

# AgriSmart

Sustainability and digital skills for the agricultural sector



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Erasmus+ Programme  
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# AGRISMART TRAINER HANDBOOK FOR VET PROVISION

## AUDIENCE OF THIS DOCUMENT

Teachers and trainers of vocational education and training.

## ACRONYMS AND DEFINITIONS

The complete "Glossary" for each Learning unit is provided in the T1 O2 output. We suggest to deepen the project website: <https://agri-smart.eu/>



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## **SCOPE**

AgriSmart is an Erasmus+ KA202 project that aims to adapt VET & WBL provision to existing and emerging occupational needs and strengthen farmers' climate-smart and digital skills.

This document is intended to be used as an educational instrument to promote innovative topics concerning smart agriculture. In particular, the O3 scope is to provide a trainers' handbook to access the teaching materials easily and develop for the six Agrismart Learning Units (LUs), which focus on Common Agricultural Policy (CAP), Sustainable Agriculture, Sustainable Water Use, Sustainable Weed and Pest Management, Agriculture 4.0 and Data for Sustainable Production.

This document summarises some important information to understand learning units' structure connections and provides additional information to trainers on designing their lesson plans and customising the material. The document is organised into two main sections. Chapter 1 focuses on targeting class topics tailored to the student to develop an adequate didactic structure. Therefore, the LU material should be the basis for building a lesson plan, but it should not be considered a ready-to-go material without adequate customisation by the trainer. Chapter 2 summarise for each LU the most important information and additional teaching resources to plan the training. This section aims to provide the Agrismart trainers with a simple tool to navigate the LUs material and design an active training for farmers to increase their understanding and skills on sustainability and digital agriculture.



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## 1. INTRODUCTION

Learning units (LUs) structure and connections are fundamental to developing an adequate lesson plan targeting farmers and professionals. The LUs begins with an introductory LU about "Common Agricultural Policy (CAP)" (LU1), which represents a contextual and legislative background for all other LUs. LU1 introduces the fundamentals of environmental protection and sustainability, the efficiency of food production, innovations in the agricultural sector and rural community development. Subsequently, a second introductory LU introduces the general topic of "sustainable agriculture" (LU2) and provides the background needed to navigate the following LUs. The overarching objective of LU1 and LU2 is to support the acquisition of general knowledge and skills about the legislative context and the importance of sustainable agriculture practices before moving to more technical LUs, recognising the fact that digital technologies are not valuable "per se" but as a way to achieve sustainability and comply with the regulations while maintaining or increasing commercial farm profitability.

AgriSmart LUs 3 and 4 introduce critical aspects of sustainable farming practices. LU3, "sustainable water use management", refers to one of the most important elements for life on Earth, water, and illustrates approaches to reducing agricultural activities' significant impact on water resource availability and quality. LU4 deals with "sustainable pest and weed management" as another critical area to address the sustainability challenges in agriculture. Both LUs can be connected with lectures about agronomy, climate change, sustainable agricultural practices (e.g. organic farming; permaculture) and the use of technological innovation at the field and farm level. While these topics are not exhaustive to cover agricultural sustainability practices (i.e., other important aspects include fertilisation, soil management, crop rotation/spatial management, etc.), they provide a reference to discuss the linkage to digital technologies and prepare for the subsequent LUs.

LU 5 and 6 are strictly connected to the previous learning units because they cover theoretical and practical aspects of enhancing sustainability using technological innovation. LU5 is about "Agriculture 4.0" and provides a broad illustration of digital technologies in agriculture, including a glossary for the key terminology. The unit is naturally connected to LU6 "data for sustainable production". This LU is expected to be very practical and, using the knowledge and skills acquired by trainees with the previous LUs, has the goal to support the development of trainees' ability to perform simple but



fundamental, practical actions using digital data and to see the value of applying digital technologies for improving plot and farm management.

## 1.1 UNDERSTANDING DIGITAL AGRICULTURE

The Agrismart training lays its foundations on the exponential growth of devices, technology and tech companies offering digital agricultural services that farmers and agricultural professionals are and will increasingly encounter in their daily work. The digitalisation of agriculture is happening through the proliferation of mobile technologies, distributed computing capabilities of the machines and remote sensing technologies also promoted and financed by the EU governments.

The practical knowledge about digital agriculture accessibility, tools and management for farmers opens up new opportunities to improve their lives and livelihoods by lowering production costs and reducing information asymmetries. In addition, technology can support the sustainable improvement of agricultural practices toward higher resource-use efficiency and reduced environmental impacts.

However, for farmers, the lack of knowledge and experience in digital agriculture legislation, services, tools and applications can limit the possibilities of digital transformation of the agricultural sector.

Understanding the digital agriculture revolution and its technical solutions can support farmers in taking better farm management decisions (for instance, related to plant nutrition and health, irrigation, animal feeding, etc.) and can support farmers in increasing their incomes and yields while adopting more sustainable agronomic practices.

The teachers and trainers that will assist and inform farmers through this handbook and all the Agrismart training materials will help the farmers to become independent users of tools and technical information concerning digital agriculture.



## 1.2 TEACHING METHOD

AgriSmart output 1 describes the structure and outcomes of LUs, while output 2 includes the content of each LU. LU 1 and 2 provide the general background needed to understand agriculture sustainability and digital farming, LU 3 and 4 focus on sustainable crop management, and LU 5 and 6 introduce digital agriculture with a strong practical approach. The proposed sequence of LUs is recommended but not mandatory, as the trainer is expected to adapt it to the trainee's level.

As part of the development of each LU, it is strongly recommended to develop an active and participative educational approach according to Agricultural Knowledge and Innovation Systems (AKIS). Active educational methods have been long and widely applied, and those educational practices have proved their effectiveness; in training planning, new and traditional teaching methods should be carefully considered as any specific method brings pros and cons determined by the educational context as well as by the users' personalities (ScientixBlog, 2017).

