REGINA Learning Methodology & Tools

Regenerative agriculture.
An innovative approach towards mitigation
of climate change through multi-tier learning.

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Introduction

According to Willett et al. (2019), agricultural production systems around the world pose a severe threat to ecosystem resilience and climate stability. These systems are a major cause of environmental degradation and contribute to the violation of planetary boundaries. For instance, the loss of species biodiversity and ecosystem services such as pollination (Gossner et al. 2016; IPBES 2018), soil erosion, a decline in soil fertility, water resource damage, and coastal ecosystem degradation (Fader et al. 2013; Rist et al. 2014) are some of the significant impacts. Globally, agriculture and correlated food systems contribute to over a third of global greenhouse gas (GHG) emissions, making food production a substantial contributor to climate change. In particular, food systems are estimated to be responsible for 34% of GHG emissions, with animal-based foods alone accounting for 20% (Xu et al. 2021; Crippa et al. 2021). Additionally, agriculture is highly susceptible to changes in temperature and rainfall patterns, which are predicted to become more irregular due to climate change. The impact of agriculture on the environment has steadily increased, accounting for 26% of global greenhouse gas emissions, 50% of the world's habitable land, and 70% of global freshwater withdrawals (Ritchie et al. 2022). Recurring extreme weather events have caused significant blows to the entire sector, determining additional pressure on farmers. Farmers, especially smallholders who produce approximately a third of the world's food, are increasingly facing challenges with harvest and livestock losses as they try to adjust to these changing weather conditions. Therefore, different countries want to overcome those problems through the reduction of input use while maximizing input efficiency.

It has become increasingly clear over the last thirty years that farming and food systems require significant transformations to establish sustainable pathways (European Commission, 2020; European Commission Directorate-General for Research and Innovation, 2020; UNFSS, 2021). The European Commission's Green Deal, particularly the Biodiversity and Farm to Fork Strategies, are aimed at addressing climate change and biodiversity loss while also ensuring the production of a sufficient supply of nutritious food. This is in line with the broader context of the need for fundamental transformations in farming and food systems to achieve sustainability. To put the EU food system on a transformative path towards greater sustainability, the Farm to Fork and Biodiversity Strategies have set a series of ambitious targets by 2030:

• the aim is to reduce the use and risk of chemical pesticides by 50%, as well as decrease the usage of more dangerous pesticides by the same percentage;

• the goal is to decrease nutrient losses by a minimum of 50% while simultaneously ensuring that soil fertility remains stable. This will lead to a reduction of at least 20% in the use of fertilizers;
• decrease the sales of antimicrobials for farmed animals and aquaculture by 50%;
• to have 25% of agricultural land under organic farming;
• to have a minimum of 10% of the area under high-diversity landscape features.

The ultimate goal is to make European food production a global sustainability standard. This will be achieved by strengthening various efforts to combat climate change, protect the environment, and preserve biodiversity in European agricultural landscapes. Specifically, the European Commission put the Green New Deal as the priority to be addressed, i.e. promoting the efficient use of the resources, biodiversity re-establishment, and pollution reduction. Accordingly, the pivotal role of innovative farming systems has been identified to ensure the availability of resources for future generations.

Queiroz et al. (2021) suggest that achieving greater sustainability and resilience in agricultural production requires a systemic approach. Such an approach should not only focus on mitigating the impacts of existing global crises on agriculture but also identify the necessary transformations to reduce the contribution of agricultural production to these crises. In addition, it should aim to enhance the resilience of the food system as a whole. Different approaches have been studied regarding agricultural sustainability, such as agroecology, conservation farming, organic farming, ecological intensification, and carbon farming. Besides these, Regenerative Agriculture (RA) has been identified that address similar purposes to the previous systems, i.e. enhancing ecosystem services including carbon capture and storage, maintaining agricultural productivity, and increasing biodiversity (Oberč and Arroyo Schnell 2020). RA uses a holistic and systemic approach to farming that integrates ecological principles and practices to enhance soil health, biodiversity, and ecosystem services. Further, RA emphasizes the importance of regenerating natural resources, improving farmer livelihoods, and fostering community and economic resilience. The RA recognizes the importance of working with nature rather than against it, so emphasizes the use of diversified farming systems (such as. cover crops, crop rotations, reduced tillage, and other practices) that enhance soil health and promote biodiversity. This approach is seen as a way to address environmental and social challenges associated with conventional agriculture, including climate change, soil degradation, and loss of biodiversity. Nevertheless, RA emphasizes the restoration opportunities for soils in the agricultural landscape and the interplay of various crops, ruminants, and non-ruminant farm animals in the production chain. These principles are also present in agroecology and organic agriculture, but

the concept is considered broader and less prescriptive than other related concepts. RA aims for a limited and more targeted use of, for example, modern plant and animal breeding technology, tilling, inorganic fertilizers, or pesticides, rather than excluding their use altogether. Therefore, RA could be a more flexible approach to achieve the sustainability of the agricultural sector while using the modern tools of conventional agriculture. On the other hand, RA is a useful way because it seeks to restore and enhance soil health, biodiversity, and ecosystem services, while also addressing social and economic concerns. It has been widely demonstrated that previous sustainable practices are well-linked with the economic profitability of the agricultural practice.

The REGINA (title: Regenerative agriculture. An innovative approach towards mitigation of climate change through multi-tier learning) is an ERASMUS+ project that responds to the need to re-direct farming practices to a more environment-friendly and climate change-mitigating system while keeping stable economical profitability. Specifically, it entails investing in the diffusion of agricultural knowledge and maintaining a holistic approach. It involves different partnerships that answer to the needs of the target groups; University and Secondary Education teachers, students in fields directly or indirectly related to RA, farmers, and those who are to be introduced to RA together with farmers' associations, development agencies, farmers' advisors, policymakers and public authorities are actively involved in the project. Their collaboration is the central point of the project which aim to improve agricultural knowledge and skills.

This project aims to design a learning methodology and appropriate innovative learning tools to introduce an interdisciplinary course of study on Regenerative Agriculture (RA) for university students, adaptable for secondary school study and adult learning. The course will address major issues of our time focused on global climate change, soil health, and enhanced ecosystem services, as well as food and water security. An online platform will bring together the learning material and tools, allowing real-time interaction among users. The platform will offer open learning resources and an open library that will be continuously enriched and updated by users. This library will include an online Library of Good Practice in RA, with visualized case studies of RA, a publications index, links, and other documents relating to RA. Additionally, the platform will provide audio-visual lectures for adult learners, HE & SE eLearning courses.

The objectives of the course are to promote the principles and practices of RA across Europe, together with research and report on the existing good practices of RA in the countries while identifying problems and attitudes that hinder further development of RA. It could be eventually created a RA Library for farmers that will be constantly updated. The project also aims to create

and manage a new flexible methodology and educational content to deliver RA courses to agricultural students and related disciplines, equip future agronomists and related professionals with knowledge and skills to become leaders in RA, and help farmers adjust their everyday practices accordingly. The project will also adapt and pilot-test the HE methodology, learning content, and tools to meet the needs of secondary education students in agriculture and related professions and non-formal adult learners, especially targeting farmers. The project will design an interdisciplinary, digital open learning environment for all 3 tiers of education, host the learning resources created by the project, and offer interaction possibilities with local and national stakeholders and farmers' communities. The project aims to continuously enrich these resources through the active involvement of users. It will prepare and publish a Guidebook on RA Learning, addressing tertiary and secondary students and educators, trainers, advisors, other stakeholders in the field of agriculture, and farmers themselves. Finally, the project will disseminate widely its products and results through the dedicated REGINA platform and the publicity and communication efforts of all project partners.

References

Crippa, M., Solazzo, E., Guizzardi, D. Monforti-Ferrario, F., Tubiello, F.N. and Leip, A. (2021). Food systems are responsible for a third of global anthropogenic GHG emissions. Nature Food 2, 198–209. https://doi.org/10.1038/s43016-021-00225-9.

European Commission (2020). A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system, COM (2020) 381.

European Commission, Directorate-General for Research and Innovation (2020). Resilience and transformation: report of the 5th SCAR Foresight exercise expert group: natural resources and food systems: transitions towards a 'safe and just' operating space. https://data.europa.eu/doi/10.2777/025150.

Fader, M., Gerten, D., Krause, M., Lucht, W. and Cramer, W. (2013). Spatial decoupling of agricultural production and consumption: quantifying dependences of countries on food imports due to domestic land and water constraints. Environmental Research Letters 8, 021002

Gossner M.M., Lewinsohn T.M., Kahl T., et al. (2016). Land-use intensification causes multitrophic homogenization of grassland communities. Nature 540, 266–269.

IPBES (2018). The IPBES regional assessment report on biodiversity and ecosystem services for Europe and Central Asia. Rounsevell, M., Fischer, M., Torre-Marin Rando, A. and Mader, A. (eds.). Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany. 892 pages.

Oberč, B.P. and Arroyo Schnell, A. (2020). Approaches to sustainable agriculture. Exploring the pathways towards the future of farming. Brussels, Belgium: iUCN EURO.

Queiroz, C., Norström, A.V., Downing, A., et al. (2021). Investment in resilient food systems in the most vulnerable and fragile regions is critical. Nature Food 2, 546–551. https://doi.org/10.1038/s43016-021-00345-2.

