

**Livret JRL-AT**

**« Junior Research Lab for Agricultural Transitions »**

**2023-2024**

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## General présentation of JRLAT

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<b>Dates of course : from 06/09/2023 to 26/01/2024</b>
<b>Key words</b> <u>Agriculture-related themes</u> : Sustainable agriculture, Precision farming, Digital agriculture, Agroecology, Climate-smart agriculture, Food security, Crop diversification, Genetic engineering, Organic farming, Soil health, Irrigation management, Rural development, Agricultural policy, Food waste reduction, Agri-food value chain, Agricultural automation, Agroforestry, Sustainable intensification, Agricultural biotechnology, Data analytics, Precision livestock farming, Climate change resilience, Conservation agriculture, Agrochemical reduction, Remote sensing, Post-harvest technologies, Agricultural finance, Livestock genetics, Renewable energy in agriculture, Integrated pest management and many others <u>Research skills related themes</u> : Subject knowledge, Information retrieval, Critical thinking, Problem solving, Inquiring mind, Enthusiasm, Self-confidence, Self-reflection, Preparation and prioritization, Time management, Continuous professional development, Health and safety, Ethics, principles and sustainability, Project planning and execution, Teamwork, Communication methods, Society and culture

### General theme of the major

The context of the course is deliberately oriented towards sustainability transitions, preserving climate, energy, natural resources, biodiversity and the environment. The semester is based on the acquisition of transversal research skills and disciplinary knowledges, and their deployment on a research project since we deeply believe that providing students with the practices of a proper and ethical scientific approach will help them to think, explore, test and validate ways for the transitions needed to mitigating and adapting to the global change, whether they have the project to become professional scientists or not.

The goal is to find a balanced experience including the learning of strong disciplinary fundamentals through Problem-based learning, while promoting the interaction and interculturality among students, learning activities dedicated to the practice of research and common masterclasses.

The semester aims to strengthen the scientific background of the students, to get them trained through real and collaborative research activities within a cohort of French and International students, to develop their critical mindset, their scientific rigor, their creativity and their taste for innovation and research while developing the systemic and multidisciplinary vision that characterizes engineers in the French Grande Ecole assertion (equivalent to MsC).

**The disciplinary scientific knowledge** is obtained as follows:

- Disciplinary courses based on a problem-based learning delivered by academics from Institut Agro Montpellier and associated with professional scientists of the large Agropolis and Montpellier University communities is offered (25% of the schedule). The offer spans the field of expertise of l'Institut Agro Montpellier on a catalog available online in the preceding spring. Advanced Ecology, Genetics, Advanced and Applied Evolution, Sociology, Environmental Economics, Water management, Agro resources processing are offered on a regular basis. Supplementary offers may complement those courses on a year-to-year basis.

- Four masterclasses are organized by the students and led by external experts on the theme of sustainability transitions
- Scientific skills and further disciplinary knowledge is deepened on a case-by-case basis during a group-based research project where it is necessary.

**A research project** is carried out from start to finish in a highly autonomous manner by a small group of students under the mentoring of academics and scientific experts.

In contrast with a traditional internship in a lab, the attendees choose their research theme in a context previously defined by an academic staff, benefit from the support of senior researchers to think and design their own project and are encouraged to develop co-training. It is a bridge between academic input and research activity, an opportunity for developing international interculturality. It puts the students in the position of managing a research project from the building of working hypotheses, the acquisition of data, their analysis and the sharing of their research in written and oral form.

The research projects are addressed through the field of expertise of l'Institut Agro Montpellier and fit questions related to sustainability transitions. Every year, a team of academics is volunteering to provide expert mentoring of the students during their project. Available themes vary accordingly and their expertise and are made available online during the Spring previous to the next enrollment period.

**Transversal skills for managing a real scientific project** are also acquired through active learning sessions. The set of transversal objectives of this course enables students to develop their ability to conduct a research project.

### Organisation of the major

The semester is organized with 4 UE:

UE1 aims at delivering the scientific skills required to develop a research project (2 ECTS)

UE2 is built from the 6 available problem-based disciplinary modules (3x2ECTS)

UE3 is the main collaborative research project (8 ECTS)

UE4 is dedicated to the Methods for sustainability assessment (4 ECTS)

SEQUENTIAL MANDATORY UE		IN CHARGE	HOURS	ECTS
UE1	Scientific skills development	MARTIN Jean-François	63 (+5h de travail en autonomie)	2
UE2	Disciplinary concepts for transitions (choose 3 from 6)	DAVID Jacques MARTIN Jean-François	39,5 (+37,5h de travail en autonomie)	6
ECUE 2.1a	Mediterranean Ecology	Marie-Laure Navas Anna Medici & Pierre Berthomieu Jacques David & Vincent Ranwez Gilles Belaud  Maeva Subileau  Gwenolé Le Velly & Alexandre Sauquet		
ECUE 2.1b	Plant Molecular Physiology and Mineral Nutrition			
ECUE 2.2a	Molecular Evolution			
ECUE 2.2b	Water Management			
ECUE 2.3a	Relationships between intrinsic properties of agro-resources, processing, and end products quality and functionality			
ECUE 2.3b	Environmental Economics for Agricultural Transitions			
UE3	Collaborative research project	DAVID Jacques	47 (+175h de travail en autonomie)	8
UE4	Methods for sustainability assessment	SALOU Thibault	39 (+25h de travail en autonomie)	4
<b>Sub-total sequential UE</b>			<b>259</b>	<b>20</b>
CONTINUOUS MANDATORY ENGINEERS UE		IN CHARGE	HOURS	ECTS
Développement professionnel		DUPPI Mélanie TEZENAS Laurent	27 (+50h de travail en autonomie)	8
ECUE Stage	Stage 1ère année	DUPPI Mélanie BOURGEOIS Patrick	sur 1ère année	4
ECUE PEI	Projet d'étudiants ingénieurs	AUMASSON Géraldine	8	3
ECUE PPP	Projet professionnel et personnel	DUPPI Mélanie TEZENAS Laurent	19	1
UE LV1	Anglais	ZECCHINO Fabien DEPIERRE Jean-Marc	22	1
UE LV2	2 <sup>ème</sup> langue vivante	ELANIOU Nafissa	16,5	1
UE Stats	Statistiques	ABRAHAM Christophe	4,5	0
<b>Sub-total Continuous engineers UE</b>			<b>70</b>	<b>10</b>
<b>TOTAL Engineers</b>			<b>341,75</b>	<b>30</b>

### Links between JRLAT and 3rd year options and M2s

This training is highly recommended for entry into 3rd year options where Scientific Research is the envisioned path for the student

It is also recommended, but not mandatory, for any option of the Institut Agro Montpellier

# Les Unités d'Enseignement séquentielles

## UE 1 Scientific skills development

### **Key words**

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Subject knowledge, Information retrieval, Critical thinking, Problem solving, Inquiring mind, Enthusiasm, Self-confidence, Self-reflection, Preparation and prioritization, Time management, Continuous professional development, Health and safety, Ethics, principles and sustainability, Project planning and execution, Teamwork, Communication methods, Society and culture

### **Objectives**

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#### 1- Develop an Understanding of Research Methodology:

- Familiarize students with the fundamental concepts, principles, and techniques of research methodology.
- Enable students to critically evaluate different research methodologies and select appropriate approaches for their research projects.
- Enhance students' ability to design research studies that align with academic and ethical standards.