The value of the information and shared idea lie in how the trainers set the lessons and conduct the dialogue in the educational context. The trainers need to introduce practical education in sustainability and digital agriculture to implement practical lectures or work experience (involving farmers and professionals). The AgriSmart student, in that way, can connect the content of the LU with the professional farm work, acquiring additional practical options to prove what they learned (Euro-EducATES, 2018).

Below are suggested the main teaching method suitable in that context (CASE, 2018):

Personal Reflection; Explanation; Demonstration; Experiment-based Learning; Learning by means of experimental/practical works; Learning through discovery; Cooperative Learning; Electronic Learning (e-learning); Problem-based learning; Learning based on a case study.



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### 1.2.1 FORMS AND METHODS FOR TEACHING

AgriSmart project's students will be adults and farmers; as reported in Helen (2015) and EU SCAR AKIS (2019), it is focal to understand that this audience implies tailored educational approaches that:

- can blur the boundaries between trainers and students;
- could help them to go further from what they have already decided for themselves that is important to be learned;
- will help them to verify the information acquired with experience.

It is also important to remember that people attending the course usually expect that what they are learning will be immediately useful and farmers, in particular, may have fixed viewpoints based on their experience.

In the participative and active educational approach, it is a strong value when the students have much experience upon which to draw because personal knowledge, when shared in the right context and form, could be essential for the learning process of the whole class. In particular, during group work is essential that the trainer stimulates the adult student who has a significant ability to serve as a knowledgeable resource to play the role both of a learner and a fellow trainer

In practical activities, the emphasis is on cross-curricular integration. When the intent is to organise teaching in the form of project work, it is necessary to predict the scope of this type of work to prepare both students and teachers. In this way, the learning activities allow the students to develop the learning elements through personal and group research and practical work, from task planning and collecting data to formulating findings and presenting the results. The approach is based on an independent learning process and through discussions, team field activities and interactions with stakeholders and professionals on farms and in the community, self-reflection of the learning process, and evaluations of the newly acquired knowledge.

The activities are set up to encourage learning based on cooperation among the participants and the environment. The contents of the learning modules are designed to enable transfer and can be used



in different environments. The emphasis is on the flexible understanding of sustainable and digital agriculture and the broad possibilities of using these contents on real farms.

In general, examples of exercises or practical activities could be: participatory field visits, personal work, group work, workshop sessions, participatory focus groups on a specific topic for scaling up agricultural systems, a participatory or personal creation of interviews for experts, farm visit, expert seminar, examine traditional technologies in modern challenges on farms today, private/group development of a technological related product.

The practical examples of exercises and activities are reported in the summary sheets in Chapter 2.

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### 1.2.2 ADAPT TEACHING TO THE TARGET

In order to obtain the best from the class and lesson plan targeting the needs of the students, it is fundamental for the trainers to assess the initial knowledge level of each LU of the class.

The LU sheets from chapter 2 suggest a specific questionnaire to evaluate students' knowledge of each LU. The aim is to propose a few initial assessment questions to understand the level of the students (at least 3-5 questions for each LU). The objective of using the first questionnaire at the beginning of the course is to help the trainer to understand the needs and select effective learning tools, materials and topics for increasing the students' recognition, curiosity, and attention about topics that could be highly knowledgeable about because of their farmer activity.

Furthermore, a second questionnaire is proposed at the end of the course for the teaching assessment. The second questionnaire might be the same across LUs, and the following questions could be proposed:

1) Was the course topic difficult for you? Evaluate with a grade from 1 to 5, for which 1 is not difficult at all and 5 means very difficult.





2) Compared to initial expectations, was the course satisfactory? Evaluate with a grade from 1 to 5, for which 1 is not appreciated, and 5 means very satisfactory.

3) Do you think you will be able to use the information and innovations you learned during the course in your work?

4) What aspects or topics of the course did you particularly like?

5) Are there any suggestions for improving the course in the future (e.g. topic, teaching methods)?

Promoting the second questionnaire at the end of the course aims to understand the eventual dissatisfaction and disillusionment of students who attended the course and gain important insights on how to improve the course going forward. The answers are essential to understanding tips for enhancing teaching methodology and tools.

This handbook suggests main student-centred learning objectives such as using methods and contents that suit students learning styles, maximising student engagement and ensuring relevancy in course content taking inspiration to Marinko I. et al. 2016.

Teachers should try to attract students' interests, organise content and activities around subjects that are meaningful to the students, and determine clear opportunities that let all students develop their learning. Teachers should understand the strengths and weaknesses of the class, so the questionnaire before starting, in that case, is essential.

Teachers should also introduce transparent procedures for students who should be able to give feedback on the quality of the educational process, be consulted on curriculum content, and on the teaching and evaluation methods used. The final questionnaire is useful for that reason and also to provide an assessment for the teacher

This handbook suggests for the trainer a bottom-up approach considering students as the core of the learning process. They should be included in the important decision of the teaching schedules and topics.

Students, for example, could be mainly farmers and, in general, young adults/adults, so it is important to understand their necessity in terms of:



- the availability to attend the course. Probably the lectures will be in the afternoon or evening classes (after they finish working);

- the necessity of learning methods that value their already existing practical knowledge should have interesting lectures which attract students to listen.

The teachers should also understand that employed students cannot come to their lectures on time and/or exactly as determined by the teacher, so it is important to find compromises (e.g. recording)



## 2. REFERENCES

CASE, 2018. Knowledge Platform, Teaching and learning approaches. Supported by Erasmus+ Programme of the European Union. <https://www.case-ka.eu/index.html%3Fp=2740.html>

Euro-EducATES, 2018. O3 Handbook. Teaching tool and materials, Teaching agroecology in the transitory period and its consequences for the Agricultural Knowledge Systems, <http://www.euroeducates.eu/>

EU SCAR AKIS (2019), Preparing for Future AKIS in Europe. Brussels, European Commission.