Rist, L., Felton, A., Nyström, M., et al. (2014). Applying resilience thinking to production ecosystems. Ecosphere 5, 1–11. https://doi.org/10.1890/ES13-00330.1

Ritchie, H., Rosado P., Roser, M. (2022) "Environmental Impacts of Food Production". Published online at OurWorldInData.org. Retrieved from: 'https://ourworldindata.org/environmental-impacts-of-food' [Online Resource]

UNFSS (2021). Secretary-General's Chair Summary and Statement of Action on the UN Food Systems Summit. UN. https://www.un.org/en/food-systems-summit/news/making-food-systems-work-people-planet-and-prosperity.

Willett, W., et al. (2019). Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. The Lancet 393, 447–492. https://doi.org/10.1016/S0140-6736(18)31788-4.

Xu, X., Sharma, P., Shu, S., et al. (2021). Global greenhouse gas emissions from animal-based foods are twice those of plant-based foods. Nature Food 2, 724–732. https://doi.org/10.1038/s43016-021-00358-x.

REGINA Themes & Modules

General information

The course on Regenerative Agriculture (RA) would focus on sustainable farming practices that aim to improve soil health, increase biodiversity, and promote ecosystem resilience. The course would cover a range of topics, including soil health, crop rotation, cover cropping, agroforestry, and the use of natural fertilizers and pest control methods. The course would begin by introducing the concept of RA, its history and evolution, as well as the concept of holism and holistic approach to agriculture. Students will then face the principles of regenerative agriculture, including the importance of minimizing soil disturbance, keeping the soil covered, and maximizing biodiversity. Students would learn about the benefits of regenerative agriculture, including improved soil health, increased nutrient density in crops, and reduced greenhouse gas emissions. The course would then cover specific practices used in regenerative agriculture, such as crop rotation and cover cropping. Students would learn about the benefits of rotating crops to prevent the buildup of pests and disease, and to improve soil health by adding different nutrients and organic matter to the soil. They would also learn about cover cropping, which involves planting crops that cover the soil between cash crops. Cover crops help to prevent soil erosion, increase soil organic matter, and improve soil health. The course would cover agroforestry, which involves integrating trees and shrubs into agricultural landscapes. Students would learn about the benefits of agroforestry, including increased biodiversity, improved soil health, and increased crop yields. The course would then cover teaching on the animal management in RA. Students would learn about the benefits of properly managed grazing, including increased soil organic matter, improved soil health, and increased biodiversity. They would also learn about the importance of animal welfare and ethical considerations in livestock management.

Throughout the course, students would have the opportunity to learn from practitioners of regenerative agriculture, including farmers, researchers, and experts in the field. They would also have the opportunity to apply what they have learned by designing and implementing their own regenerative agriculture systems.

To whom is the course advised?

In general, a study course in Regenerative Agriculture is essential for anyone interested in sustainable agriculture.

It provides a strong foundation for understanding the principles and practices of Regenerative Agriculture and highlights the critical role that agriculture can play in creating a more sustainable and resilient future and land management. This course is an educational program designed to teach university students, secondary grade students, farmers and agriculture professionals about the principles and practices of regenerative soil management. This course can teach farmers how to manage their soil in a way that not only improve soils profitability, but also supports healthy ecosystems, long-term sustainable food production and contributes to mitigate the climate change.

Course structure

The course will be structured as follow (a graphical representation is also reported below):

Module 1: Regenerative Agriculture Orientation - Definition of RA (Definition created in the project), Holism, Introductory module (based on National Reports and PR1 Synthesis Report) are described.

Module 2: Agronomic aspects of Regenerative Agriculture - Rethinking the soil management through RA; Regenerative nutrition for plants; Regenerative cropping systems: crop rotations, cover crops, intercropping; Integrated technologies in RA: biosystems engineering including soil metagenomics and bioinformatics, precision agriculture, IoT. Weeding following the RA principles.

Module 3: Sustainability concepts of Regenerative Agriculture (& mitigation of climate change) - Sustainable Water use under RA; Assessing Biodiversity enhancement after the adoption of RA practices; Reduction of GHG emissions through RA (economic, social, environmental advantages); Rural development aspects of RA.

Module 4: Insights on specific crops & livestock (Practical implications) - Cereal cultivation; Industrial crops; Horticultural crops; Grassland management; Livestock management; Agroforestry

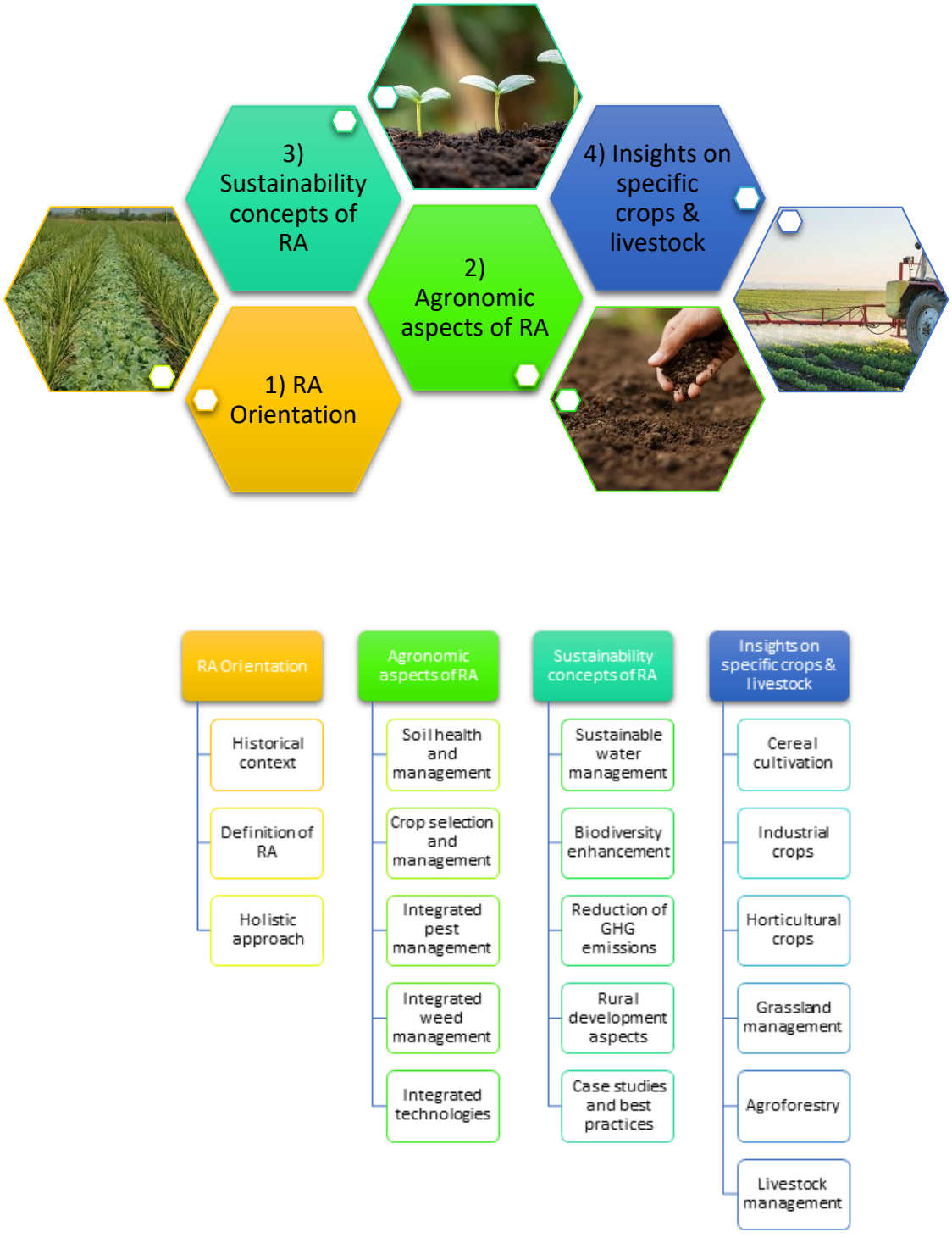


Figure 1: Course structure

Regenerative Agriculture orientation

Background

Although the term RA is relatively new, its basic idea was coined in the early 1980s by Robert Rodale, aiming to build on agriculture based on the conservation of natural resources, such as soil fertility and biodiversity. RA is a holistic approach to farming and ranching that focuses on improving soil health, increasing biodiversity, and promoting sustainable farming practices. In fact, RA is based on the idea that the health of the soil is essential for the health of the plants, animals, and people that depend on it. By building healthy soil, regenerative farmers can improve the fertility, resilience, and productivity of their land, while also reducing the need for chemical inputs and other harmful practices. Thus, it is a method of farming that seeks to regenerate the land, rather than simply extracting resources from it. The goal of regenerative agriculture is to create a healthy and resilient ecosystem that can support long-term food production while also contributing to the health and well-being of the surrounding community. This approach to farming is rooted in principles such as agroforestry, crop rotation, cover cropping, no-till farming, and holistic grazing, all of which aim to mimic natural systems and promote biodiversity. As the challenges of climate change, soil degradation, and food security continue to grow, regenerative agriculture has emerged as a promising solution for sustainable and resilient food production. By adopting regenerative practices, farmers can not only improve their own livelihoods but also contribute to a healthier and more sustainable food system for all.

