# UNIVERSITÀ DEGLI STUDI DI PALERMO

| | | | |
|---|---|---|---|
| **DEPARTMENT** | Scienze Agrarie, Alimentari e Forestali | | |
| **ACADEMIC YEAR** | 2023/2024 | | |
| **MASTER'S DEGREE (MSC)** | PRECISION AGRICULTURE | | |
| **INTEGRATED COURSE** | AGRONOMY, HERBACEOUS CROPS AND HORTICULTURE WITH PRECISION TECHNOLOGIES | | |
| **CODE** | 22802 | | |
| **MODULES** | Yes | | |
| **NUMBER OF MODULES** | 2 | | |
| **SCIENTIFIC SECTOR(S)** | AGR/02, AGR/04 | | |
| **HEAD PROFESSOR(S)** | LICATA MARIO | Professore Associato | Univ. di PALERMO |
| **OTHER PROFESSOR(S)** | LICATA MARIO<br>SABATINO LEO | Professore Associato<br>Professore Associato | Univ. di PALERMO<br>Univ. di PALERMO |
| **CREDITS** | 9 | | |
| **PROPAEDEUTICAL SUBJECTS** | | | |
| **MUTUALIZATION** | | | |
| **YEAR** | 1 | | |
| **TERM (SEMESTER)** | 2° semester | | |
| **ATTENDANCE** | Not mandatory | | |
| **EVALUATION** | Out of 30 | | |
| **TEACHER OFFICE HOURS** | **LICATA MARIO**<br>Monday 10:00 13:00 presso stanza del Dott. Mario Licata, Dipartimento di Scienze Agrarie, Alimentari e Forestali, Viale delle Scienze 13, Edificio 4, Ingresso L, Piano 2<br>**SABATINO LEO**<br>Monday 9:00 11:00 Studio del docente sito presso il Dipartimento SAAF, Ed. 5.<br>Wednesday 9:00 11:00 Studio del docente sito presso il Dipartimento SAAF, Ed. 5. | | |

**DOCENTE:** Prof. MARIO LICATA

| | |
|---|---|
| **PREREQUISITES** | The attendance of the course requires the knowledge of Agronomy, Herbaceous crops, Horticulture, Plant physiology, Biochemistry, Physics and Statistics for the understanding of the main content and objectives of the course. The course provides no mandatory prerequisites, but the knowledge of some subjects is needed to understand the main technical and practical problems of the course and to provide rational solutions. |
| **LEARNING OUTCOMES** | a) Knowledge and understanding<br>The course permits students to gain knowledge about the main agronomic practices in which precision agriculture makes it possible to make a valid contribution for improving the management efficiency of production factors with particular reference to open field herbaceous crops and horticultural crops grown in the open field and protected environment The understanding of the main contents of the course requires a specific technical language of this course.<br>b) Applying knowledge and understanding<br>The main aim of the course is to encourage the students to develop skills to plan specific agricultural practices through a rational use of cultivation inputs for the purpose of growing herbaceous and horticultural crops, in accordance with the profitability and environmental impact, exploiting the knowledge of precision agriculture applied to the main agronomic practices.<br>c) Making judgements<br>The course requires students to be able to independently assess the effects of the application of the precision agriculture techniques and practices on herbaceous and horticultural cropping systems, also in comparison with traditional agronomic practices, in order to improve the management of the agricultural activities exploiting the scientific findings. The course also requires that students have the ability to evaluate the characteristics of herbaceous and horticultural cropping systems managed with precision agriculture practices, using the acquired competence regarding the complexity of the biological, chemical and physical factors affecting the same productions.<br>d) Communications<br>The course requires that students have communication skills in order to transfer clearly information and technical solutions to professionals, entrepreneurs, administrators and commentators. It requires that the dissemination activity is also carried out towards to a non-expert public.<br>e) Lifelong learning skills<br>The course requires that students are able to study issues of the course by consulting scientific literature, scientific publications and popular magazines. It requires, also, the ability to transfer the technical knowledge gained following the course or specific meetings, in business and professional sector. |
| **ASSESSMENT METHODS** | The course includes a final exam in order to assess the level of learing and knowledge of the student throught an oral test. The oral test consists of an interview in order to check the skills and disciplinary knowledge provided by the course. Evaluation will be provided as a mark out of 30. The interview will include openended and semi-structured questions in order to verify the gained knowledge, the computing and presentation skills of the student. With regard to the evaluation of knowledge, students have to be able to make connection between the course contents. The evaluation of computing skills will be determined by the student's ability to provide independent judgments about the course contents, to understand the possible practical application of the course and to place the subject content within the target professional context. With regards to the evaluation of the computing capacities, a high quality of language will be required for the reference professional context. The highest score (30/30 with honours) will be awarded to the student who will prove to have a high capacity for judgment, a strong ability to put into practice the knowledge of the course through examples and/or models, a strong ability to provide solutions to the main problematic and to have a high quality the technical language. The lowest score (18/30) will be awarded to the student who will prove to have a low capacity for judgment, a poor ability to put into practice the knowledge of the course through examples and/or models, a poor ability to provide solutions to the main problematic and to have a low quality the technical language. In particular, the assessment method will be deemed insufficient in the event that the student demonstrates that he / she possesses an extremely lacking knowledge of the teaching topics and a poor ownership of the sectoral language. The evaluation score will increase proportionally and will reach intermediate levels between 18 and 30 with honours as the degree of knowledge demonstrated by the student on general and specific topics increases. |
| **TEACHING METHODS** | The course consists of frontal teaching and practices in laboratory, classroom, open field and protected environment and technical-educational events in the experimental farms of the Department of Agricultural, Food and Forest Sciences of University of Palermo and other Sicilian farms. |