#### 2- Enhance Critical Thinking and Analytical Skills:

- Foster critical thinking skills by encouraging students to analyze and evaluate research literature from various fields.
- Train students to identify research gaps, formulate research questions, and develop hypotheses or research objectives.
- Promote the ability to apply logical and analytical thinking to complex research problems and draw evidence-based conclusions

#### 3- Foster Literature Review and Information Retrieval Skills:

- Develop students' ability to conduct comprehensive literature reviews using appropriate databases, search engines, and research tools.
- Enhance skills in critically evaluating and synthesizing existing research findings to identify research gaps and build a strong theoretical foundation.
- Teach effective strategies for citation management, referencing, and avoiding plagiarism.

#### 4- Promote Ethical Conduct in Research:

- Raise awareness of ethical issues in research, including informed consent, confidentiality, integrity, and conflicts of interest.
- Enable students to navigate ethical review processes and adhere to ethical guidelines in conducting research.
- Foster an understanding of the responsible and respectful treatment of human subjects and the appropriate use of animals in research.

#### 5- Develop Proficiency in Research Data Collection and Analysis:

- Familiarize students with various data collection methods, such as surveys, interviews, observations, and experiments.
- Provide training in data management, organization, and analysis using appropriate statistical or qualitative analysis software.

- Enhance students' ability to interpret and present research findings effectively through appropriate visualization techniques.

6- Cultivate Effective Research Presentation and Communication Skills:

- Develop students' oral and written communication skills for presenting research findings to diverse audiences.
- Enhance proficiency in designing and delivering effective research presentations, including visual aids and interactive elements.
- Encourage students to prepare concise and coherent research reports, articles, and manuscripts suitable for publication in academic journals or conferences.

7- Foster Collaborative Research Skills:

- Encourage teamwork and collaboration in research projects, fostering an environment of shared learning and interdisciplinary approaches.
- Promote effective communication and conflict resolution skills within research teams.
- Develop an understanding of intellectual property rights and collaborative authorship practices.

***Skills assessed***

The Research Skills Training course assesses a range of skills essential for conducting effective research. Students will be evaluated on their understanding of research methodology, critical thinking abilities, and analytical skills. Assessment also includes their proficiency in conducting literature reviews, and retrieving information. Ethical conduct in research, data collection and analysis, as well as research presentation and communication skills, will be assessed. Additionally, collaborative research skills, such as teamwork and communication within research teams, are evaluated. Various assessment methods will be employed, mainly through the collaborative research project.

***Content and organization of the course***

Several research skills are explicitly taught in dedicated session:

- Literature discovery and management s a group
- Agile project management
- Research Data management
- Publishing as academics
- Research Integrity in the everyday practice
- R data management and visualization
- Sharing and versioning your code
- Writing a scientific article
- Giving a pitch presentation

Most of the content is delivered through active learning sessions where the students acquire a skill by using it directly within their research group. Each session takes place when the corresponding proficiency is required in the project so it is useful immediately and transposed to real case-study that promote engagement for the matter and full comprehension. The active learning sessions are therefore spread out during the whole semester from the very first day to the last week of the research project in December.

Lecture	TD	TP	Project	Autonomous work	Evaluation
24	22	12	4	5	1

### ***Assessment procedures***

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Each skill addressed during this UE is used within the research project. Its mastery will be addressed during and at the end of the research project in a group-base evaluation

The UE is passed if the mark obtained is equal to or higher than 10/20.



## UE 2 Disciplinary concepts for transitions (choose 3 from 6)

The Teaching Unit contains 6 different modules:

- ECUE 1a: Mediterranean Ecology
- ECUE 1b: Plant Molecular Physiology and Nutrition
- ECUE 2a: Molecular Evolution
- ECUE 2b: Water Management
- ECUE 3a: Environmental Economics
- ECUE 3b: Agroresources transformation

Each student must take 3 of them, one for each period from 1 to 3.

Cours	TD	TP	Projet	Travail en autonomie	Evaluation
24	12.5			37.5	3

### ECUE 1a: Mediterranean Ecology

#### **Persons in charge**

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Marie-Laure Navas

#### **Objectives**

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This course is based on the hypothesis that understanding the functioning of ecosystems shaped over centuries by fluctuating and unpredictable environment, in part due to human activities, can contribute to manage other ecosystems to get them adapted to climate change. The model chosen is the circum-Mediterranean zone, subject to great annual and inter-annual climatic fluctuations (with a forecast of drought exacerbation in the years to come) but also in terms of human occupation (ancient agriculture, transit zones, urbanization...).

#### **Aims of the course**

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The interventions of CEFE (Centre d'Ecologie Fonctionnelle et Evolutive) researchers specializing in these ecosystems will aim to characterize local biodiversity, its constitution and evolution, in response to environmental constraints (climate, fire, agricultural inputs, etc.) and their recent changes, its impact on the functioning of ecosystems and its various contributions to the populations.

#### **Disciplinary content and organization**

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- Conservation ecology
- Functional ecology
- Community ecology
- Fire ecology
- Agro-ecology
- Trait-based approaches

The module is planned on a period of four weeks. It encompasses 25 hours scheduled on the week time and students are expected to add 15 hours of additional homework. Academics are present with the students for half of the scheduled time for lectures, skills consolidation and other activities supporting the learning experience. Students spend the second half of the scheduled time in the dedicated learning Lab (the HIVE) to work on their own or in co-working with other students.

Evaluation is performed during the period.

### ***Assessment procedures***

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Acquisition of skills will be realized at individual and/or group levels.

A grade of 10/20 is necessary to get the credits

A retake exam will be proposed in case of a failed exam.