Main idea

The course will likely be designed to provide students with a comprehensive understanding of the principles and practices of RA, as well as the benefits and challenges of implementing these practices on a farm or ranch. The course may begin by introducing students to the historical and ecological context of regenerative agriculture, including the role of traditional and indigenous agricultural practices in maintaining healthy ecosystems. Students may then learn about the specific techniques used in regenerative agriculture, such as cover cropping, crop rotation, agroforestry, and the use of livestock in rotational grazing systems. The course may also cover the use of organic farming methods, as well as the importance of soil health and biodiversity in promoting long-term sustainability. Throughout the course, students may engage in hands-on

learning opportunities, such as visits to local farms and ranches. They may also learn about the economic, social, and environmental benefits of regenerative agriculture, such as increased soil fertility, reduced water usage, improved biodiversity, and greater resilience to climate change. Overall, the introduction of a course in regenerative agriculture represents an exciting opportunity for students to learn about sustainable farming practices that can help to promote healthy ecosystems and support local communities. By providing a foundation in the principles and techniques of regenerative agriculture, this course may inspire and empower future generations of farmers and ranchers to work towards a more sustainable and equitable food system.

Course Goals:

- Understanding the principles and practices of regenerative agriculture, including how it differs from conventional farming techniques.
- Learning about the benefits of regenerative agriculture, such as improved soil health, increased biodiversity, and reduced environmental impact.
- Gaining knowledge of the economic and social benefits of regenerative agriculture, including how it can benefit farmers and local communities.
- Examining case studies of successful regenerative agriculture projects, and understanding how to implement similar projects in your own community.
- Understanding the science behind regenerative agriculture, including soil biology, carbon sequestration, and nutrient cycling.
- Understanding the importance of regenerative agriculture in the context of broader environmental and social issues, such as climate change and food security.
- Engaging with experts in the field and connecting with other individuals and organizations working on regenerative agriculture projects.
- Developing a comprehensive understanding of how regenerative agriculture can contribute to a more sustainable and equitable food system.

Topics covered:

- Historical context - The course provides an in-depth exploration of the origins and evolution of regenerative agriculture practices. The course covers the historical, cultural, and social contexts that have shaped the development of regenerative

agriculture, and how it has evolved over time. Students in the course will learn about the traditional farming practices that have been used by indigenous peoples and small-scale farmers for centuries, and how these practices have influenced contemporary regenerative agriculture practices. The course will also cover the emergence of modern regenerative agriculture movements, such as organic farming, permaculture, and agroecology, and how they have contributed to the development of regenerative agriculture.

- Definition of RA - the course is designed to provide a comprehensive understanding of what RA is and what it entails. The course covers the principles, practices, and benefits RA, as well as its historical and cultural contexts. Students in the course will learn about the key features of RA, such as soil health, biodiversity, and ecosystem function. In addition, the course will examine the various definitions of RA that have emerged in different contexts and regions. Students will gain an understanding of the diversity of approaches to RA and the potential trade-offs and synergies between them.
- The holistic approach – the course explores the principles and practices of regenerative agriculture. The course emphasizes a whole systems approach to farming that prioritizes soil health, biodiversity, and ecological resilience. Students in the course will learn about the importance of soil microbiology, plant diversity, and animal integration in regenerative agriculture. In addition, the course will cover the social and economic dimensions of regenerative agriculture, including the role of community building, market development, and policy advocacy in promoting sustainable food systems.

Main definitions

- **Regenerative Agriculture**: a holistic approach to farming that focuses on improving the health and vitality of soil, increasing biodiversity, and reducing the environmental impact of agriculture.
- **Holism:** philosophical and theoretical approach that views systems and phenomena as interconnected wholes, rather than as a collection of individual parts. It emphasizes the importance of understanding the whole system, rather than just the individual components, and recognizes that the whole is greater than the sum of its parts.
- **Soil Health**: the capacity of soil to function as a living system that sustains plants, animals, and humans. Healthy soil has good structure, nutrients, water-holding capacity, and microbial activity.

- **Carbon Sequestration**: the process of capturing and storing carbon from the atmosphere into soil, plants, or other organic matter, reducing the concentration of carbon dioxide in the atmosphere.
- **Biodiversity:** the variety of living organisms, including plants, animals, and microorganisms, in an ecosystem.
- **Sustainable Agriculture**: a system of farming that aims to meet the needs of the present without compromising the ability of future generations to meet their own needs.
- **Agroforestry**: a land-use management system that integrates trees or shrubs with crops and/or livestock, creating a more diverse and productive ecosystem.
- **Permaculture**: a design system that mimics the patterns and relationships found in natural ecosystems, creating sustainable and self-sufficient human habitats.
- **Cover Crops**: crops that are grown primarily to improve soil health, prevent erosion, and suppress weeds, rather than for harvest.
- **No-till Farming**: a farming technique that minimizes soil disturbance and erosion by eliminating ploughing and other tillage operations.
- **Crop Rotation**: a farming practice that involves planting different crops in a particular order to improve soil health, prevent pests and diseases, and increase yields.
- **Livestock Integration**: incorporating livestock into the farming system to improve soil health, reduce weed growth, and provide additional income streams.
- **Natural Pest Management**: using natural methods to control pests and diseases, such as crop rotation, companion planting, and biological control.
- **Composting**: the process of decomposing organic waste into a nutrient-rich soil amendment that can be used to improve soil health and fertility.
- **Water Management**: the practice of conserving and managing water resources to ensure sustainable agriculture and protect the environment.
- **Food Justice**: the principle that all people should have access to healthy, affordable, and culturally appropriate food, regardless of their income or location.

Agronomic aspects of Regenerative Agriculture

Background

Soil is the foundation of agriculture, and the productivity of crops is directly impacted by the health of soil. Therefore, Regenerative agriculture practices aim to enhance soil health by boosting soil organic matter, enhancing soil structure, and promoting soil biodiversity. The application of correct agronomic practices is crucial because agriculture contributes significantly to greenhouse gas emissions, and the way we manage our soils can have a significant impact on the carbon cycle. Implementing regenerative agriculture practices can assist in carbon sequestration, reducing the amount of carbon dioxide in the atmosphere. Moreover, regenerative agriculture practices aim to establish sustainable farming systems that can provide food for future generations while reducing the impact on the environment. In addition, regenerative practices can have economic benefits for farmers by lowering the requirement for expensive inputs such as fertilizers and pesticides.

Main idea

The module is designed to provide a detailed understanding of the agronomic practices and techniques involved in implementing regenerative agriculture on farms. Regenerative agriculture is a holistic approach to farming that focuses on enhancing soil health, biodiversity, and ecosystem services, while also improving productivity and profitability. Overall, the "Agronomic Aspects of Regenerative Agriculture" module aims to provide participants with a comprehensive understanding of the agronomic practices and techniques involved in implementing regenerative agriculture on farms, and how these practices contribute to improving soil health, enhancing biodiversity, and increasing productivity and profitability.

Course Goals:

- Develop a strong foundation in soil health and its importance in Regenerative Agriculture.
- Learn about crop selection and management techniques for Regenerative Agriculture systems.

- Understand natural pest control methods and how they can be implemented in Regenerative Agriculture.
- Understand sustainable weed control methods.
- Identify and evaluate different types of integrated technology (i.e. precision agriculture, data analytics) that can be used to improve crop management and reduce environmental impact.

Topics covered:

The module covers a range of topics related to soil management, including soil health assessment, soil biology, soil fertility, nutrient management, cover cropping, crop rotation, conservation tillage, and integrated pest management. It also emphasizes the importance of reducing soil erosion, increasing water retention, and improving the quality of soil organic matter. The module covers the importance of soil health in regenerative agriculture and the role of organic matter, soil biology, and nutrient cycling. Participants may learn about soil testing, nutrient management, and the use of cover crops and green manures. The module covers also the benefits of reduced tillage practices and the use of no-till or conservation tillage techniques to improve soil structure, retain soil moisture, and reduce soil erosion. Another important topic of the course it is the use of natural fertilizers and pest management techniques in regenerative agriculture, such as composting, intercropping, and the use of natural predators and beneficial insects. The student will also learn about the benefits of crop rotation and the importance of diversifying crop species to maintain soil health and manage pests and diseases. The module may cover also the integration of livestock into regenerative agriculture systems, such as the use of rotational grazing to improve soil health, reduce inputs, and increase productivity.

- **Soil health and management**: This would cover the fundamental principles of soil health, including soil structure, nutrient cycling, and microbial activity. Students would learn how to assess soil health and implement practices such as cover cropping, reduced tillage, and crop rotation to improve soil health.
- **Crop selection and management**: This component would cover the selection and management of crops for Regenerative Agriculture systems, including the use of cover crops, intercropping, and the integration of livestock into cropping systems.
- **Integrated pest management:** Students would learn about the use of natural pest control methods in Regenerative Agriculture, including the use of beneficial insects,

crop rotation, and other techniques for reducing pest pressure without the use of synthetic pesticides.

- **Integrated weed management**: Students will learn about the principles of IWM and how it can be used to control weeds while promoting soil health and biodiversity. The course will cover a range of topics, including cultural, mechanical, and chemical control methods, as well as the importance of taking a holistic approach to weed management.
- **Integrated technology**: Students will learn how technological advancements can be used to enhance soil health, biodiversity, and crop productivity, while minimizing environmental impact. The course will cover a range of topics, including precision agriculture, data analytics, drones, and robotics, as well as the potential benefits and limitations of using technology in regenerative agriculture.