Helen W. 2015. Teaching Adults: What Every Trainer Needs to Know About Adult Learning Styles.

Helen W. Post Executive Director, Utah Parent Center. <https://www.ioaging.org/wp-content/uploads/2015/03/teachingadults-whattrainersneedtoknow-sml.pdf>

Marinko I. et al 2016, EMPOWERING TEACHERS FOR A STUDENT-CENTRED APPROACH. TEACHERS' HANDBOOK ON STUDENT-CENTRED APPROACH <https://ec.europa.eu/programmes/erasmus-plus/project-result-content/c55c65b9-7799-482e-b941-cfe94b3f3924/2%20SCL%20RESEARCH%20IN%20ENGLISH.pdf>

ScientixBlog, 2017. Methods of developing an active mind (Active-participative methods) <http://blogs.eun.org/scientix/2017/02/methods-of-developing-an-active-mind-active-participative-methods/>



### 3. LEARNING UNIT SUMMARY SHEETS

#### 3.1 COMMON AGRICULTURAL POLICY (CAP)

LU1: COMMON AGRICULTURAL POLICY (CAP)					
<b>Abstract</b>	<p>This learning unit focuses on a general overview of the CAP, its benefits for farmers and EU citizens, and introducing new strategies proposed by the EU Commission for the future of the new Common Agricultural Policy, which will be implemented from 1 January 2023.</p> <p>The objective of this unit is to familiarise the farmers with the overall aspects of the new CAP policies, focusing on issues related to climate change, biodiversity loss and management of natural resources.</p> <p>Furthermore, another objective is presenting the novelties of the new CAP, which were introduced in response to criticism from previous periods- the new CAP will also ensure a fairer distribution of CAP support, especially to small and medium-sized family farms and young farmers.</p>				
<b>Connection with other LU</b>	<p>This LU represents a legislative background for all other learning units, mainly in terms of environmental protection and sustainability, the efficiency of food production, support of innovations in the agricultural sector, and supporting rural community development in general.</p>				
<b>Structure and additional learning methods of the LU</b>	<b>Topic</b>	<b>Hours</b>	<b>Theory</b>	<b>Practice</b>	<b>Additional</b>
	THE BENEFITS OF THE CAP	8	X		Focus group
	THE NEW CAP	16	X		Expert seminar, focus group
	CAP REFORM AND THE NEW	16	X		Exper seminar, focus group



	<p>MODEL OF AGRICULTURE AND SUSTAINABILIT Y</p>				
<p><b>Additional resources from other courses/videos/tutori als on the topics</b></p>	<p>Reforming the Common Agricultural Policy: <a href="https://www.youtube.com/watch?v=tcQTN6CGpQw">https://www.youtube.com/watch?v=tcQTN6CGpQw</a></p> <p>Timeline: The Common Agricultural Policy: <a href="https://www.youtube.com/watch?v=Z3tUtTMIXuA">https://www.youtube.com/watch?v=Z3tUtTMIXuA</a></p> <p>Unpacking the CAP: exploring the most common concerns: <a href="https://www.youtube.com/watch?v=JOZCk1DdDR0">https://www.youtube.com/watch?v=JOZCk1DdDR0</a></p>				
<p><b>Questionnaire for initial evaluation of students' knowledge</b></p>	<p>General questions could be the same for each LU, e.g., Nationality, Sex, Age, Education, Role in the Farm, Farm's hectare, farm production,</p> <p>It is essential to understand what is helpful to investigate and which topics of LU1 as new may be of greater interest.</p> <p>Do you have enough information about the original CAP?</p> <p>Are you aware of the proposed reforms in New CAP?</p> <p>Do you have information about your national strategic plan for the CAP?</p> <p>Have you heard any criticism of the CAP implementation in the past?</p> <p>Are you aware of the benefits that CAP brings to farmers?</p> <p>Reforming the Common Agricultural Policy: <a href="https://www.youtube.com/watch?v=tcQTN6CGpQw">https://www.youtube.com/watch?v=tcQTN6CGpQw</a></p> <p>Timeline: The Common Agricultural Policy:</p>				



	<p><a href="https://www.youtube.com/watch?v=Z3tUtTMIXuA">https://www.youtube.com/watch?v=Z3tUtTMIXuA</a></p> <p>Unpacking the CAP: exploring the most common concerns:</p> <p><a href="https://www.youtube.com/watch?v=JOZCk1DdDR0">https://www.youtube.com/watch?v=JOZCk1DdDR0</a></p>
<b>Questionnaire at the end of the course for the teaching assessment</b>	<p>1) Was the course topic complex for you? Evaluate with a grade from 1 to 5, for which 1 is not difficult at all and 5 means very difficult</p> <p>2) Compared to initial expectations, was the course to your satisfaction? Evaluate with a grade from 1 to 5, for which 1 is not appreciated at all and 5 means very welcome</p> <p>3) Do you think you will be able to use the information and innovations you learned during the course in your work?</p> <p>4) What aspects or topics of the course did you particularly like?</p> <p>4) Are there any suggestions for improving the course in the future (e.g. topic, teaching methods)?</p>
<b>Evaluation</b>	<p>See the chapter Learning Unit 5 in O2 T2 document: Common Agricultural Policy- part "Evaluation Standard" in AGRISMART CURRICULUM</p> <p>We propose: Oral: discuss the main topics</p> <p>Written: multiple-choice test, open-text questions</p>
<b>Exercise/Practical activity</b>	<p>The O1 and O2 did not specify a practical activity for that LU; however, focus group discussion during lessons for developing a critical and innovative vision about future policy is recommended. It could be helpful, for example, to simulate the participation or get involved in activities promoted by the European Commission, such as: "Call for expression of interest for experts participating in Focus Groups of the European Innovation Partnership on 'Agricultural Productivity and Sustainability"</p>



	<p><a href="https://ec.europa.eu/eip/agriculture/sites/default/files/20211123_calltext_fg44-46_final.pdf">https://ec.europa.eu/eip/agriculture/sites/default/files/20211123_calltext_fg44-46_final.pdf</a></p> <p>Furthermore, seminars and interviews with professionals working on the topic for the EU research centre on the territory or other experts linked to the topic are recommended.</p>
<b>Teaching materials and media</b>	White/Blackboard, notepad, laptop, pencil, video equipment, flipchart, visualisation tools for presentation and watching videos
<b>Place or classroom and auxiliary accessories needed for the activities</b>	Classroom; computer; projector; Wi-fi access.