## **ECUE 1b: Plant Molecular Physiology and Mineral Nutrition**

### ***Persons in charge***

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Anna Medici & Pierre Berthomieu

### ***Objectives***

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In the era of transitions towards sustainable agriculture, the study of organisms, ecotypes or varieties with best performances is linked to the identification of key genes and characterization of their function. In the context of the semester, the course aims at teaching the strategies and tools used to identify the function(s) of a plant gene. It is based on the analysis of scientific papers published in the fields of plant mineral nutrition and adaptation to climate change. As such, the students will gain knowledge in these thematic fields. The approaches and methods developed in the papers are analyzed in depth and the students are expected to be able to propose on their own research programs to decipher the function of a gene in a specified context.

### ***Aims of the course***

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- Acquisition of academic knowledge in plant molecular physiology and plant mineral nutrition
- Self-learning capacity and development of lifelong learning
- Critical thinking in the analysis of the scientific literature
- Development of group working capacities
- Oral and writing scientific communication skills

### ***Disciplinary content and organization***

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Key concepts and tools of plant molecular physiology and of plant mineral nutrition:

- origin, making of and use of mutants
- identification, cloning and functional analysis of genes of interest
- in situ and ex situ gene expression analyses
- analysis of gene regulatory networks
- ion transport measurements at both the cell and whole plant levels
- regulation of mineral nutrition in response to environmental cues

The module is planned within a four-week-long period. 25 hours are scheduled on the week time and students are expected to add 15 hours of additional homework. Academics are present with the students for half of the scheduled time for lectures, skills consolidation and other activities supporting the learning experience. Students spend the second half of the scheduled time in the dedicated learning Lab (the HIVE) to work on their own or in co-working with other students.

Evaluation is performed all along the course as well as at the end of the period.

### ***Assessment procedures***

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Acquisition of skills will be realized at individual and/or group levels.

A grade of 10/20 is necessary to get the credits

A retake exam will be proposed in case of a failed exam.

## ECUE 2a: Molecular Evolution

### **Persons in charge**

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Jacques David & Vincent Ranwez

### **Objectives**

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Genetic diversity is essential for adaptation to climatic transitions, in crop and wild species as well. Preservation and use of the biodiversity of wild relatives can be reevaluated through DNA sequence analysis and theoretical concepts.

The course is thus an introduction to molecular evolution, it will provide students with knowledge and skills in population genetics and phylogenetic analysis. In this module, examples and case studies will be presented and students will have to seek out a deeper understanding of molecular evolution concepts and their use on real DNA data for the final aims to bring solutions to conservation and management of genetic diversity. Breeding (Plant, animal and any organisms) and conservation biology are the applied outputs of the course.

### **Aims of the course**

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- Acquisition of academic knowledges in molecular evolution
- Molecular sequence manipulation skills
- Self-learning capacity and development of lifelong learning
- Critical thinking in the use of DNA information
- Problem solving abilities in breeding and conservation biology
- Development of group working capacities
- Oral and writing scientific communication skills

### **Disciplinary content and organization**

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Key concepts and tools of population genetics and molecular evolution:

- Data acquisition: principle of sequencing/genotyping techniques
- Identification and alignment of homologous/orthologous sequences
- Dynamics of genes in population (population genetics, coalescent theory)
- Molecular diversity indicators (theta,  $H_e$ ,  $N_e$ , phylogenetic diversity etc.)
- Selection footprints: Synonymous/ non synonymous polymorphism, neutrality test including Mc Donald Kreitman test, codon model (PAML)
- Evolutionary scenario inference
  - non equilibrium population dynamics: coalescence based evolutionary scenario (drift, selection and migration), in silico simulation and test of fit of real data (Approximate Bayesian Computation)
  - among species: Phylogeny inference

The module is planned on a period of four weeks. It encompasses 25 hours scheduled on the week time and students are expected to add 15 hours of additional homework. Academics are present with the students for half of the scheduled time for lectures, skills consolidation and other activities supporting the learning experience. Students spend the second half of the scheduled time in the dedicated learning Lab (the HIVE) to work on their own or in co-working with other students.

Evaluation is realized during the period.

### **Assessment procedures**

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Acquisition of skills will be realized at individual and/or group levels.

A grade of 10/20 is necessary to get the credits

A retake exam will be proposed in case of a failed exam.

## ECUE 2b: Water Management

### ***Persons in charge***

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Gilles Belaud

### ***Objectives***

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Water resources are largely affected by climate change and anthropogenic drivers. Among them, agriculture has a huge impact on water resources, due to the withdrawals for irrigation, land management, release of contaminants... At the same time, reduced water availability is at the origin of crises and forces to develop new models for agricultural water uses.

The objectives of this course is to introduce major issues of water management for agricultural transitions, to illustrate the need for interdisciplinary approaches to address them (from biophysical sciences to social sciences), and to show how solutions can be designed and evaluated.

### ***Aims of the course***

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- Acquisition of academic knowledge in water sciences
- Development of capacity for interdisciplinary analysis
- Self-learning capacity and development of lifelong learning
- Critical thinking in the use of field data and reports
- Development of group working capacities
- Oral and writing scientific communication skills

### ***Disciplinary content and organization***

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- Challenges for water management in agricultural transitions: agroecology and water, water quality, groundwater (over-)exploitation, basin closure
- Water cycle and agricultural systems: agro-hydrology, transfer of contaminants, irrigation strategies, anthropogenic and climatic drivers
- Interdisciplinary analyses of solutions to address water crises (waste water reuse, storage, water harvesting, collective versus individual solutions); environmental impact assessment, modelling

The module is planned on a period of four weeks. It encompasses 25 hours scheduled on the week time and students are expected to add 15 hours of additional homework. Academics are present with the students for half of the scheduled time for lectures, skills consolidation and other activities supporting the learning experience. Students spend the second half of the scheduled time in the dedicated learning Lab (the HIVE) to work on their own or in co-working with other students.

Evaluation is realized during the period.

### ***Assessment procedures***

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Acquisition of skills will be realized at group levels.

A grade of 10/20 is necessary to get the credits

A retake exam will be proposed in case of a failed exam.