Main definitions

- **Soil Health**: The physical, chemical, and biological properties of soil that enable it to function as a dynamic living system capable of sustaining plant and animal life, storing carbon, and filtering and cycling nutrients and water.
- **Cover Crops**: Plants grown between cash crop seasons to protect and enhance soil health by reducing erosion, adding organic matter, and suppressing weeds.
- **Crop Rotation**: The practice of growing different crops in succession on the same field to maintain soil fertility, control pests and diseases, and reduce erosion.
- **Conservation Tillage**: A farming practice that minimizes soil disturbance by leaving crop residues on the soil surface and reducing the use of tillage equipment, thereby reducing erosion and preserving soil structure.
- **Integrated Pest Management**: A holistic approach to pest control that uses a combination of biological, cultural, and chemical methods to manage pests and diseases while minimizing environmental impact.
- **Nutrient Management**: The practice of balancing nutrient inputs and outputs to maintain soil fertility and promote healthy plant growth, while minimizing environmental pollution.
- **Agroforestry**: The integration of trees and shrubs with crops and/or livestock to enhance soil health, increase biodiversity, and provide ecosystem services such as shade, wind protection, and carbon sequestration.

- **Precision Agriculture**: The use of advanced technologies such as GPS, sensors, and data analytics to optimize crop management, reduce input costs, and minimize environmental impact.
- **Organic Agriculture**: A production system that relies on natural inputs and processes to promote soil health, biodiversity, and environmental sustainability, while also producing nutritious food and fiber.

Sustainability concepts of Regenerative Agriculture

Background

Agriculture can have a significant impact on the environment and is a well-known contributor to greenhouse gas emissions. Sustainable agricultural practices help protect soil, water, and biodiversity by reducing pollution, conserving resources, and minimizing the use of harmful chemicals. Further, sustainable agriculture practices such as crop rotation, agroforestry, and conservation tillage can reduce greenhouse gas emissions and help mitigate climate change. Sustainable agriculture ensures that food production can continue for generations to come. By using methods that maintain soil fertility and reduce the use of non-renewable resources, sustainable agriculture helps to ensure that food production is not only environmentally responsible but also economically and socially viable. Sustainable agriculture can provide economic benefits to farmers and rural communities. By using practices that reduce input costs, such as using natural fertilizers and pest control methods, farmers can increase profits. Additionally, sustainable agriculture can create jobs and provide opportunities for small-scale farmers to participate in local and regional food systems. Achieving sustainable agriculture requires a comprehensive and integrated approach that addresses environmental, social, and economic factors. Some strategies can be jointly used to move towards a more sustainable agriculture: Adopt agriculture practices, such as cover cropping, crop rotations, agroforestry, and integrated pest management; Promote approach to farming promoting biodiversity, reduce the use of synthetic inputs, and enhance ecosystem services; Reduce food waste, using water-efficient irrigation systems, and improving energy efficiency in farming operations; Support local food systems; Invest in research and education as these can help to identify and promote sustainable agriculture practices, as well as to educate farmers, policymakers, and the public about the importance of sustainable agriculture.

Overall, achieving sustainable agriculture requires a multifaceted approach that addresses the environmental, social, and economic dimensions of food systems. By adopting regenerative agriculture practices, promoting agroecology, reducing waste and increasing efficiency, supporting local food systems, promoting food sovereignty, and investing in research and education, we can move towards a more sustainable and resilient food system.

Main idea

This course explores the principles and practices of regenerative agriculture from a sustainability perspective. The course typically covers the principles and practices of regenerative agriculture, which is a holistic approach to farming that seeks to improve soil health, increase biodiversity, and enhance ecosystem resilience. The course may include topics such as biodiversity, carbon sequestration, and water conservation, as well as the social and economic dimensions of sustainable agriculture. Students will learn about the importance of soil health, biodiversity, water conservation, energy efficiency, social sustainability, and policy and economics in supporting healthy and productive agricultural systems. They may also explore practical strategies for implementing regenerative practices on farms, such as cover cropping, crop rotations, intercropping, and agroforestry. The course is designed to provide students with a comprehensive understanding of the principles and practices of regenerative agriculture, and to equip them with the knowledge and skills needed to pursue careers in sustainable agriculture, conservation, and related fields.

Course goals:

- To understand the principles and practices of regenerative agriculture and its relationship to sustainability.
- To identify the key factors that contribute to the sustainability of regenerative agriculture systems.
- Challenges and opportunities in promoting sustainable agriculture from a policy and economics perspective.
- Effectiveness of different sustainability practices in regenerative agriculture.
- To develop practical skills for implementing sustainable agriculture practices in personal and professional contexts.
- To analyze case studies of successful regenerative agriculture systems and apply principles to real-world scenarios.
- To understand the role of community development in promoting sustainable agriculture.
- Discussion and critique of sustainability concepts and practices in regenerative agriculture.

Topics covered

An examination about the principles and practices of regenerative agriculture, including building healthy soil, enhancing biodiversity, improving ecosystem services, mitigating and adapting to climate change, conserving water, and integrating livestock management will be carried out. In addition to learning about the technical aspects of regenerative agriculture, students in the course may also examine the social and cultural factors that shape sustainable food systems, including issues related to land tenure, farm labor, food access, and food justice. They may explore case studies of successful regenerative agriculture projects and initiatives and consider the policy and advocacy implications of sustainable agriculture. The course will include case studies and on-site visits to regenerative agriculture systems, as well as opportunities for students to design and implement sustainable agriculture projects. Through a combination of lectures, discussions, case studies, and hands-on activities, the holistic approach of RA and its potential to create sustainable food production systems that are socially and economically viable in addition to being environmentally sustainable. By the end of this module, the student will have the knowledge and skills to design and implement RA practices in a way that promotes sustainability and resilience in agricultural systems.

- **Sustainable water management**: This module would cover the importance of water management in regenerative agriculture, including the use of techniques such as rainwater harvesting, contour farming, and irrigation management.
- **Biodiversity enhancement**: This module would explore the role of biodiversity in regenerative agriculture, including the benefits of diverse ecosystems, and the strategies used to enhance biodiversity, such as intercropping and agroforestry.
- **Reduction of GHG emissions**: This module would examine the potential of regenerative agriculture to mitigate climate change by reducing the emission of GHG as well as sequestering carbon in soils This module also includes the role of practices such as no-till farming, cover cropping, and agroforestry in mitigating the climate change.
- **Rural development aspects**: This module would explore the economic viability of regenerative agriculture, including the potential for increased profitability, market demand, and certification and labeling programs.
- **Case Studies and Best Practices**: This module would showcase successful examples of regenerative agriculture in practice, including case studies from the REGINA partners, and highlight best practices for implementation.

Main definitions

- **Sustainability**: Meeting the needs of the present without compromising the ability of future generations to meet their own needs. In agriculture, sustainability encompasses environmental, social, and economic considerations.
- **Biodiversity**: The variety of life in a particular ecosystem or region, including the number and variety of species, genetic diversity, and ecosystem diversity.
- **Ecosystem Services**: The benefits that people derive from ecosystems, including provisioning services (e.g., food, water), regulating services (e.g., climate regulation, flood control), cultural services (e.g., recreation, aesthetic values), and supporting services (e.g., nutrient cycling, soil formation).
- **Carbon Sequestration:** The process of capturing and storing carbon from the atmosphere in vegetation, soils, and other organic matter, in order to mitigate climate change.
- **Holistic Management**: A decision-making framework that aims to optimize the health of the ecosystem, the productivity of the land, and the well-being of people, through a focus on whole system thinking, goal setting, and monitoring.
- **Social Justice**: The fair and equitable distribution of resources and opportunities, including access to land, water, and other natural resources, as well as fair wages and working conditions for farmers and farm workers.

Insights on specific crops and livestock

Background

Crops and livestock cultivation under RA is an approach that focuses on promoting the health and productivity of the ecosystem while producing high-quality food for human consumption. The goal of regenerative crop cultivation is to enhance soil health and fertility, promote biodiversity, reduce soil erosion, and minimize the use of synthetic fertilizers and pesticides. In this framework, livestock represents the essential part of the farming system as animals produce manure that can be used instead of the mineral fertilizer, achieving the circularity of the farms. RA can enhance the nutrient content of the crops produced and improve their resilience to pests and diseases. Regenerative cultivation practices can also have positive impacts on climate change mitigation, as the sequestration of carbon in the soil can offset greenhouse gas emissions from crop and livestock production. Additionally, RA practices can contribute to the development of more sustainable and resilient rural communities, by enhancing food security and creating job opportunities.

Main idea

As the demand for sustainable and organic food grows, there is an increasing need for farmers and professionals in the agriculture industry to have a deep understanding of regenerative agriculture and its various practices. This includes a specific knowledge of how to apply regenerative agriculture principles to specific crops and livestock. The course "Insights on Specific Crops & Livestock in Regenerative Agriculture" provides students with an in-depth understanding of specific crops and livestock in regenerative agriculture. By focusing on specific crops and livestock, the course will delve into the unique characteristics and needs of different plants and animals and how they can be integrated into a regenerative agriculture system. The course will also provide students with an understanding of the benefits of regenerative agriculture and how it can be used to promote sustainable and environmentally friendly agriculture practices. The course will cover different types of crops and livestock, their characteristics, and how they can be integrated into a regenerative agriculture system. The example of some farmers could enhance student knowledge as practical tip will be enormously useful for them. Some tips from other farmers will be also considered in order to clarify the right position of specific crop into the crop rotation or intercropping.