### 3.2 SUSTAINABLE AGRICULTURE

LU 2: SUSTAINABLE AGRICULTURE					
<b>Abstract</b>	<p>The European Union and the United Nations have set targets for protecting soil, water, air, climate, and biodiversity. Agriculture plays a central role in achieving the goals, as it is one of the most critical land users. Sustainable agriculture could contribute to achieving environmental goals. It would even benefit from it because it depends on fertile soils, reliable climatic conditions and a high level of biodiversity. This unit explains to the learner what is necessary for agriculture to become part of sustainable development?</p>				
<b>Connection with other LU</b>	<p>This teaching unit deals with the general structures of sustainable agriculture and refers to further information when working through the chapters. LU 1 refers to legislative structures (CAP and the new model of agriculture and sustainability), LU 3 to the sustainable use of water resources, LU 4 to sustainable crop protection, and LU 5 shows the achievement of sustainability through digital application methods LU6 points to the handling of data.</p>				
<b>Structure and additional learning methods of the LU</b>	<b>Topic</b>	<b>Hours</b>	<b>Theory</b>	<b>Practice</b>	<b>Additional</b>
	SUSTAINABLE AGRICULTURE PRINCIPLES	2	X		Expert seminar
	SUSTAINABLE AGRICULTURE METHODS	4	X		Focus group
	SUSTAINABLE AGRICULTURE GOALS	4	x		





<p><b>Additional resources from other courses/videos /tutorials on the topics</b></p>	<p>FAO of the United Nations: <a href="https://sustainability">https://sustainability</a></p> <p>Methods of sustainable agriculture</p> <p><a href="https://www.youtube.com/watch?v=XzSCchrmBt8g">https://www.youtube.com/watch?v=XzSCchrmBt8g</a></p> <p>Lexikon der Nachhaltigkeit Achener Stiftung Kathy Beys,</p> <p><a href="https://www.nachhaltigkeit.info/artikel/nachhaltige_landwirtschaft_1753.htm">https://www.nachhaltigkeit.info/artikel/nachhaltige_landwirtschaft_1753.htm</a></p> <p>Organic farming in Europe</p> <p><a href="https://www.youtube.com/watch?v=0IJX1rCgSYg">https://www.youtube.com/watch?v=0IJX1rCgSYg</a></p> <p>Agricultural strategies</p> <p><a href="https://www.bmu.de/fileadmin/Daten_BMU/Download_PDF/Bodenschutz/eckpunktepapier_ackerbaustrategie_bf.pdf">https://www.bmu.de/fileadmin/Daten_BMU/Download_PDF/Bodenschutz/eckpunktepapier_ackerbaustrategie_bf.pdf</a></p> <p>Sustainable agriculture publication</p> <p><a href="https://www.researchgate.net/profile/John-Reganold/publication/260785326_Sustainable_Agriculture/links/548fae360cf2d1800d86298f/Sustainable-Agriculture.pdf">https://www.researchgate.net/profile/John-Reganold/publication/260785326_Sustainable_Agriculture/links/548fae360cf2d1800d86298f/Sustainable-Agriculture.pdf</a></p>
<p><b>Questionnaire for initial evaluation of students' knowledge</b></p>	<p>General questions can be the same for each LU e.g. nationality, gender, age, education, role in the holding, hectares of the holding, production of the holding,</p> <p>It is essential to understand what is helpful to investigate and which topics of LU2 as new may be of greater interest.</p> <p>Do you have enough information about sustainable agriculture?</p> <p>Do you know the principles of sustainable agriculture?</p> <p>Do you know methods for achieving sustainable agriculture?</p> <p>Are you aware of the goals and the resulting benefits of sustainable agriculture?</p>



<p><b>Questionnaire at the end of the course for the teaching assessment</b></p>	<p>1) Was the course topic complex for you? Rate with a grade of 1 to 5, for which 1 is not difficult at all and 5 means very difficult</p> <p>2) Was the course to your satisfaction compared to the original expectations? Rate with a score of 1 to 5, for which 1 is not appreciated at all and 5 is very welcome</p> <p>3) Do you think you will be able to use the information and innovations you have learned through the course in your work?</p> <p>4) Which aspects or topics of the course did you particularly like?</p> <p>4) Are there any suggestions for improving the course in the future (e.g. topic, teaching methods)?</p>
<p><b>Evaluation</b></p>	<p>Multiple choice test, open text questions (see O2 T2 document)</p>
<p><b>Exercise/Practical activity</b></p>	<p>The O1 and O2 did not specify a practical activity for that LU; however, focus group discussion during lessons for developing a critical and innovative vision of Sustainable Agriculture is recommended. It could be helpful to simulate the participation or get involved in activities promoted by the European Commission, such as: "Call for expression of interest for experts participating in Focus Groups of the European Innovation Partnership on 'Agricultural Productivity and Sustainability'"</p> <p><a href="https://ec.europa.eu/eip/agriculture/sites/default/files/20211123_calltext_fg4-46_final.pdf">https://ec.europa.eu/eip/agriculture/sites/default/files/20211123_calltext_fg4-46_final.pdf</a></p> <p>Furthermore, seminars and interviews with professionals working on the topic for the EU research centre on the territory or other experts linked to the topic are recommended.</p>



<b>Teaching materials and media</b>	White/blackboard, notepad, laptop, pencil, video equipment, flipchart, visualisation tools for presenting and watching videos
<b>Place or classroom and auxiliary accessories needed for the activities</b>	Classrooms; Computer, projector.