## ECUE 3a: Relationships between intrinsic properties of agro-resources, processing, and end products quality and functionality

### ***Persons in charge***

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Maeva Subileau

### ***Objectives***

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To move forward with agro-ecological transition, the entire production and value chain of agro-resources must be reconsidered, including the transformation processes. Low-energy and low-water consuming processes, use of alternative bio-based materials, adaptability to variable agro-resources, are examples of such a transition in the process design. Through problem-solving exercises and case studies, the course will focus on the relationships between the agro-resources composition and structure, the effect of processing, and the resulting properties that can be obtained. The aim is to understand how, beyond composition, the products properties (nutritional,

sensory, sanitary...) rely on the raw matter structural organization, and how rational processing can be designed and improved toward targeted functional properties, product durability and added value (applications can be food and non-food). Depending on fundamental comprehension objectives and/or environmental/industrial challenges, compromise between different processing steps or between different qualities will be addressed.

### ***Aims of the course***

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- Acquisition of general knowledge regarding agro-resources (raw materials) structures and functions, focusing on cereal grains.
- Ability to identify and characterize properties and quality of materials (including technical methodology for analysis)
- Critical thinking on the effect of processing on material functionalities (e.g. nutritional quality, bioavailability, mechanical or sensory properties, sanitary quality, hydration properties...)
- Abilities in the management of functional properties
- Identification of the demands/challenges/constraints (regarding product, process, environment, transfer...) in relation with the need to rethink global vs local production by means of alternative low-processing solutions
- Ability to establish a benefit-risk analysis on product and process quality, adopting a multicriteria and multifactor view and seeking compromises
- Self-learning capacity and development of lifelong learning
- Development of group working capacities
- Oral and writing scientific communication skills

### ***Disciplinary content and organization***

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Biochemical composition of the agro-sourced raw materials will be addressed in relation with concepts of quality and functionality. Based on the example of wheat, the course will demonstrate how, beyond composition, the physical chemistry of constituents (their structure and interactions, but also contaminants possibly present in the matrix) play key roles in the final properties of the intermediate and end products depending on the processing itineraries chosen.

The choices of raw materials (e.g., variety), and process itineraries (through first and second transformation: from farm to fork) will be studied in relation with their effects on the management of quality, energy, and customized properties. Physical and chemical processes, fractionation, but also physiological (e.g., germination) or microbial ones will be explored.

Examples of analytical tools at different study scales for mechanistic understanding of processes and fine characterization of biomarkers will be made available. Knowledge engineering tools could be used to address benefit-risk and compromise issues.

The module is planned on a period of four weeks. It encompasses 25 hours scheduled on the week time and students are expected to add 15 hours of additional homework. Academics are present with the students for half of the scheduled time for lectures, skills consolidation and other activities supporting the learning experience. Students spend the second half of the scheduled time in the dedicated learning Lab (the HIVE) to work on their own or in co-working with other students.

Evaluation is realized during the period.

### ***Assessment procedures***

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Acquisition of skills will be realized at individual and/or group levels.

A grade of 10/20 is necessary to get the credits

A retake exam will be proposed in case of a failed exam

## **ECUE 3b: Environmental Economics for Agricultural Transitions**

### ***Persons in charge***

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Gwenolé Le Velly & Alexandre Sauquet

### ***Objectives***

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The objectives of this course is to understand how environmental economists looks at the agricultural transitions by answering the following questions:

- How can the basic concepts of microeconomics (rivalry and excludability, externalities, etc.) and the insights of behavioral economics (dependence on norms, risk perception, etc.) explain the obstacles to changing agricultural practices.
- How can public policies remove some of these constraints?
- How can experimental and quasi-experimental evaluation methods help to analyze and improve those policies?

### ***Aims of the course***

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In this module, you will learn to characterize a situation of overpollution, or insufficient provision of an ecological service using the basic theoretical frameworks of microeconomics in the presence of externalities. You will then think about the various policy instruments that can be used to resolve this situation. In this course, you will also analyze how behavioral factors, linked to risk or social norms, can impact the behavior of the farmers. Finally, you will get acquainted with the evaluation of public policies using experimental and quasi-experimental methods.

### ***Disciplinary content and organization***

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Key concepts and tools of Economics:

- Supply and demand, economic surpluses
- Market failures, externalities, rivalry and excludability
- Economic and regulatory instruments
- Behavioral economics
- Impact evaluation

The module is planned on a period of four weeks. It encompasses 25 hours scheduled on the week time and students are expected to add 15 hours of additional homework. Academics are present with the students for half of the scheduled time for lectures, skills consolidation and other activities supporting the learning experience. Students spend the second half of the scheduled time in the dedicated learning Lab (the HIVE) to work on their own or in co-working with other students.

Evaluation is realized during the period.

### ***Assessment procedures***

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Acquisition of skills will be realized at individual and group levels.

A grade of 10/20 is necessary to get the credits

A retake exam will be proposed in case of a failed exam

## UE 3 Collaborative research project

### **Key words**

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Sustainable agriculture, Precision farming, Digital agriculture, Agroecology, Climate-smart agriculture, Food security, Crop diversification, Genetic engineering, Organic farming, Soil health, Irrigation management, Rural development, Agricultural policy, Food waste reduction, Agri-food value chain, Agricultural automation, Agroforestry, Sustainable intensification, Agricultural biotechnology, Data analytics, Precision livestock farming, Climate change resilience, Conservation agriculture, Agrochemical reduction, Remote sensing, Post-harvest technologies, Agricultural finance, Livestock genetics, Renewable energy in agriculture, Integrated pest management, Subject knowledge, Information retrieval, Critical thinking, Problem solving, Inquiring mind, Enthusiasm, Self-confidence, Self-reflection, Preparation and prioritization, Time management, Continuous professional development, Health and safety, Ethics, principles and sustainability, Project planning and execution, Teamwork, Communication methods, Society and culture

### **Objectives**

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Students will learn the main methods of the scientific process and apply it to a self-defined question.

They will develop their critical mindset, their scientific rigor, their creativity and their taste for innovation and research while developing the systemic and multidisciplinary vision that characterizes engineers in the French Grande Ecole (equivalent to MSc)

They develop their ability to work in groups in order to develop a collective intelligence by learning to listen in a multicultural and international environment while respecting appropriate ethical rules.

They develop their autonomy, their capacity for self-learning to be applied to any field in the future. They learn to generate ideas and defend them before a scientific authority while accepting to examine them critically.

They learn to step back and analyze scientific work, to rigorously source their arguments, and to combine them to discuss the relevance of their results.

They accumulate domain oriented scientific knowledge necessary for the realization of their project.