Course goals:

- To provide students with a comprehensive understanding of regenerative agriculture and its principles, as well as the unique benefits it can offer to specific crops and livestock.
- To educate students on the different types of crops and livestock, their characteristics, and how to integrate them into a regenerative farming system.
- To teach students the various regenerative practices used in crop production (e.g. cover cropping, crop rotations, reduced tillage, and organic fertilization) and how they can be applied to specific crops.
- To educate students on the importance of soil health and its role in regenerative agriculture, including the use of soil testing, soil amendments, and crop selection to improve soil health.
- To provide students with the knowledge and skills necessary to design and implement a regenerative agriculture system, including the use of livestock as an integral component of a sustainable farming system.
- To promote critical thinking and problem-solving skills in students, enabling them to identify and solve issues related to specific crops and livestock in regenerative agriculture.
- To instill in students an appreciation for the importance of sustainable agriculture practices and their potential to benefit the environment, local communities, and the economy.

Topics covered

- Cereal cultivation – example of approach to cereal production that focuses on promoting the health and productivity of the soil ecosystem while producing high-quality cereals for human consumption. Principles and practices of RA, including reducing tillage, promoting crop rotation, and integrating other new practices will be addressed during the course with specific examples aimed at the cultivation of cereals.
- Industrial crops - Technical aspects of industrial crop cultivation under RA will be deeply analysed through the combination of the knowledge of different professional figures. The importance of specific crop will be pointed out along with its role in the rural development of a definite Country. The module will also deepen both the biology

and botany of used crops, in order to match crop phenology with the correct time of intervention; it improves the efficiency of intervention while reducing the amount of input required, in line with the guidelines of RA.

- Horticultural crops - The benefits of improving soil health, nutrient availability for vegetables, and resilience of the ecosystems could be strongly useful for horticultural farmers. Again, specific horticultural crops will be deeply studied both through conventional systems along with RA system. This module can be integrated with the water footprint of vegetable obtained under RA with respect to the conventional system, as vegetable require more water than common herbaceous crops.
- Grassland management - In line with the as-much-biodiverse-as possible policy, the management of grasslands is included in the possible systems that can shift towards RA. Another important aspect will be the grassland management. A full map with the grassland area will be showed in order to scale the possible change toward RA. Furthermore, an indicative grassland management under RA will be studied and assessed: RA tillage management, the sowing of the right plant during the right period of the year, and the correct pest and disease management.
- Agroforestry - The course would cover: tree-crop interactions and their benefits; agroforestry systems and their design; plant and tree propagation techniques; soil health and management; livestock integration and management; pest and disease management in agroforestry systems; market analysis and value chain development. Students would learn about the benefits of agroforestry for both farmers and the environment, and gain practical skills in designing and implementing agroforestry systems.
- Livestock management – In this module the correct management of livestock will be assessed in order to reduce the input requirement of an ideal farm. This module would cover the principles and practices of regenerative livestock management, including rotational grazing, integrating livestock into cropping systems, and using livestock to improve soil health. The best RA practices will be studied and some case studies will be reported in order to achieve the perfect match between theoretical and practical principles.

Main definitions

- **Crop/livestock selection**: The process of choosing a specific crop or livestock species based on various factors such as climate, soil type, market demand, and resource availability.
- **Agroforestry**: It is a field that focuses on the integration of trees, crops, and livestock on the same piece of land.
- **Genetics:** The study of inherited traits in plants and animals, which can be used to improve crop and livestock productivity, disease resistance, and other desirable characteristics.
- **Nutrition:** The study of how nutrients are obtained, processed, and used by living organisms, including plants and animals, and how they can be optimized for maximum health and productivity.
- **Marketing**: The process of promoting and selling crops and livestock, which includes market analysis, branding, packaging, pricing, and distribution.
- **Sustainability:** The practice of managing resources in a way that meets the needs of the present without compromising the ability of future generations to meet their own needs, including soil health, biodiversity, and resource conservation.
- **Value-added products**: The creation of new or enhanced products from crops or livestock, which can increase their market value and profitability, such as processed foods, biofuels, or specialized products like wool or honey.
- **Animal welfare**: The ethical and humane treatment of animals, which includes proper housing, feeding, and healthcare, as well as minimizing stress and pain during handling and processing.
- **Environmental impact**: The assessment of the impact of crop and livestock production on the environment, including soil erosion, water quality, greenhouse gas emissions, and habitat destruction, and strategies to minimize negative impacts.

Learning Objectives & Outcomes

Characteristics of the Learners:

After having mastered the basic subjects, university students participating in the course are ready to learn the material of the REGINA course (Basic subjects: botany, soil science, agrometeorology, etc.)

As for secondary school students, the course material, or part of it, can be integrated into the curriculum during the learning of professional skills.

Farmers participating in the training are expected to have a professional curiosity.

Characteristics of the Teacher

The course trainers possess appropriate professional qualifications and experience. They hold the academic degree required in university education. Applying modern technologies and techniques, the trainers teach with a learner-centred approach, use practical examples, cooperative teaching and learning techniques, elements of project learning and hold interactive lectures. Involving external experts, decision-makers into the process of teaching and practitioners into fieldwork training is also an integral part of their job. Teachers, practitioners and policy makers maintain ongoing live contact for exchange of experience and continuous improvement. They also ensure that up-to-date guidelines, objectives and regulations are integrated into educational material as soon as possible. In order to ensure interdisciplinarity, the teachers working in various disciplines cooperate with each other and jointly develop the teaching materials.

Description of learning objectives, targets of the course:

Students in Higher Education (HE)

- Are able to understand and correctly apply the basic concepts related to regenerative agriculture, and are able to define RA.
- Understand the concepts of regenerative agriculture and are able to critically evaluate different soil management practices and methods. They are able to select

the methods fitting into the RA approach and to plan preparation or the soil for different crops (taking climatic and soil conditions into account).

- Understand the principles of plant nutrition. He/she applies a critical view on the questions of nutrient management and is able to develop a nutrient management plan in line with the RA approach. He/She has the ability to analyse soil test results and make recommendations for fertiliser selection.
- Are able to plan the crop structure of a farm based on RA guidelines, to set up crop rotations. They bear the ability to select cover crops, green manure crops, catch crops and to integrate them into the crop structure. They are able to critically evaluate the elements of a crop rotation and make improvements where necessary.
- Are able to synthesise their knowledge in order to successfully put the results of e.g. metagenomics, bioinformatics and precision farming into practice.
- Are able to identify steps towards sustainable water management, to apply guidelines for soil cultivation and crop structure to conserve moisture. They are able to critically evaluate different agrotechnical elements in terms of moisture conservation and to propose solutions to identified failures.
- Know and understand the role of biodiversity growth, which to be accomplished, they are able to plan and implement changes in crop production.
- Understand the role of RA in reducing GHG emissions, recognise the economic, environmental and social benefits and bearing these elements in mind, they are able to plan farming processes.
- Understand the role of RA in rural development.
- Are able to analyse and evaluate the role of different arable and horticultural crops, grassland and livestock in RA. They synthesise their knowledge in the course of planning crop, horticultural, grassland and livestock production. They apply the principles of RA and able to evaluate production indicators, make decisions to optimise indicators in the light of RA.

Have the ability to carry out a case study, analyse the results and compare them with the results of conventional farming. They are able to draw appropriate conclusions and, based on the results, to improve/refine the RA methods used in the process.

Teachers in Higher Education (HE)

The project-based, practice-oriented teaching elements are widely used by the teachers. They aim to give students as much insight as possible into RA through the analysis and joint processing of case studies and, on the other hand, through the processing of information reflecting the opinions and perceptions of decision-makers and farmers.

The aim is to exchange international experience, update the knowledge base, present good practices, and their evaluation.

For stakeholders (farmers) - here: learning needs - reflection on PR1 survey results

It is important for policy makers and agricultural businesses to have creative engineers with up-to-date knowledge and good collaboration skills in the labour market. Students who are able to work in teams, apply critical thinking skills and work independently are in demand. They are interested in developing a training structure that reflects these principles.

Different target groups/specific aims (secondary school, other tiers of education, adults)

Successful completion of the course will equip the **university student** with the skills of:

Knowledge: He/She knows and uses of the basic concepts of science, engineering, technology, food chain safety and management supporting regenerative agriculture. He/She knows the modern technologies used in RA and their practical application, also knows the impacts of agricultural production on natural ecosystems and their economic impacts. He/She understands the new challenges of climate change and the importance of adaptation.

He/She has the ability to work well in a cooperative environment, interpret and communicate professional instructions clearly to the employees. He/She is able to identify pests, pathogens, weeds and their natural enemies, to plan and implement integrated pest management with low chemical inputs. He/She is also able to interpret, comply with and enforce regulations and legislation relevant to RA. He/She must have good communication skills, which enable them

to express their professional opinions and positions and, in the event of a dispute, to defend them.

Attitude: He/She has a constructive approach towards professional issues and is sensitive to new production trends in RA and seeks to introduce them. He/She is sensitive to the environmental, animal welfare and food safety aspects of agricultural production, both in the light of formulation of his/her position and in his/her daily work.

Autonomy. The student is capable of independent, regenerative farming and counselling. He/She takes responsibility for the decisions he/she takes over the performance of his/her duties. He/She understands and credibly represents the importance of RA, both at national and international level. He/She is committed to maintaining and improving the positive image of RA in society. His/Her communication articulates their professional convictions in a responsible manner. He/She expresses their opinions independently, professionally and responsibly.