### 3.3 SUSTAINABLE WATER USE MANAGEMENT

#### LU 3: SUSTAINABLE WATER USE MANAGEMENT

##### Abstract

This teaching unit focuses on water as the main factor determining the growth and development of plants, determining the effects of plant and animal production. It concerns water management plans and drought prevention, which must consider the multifunctional role of agriculture and its importance for landscape services. It raises the need to limit the agricultural production method, characterised by high water consumption on the one hand and water pollution on the other, and the cheapest way to reduce water stress on agricultural land is by introducing good cultivation practices.

Aims of the course: familiarising farmers with the concept of melioration as the basis for improving the efficiency of farmland management, getting acquainted with precise irrigation that saves water, what role can farmers play in solving the problem of drought, how to store water for agricultural purposes, informing farmers about the need to stop water evaporation by introducing trees and other solutions that keep water in the landscape, showing that the maintenance of grassland and permanent vegetation (trees and shrubs) along watercourses also contributes to the growth of biodiversity, showing how excess water in agricultural areas increases the risk of the outflow of nutrients, familiarisation with the problem of high water consumption characterising the entire production chain in industrial farming, which poses a severe risk of water scarcity, both for the needs of this sector and for other sectors of agricultural production.

An additional goal of the course is to conduct a practical exercise that will test the acquired knowledge on, among others, how you can not only drastically reduce water consumption and costs but also increase yield and quality compared to unsustainable irrigation.



	The introductory questionnaire will test the baseline knowledge and provide a range of theoretical and practical lessons.				
<b>Connection with other LU</b>	<p>In general: LU 3 can be connected with lectures about agronomy, sustainable agricultural practices (e.g., livestock production, organic farming), technological innovation, and EU common policy.</p> <p>Concerning AgriSmart: LU3 should be conducted after LU 2 because the theory and the practical activities are interlinked. LU3 would also benefit from the other LUs, but this is not a strict requirement.</p>				
<b>Structure and additional learning methods of the LU</b>	<b>Topic</b>	<b>Hours</b>	<b>Theory</b>	<b>Practice</b>	<b>Additional</b>
	INTRODUCTION	3	X		
	WATER IN AGRICULTURE	3	X		
	NATURAL RETENTION	6	X		
	WATER MELIORATION	6	X		
	IRRIGATION	6	X	X	
	LIVESTOCK PRODUCTION	10	X	X	Expert seminar
	PROTECTION OF WATER RESOURCHES	8	X	X	Expert seminar



	GOOD PRACTICES	3	X	X	Field visit in a good practice study farm
<b>Additional resources from other courses/videos/tutorials on the topics</b>	All the material is provided in output 2 T1 and T3				
<b>Questionnaire for initial evaluation of students' knowledge</b>	<ol style="list-style-type: none"> <li>1. What is the role of water on your farm? / What does it matter?</li> <li>2. How big is your farm?</li> <li>3. How do you increase water availability for crops?</li> <li>4. Do you use good practices on your farm to preserve water in the soil?</li> <li>5. Do you use drainage systems?</li> <li>6. Has grassland been used as a buffer zone between crops and watercourses on your farm?</li> <li>7. How do you solve the problem of drought? How do you prevent it on your farm?</li> <li>8. How do you store water for agricultural purposes?</li> </ol>				
<b>Questionnaire at the end of the course for the teaching assessment</b>	<ol style="list-style-type: none"> <li>1. Was the subject of the course difficult for you? Rate from 1 to 5, where 1 means the course is not challenging and 5 means challenging.</li> <li>2. Was the course satisfactory for you compared to your initial expectations? Rate from 1 to 5, with 1 being unsatisfactory and 5 being very welcome.</li> </ol>				



	<p>3. Do you think you will be able to use the information and innovations you have learned during the course in your work?</p> <p>4. What aspects or topics of the course did you particularly like?</p> <p>5. Are there any suggestions for improving the course in the future (e.g. topic, teaching methods)?</p>
<p><b>Evaluation</b></p>	<p>See the chapter "Evaluation" in LU3- quiz</p> <p>The exercises will be done after studying module 3. The final stage is filling in the quiz and answering min 70% correctly.</p>
<p><b>Exercise/Practical activity</b></p>	<p>The O1 and O2 did not specify a practical activity for that LU; however, focus group discussion during lessons for developing a critical and innovative vision about sustainable water use is recommended. It could be helpful to simulate the participation or get involved in activities promoted by the European Commission, such as: "Call for expression of interest for experts participating in Focus Groups of the European Innovation Partnership on 'Agricultural Productivity and Sustainability'" <a href="https://ec.europa.eu/eip/agriculture/sites/default/files/20211123_calltext_fg44-46_final.pdf">https://ec.europa.eu/eip/agriculture/sites/default/files/20211123_calltext_fg44-46_final.pdf</a> Theme: 46 Water: Nature-Based Solutions for water management under climate change: <a href="https://ec.europa.eu/eip/agriculture/sites/default/files/20211123_calltext_fg44-46_final.pdf">https://ec.europa.eu/eip/agriculture/sites/default/files/20211123_calltext_fg44-46_final.pdf</a></p> <p>It is also suggested that a field visit at least on a farm with crops and livestock productions is considered the best case study for LU purposes, and seminars/interviews with professionals'/expert farmers are recommended.</p>
<p><b>Teaching materials and media</b></p>	<p>White/Blackboard, notepad, laptop, GPS, smartphone, pencil, video equipment, flipchart, visualisation tools for presentation and watching videos.</p>



<b>Place or classroom and auxiliary accessories needed for the activities</b>	Classroom; computer, projector, working space for practical work.  Interview with professionals developing devices, tools, and start-ups linked to the territory.