They strengthen their capacity in data analysis, R programming and scientific writing and communication

### **Skills assessed**

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Students will be evaluated

- as a group for the written report and the application of the good practices learned in other modules: the scientific mastering of the subject, the rigor, the conciseness, the relevance of the experiments and the quality of the analyses and discussions in relation to the state of the art are the main evaluation criteria
- individual peer-review: the relevance and depth of commentary on another group's work are evaluated
- individual oral presentation: a 3 min presentation without support will permit to evaluate the communication skills of the students towards a non-specialist although scientific audience.

A grade of 10/20 is necessary to get the credits

A retake exam will be proposed in case of a failed exam.

### **Content and organization of the course**

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The research projects are addressed through the field of expertise of l'Institut Agro Montpellier and its associated large scientific community in agriculture and fit questions related to sustainability transitions. Every year, teams of academics are volunteering to provide expert mentoring of the students during their project. Available themes vary

accordingly and their expertise. Projects are made available online during the Spring previous to the next enrollment period and the final list is obtained after the vote and self-organization of the whole class.

The Project's fair takes place mid-June. Once chosen, students acquire disciplinary scientific knowledge according to the project in which they are involved. They also benefit from the regular presentation of the other groups. They thus are made aware of the multi-disciplinary aspects of transitions.

In contrast with a traditional internship in a lab, the attendees choose their research theme in a context previously defined by an academic staff, benefit from the support of senior researchers to think and design their own project and will be encouraged to develop co-training. It is a bridge between academic input and research activity, an opportunity for developing international interculturality. It puts the students in the position of managing a research project from the building of working hypotheses, the acquisition of data, their analysis and the sharing of their research in written and oral form.

Cours	TD	TP	Projet	Travail en autonomie	Evaluation
			<b>35</b>	<b>175</b>	<b>12</b>

### ***Assessment procedures***

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The research project is evaluated through three activities:

- the quality and compliance to the provided rules of the scientific article written by each group of students
- the relevance and depth of the individual peer review that each student write at the end of the semester to comment the scientific article from another group
- a short individual oral presentation in front of the class

A grade of 10/20 is necessary to get the credits

A retake exam will be proposed in case of a failed exam.



## UE 4 Towards the concept of absolute sustainability in environmental assessment

### **Key words**

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Sustainability, Environmental assessment, Absolute sustainability, Sustainable development, Ecological footprint, Environmental impact assessment, Triple bottom line, Life cycle assessment, Environmental indicators, Environmental management, Resource efficiency, Ecosystem services, Greenhouse gas emissions, Biodiversity conservation, Climate change mitigation, Circular economy, Sustainable practices, Stakeholder engagement, Environmental policy, Sustainable decision-making.

### **Objectives**

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Achieving greater sustainability of agricultural and food production systems involves changes to existing systems. These choices will be driven by political, economic and technical considerations. To ensure that these choices will indeed lead to greater sustainability, the options considered must be evaluated. Many environmental assessment methods, meeting different objectives, exist. This course aims to train students in the principles and tools of environmental assessment, as well as the issues and research fronts facing these methods.

The research challenge of the teaching module:

- Why are we limited to only being able to achieve relative sustainability using Life Cycle Assessment (LCA) approaches?
- How could the concept of planetary boundaries and safe operating space may open the way towards absolute sustainability?
- Let's try to apply this to some cases studies (even if it is still partially) and see how it changes the perspective in terms of decision support.

### **Skills assessed**

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- Acquisition of academic knowledges in molecular evolution
- Molecular sequence manipulation skills
- Self-learning capacity and development of lifelong learning
- Critical thinking in the use of DNA information
- Problem solving abilities in breeding and conservation biology
- Development of group working capacities
- Oral and writing scientific communication skills

### **Content and organisation of the course**

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Issues, key concepts and tools of sustainability assessment:

- Issues relating to the collapse of biodiversity, planetary boundaries, etc.
- Methods to assess sustainability
- Life Cycle Assessment (LCA)
- Concepts of weak/strong sustainability, relative/absolute sustainability
- Eco-design

This module consists of lectures in which students will acquire the basic concepts of sustainability assessment. Most of the time is devoted to self-learning or practical work and relies on available resources provided by the teaching team to favor self-learning. Students are also put in a situation of co-working and sharing between them within the HIVE. The module is planned on a period of four weeks. It encompasses 25 hours scheduled on the week time and students are expected to add 15 hours of additional homework. Academics are present with the students for half of the scheduled time for lectures, skills consolidation and other activities supporting the learning experience. Students spend the second half of the scheduled time in the dedicated learning Lab (the HIVE) to work on their own or in co-working with other students.

Cours	TD	TP	Projet	Travail en autonomie	Evaluation
18	11		8	25	2

### ***Assessment procedures***

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The evaluation is based on a group-written report addressing a research question that takes the form of a short project. The UE is passed if the mark obtained is equal to or higher than 10/20.

## Les Unités d'Enseignement continues Ingénieur

### UE Développement professionnel

<b>Responsables pédagogiques</b> Mélanie DUPPI - 04.99.61.30.15 - <a href="mailto:melanie.duppi@supagro.fr">melanie.duppi@supagro.fr</a> Laurent TEZENAS - 04.67.61.70.54 - <a href="mailto:laurent.tezenas@supagro.fr">laurent.tezenas@supagro.fr</a>	
<b>Assistante de formation</b> Assimine AHAMADA - 04.99.61.28.28 - <a href="mailto:assimine.ahamada@supagro.fr">assimine.ahamada@supagro.fr</a>	
<b>Nombre d'heures</b> : 27 (+ 50h en autonomie)	<b>8 ECTS</b>
<b>Mots clés</b> : Gestion de projet, compétences, milieu professionnel, communication, travail en équipe, interdisciplinarité	
<b>UE et ECUE (élément constitutifs d'UE)</b>	L'UE DP en S7 contient 3 Ecue : <b>ECUE PEI</b> : <ul style="list-style-type: none"><li>• Responsable pédagogique : Géraldine Aumasson – 04.99.61.29.84 – <a href="mailto:geraldine.aumasson@supagro.fr">geraldine.aumasson@supagro.fr</a></li><li>• Assistante de formation : Assimine Ahamada - 04.99.61.28.28 - <a href="mailto:assimine.ahamada@supagro.fr">assimine.ahamada@supagro.fr</a></li></ul> <b>ECUE Stage en entreprise agricole</b> : <ul style="list-style-type: none"><li>• Responsables pédagogiques : Mélanie Duppi (IA) – 04.99.61.30.15 - <a href="mailto:melanie.duppi@supagro.fr">melanie.duppi@supagro.fr</a> Patrick Bourgeois (SAADS) – 04.67.61.70.09 – <a href="mailto:patrick.bourgeois@supagro.fr">patrick.bourgeois@supagro.fr</a></li><li>• Assistantes : Katty Fernandez (IA) – 04.99.61.26.43 – <a href="mailto:katty.fernandez@supagro.fr">katty.fernandez@supagro.fr</a> Cécile Verdeille (SAADS) – 04.99.61.70.60 – <a href="mailto:cecile.verdeille@supagro.fr">cecile.verdeille@supagro.fr</a></li></ul> <b>ECUE Projet personnel et professionnel (PPP) et communication</b> : <ul style="list-style-type: none"><li>• Responsables pédagogiques : Mélanie DUPPI - 04.99.61.30.15 - <a href="mailto:melanie.duppi@supagro.fr">melanie.duppi@supagro.fr</a> Laurent TEZENAS - 04.67.61.70.54 - <a href="mailto:laurent.tezenas@supagro.fr">laurent.tezenas@supagro.fr</a></li><li>• Assistante de formation : Assimine Ahamada - 04.99.61.28.28 - <a href="mailto:assimine.ahamada@supagro.fr">assimine.ahamada@supagro.fr</a></li></ul>