Secondary school students: are able to recognise the benefits of RA, strive to use it and deepen their knowledge.

Practitioners and farmers will gain new information that will enable them to carry out their activities more effectively and confidently. They will receive guidance on how to make the transition to RA. They will learn about its benefits and risks in order to make responsible and well-grounded decisions on the future of their business. Learning about international findings in the field will provide the opportunity to gain knowledge on RA and an access to professionally sound knowledge at an academic level.

Learning Approaches

"Which are teaching methods of industrial design for regenerative agriculture revolution?"

Hands-on Learning: Industrial design for regenerative agriculture involves designing and implementing practical solutions for sustainable agriculture. Hands-on learning experiences can be an effective way to teach students how to apply design principles in real-world settings. This can include field trips to regenerative farms, internships with sustainable agriculture companies, and project-based learning.

Multidisciplinary Approach: Regenerative agriculture involves many different disciplines, such as ecology, agronomy, soil science, and animal husbandry. Industrial design programs for regenerative agriculture should incorporate a multidisciplinary approach to help students understand the complexities of sustainable agriculture and develop solutions that consider the many different factors at play.

Design Thinking: Design thinking is a problem-solving approach that involves empathy, experimentation, and iteration. It can be an effective way to teach students how to design solutions for regenerative agriculture. This can include exercises that help students identify user needs, brainstorm potential solutions, and prototype and test their designs.

Collaboration: Collaboration is essential in industrial design for regenerative agriculture. Students should be encouraged to work in teams to develop solutions that consider the needs of all stakeholders, including farmers, consumers, and the environment. This can involve group projects, peer reviews, and presentations.

Sustainability and Ethics: Sustainability and ethics are key considerations in regenerative agriculture. Industrial design programs for regenerative agriculture should teach students about the principles of sustainability, including the importance of reducing waste and using renewable resources. Students should also learn about the ethical considerations involved in designing solutions for sustainable agriculture, such as animal welfare and social justice.

Teaching methods

The following teaching methods (face-to-face work, cooperative group work, project work) are the most effective ways of presenting the opportunities offered by RA, which are best suited to transfer academic and practical knowledge, combining traditional and modern teaching approaches.

Frontal work involves students learning the same content under the direct guidance of the teacher, through lectures, explanations, discussions and demonstrations. These methods assume that the students are able to learn the content outlined in the given system because they have almost identical prior knowledge. The work of highly qualified lecturers results in the reorganisation of students' prior knowledge and the anchoring of new skills. The method is most successful when the instructor's personality is inspiring and motivating for the students. This method of teaching is most effective when covering large chunks of material.

In **cooperative group work** (2-4-6 students), students work together to learn and are responsible not only for their own progress but also that of their peers. The success of the group depends equally on the individual work of each student. During their activity, groups can collect rewards of different "values", such as (in order of increasing value) a corncob, a tractor, a combine harvester, or a wood plough, a basic plough, a reversible plough. This method is an excellent way to experience cooperation, competition and the development of related skills. The transparent display of the rewards to be collected increases the competitive spirit (e.g. in the implementation of the rally method).

The method of **competition** between groups of students can be implemented in the following steps:

- first, the material to be learned is worked through in a frontal approach (lecture, explanation),
- then a competition or competition between the groups.

Another possible teaching method to transfer the RA knowledge is the **jigsaw puzzle**. In a jigsaw puzzle, the available pieces must be put together to form a whole, meeting the requirements of the game. Each piece carries information on its own (pictures, diagrams, text), but its full meaning is revealed when it is put together with the other pieces.

This method can be used for tasks where the focus is on learning new skills. To achieve this, a considerable amount of source material has to be processed, and it is particularly important to select the members of the group in such a way that they are able to solve the tasks assigned to them.

An example of how this can be achieved is for students to carry out independent literary research on the following topics:

- organic matter in soil,
- humic substances,
- consumption of organic matter,
- organic matter in the soil, humus in the soil, organic matter loss, organic matter accumulation,
- humic acids,
- fulvic acids.

By applying and combining these elements of information, they are able to gain an overview of soil organic matter management and, on this basis, to produce a comprehensive body of material and knowledge.

Project work is a specific form of collaborative group work, where students' communication skills play an important role, but at the same time, working in this way has a feedback effect on the development of these skills. The project method gives students freedom of choice and encourages them to take responsibility. Students work in a heterogeneous group of 3-5 people and plan the steps of the work, the methods to be used, establish the division of labour within the group, and define the tasks to be carried out by each member of the group. After the work has been carried out independently, the results can be synthesised and integrated. Students should also be prepared to present the results of the work or research they have done. This could

be a presentation or an interview with farmers and a case study, the development of cultivation techniques for different crops in RA, written material with photos, or video material.

Afterwards, the work completed is evaluated, which is influenced by many aspects, e.g:

- the characteristics of the course material,
- the time available,
- the personality of the teacher,
- methodological culture of the teacher,
- the material conditions.

Types of assessment recommended in the course:

Diagnostic: to assess students' prior knowledge of RA.

Formative: continuous assessment of progress, rewarding progress as described earlier (collecting corn cobs, etc.) to deepen knowledge.

Summative: qualitative assessment at the end of the learning process, method: exam, which can be oral, written, presentation (PPT, interviews, case study, film, etc.). Numerical assessment on a five-point scale.

Example of how to implement project work

Project work

I. Getting to know each other and warming up

Four corners method: instructor gets to know the students' prior knowledge

The method can be used to identify which students within the group have similar levels of knowledge and interests. We formulate four answers on the new topic in numerical terms, which are:

- I have not heard of it at all,
- I have heard of it but have no relevant knowledge,
- I have studied it, but it hasn't really grabbed me,
- I've learned about it and I'm interested.

The questions are placed on A/4 moderation cards at 4 points or corners of the venue. Groups are formed based on the answers to the questions, giving the trainer an insight into the knowledge and interest of the audience in the topic being discussed. The resulting groups may even form the basis for further collaborative work.

Group mirror: students get to know each other (group exercise)

The aim of the method is for students to get to know each other and find possible points of contact, making it easier for everyone to get in touch. It can be used well before starting to work together. A table with questions for each group member is prepared and students write their answers on it. While studying the completed group mirror, students are asked to find 3-4 partners with whom they have some common traits, interests, etc. Based on these common traits, groups can be formed, which can work together after the group mirror.

Name	**Educational level**	**Programme**	**Hobby**	**Does your family have a farm?**
XY	BSc	AE	reading	no
ZW	BSc	AE	running	yes

Passport method: students get to know each other (pairs)

The objective of the method is for students to get to know each other by working in pairs, in a way that pairs formed by random selection (e.g. the string method) have a short, informal conversation with each other. The aim is that they can then introduce their pair to the rest of the group. The lecturer can also give the participants a completely free hand during the introduction, or even ask one or more compulsory questions, such as "What kind of music do you like?" or "What is your favourite colour?". Similar to the group mirror method, it is also a good idea to use it before starting to work together.

II. Orientation, setting goals and ideas

Now - then - later: setting goals and brainstorming.

The method allows students to identify the elements and steps of a planned project and to organise them in chronological order and according to difficulty level, in order to clarify the next steps and tasks. The aim of the method is to motivate the group to take the first steps, to help organise ideas, to prepare the first draft of the project and to help with further planning.

In the now-then-later method, students write their ideas for the planned project on moderation cards, one by one, in small groups. The cards are then arranged by each group in a prepared now-then-later table. If the group does not think an idea is feasible, it is put aside. Nothing should be thrown away, the card should be put up for discussion later!

After the discussion, the groups can change the system of the cards if they think it is necessary. At the end, the small groups stick the previously rethought moderation cards in their final place and the plan is ready. The following points are still to be discussed by the groups (someone in the group should take minutes):

- When is the next project meeting?
- Who is actively involved in the project?
- What tasks need to be completed before the next meeting?
- Who will do what, with what deadline?

Group Idea-mix: brainstorming, decision, problem solving.

This method is best used when you want to work on a more complex topic or to gather ideas to solve a more complex problem. It is also an opportunity to assess students' knowledge of the topic: prior knowledge at the introduction of a topic and results at its conclusion. In fact, it is an individual brainstorming in written form, in which students collect ideas for 3-4 starter questions at a time in individual work. All the rules of brainstorming apply to this brainstorming session as well (no bad ideas, all ideas can be important, the more ideas a student collects the better, but don't censor their ideas too much.) The papers are then stacked neatly on top of each other, and folded so that there is one pile for each guiding question. Then form as many groups as you have piles of paper. Students decide which question they would like to work on, evaluate their ideas and present the results.

III. Cooperation, Project Design

Work plan poster: planning, decision

The work plan allows the groups to plan the progress of the project, the steps and their deadlines, and to record which tasks each group member will take on. The work plan poster reinforces in the students the feeling that they are all responsible for the common result, that the success of the work depends on them and on the specific tasks they have undertaken. As a teacher the method can help you to get an overview of the group's activities, the roles of the members and the status of the work process.

The work plan poster can also be used to check during the work process which tasks have been completed and how much time they have left to complete each task, allowing them to reallocate their efforts if someone has fallen behind. At the end of the time available, students can quickly run through to see if everything has been completed. The work plan is filled in by the students when they plan the project. As a teacher this method gives you an overview of the group's activities, the roles of the members and the status of the workflow.