**MODULE**
**HORTICULTURE**

*Prof. LEO SABATINO*

**SUGGESTED BIBLIOGRAPHY**

-Davide Misturini. Precision farming. Strumenti e tecnologie per un'agricoltura evoluta. (2020) Edagricole. Edizioni Agricole di New Business Media srl. Milano. (ISBN: 978-88-506-5587-8).
-Raffaele Casa. Agricoltura di precisione. Metodi e tecnologie per migliorare l'efficienza e la sostenibilità dei sistemi colturali. (2016). Edagricole, Edizioni Agricole di New Business Media srl. Milano. (ISBN 978-88-506-5510-6).
-Romano Tesi. Orticoltura mediterranea sostenibile. (2010). Patron Editore Bologna (ISBN 8855530623).

| | |
|---|---|
| **AMBIT** | 21005-Attività formative affini o integrative |
| **INDIVIDUAL STUDY (Hrs)** | 45 |
| **COURSE ACTIVITY (Hrs)** | 30 |

**EDUCATIONAL OBJECTIVES OF THE MODULE**

The aim of the course is to allow students to understand and analyze modern vegetable production by applying the principles of precision agriculture, through modeling. The course includes an introductory part concerning the structural characteristics relating to high-tech greenhouse and the tools to support the management of the crop cycles. The course will be divided into two main themes: precision agriculture applied to the cultivation of horticultural species in the open field and precision agriculture applied to the cultivation of horticultural species in a protected and controlled environment. The topics concerning precision agriculture applied to soilless crops will also be included.

## SYLLABUS

| Hrs | Frontal teaching |
|---|---|
| 2 | Example of data acquisition, processing and management. Simulation models in precision horticulture. |
| 2 | Structural characteristics of protective structures. Implementation of technologies within simple protective structures (tunnels and tunnel greenhouses). |
| 2 | Influence of cover material on the crop response;  greenhouse conditioning systems. |
| 4 | Soilless cultivation: cultivation principles and techniques in precision horticulture. The use of advanced sensors for crop monitoring, data reading and administration of the production inputs required by the crops. |
| 8 | Precision agriculture applied to the main fruiting vegetables grown in open fields and protected environments: tomato, eggplant, sweet pepper, watermelon, melon, zucchini squash. |
| 4 | Precision agriculture applied to the main leafy vegetables grown in open fields and protected environments: lettuce and basil. |
| 2 | Notes on herbaceous grafting. |

| Hrs | Practice |
|---|---|
| 6 | Educational excursions in Sicily to the most suitable areas for open field horticulture and protected environments (Provinces of Trapani, Agrigento and Ragusa). Exercises in the laboratory of the Department of Agricultural, Food and Forestry Sciences. |