### Objectifs

#### Objectif général :

L'objectif de cette UE est de préparer les étudiants au milieu professionnel : par la mise en situations professionnelles, l'acquisition de compétences transversales, la préparation au projet professionnel et la préparation à l'emploi.

Les expériences professionnelles associées à cette UE (stage et projet étudiant) visent le développement de compétences professionnelles, disciplinaires et transversales (gestion de projet, communication, analyse, expression écrite et orale...), et contribuent à la construction du projet professionnel des étudiants.

Les enseignements proposés permettent aux étudiants de valoriser ces expériences dans la construction de leur projet professionnel et visent le développement de compétences en communication, la préparation à la recherche de stage et plus globalement la préparation à l'insertion professionnelle.

#### Sous-objectifs :

##### ECUE stage :

En dominante, cette ECUE fait suite aux stages réalisés dans le cadre de l'UE/ECUE « stage en entreprise agricole », en tronc commun des cursus IA et SAADS. Cette ECUE vise à développer sa connaissance de la réalité agricole (ou agroalimentaire) de son pays ou d'un autre pays, et mettre en œuvre des pratiques agricoles ou agroalimentaires, adaptées à la structure professionnelle de stage.

Les étudiants rédigent un rapport de stage dont les objectifs sont les suivants : analyser le fonctionnement d'une entreprise agricole sur les plans économiques, sociaux et techniques ; analyser un projet d'évolution ou une problématique de l'entreprise (cursus IA).

Les étudiants entrants directement en 2<sup>ème</sup> année ingénieur, n'ayant pas vécu l'UE/ECUE « stage en entreprise agricole » du tronc commun, réalisent quant à eux un exercice de présentation orale, dont les objectifs sont les suivants : présenter la structure professionnelle ainsi que les objectifs de la mission et résultats obtenus, apporter une analyse critique sur cette expérience.

#### **ECUE PEI :**

L'ECUE PEI en dominante a des objectifs qui sont dans la continuité de ceux de l'ECUE PEI en tronc commun. Les étudiants vont ainsi poursuivre l'acquisition de compétences en gestion de projet à savoir : utiliser des outils de gestion de suivi de projet, travailler en équipe pour répondre à la commande d'un commanditaire extérieur à l'école, récolter puis analyser des données, émettre des préconisations, fournir des livrables en adéquation avec la commande et construire des supports de communication afin de présenter à l'oral les résultats de leur travail.

#### **ECUE PPP et communication :**

L'ECUE « projet personnel le professionnel et communication » a pour objectif de préparer les étudiants à la recherche de stage (ou d'emploi) : savoir identifier et mobiliser son réseau professionnel, savoir organiser sa recherche de stage ou d'emploi, savoir candidater. Les étudiants sont notamment accompagnés pour identifier et valoriser leurs compétences et élaborer leurs outils de candidature : Cv, lettres de motivation, pitches de présentation personnelle. Chaque étudiant bénéficie d'une correction personnalisée de ses outils de candidature, apportée par des professionnels du recrutement et positionnée avant le Forum des métiers (fin novembre).

Au-delà des rencontres proposées dans le cadre du Forum des métiers de l'Institut Agro Montpellier, les étudiants ont l'opportunité, dans cette ECUE, d'échanger avec des recruteurs sur les techniques de recrutement pratiquées. Ils sont par ailleurs sensibilisés au droit du travail, afin d'acquérir les connaissances de base liées à la négociation de leurs futurs contrats.

Enfin, cette ECUE a pour objectif d'apporter aux étudiants des bases en communication leur permettant, en situation professionnelle, d'identifier, prévenir et sortir des conflits.

### ***Organisation générale et positionnement de l'UE dans l'année***

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**ECUE PEI :** Les étudiants poursuivent le projet démarré au cours du semestre 6. Le travail personnel se fait principalement pendant les journées PEI ciblées, ainsi que les demi-journées libérées à l'emploi du temps. L'ECUE prend fin en décembre, lors de la soutenance finale.

**ECUE stage :** La période de stage est réalisée en première année du cursus, et rattachée à l'UE/ECUE « stage en entreprise agricole » du tronc commun IA et SAADS. Le rapport de stage est rendu au cours du S7.

**ECUE PPP et communication :** Les TD ont lieu en continu, tout au long du semestre.

### ***Capacités évaluées***

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#### ***Concepts-clés à mobiliser***

- ECUE stage : systèmes de cultures et d'élevage, autonomie
- ECUE PEI : conduite de projet, notion d'interculturalité, travail collaboratif
- ECUE PPP et communication : techniques de recherche de stage et de construction du projet professionnel, droit du travail,

#### ***Outils et méthodes à maîtriser***

- Rédaction de supports (rapports, notes de synthèse, CV et lettres, profils réseaux sociaux) en tenant compte des consignes transmises et des attentes des destinataires
- Présentation à l'oral du travail réalisé, des compétences développées en s'adaptant au public (jury, tuteur, étudiants) en s'appuyant sur des supports adaptés (diaporamas par exemple)
- Mobilisation des connaissances disciplinaires spécifiques à l'étude, au projet, à la compréhension de l'organisation de la structure professionnelle
- Analyse du fonctionnement d'une entreprise agricole, analyse économique, analyse d'un projet multicritère, en repositionnant l'entreprise dans son environnement (ECUE stage)
- Conduite de projet : organisation du travail en équipe, gestion d'un budget, d'un planning, adoption d'une démarche interdisciplinaire (ECUE PEI)