IV. Problem solving and knowledge acquisition

Case study: problem solving and knowledge acquisition

The objective of the method is to gain problem-solving, analytical knowledge by analysing specific cases and the related documents. The case study is one of the main methods of exemplary, task-oriented, close-to-reality learning, whereby students study events and happenings in a simplified and focused way. The purpose is for students to draw generalisations from specific cases, while learning key concepts. Students are introduced to a specific case and then given the information they need to complete their knowledge of the case. The material is used to examine the case from the point of view of the people involved and as an external observer. They will be given questions to help them with this exercise. In cases involving multiple actors, it is also possible for each group to analyse the perspective of a different actor.

Presentation: synthesisation

Presentations can be made following independent work in pairs or groups. Using a variety of tools, students present the results of their work to others, sharing with them the specific knowledge they have acquired. The way in which the students present their work can be specified in the assignment, but if the groups are already familiar with several methods, it is advisable for them to choose the presentation tool that best suits their "taste" and the message they want to communicate.

V. Evaluation

Mind map: repeating and assessment.

A method for organising and documenting topics/ideas, visualising information from new material, e.g. a text that has been read, and for reviewing and organising information. It can also be used to visualise group results. The mind map as a method is used to visualise topics related to a given subject.

Everyone becomes part of the process, and learners can express and compare their ideas. The method facilitates communication, it can be a kind of "idea pool" that can be added to and modified. It is structured and also shows how the ideas/sub-themes are connected.

Mind-maps can be made alone, in pairs or in small groups, and then displayed or exhibited. Mind maps can also be used to pre-structure internet searches, allowing students to identify topics and keywords that they can search for using search engines. This makes the actual work at the computer much more intensive.

VI. Feedback

Competency cross: assessment and feedback

The aim of the method is to develop students' self-awareness and their ability to identify their strengths and weaknesses, to think about what they know well and where they need to improve. By also articulating what they like to do and what they dislike doing, their motivation is also strengthened.

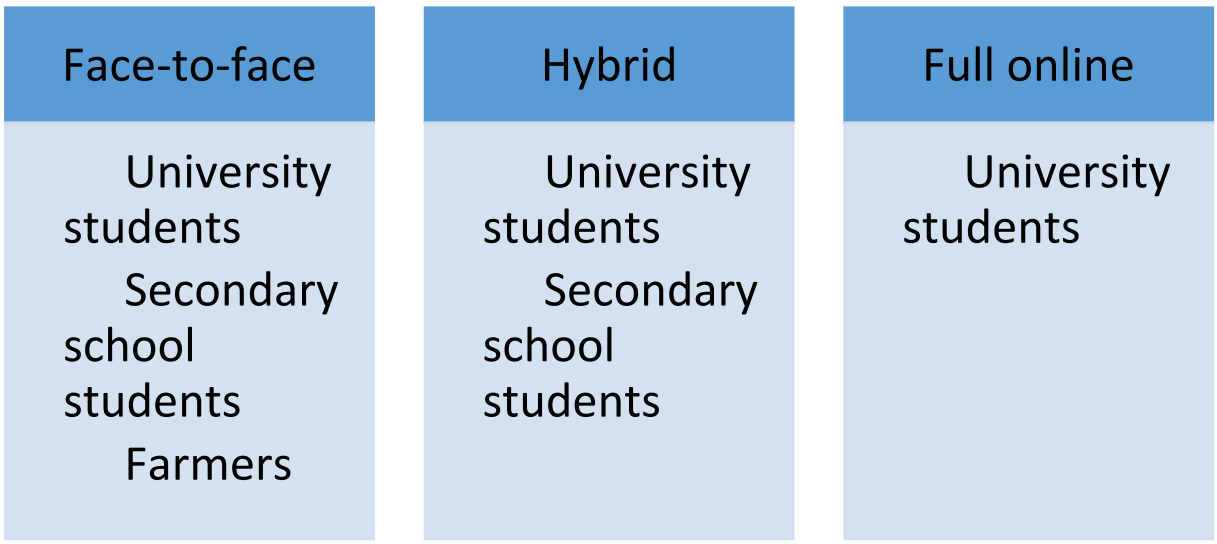
Students are asked to assess their competences within the subject/field, i.e. how well they apply certain learning techniques, how successfully they have acquired certain skills, and then to write each competence in the categories of the coordinate system below. After individual work, pupils pair up and compare their learning characteristics in pairs.

They look for the reasons why certain competences are in the right place and give each other tips on how to improve certain skills and techniques, and how to get them interested in activities they may not have liked. By studying the competency checklists, we can gain a lot of useful

information about students' goals, aspirations, learning habits and characteristics, which can be used to plan the teaching-learning process.

The prior knowledge and learning style of the students in relation to the learning of a given subject can have a great influence on the effectiveness of learning.

Delivery methods



The REGINA course can be implemented primarily using the three delivery methods listed above. In view of the nature of the subject and the discipline, the fully online solution is the least practical. Due to the over-representation of practical knowledge, the hybrid method proves to be the maximum option where online learning can be integrated into the course. However, face-to-face teaching would give the best practical experience to the students. Some of the knowledge can still be acquired online.

For secondary school students, the face-to-face and the hybrid solution are recommended, for farmers only the face-to-face option seems to be good and useful in Hungary. The partners may pick other options, however, depending on the local specificities and needs.

Number of students:

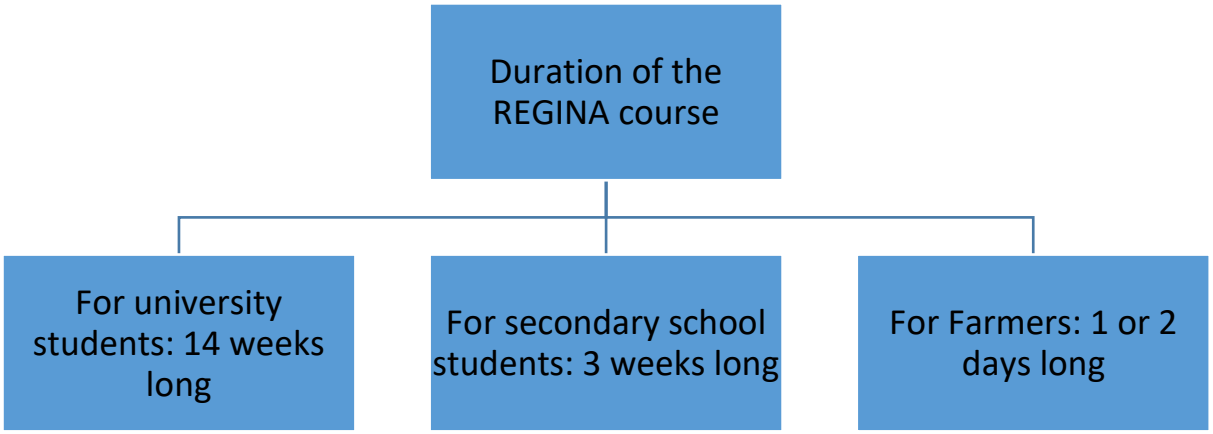
The number of university students involved in the training may vary depending on the capacity of the institution which provides the training.

The number of students per group may vary between 5 and 15 in Hungary.

In secondary schools, the whole class involved can benefit from the training, however, teachers may decide whether they include only certain groups of students (interested ones, ones involved in talent management) into the course.

As many farmers as possible should participate in the training organised for them, since it would result in a much wider dissemination of knowledge. Depending on the number of interested farmers in the catchment area of the training site, I would expect somewhere between 20 and 50 participants. As for foreign partners, this number may depend on the local conditions given.

Duration of the REGINA course:



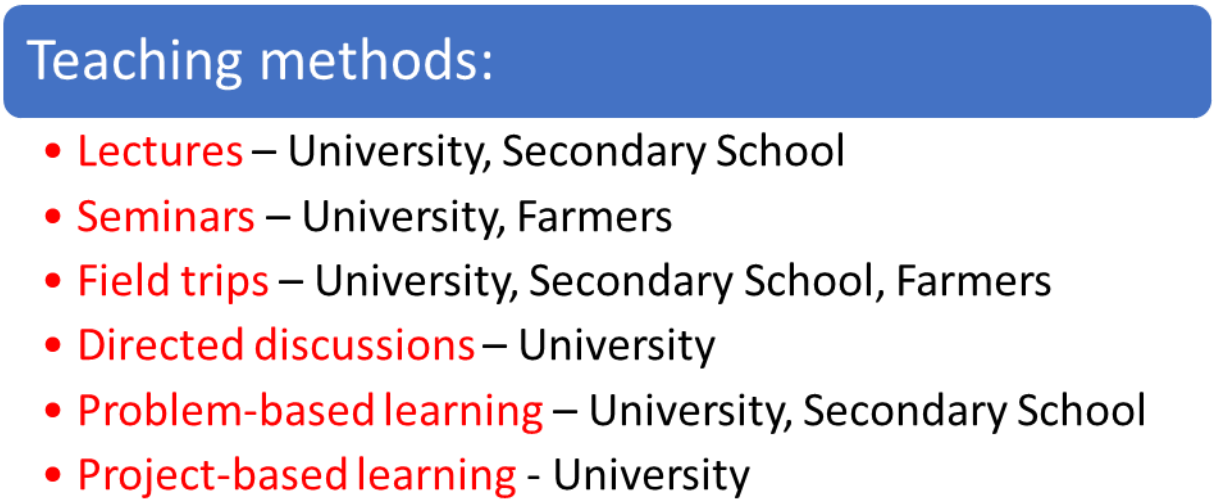
The course is one semester long for university students. The average duration is 14 weeks, 1+2 hours per week which also includes the time necessary spent with assessment.

