BRES2106 Integrated management of the soil-plant system

[52.5h+22.5h exercises] 6 credits

This course is taught in the 2nd semester

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Language:	French
Level:	Second cycle

Aims

The course aims at integrating soil-plant interactions at the field scale to support a better management of cultivation systems and of their impacts on the soil, the plant and the underground microbial communities.
Knowledge - The student will gain a dynamic perception of soil-plant interactions in the perspective of the functioning of the cultivated soil (macroscopic and rhizosphere scales) and of the strategies of the plant to explore the soil (including the plant responses to the soil environment and the effect of the cultivation system on the soil).
Know-how - The student will be able to use this knowledge to develop an environment-friendly and rationale management of cultivation systems, which involves the adoption of ad hoc technical solutions and the monitoring of the cultivation system.

Main themes

The course is comprised of three modules:
Module A: Soil-plant interactions
A1 Properties, functioning and evolution of the cultivated soil in time and space: what makes the soil fertility?
A2 Dynamics of root exploration
A3 Rhizosphere processes
Module B: Biosoil processes and cycles
B1 Nutrient cycling in the soil-plant system
B2 Role of underground communities in nutrient cycling. Ecological requirements, functions of soil microbes in the soil chemistry
B3 Soil degradation and alteration of biological properties
Module C: Fertilisation
C1 Estimation of nutrient demand
C2 Usage of mineral and organic fertilizers, forecasting methods
C3 Recent technological development

Content and teaching methods

The themes discussed in this course are :
Module A: Soil-plant interactions
A1 Properties, heterogeneity, functioning and evolution of cultivated soils. Factors influencing soil fertility and indicators of soil fertility. Assessment of soil nutrients and organic matter. Bio-availability.
A2 Soil exploration by roots: growth and development of the root system of major crop species, impact of transient or local soil conditions on root distribution. Root architecture modelling.
A3 Rhizosphere processes: soil-plant interactions at the rhizospere scale (uptake, acquisition strategies, exsudation) in a dynamic perspective.
Module B : Processes and biogeochemical cycles.
B1: Nutrient cycling in the plant-soil system: study of cycles at the field and profile scale. Loss estimations; perception through anlytical data.
B2 : Impact of soil living organisms (fauna and flora) on major nutrients cycling, ecological demands/significance and biogeochemical function of living organisms : biocenoses study with particular emphasis lay upon rhizosphere; symbioses (Rhizobium, mycorrhizae, ...)
B3 : Soils Degradation and "impoverishment ou fertily loss": genesis (ou evolution) of soils under intensive farming practices, degradation of soils biological functions , notions of soil resistance against roots deseases (je ne connais pas l'expression suppresive soil) suppressive soils versus root pathogens (pedo- climatic and cultivation/ cultural factors: cases studies).
Module C: Fertilisation
C1 Estimation of needs in nutrients: methods of diagnosis and measurement (field trials, plant tissue and soil analysis, deficiency symptoms, indicator plants; methods of analysis)
C2 Mineral and organic fertilisers; description of the different fertilisers available and use in crop management taking into account soil and climate, fertiliser recommendation (case studies)
C3 New trends in fertilisation, organic agriculture, intensive agriculture, and environmental issues (case studies)

Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

Prerequistes
Soil sciences (mandatory), applied soil sciences (recommended)
Fertilisation : plant production, plant physiology

Other credits in programs

BIR22/7A	Deuxième année du programme conduisant au grade de bio-ingénieur : Sciences agronomiques (Ressources en eau et en sol)	(6 credits)
BIR22/7E	Deuxième année du programme conduisant au grade de bio-ingénieur : Sciences et technologie de l'environnement (Ressources en eau et en sol)	(6 credits)