written/ oral presentation of new findings in rhizosphere ecology research.

Obvezna literatura

1. Beeckman T. (2010). Root Development. Annual Plant Reviews Vol. 37. Wiley-Blackwell, Ltd., Publications.
2. Taiz L. and Zeiger E. (2002). Plant Physiology. Sinauer Associates, Inc., Publishers, Sunderland Massachusetts.
3. Gregory P. J. (2006) Plant roots : their growth, activity, and interaction with soils. Blackwell Publishing Ltd, 9600 Garsington Road, Oxford OX4 2DQ, UK

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Preporučena literatura

1. Park, N.S. (1999) Physicochemical and Environmental Plant Physiology. Second edition. Academic Press.
2. Marschner, H. (1995) Mineral nutrition in Higher Plants (2nd ed.), Academic Press, London.
3. Fageria, N.K., Baligar, V.C., Jones, C.A. (1997) Growth and mineral nutrition of field crops. (2nd ed. rev. and expanded). Marcel Dekker. New York.

Sličan kolegij na srodnim sveučilištima

- Rhizosphere Processes - Nutrient Acquisition and Stress Adaptations of Higher Plants (3302-490) University of Hohenheim
- Rhizosphere Ecology (751-5123-00L), ETH Zürich

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