- Precision Agriculture

.- Module: Herbaceous and Horticultural Crops

Prof. Vincenzo Tabaglio

COURSE AIMS AND INTENDED LEARNING OUTCOMES

The course aims to provide the student with up-to-date knowledge of the possible applications of precision agriculture in the herbaceous and horticultural crops sector, with a view to agrarian sustainability. Starting with a basic introduction to sensors, covered in preparatory courses, the possible adoption of precision techniques in soil tillage, sowing, fertilisation, irrigation, weeding, defence, and harvesting will be discussed.

**Expected learning outcomes**: at the end of the course, students will have a basic knowledge of precision farming techniques applied to herbaceous and horticultural crops, and will be able to discuss their possible adoption in the various agroecosystems. Students will be able to read the precision maps of yields, soil characteristics and cultivation, integrating this information in the preparation of prescription maps for the various cultivation operations. The analysis of case studies will also allow students to discuss the economic and environmental opportunities for adopting various precision agriculture achievements (sensors, tools, software) from time to time, in order to strengthen the sustainability of agroecosystems.

COURSE CONTENT

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| Topics | ECTS |
| Introduction |  |
| Current and future applications of precision agriculture to the cultivation techniques used for herbaceous and horticultural crops. A judgment of sustainability. Brief economic considerations. | 0.5 |
| The cultivation technique in precision agriculture |  |
| Prerequisites for adopting precision agriculture. The initial acquisition of pedological and agronomic information. Mapping of land and production. IT needs. Decision support systems (DSS). | 1.0 |
| Soil processing and sowing. | 1.0 |
| Fertilisation. Irrigation. | 0.5 |
| Defensive measures. Harvesting. | 0.5 |
| Case studies. | 0.5 |
| Tutorials |  |
| Seminars, educational visits and classroom tutorials. | 1.0 |

READING LIST

Casa R. (Ed.), 2017. *Agricoltura di Precisione. Metodi e tecnologie per migliorare l'efficienza e la sostenibilità dei sistemi colturali*. Edagricole - New Business Media, Milan.

Grignani C. (Ed.), 2016. *Fertilizzazione sostenibile. Principi, tecnologie ed esempi operativi.* Edagricole - New Business Media, Milan.

Further reading references for the individual topics will be provided during the course. The additional teaching material and what was projected in class will be made available through the Blackboard platform.

TEACHING METHOD

Theoretical frontal lectures in which the main topics of the course will be addressed with the aid of PowerPoint presentations.

In-depth seminars held by professors, technicians or experts in the sector.

Frontal tutorials during which students will be given practical exercises to solve according to the methods seen during lectures. The slides used in the lectures and tutorials will be made available at the end of each lesson on the Blackboard platform.

Educational visits to agricultural companies, research institutes and other companies in the sector, where some of the topics addressed in lectures will be analysed in detail.

ASSESSMENT METHOD AND CRITERIA

Final oral exam, on all the topics covered during the course. The duration of the discussion is approximately 20 minutes, during which three questions will be posed, each carrying a maximum mark of 10/30. The final mark will be out of 30. Students will have to demonstrate their basic knowledge of precision agriculture applied to open field herbaceous and horticultural crops, and be able to discuss its possible adoption on a farm according to the available techniques, with a view to agroecological, environmental and economic sustainability. They will also have to demonstrate clarity of language and an ability to connect different topics.

NOTES AND PREREQUISITES

For a fruitful understanding of the topics covered during lectures, the student must possess basic knowledge in the areas of geomatics, sensors and automation, as well as an adequate knowledge of agronomy and herbaceous crops.

Information on office hours available on the teacher's personal page at http://docenti.unicatt.it/.

- Module: Tree Crops

Prof. Tommaso Frioni

COURSE AIMS AND INTENDED LEARNING OUTCOMES

The aim of the course is to provide students with the fundamental concepts of precision agriculture as applied to tree crops. The main integrated management techniques used in precision systems and technologies will be analysed.

Intended learning outcomes: at the end of the course, students will be able to understand the expression level of the main factors of intra-parcel variability in vegetative production, will be able to manage the main precision methods that can be adopted in the arboretum, and will know the most recent technical solutions available on the market. Students will be able to produce an on-the-ground validation of a vigour map and evaluate the possibility of adopting variable rate management techniques. With regard to agronomy and tree crops, students will learn how to prepare a prescription map for efficient site-specific management of the main cultivation operations (eg fertilisation, irrigation, harvesting).

COURSE CONTENT

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| --- | --- |
| Topics | ECTS |
| Introduction |  |
| The scales of variability (global, regional, orchard/vineyard, crown, fruit). Interpretation of remote sensing data related to soil and crop properties. Sampling methods. The management of spatial and temporal variability in the arboretum. Definition of optimal vigour. | 1.5 |
| Variable rate applications in the arboretum |  |
| Variable rate applications and technologies. Prescription map. Variable dose fertilisation, irrigation and seeding. Phytosanitary treatments in precision agriculture. | 1.5 |
| Fruit harvesting and affordability |  |
| Production mapping systems. Selective harvesting. Selection of the fruits in the plant. Economic evaluation of precision agriculture in arboreal systems. | 1.0 |
| Tutorials |  |
| Seminars, educational visits and classroom tutorials. | 1.0 |

READING LIST

Casa R. (Ed.)*, Agricoltura di Precisione. Metodi e tecnologie per migliorare l'efficienza e la sostenibilità dei sistemi colturali,* Edagricole - New Business Media, Milan, 2017.

Further reading references related to the topics covered in class will be indicated during the course. Any additional material (including whatever is projected in class) will be made available on the Blackboard platform.

TEACHING METHOD

The course teaching will be carried out through the following activities:

1) Frontal lectures in which the lecturer will address the course contents by combining concepts and notional aspects with various application examples. The interactions between lecturer and students will be promoted through the discussion of specific case studies.

2) Classroom exercises for the creation of a prescription map. Technical seminars.

3) Field visits for a better understanding of how different precision farming solutions can be adopted according to crop and environmental needs and different commercial objectives.

ASSESSMENT METHOD AND CRITERIA

Final oral exam. The exam consists of at least three questions of a general nature, from which further specific questions may arise. Comprehensive answers to each topic are worth 10/30. The final mark will be out of 30. Pass mark : Mark ≥18/30.

Students will have to demonstrate their: a) mastery of the main techniques of precision agriculture applied to tree cultivation, both in terms of theoretical knowledge acquired (knowing), and in terms of the ability to use them in specific operational contexts according to current technical possibilities, with a view to economic and environmental sustainability (know-how); b) clarity of language; c) ability to connect different topics.

NOTES AND PREREQUISITES

For a fruitful understanding of the topics covered during lectures, the student must possess basic knowledge in the areas of geomatics, sensors and automation, as well as an adequate knowledge of agronomy and tree crops.

Information on office hours available on the teacher's personal page at http://docenti.unicatt.it/.