**MODULE**
**AGRONOMY AND HERB FARMING**

*Prof. MARIO LICATA*

**SUGGESTED BIBLIOGRAPHY**

- Davide Misturini. Precision farming. Strumenti e tecnologie per un'agricoltura evoluta. (2020) Edagricole. Edizioni Agricole di New Business Media srl. Milano. (ISBN: 978-88-506-5587-8).
- Raffaele Casa. Agricoltura di precisione. Metodi e tecnologie per migliorare l'efficienza e la sostenibilità dei sistemi colturali. (2016). Edagricole, Edizioni Agricole di New Business Media srl. Milano. (ISBN 978-88-506-5510-6).
- Qin Zhang. Precision agriculturetechnology for crop farming. (2016). CRC Press. Taylor & Francis Group. Boca Ratom, FL. (ISBN 978-1-4822-5107-4).
- Bruno Basso, Luigi Sartori, Matteo Bertocco M. Agricoltura di precisione. Concetti teorici e applicazioni pratiche. (2010). Edizioni L'Informatore Agrario SpA. Verona. (ISBN 978-88-7220-229-9).

| | |
|---|---|
| **AMBIT** | 50544-Discipline della produzione |
| **INDIVIDUAL STUDY (Hrs)** | 90 |
| **COURSE ACTIVITY (Hrs)** | 60 |

**EDUCATIONAL OBJECTIVES OF THE MODULE**

The aim of the course "Agronomy and herbaceous crops using precision agriculture techniques and practices" provides students with skills in the use of tools and technologies to analyze and manage the herbaceous crops by applying principles and precision agriculture techniques and practices in order to improve the efficiency of the productive process in agronomic and environmental terms. In the first part of the module, crop simulation models of high agronomic interest will be explained. In the second part, the main agronomic practices of precision agriculture will be examined: soil tillage, sowing, fertilization, irrigation, weed control. In the final part of the module, the case studies and the application of precision agriculturepractices on herbaceous crops will be explained.

## SYLLABUS

| Hrs | Frontal teaching |
|---|---|
| 1 | Presentation and main aims and methods of the course. |
| 6 | Crop simulation models in precision agriculture: simulation of the phenological development and crop yield regarding herbaceous crops. Simulation models of water and nitrogen availability in the soil. |
| 4 | Soil tillage with precision agriculture techniques. Processing types and strategies. Variable soil tillage based on sensors (control of soil roughness, control of the degree of burial of crop residues). Variable soil tillage based on prescription maps (tillage with variable intensity and depth). Agronomic and environmental considerations |
| 3 | Precision seeding. Variable rate and depth seeding based on prescription maps. Variation of the type of seed and control of the uniformity of seed placement. Agronomic and environmental considerations. |
| 4 | Mineral and organic precision fertilization. The fertilization plan. Mineral fertilization based on sensors and prescription maps. Monitoring of the nutritional status and vegetative vigor of the crop through the use of indices. Main techniques for variable rate fertilization in precision agriculture. The pH correction. Agronomic and environmental considerations. |
| 5 | Precision irrigation. Interpretation of the site-specific variability and precision irrigation strategies (mapping, sampling, variable rate irrigation prescription strategies). Sensors for estimating vegetative vigor and crop water status. Irrigation management with precision agriculture techniques (variable rate sprinkling irrigation systems, site-specific micro-irrigation and sub-irrigation systems). Agronomic and environmental considerations. |
| 4 | Weed control with precision agriculture techniques. Sensors in the description of the spatial variability of weeds. Methodologies for drafting prescription maps for weed control and weed management. Weeding strategies and techniques. Criteria and systems for control of the dose, the targeted distribution on herbaceous crops. |
| 4 | Precision agriculture of cereal crops. Case studies. Agronomic considerations. |
| 3 | Precision agriculture of legume crops. Case studies. Agronomic considerations. |
| 4 | Precision agriculture of industrial crops. Case studies. Agronomic considerations. |
| 2 | Precision agriculture of forage crops. Case studies. Agronomic considerations. |

| Hrs | Practice |
|---|---|
| 10 | Practices on the use of crop simulation models. Practice on the nutritional management of a herbaceous crop with precision agriculture techniques. Practice on the irrigation management of a herbaceous crop with precision agriculture techniques. Practices on open field on the use of sensors to determine and assess the water status of a herbaceous crop. |

| Hrs | Others |
|---|---|
| 10 | Technical-educational events at an experimental farm of the Department of Agricultural, Food and Forest Sciences of University of Palermo and Sicilian farm where agronomic practices based on precision agriculture are used. |