### 3.4 SUSTAINABLE PEST AND WEED MANAGEMENT

LU: 4 SUSTAINABLE PEST AND WEED MANAGEMENT					
<b>Abstract</b>	<p>EU rules on the sustainable use of pesticides aim to protect human health and the environment from the potential risks and effects. These rules promote the reduction of pesticides by integrated pest management and alternatives to chemical pesticides.</p> <p>This Learning Unit (LU4) shows the learner information and practical cases about sustainable weed management and pest management. Sustainability in crop protection always protects the resources' environment and biodiversity.</p>				
<b>Connection with other LU</b>	<p>This teaching unit deals with the general structures of sustainable pest and weed management and refers to further information when working through the chapters. LU1 refers to legislative structures (CAP and the new model of agriculture and sustainability), LU5 shows the achievement of sustainability through digital application methods and LU6 points to data handling.</p>				
<b>Structure and additional learning methods of the LU</b>	<b>Topic</b>	<b>Hours</b>	<b>Theory</b>	<b>Practice</b>	<b>Additional</b>
	WHAT IS SUSTAINABLE WEED MANAGEMENT	2	X		
	METHODS OF SUSTAINABLE WEED MANAGEMENT	8	X		Field visit in a best-case study farm



	WHAT IS SUSTAINABLE PEST MANAGEMENT	2	X		Expert seminar
	METHODS OF SUSTAINABLE PEST MANAGEMENT	8	X		Field visit in a best-case study farm
<b>Additional resources from other courses/videos/tutorials on the topics</b>	<a href="https://www.youtube.com/watch?v=47-vE7xtHx0">https://www.youtube.com/watch?v=47-vE7xtHx0</a> <a href="https://www.youtube.com/watch?v=-9wpaib-uEs">https://www.youtube.com/watch?v=-9wpaib-uEs</a> <a href="https://youtu.be/ffr8iDicY9I">https://youtu.be/ffr8iDicY9I</a> <a href="https://www.sciencedirect.com/science/article/pii/S0168169918312869">https://www.sciencedirect.com/science/article/pii/S0168169918312869</a>				
<b>Questionnaire for initial evaluation of students' knowledge</b>	<p>General questions can be the same for each LU e.g. nationality, gender, age, education, role in the holding, hectares of the holding, production of the holding,</p> <p>It is essential to understand what is helpful to investigate and which topics of LU4 as new may be of greater interest.</p> <p>What is your professional function?</p> <p>How familiar are they with sustainable crop protection?</p> <p>Do you know methods for achieving sustainable agriculture?</p> <p>Are you aware of the goals and the resulting benefits of sustainable pest and weed management?</p>				
<b>Questionnaire at the end of the course for</b>	<p>1) Was the course topic complex for you? Rate with a grade of 1 to 5, for which 1 is not difficult at all and 5 means very difficult</p>				



<p><b>the teaching assessment</b></p>	<p>2) Was the course to your satisfaction compared to the original expectations? Rate with a score of 1 to 5, for which 1 is not appreciated at all and 5 is very welcome</p> <p>3) Do you think you will be able to use the information and innovations you have learned through the course in your work?</p> <p>4) Which aspects or topics of the course did you particularly like?</p> <p>5) Are there any suggestions for improving the course in the future (e.g., topic, teaching methods)?</p>
<p><b>Evaluation</b></p>	<p>In writing: Multiple choice test, open text questions</p>
<p><b>Exercise/Practical activity</b></p>	<p>The O1 and O2 did not specify a practical activity for that LU; however, focus group discussion during lessons for developing a critical and innovative vision about sustainable pest and weed management. It could be helpful to simulate the participation or get involved in activities promoted by the European Commission, such as: "Call for expression of interest for experts participating in Focus Groups of the European Innovation Partnership on 'Agricultural Productivity and Sustainability'"</p> <p><a href="https://ec.europa.eu/eip/agriculture/sites/default/files/20211123_calltext_fg44-46_final.pdf">https://ec.europa.eu/eip/agriculture/sites/default/files/20211123_calltext_fg44-46_final.pdf</a></p> <p>Theme: 44: Sustainable ways to reduce the use of pesticides in pome and stone fruit production</p> <p><a href="https://ec.europa.eu/eip/agriculture/sites/default/files/20211123_calltext_fg44-46_final.pdf">https://ec.europa.eu/eip/agriculture/sites/default/files/20211123_calltext_fg44-46_final.pdf</a></p> <p>It is also suggested that a field visit at least on a farm with crops and livestock production considered the best case study for LU purposes, and</p>



	seminars/interviews with professionals'/expert farmers are recommended.
<b>Teaching materials and media</b>	White/blackboard, notepad, laptop, pencil, video equipment, flipchart, visualisation tools for presenting and watching videos
<b>Place or classroom and auxiliary accessories needed for the activities</b>	Classrooms; Computer, projector.