- Analyse d'expériences, valorisation à l'écrit et à l'oral, explicitation de sa trajectoire et de ses choix de formation (ECUE PPP et communication)

### Comportements

- Adopter une posture professionnelle
- S'adapter et s'intégrer dans une équipe et/ou un milieu professionnel nouveau (ouverture d'esprit, capacité d'écoute, intégration des différences culturelles)
- Développer une attitude collaborative lors des travaux de groupe ou d'équipe

### Contenu de l'UE et programme

Discipline	cours	TD/TP	Autres activités pédagogiques en autonomie	Examen	Total
ECUE PEI	1	6	50	1	58
ECUE Stage	0	0			0
ECUE PPP/com	1	18			19
TOTAL UE	2	24	50	1	77

### ECUE PEI

COURS (1 h)	Remise en route des PEI après la période estivale
TD (6 h dont 2h pendant journée PEI)	Travail dans un contexte interculturel et accueil de nouveaux entrants dans les groupes Préparation à la soutenance orale (pendant journée PEI) Co-développement : analyse des difficultés vécues en situation professionnelle PEI
Travail en autonomie (50h)	Temps libéré à l'emploi du temps « journées PEI »

### ECUE PPP COM

COURS (1 h)	Introduction de l'UE Développement Professionnel : organisation, modalités, évaluation
TD (18 h)	Analyser ses expériences et identifier ses compétences Organiser sa recherche de stage (ou d'emploi) Préparation de candidatures : les attendus du CV et de la lettre de motivation Atelier corrections CV/lettres de motivation Pitch de présentation personnelle et simulations d'entretien de recrutement Techniques de recrutement : la vision d'un employeur Le réseau professionnel : l'identifier, le créer, l'utiliser, l'entretenir Communication non violente Sensibilisation au droit du travail

### Modalités d'évaluation

ECUE stage (50%) : rapport de stage, rendu écrit réalisé en tronc commun (étudiants ingénieurs agronomes)  
ECUE PEI (37,5%) : rapport écrit, soutenance orale 1h  
ECUE PPP/communication (12,5%) : rendu écrit

### Structures de recherche et professionnels associés

Commanditaires PEI, organismes de stage  
Interventions de professionnels en TD (PPP).

## UE LV1 – Communication en langue anglaise

<b>Responsables pédagogiques</b> Jean-Marc Dépierre - 04 99 61 28 53 - <a href="mailto:jean-marc.depierre@supagro.fr">jean-marc.depierre@supagro.fr</a> Fabien Zecchino - 04 67 61 70 62 - <a href="mailto:fabien.zecchino@supagro.fr">fabien.zecchino@supagro.fr</a>	
<b>Assistants de formation :</b> Olga COLLIN - 04 99 61 27 14 - <a href="mailto:olga.collin@supagro.fr">olga.collin@supagro.fr</a> Maija MIIKKOLA - 04 99 61 27 14 - <a href="mailto:maija.miikkola@supagro.fr">maija.miikkola@supagro.fr</a>	
<b>Nombre d'heures :</b> 22h	<b>1 ECTS</b>
<b>Mots clés :</b> compétences linguistiques, interculturel, communication professionnelle, champ lexical/grammatical, évaluation	
<b>UE et ECUE (élément constitutifs d'UE)</b>	Pas d'ECUE dans l'UE

### Objectifs

#### **Objectif 1 : Affirmer son projet professionnel**

- Se doter d'outils personnels et élaborer des stratégies en vue de son intégration dans le monde du travail dans un contexte international : CV, lettre de motivation, entretien d'embauche...

#### **Objectif 2 : Communiquer, échanger et argumenter**

- Renforcer les acquis des semestres précédents dans les domaines de la communication, de la prise de parole, de l'argumentation, de l'animation de débats et du travail d'équipe
- Identifier les stratégies de communication en lien avec son domaine de spécialité
- Savoir présenter et valoriser son activité professionnelle à destination du grand public

#### **Objectif 3 : Renforcer sa maîtrise linguistique et développer ses connaissances lexicales**

- Renforcement du vocabulaire général et agronomique
- Acquisition et renforcement du vocabulaire du champ de spécialisation (suivant la dominante choisie)
- Consolidation des acquis grammaticaux des cycles précédents
- Développement de la maîtrise phonétique (prononciation, prosodie, rythme, accentuation...)

### Organisation générale et positionnement de l'UE dans l'année

UE transversale sur le semestre 7, l'anglais est enseigné de septembre à fin décembre à raison de 11 séances de 2h hebdomadaires.

La présence est obligatoire. A chaque absence non justifiée, il sera attribué un « 0 » comptant pour la moyenne. Des groupes de niveaux sont constitués pour un meilleur apprentissage.

### Contenu de l'UE et programme

#### **1 : La recherche d'emploi**

- Savoir rédiger un CV et une lettre de motivation en anglais
- Réaliser un entretien d'embauche

#### **2 : Le compte-rendu écrit**

- Savoir rédiger un écrit à caractère professionnel (compte-rendu, résumé scientifique, email...) de manière appropriée et efficace

#### **3 : La communication à caractère professionnel**

- Savoir présenter et promouvoir son activité en anglais
- Se familiariser avec les outils de communication en lien avec son domaine de spécialité

#### **4 : Le management interculturel**

- Appréhender l'influence et les effets de la dimension culturelle dans un cadre de travail international

## **Capacités évaluées**

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### **Concepts-clés à mobiliser**

Etre capable de comprendre et de s'exprimer couramment en langue étrangère  
Maîtriser les stratégies de communication en langue étrangère

### **Outils et méthodes à maîtriser**

Savoir présenter et valoriser ses compétences professionnelles

### **Comportements**

Savoir communiquer et interagir dans un contexte interculturel

## **Modalités d'évaluation**

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Contrôle continu : 100 %. On cherchera à évaluer au moins trois des cinq compétences linguistiques (compréhension orale, compréhension écrite, expression orale, expression écrite, interaction orale).