3.5 AGRICULTURE 4.0

LU 5: AGRICULTURE 4.0					
<b>Abstract</b>	<p>This learning unit focuses on:</p> <p>the definition of Agriculture 4.0 and the phases that paved the way to modern agricultural production; the definition of precision agriculture and smart farming. The other main topics refer to the description of Digital technologies used in agricultural production, such as sensors, soil sensing technologies, crop sensing technologies, environmental sensors, agricultural machinery, and sensors for livestock.</p> <p>The LU will present a wide range of ICT applications and sensor tools in practice. The knowledge requirements of current farm managers are also oriented in this area. Researchers and trainers need to master existing solutions in the market and use professional tools to provide a scientific view of the issue- education and training courses must take these facts into account.</p>				
	<p><b>Connection with other LU</b></p> <p>In general: connection with lectures about agronomy, agricultural activities (e.g. livestock production, organic farming), technological innovation, and EU common policy.</p> <p>In particular: LU is strictly connected to the next learning unit (LU 6), whereas the following module specifies the use and exploitation of data within Agriculture 4.0.</p>				
<b>Structure and additional learning methods of the LU</b>	<b>Topic</b>	<b>Hours</b>	<b>Theory</b>	<b>Practice</b>	<b>Additional</b>
	WHAT IS AGRICULTURE 4.0?	16	X		



	<p>DIGITAL TECHNOLOGIES IN AGRICULTURE (INCLUDING SENSORS AND SENSING TECHNOLOGIES)</p>	<p>40</p>	<p>X</p>	<p>Field visits, good practice examples of successful enterprises, practical workshops</p>
<p><b>Additional resources from other courses/videos/tutorials on the topics</b></p>	<p>The Future of Farming <a href="https://www.youtube.com/watch?v=Qmla9NLFbVU&amp;t=3s">https://www.youtube.com/watch?v=Qmla9NLFbVU&amp;t=3s</a></p> <p>What is Precision Agriculture? What is the meaning of Precision Farming? <a href="https://www.youtube.com/watch?v=WhAfZhFxHTs">https://www.youtube.com/watch?v=WhAfZhFxHTs</a></p> <p>What is IoT, and what does it mean for farmers? <a href="https://www.youtube.com/watch?v=pOLAIVUs9S8">https://www.youtube.com/watch?v=pOLAIVUs9S8</a></p> <p>Moisture Sensing for Smart Agriculture <a href="https://www.youtube.com/watch?v=hb6my_5eiOU">https://www.youtube.com/watch?v=hb6my_5eiOU</a></p>			
<p><b>Questionnaire for initial evaluation of students' knowledge</b></p>	<p>General questions could be the same for each LU, e.g., Nationality, Sex, Age, Education, Role in the Farm, Farm's hectare, farm production,</p> <p>It is essential to understand what is helpful to investigate and which topics of LU5 as new may be of greater interest.</p> <p>Do you have a smartphone?</p> <p>Do you have a pc?</p>			



	<p>Do you have information on current information and communication technologies (ICT) used in agricultural production?</p> <p>Do you use information and communication technologies (ICT) in agricultural production?</p> <p>Do you know the field of soil sensing technology?</p> <p>Do you know the field of crop sensing technology?</p> <p>Do you know what sensors for Agricultural Machines are used in precision agriculture?</p> <p>Do you know what sensors in livestock are used in precision agriculture?</p>
<p><b>Questionnaire at the end of the course for the teaching assessment</b></p>	<p>1) Was the course topic complex for you? Evaluate with a grade from 1 to 5, for which 1 is not difficult at all and 5 means very difficult</p> <p>2) Compared to initial expectations, was the course to your satisfaction? Evaluate with a grade from 1 to 5, for which 1 is not appreciated at all and 5 means very welcome</p> <p>3) Do you think you will be able to use the information and innovations you learned during the course in your work?</p> <p>4) What aspects or topics of the course did you particularly like?</p> <p>4) Are there any suggestions for improving the course in the future (e.g. topic, teaching methods)?</p>
<p><b>Evaluation</b></p>	<p>See the chapter Learning Unit 5: Agriculture 4.0- part "Evaluation Standard" in AGRISMART CURRICULUM</p> <p>We propose: Oral response with Explanation / written exam / online test / practical assessment in the field.</p>



<b>Exercise/Practical activity</b>	<p>It could be helpful to simulate the participation or get involved in activities promoted by the European Commission, such as: "Call for expression of interest for experts participating in Focus Groups of the European Innovation Partnership on 'Agricultural Productivity and Sustainability"</p> <p><a href="https://ec.europa.eu/eip/agriculture/sites/default/files/20211123_calltext_fg44-46_final.pdf">https://ec.europa.eu/eip/agriculture/sites/default/files/20211123_calltext_fg44-46_final.pdf</a></p> <p>Theme: 45: Digital tools for sustainable nutrient management</p> <p><a href="https://ec.europa.eu/eip/agriculture/sites/default/files/20211123_calltext_fg44-46_final.pdf">https://ec.europa.eu/eip/agriculture/sites/default/files/20211123_calltext_fg44-46_final.pdf</a></p> <p>Also are important field visits at good practice examples of successful agricultural enterprises and develop practical workshops.</p> <p>Furthermore, seminars and-or interviews with professionals and-or farmers developing devices, tools, and start-ups linked to the territory are recommended.</p>
<b>Teaching materials and media</b>	<p>White/Blackboard, notepad, laptop, smartphone, pencil, video equipment, flipchart, visualisation tools for presentation and videos.</p>
<b>Place or classroom and auxiliary accessories needed for the activities</b>	<p>Classroom; computer, projector, working space for practical work.</p> <p>Field visits, at least on a farm with crops and livestock productions considered the best case study for LU purposes, practical workshops in the field.</p>





### 3.6 DATA FOR SUSTAINABLE PRODUCTION

#### LU 6: DATA FOR SUSTAINABLE PRODUCTION

##### Abstract

This learning unit focuses on data, including its sources, use and legal aspects. Practical aspects related to data such as collection, analysis and practical use for companies are also strongly recommended and considered. The objectives of the course are: to bring farmers closer to data concepts and their use in farm-related services; the quality of the data, their origin and data exchange; teaching about managing data and finding new data; attention to legal and data security aspects; how to collect data and what are the sources; practical applications of data collection and processing and visualisation.

The ultimate goal is to carry out a practical exercise that brings together all the knowledge provided by the lessons to explore the potential of using data in favour of the farm.

Therefore, the farmer must know and understand the exponential growth of data accompanying the digitisation of agriculture through the proliferation of mobile technology, remote sensing technologies, and distributed computing capabilities. Knowing the materials and methods of effective data management for farms will open up new opportunities to improve the lives and livelihoods of farmers by lowering costs and reducing information asymmetries. For farmers, the lack of experience in data management or the adoption of data-driven services can limit the possibilities of digital transformation of the agricultural sector. Data revolution in agriculture and information and communications technology (ICT) for agriculture services can support farmers in addressing their challenges and increasing their incomes and yields.

Furthermore, the data can support the improvement of agricultural practices towards greater efficiency in the use of resources and a lower environmental impact. This LU wants to support the knowledge of new



	<p>concepts for farmers concretely. The starting level of knowledge will be probed thanks to an initial questionnaire. A series of theoretical and practical lessons will show understanding through the application, analysis and synthesis of practical work and the "evaluation" phase.</p>				
<p><b>Connection with other LU</b></p>	<p>In general: connection with lectures about agronomy, agricultural activities (e.g. livestock production, organic farming), technological innovation, and EU common policy.</p> <p>In particular, LU is strictly connected to the previous (LU 5) because the theory and the practical activity are connected to the theory (e.g. content, glossary, evaluation).</p>				
<p><b>Structure and additional learning methods of the LU</b></p>	<p><b>Topic</b></p>	<p><b>Hours</b></p>	<p><b>Theory</b></p>	<p><b>Practice</b></p>	<p><b>Additional</b></p>
	WHAT IS DATA	3			
	SHARING DATA	3			
	DATA QUALITY AND PROVENANCE	6	X	X	
	PERSONAL DATA PROTECTION	6			Expert seminar
	DATA SOURCES	8	X	X	
	HOW DATA IS COLLECTED	8	X	X	Field visit in a best-case study farm



	DATA ANALYSIS AND VISUALISATION	8	X	X	Expert seminar
	EXPLORING THE POTENTIAL OF DATA	10	X	X	Expert seminar
<b>Additional resources from other courses/videos/tutorials on the topics</b>	<p>Farm Data Management, Sharing and Services for Agriculture Development Online Course (Version v1.0). Zenodo.  <a href="http://doi.org/10.5281/zenodo.3663553">http://doi.org/10.5281/zenodo.3663553</a>  <a href="https://fastplatform.eu/">https://fastplatform.eu/</a>  <a href="https://agridata.ec.europa.eu/extensions/DataPortal/home.html">https://agridata.ec.europa.eu/extensions/DataPortal/home.html</a>  <a href="https://www.gaia-x.eu/">https://www.gaia-x.eu/</a>  <a href="https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/programmes/digital">https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/programmes/digital</a></p>				
<b>Questionnaire for initial evaluation of students' knowledge</b>	<p>General questions could be the same for each LU, e.g., Nationality, Sex, Age, Education, Role in the Farm, Farm's hectare, farm production,</p> <p>It is essential to understand what is helpful to investigate and which topics of LU6 as new may be of greater interest.</p> <p>Do you have a smartphone?</p> <p>Do you have a pc?</p> <p>Do you collect data on your farm?</p>				



	<p>Who is the data manager of your farm (e.g. the person who manages information flows such as seed available in the warehouse versus the one to be bought)</p> <p>Do you manage your "country notebook" using an Excel file or similar?</p> <p>What is the most advanced technological device/tool/machine you possess?</p> <p>How do you feel familiar with data supported by technological devices (from 1 to 5, 1 is unfamiliar to 5, which means very familiar)?</p>
<b>Questionnaire at the end of the course for the teaching assessment</b>	<p>1) Was the course topic complex for you? Evaluate with a grade from 1 to 5, for which 1 is not difficult at all and 5 means very difficult</p> <p>2) Compared to initial expectations, was the course to your satisfaction? Evaluate with a grade from 1 to 5, for which 1 is not appreciated at all and 5 means very welcome</p> <p>3) Do you think you will be able to use the information and innovations you learned during the course in your work?</p> <p>4) What aspects or topics of the course did you particularly like?</p> <p>4) Are there any suggestions for improving the course in the future (e.g. topic, teaching methods)?</p>
<b>Evaluation</b>	<p>See the chapter "Evaluation" in LU6_AgriSmart_O2_Unit-6_15_02_2021</p> <p>We propose: exercises/group work during the lessons;</p> <p>multiple-choice questions; open questions.</p>



<b>Exercise/Practical activity</b>	<p>See theory in practice box 1, 2 3 and subchapter 3.1 in “LU6_AgriSmart_O2_Unit-6_15_02_2021”.</p> <p>In that section, we propose specific examples of practical exercises. They could do it alone or in groups.</p> <p>It is also suggested that a field visit, at least on a farm with crops and livestock productions considered the best case study for LU purposes.</p> <p>Furthermore, seminars and-or interviews with professionals and-or farmers developing devices, tools, and start-ups linked to the territory are recommended. Focus group connected with previous LU are recommended following the EU action promoted such as: "Call for expression of interest for experts participating in Focus Groups of the European Innovation Partnership on 'Agricultural Productivity and Sustainability"</p> <p><a href="https://ec.europa.eu/eip/agriculture/sites/default/files/20211123_calltext_fg44-46_final.pdf">https://ec.europa.eu/eip/agriculture/sites/default/files/20211123_calltext_fg44-46_final.pdf</a></p>
<b>Teaching materials and media</b>	White/Blackboard, notepad, laptop, GPS, smartphone, pencil, video equipment, flipchart, visualisation tools for presentation and watching videos
<b>Place or classroom and auxiliary accessories needed for the activities</b>	Classroom; computer, projector, working space for practical work.