Niveau visé (selon le cadre européen pour l'enseignement des langues) : C1, niveau minimal attendu : B2 (785pts au TOEIC / 160pts au Cambridge)

## UE LV2 – Communication en langue vivante (Allemand – Espagnol – Portugais)

<b>Responsables pédagogiques</b> Nafissa ELANIOU - 04.99.61.22.27 – <a href="mailto:nafissa.elaniou@supagro.fr">nafissa.elaniou@supagro.fr</a>	
<b>Assistante de formation :</b> Olga COLLIN - 04 99 61 27 14 - <a href="mailto:olga.collin@supagro.fr">olga.collin@supagro.fr</a>	
<b>Nombre d'heures :</b> 16,5h	<b>1 ECTS</b>
<b>Mots clés :</b> compétences linguistiques, interculturel, communication professionnelle, champ lexical/grammatical, évaluation	
<b>UE et ECUE (éléments constitutifs d'UE)</b>	Pas d'ECUE dans l'UE

### **Objectifs de l'UE**

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L'UE LV2 a pour objectif de répondre aux compétences linguistiques, communicationnelles et interculturels d'un(e) ingénieur(e) à l'international.

Afin d'atteindre cet objectif général, 2 axes majeurs seront privilégiés au cours de la formation et la primauté sera donnée à la communication orale.

- Compréhension et mobilisation d'éléments de cultures étrangères pour développer des compétences interculturelles et inter-linguistiques dans des situations socio-professionnelles de référence.
- Développement et approfondissement des éléments de la langue scientifique et technique en lien avec le domaine d'étude.

### **Organisation générale et positionnement de l'UE dans l'année**

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Les enseignements se déroulent à hauteur d'1,5 heure par semaine selon un calendrier établi en début de semestre.

Un test de positionnement peut être proposé aux étudiant(e)s.

Les cours de LV2 du tronc commun s'articulent autour de thématiques ou objectifs précis en fonction des niveaux de langue :

- ➔ Pré A1 à A2 : Comprendre, parler, lire et écrire une langue étrangère au plus proche de l'authenticité pour communiquer de façon efficace dans des situations sociales de référence
- ➔ A2 à C1 : Comprendre, parler, lire et écrire une langue étrangère au plus proche de l'authenticité pour communiquer de façon efficace dans des situations socio-professionnelles de référence.

### **Contenu de l'UE et programme**

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Le contenu de l'UE varie selon le niveau de LV2

Les niveaux A2 à C1 pourront développer les compétences suivantes :

#### **1 : Affirmer son projet professionnel**

- Savoir rédiger un CV et une lettre de motivation.
- Réussir un entretien de recrutement en valorisant son parcours.
- Se projeter dans son avenir professionnel.

#### **2 : Echanger, convaincre et argumenter dans des situations sociales ou professionnelles :**

- Conduire un débat.
- Rédiger un écrit argumentatif pour valoriser un projet, une idée.
- Savoir prendre la parole pour défendre un point de vue et argumenter.
- Renforcer les techniques de présentation pour communiquer efficacement ses idées.



- Comprendre, créer, et mettre en œuvre des stratégies de communication efficaces pour convaincre un auditoire.
  - Concevoir un support de présentation visuel impactant et s'en saisir pour valoriser ses idées et son propos.
- 3 : Communiquer avec des locuteurs de différentes cultures :**
- Connaître et se saisir des différences culturelles propre aux différents pays de référence.
  - Comprendre ou communiquer en tenant compte de la diversité diatopique (variation d'une même langue d'un espace géographique à un autre).
  - Connaître la phonétique et les subtilités linguistiques favorisant l'intégration.

### ***Exemples de compétences transversales évaluées***

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- Organiser son travail pour participer à un projet.
- Mobiliser des stratégies adaptées à une intention de communication.
- Concevoir des supports de communication efficaces.
- Mobiliser des éléments culturels, interculturels dans le cadre d'un projet ou d'une tâche.
- S'exprimer à l'oral ou à l'écrit de façon claire et organisée dans un contexte social ou professionnel de référence.

### ***Modalités d'évaluation***

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#### Contrôle continu :

- Pour chaque semestre, un minimum de 3 compétences langagières est évalué (coefficients identiques).

#### Absentéisme et retards :

- Présence en cours de langue obligatoire, quel que soit le niveau de l'étudiant.
- En cas d'absence justifiée, les étudiant(e)s font passer leur justificatif (rendez-vous médical, administratif, décès d'un proche, convocation...) au service de la scolarité et en adresse une copie au coordinateur/à la coordinatrice dès leur retour et au plus tard sous 8 jours.

L'absence est alors excusée et n'entraîne aucune sanction.

Pour chaque absence non justifiée, un zéro sera ajouté à la moyenne du semestre

En cas de retard de plus de 5mn, l'enseignant(e) est en droit de ne pas accepter l'étudiant(e) en cours et le retard est donc assimilé à une absence.

## UE Statistiques

<b>Responsable pédagogique</b> Christophe ABRAHAM – 04.99.61.26.51 – <a href="mailto:christophe.abraham@supagro.fr">christophe.abraham@supagro.fr</a>	
<b>Nombre d'heures</b> : 4,5	<b>0 ECTS</b>
<b>Mots clés</b> : raisonnement statistique, modélisation, analyse de données, modèle linéaire	
<b>UE et ECUE (éléments constitutifs d'UE)</b>	Pas d'ECUE dans l'UE

### Objectifs de l'UE

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L'objectif de cette UE est de revoir les bases du raisonnement statistique (inférence) et d'étudier plus en détails le modèle linéaire ; en particulier, l'analyse de la variance.

### Capacités évaluées

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Savoir inférer à partir d'un échantillon des propriétés pour une population, capacité à transformer une question agronomique en test d'hypothèses.

Connaissance théorique et mise en pratique du modèle linéaire à l'aide du logiciel R.

### Contenu de l'UE et programme

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Cette UE permet de voir ou revoir des concepts de base de statistique à partir de l'analyse pratique de données à l'aide du logiciel R. Plusieurs jeux de données associés à des questions sont proposés aux étudiants au début de l'UE (défis). Les étudiants choisissent un jeu de données et mettent en pratique une méthode statistique pour apporter des réponses aux questions posées. Ils peuvent travailler en autonomie et sont guidés par un enseignant pendant des séances de TD ou de classes inversées.

COURS (1,5 h)	Modèle linéaire, bases de statistiques (Statistiques descriptives, Estimation, Tests)
TD (3 h)	Modèle linéaire, bases de statistiques (Statistiques descriptives, Estimation, Tests)
Travail personnel	Cette UE se mènera en logique de classe inversée et chaque CM sera préparé en amont par du travail personnel sous formes d'exercices et de questionnements préalables sur la base de supports documentaires fournis.

### Modalités d'évaluation

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L'UE n'est pas évaluée de manière indépendante mais les comptes rendus de TD ou de travaux personnels peuvent être comptabilisés dans la moyenne du contrôle continu des UE séquentielles.