In secondary schools, a shorter course would be preferable, for example a 3-week period, as follows: in the first week, in the framework of a subject relevant to the topic, the students would

learn the material chosen by the teacher for 1-4 lessons, in the second week they would go on a field trip and are given an independent task (e.g.: making a ppt about the farm), and in the third week they would prepare and present their independent work, which is assessed by the teacher. This section may be modified as the schools involved suggest.

For farmers, 1 – 2-day long events, trade/ professional days, presentations would be ideal because they cannot take time away from work for longer periods.

Teaching methods and activities



Lectures: frontal teaching with explanations, students listen, take notes.

Seminars: analysis of practical problems in small groups, independent research, tasks are given to students.

Field trips: study tour/trips to farmers interviewed in PR1. The field trip will enable students to learn about the practical application of RA. They will ask questions from the farmer, which will help them in the project assignment.

Directed discussion. Discussion of the main questions of RA. Students argue and give "pros and cons" regarding the conventional and regenerative agriculture.

Problem-based learning: students work out a solution to an outlined problem with the help of what they have learned on the field trip.

Project-based learning: students solve an assigned task independently using what they have learned previously and present it to the group (e.g. in the form of a PPT)

The application of scope of methods described above for the modules of REGINA:

The major units of each module are introduced via **frontal teaching**. PowerPoint presentations and videos are the most commonly used techniques for the introduction of the course material. After covering the major units, the cooperative methods can be applied.

Adjusted to the university timetable, the duration of a lecture is 45 minutes or a multiple of this.

The literature recommended by the lecturer helps the students process the material introduced during the frontal teaching.

Example:

- ***Module 2***
- ***Agronomic aspects of RA***
- ***Soil health and management***

Frontal teaching During the lecture, the lecturer explains the possible positive and negative effects of soil tillage operations on the various physical, chemical and biological processes in the soil.

He/She describes the errors in cultivation and the techniques how to avoid them.

He/She presents the most important aspects of managing soil organic matter. He/She defines the building and decomposition processes in the soil and the relationship between organic matter content and tillage.

(The actual material covered may vary depending on the length of the lecture and may be split into several blocks.)

Co-operative group work: Reaching this part of the lecture, the teacher has several options how to engage students in the process of learning. It is advisable to divide the students into smaller units, forming small groups of 2-4-6 students. Co-operative group work is mainly used

during seminars, tutorials or when the total number of students in the group is less than 20. In relation to the topic outlined above, the following options are possible:

Jigsaw puzzle: First, the teacher selects a topic (e.g.: errors in cultivation, organic matter management, soil conservation, soil water management) and prepares a diagram in advance, then a cut-up version of the diagram is given to the group(s) (optionally, the version given out may include blanks which the students have to fill in with the information having been presented by the lecturer).

The group/s' task is to put the diagram together based on their prior knowledge. After each puzzle has been successfully completed, the groups can move on to the next task.

Using the puzzles as a starting point, the following cooperative technique can be a viable method to **complete the project task**.

The completion requires the application of what the students have previously learned in theory and what they have experienced, for example during their field trips.

Their task is to prepare a presentation on a topic or problem. The group members allocate the tasks amongst themselves, mutually agreeing which group member is responsible for which subtask and outline the tasks to be done using a **now-then-later chart** or **group brainstorming**.

The ideas are discussed with the help of the teacher, making team orientation and *formative assessment* possible.

The next stage of implementation is **preparing for and giving a presentation** in which the student groups outline the actual problem and the solution/solutions they suggest.

At the end of the presentation, they ask questions from their peers in relation to the topic.

Applying a technique commonly used in **gamification**, groups can earn various "rewards" by presenting the milestones during the task, and the number of these rewards will shape the mark the group can achieve at the final evaluation.

Regarding **evaluation**, students may also self-evaluate their own performance within the group and/or be involved in the evaluation of the other groups.

Application of Digital Tools: the REGINA Platform

The Moodle LMS is a popular, free, open-source, easy-to-develop learning support tool that is used worldwide. The largest number of registered Moodle servers is in the USA (12.826), and within Europe in Germany (10.083). In Hungary, there are 748 sites (559 private), of which 24 servers are associated with Higher Education Institutions. In addition to universities, many conferences, other educational institutions, secondary schools, and business enterprises are also interested in using MLMS.[1]. Moodle is well-suited for both face-to-face and distance learning, and MOOCs in MLMS (paid, certificate courses) are becoming increasingly common in Higher Education.

The all day/any time availability of these courses offers maximum flexibility timewise for learning and is well suited for adults, working learners, and also suited for full-time and distance learners in Higher Education. There is usually more than one thread of electronic communication between the university and the students, who simultaneously read e-materials and communicate with their fellow students, e.g. over the phone or via email, chat (Clark, 2020).

At University of Győr, we have been working on making education more efficient for almost 20 years, applying learning management systems. The LMS system we have chosen is Moodle3, which is hosted on our own servers under the name SzeLearning (www.szelearning.hu).

In addition to our educational materials, you can also find courses and other educational materials for projects. This is why we chose Moodle for the Regina Platform, as we already have experience in this area.

[1] https://stats.moodle.org/

We have created a site for the Regina Platform in harmony with the project's identity.

We can manage participants at the following authorisation levels:

- Administrator : manage the site, full administration rights
- Teacher: vice admin, create courses, modify, upload, manage users
- Content developer: create courses, modify, upload
- Student/Farmers: guest or registered user
- Guest

As we have become accustomed to in Moodle, courses can be made completely free of charge, so guests and other registered users do not need a login key to access the course and can attend it freely. (https://youtu.be/LSVLLu7GzHE)

The learning materials of the Regina Platform are divided into the following sections:

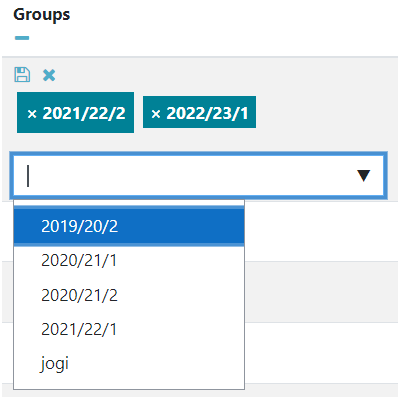
Week	Course Description (90 min lecture)	No. Of Module
1	Definition of RA, Social and economic aspects of RA	1
2	No lecture	
3	Rethinking the soil management through RA	2
4	No lecture	
5	Integrated technologies in RA: biosystems engineering including soil metagenomics and bioinformatics, precision agriculture, IoT	2
6	No lecture	
7	Sustainable water management	3
8	No lecture	
9	Reduction of GHG emissions	3
10	No lecture	
11	Cereal cultivation	4
12	No lecture	
13	Horticultural crops	4
14	No lecture	

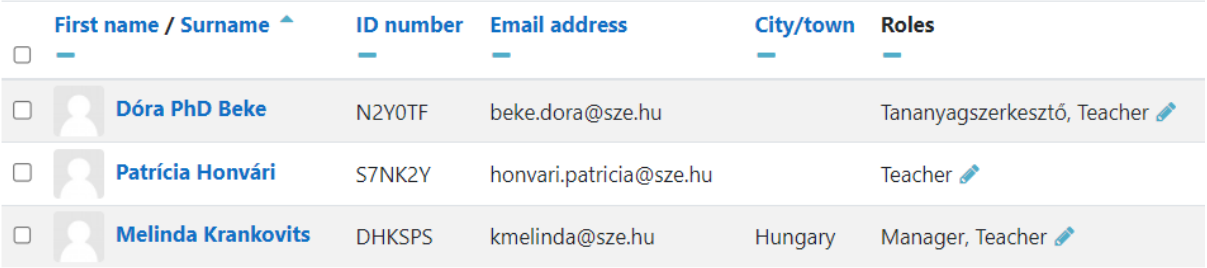
Week	Course Description (90 min seminar)	No. Of Module
1	Definition of RA	1
2	The holistic approach: agricultural, social, economic, and ecological approach	1
3	Soil health and management	2
4	Integrated technology	2
5	Crop selection and management	2
6	Sustainable water management	3
7	Biodiversity enhancement	3
8	Reduction of GHG emissions	3
9	Rural development aspects	3
10	Industrial crops	4
11	Livestock management	4
12	Agroforestry	4

No. of Field Trip	Course Description 8x45 min field trip 1	No. of Field Trip	Course Description 8x45 min field trip 2
1	Good practices - farm visit	2	Good practices - farm visit

The site is mainly in English.

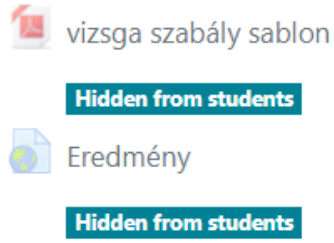
Participants and farmers from different countries will have the opportunity to display content according to their own interests and country. Users can be classified according to previously created groups.





First name / Surname	ID number	Email address	City/town	Roles
Dóra PhD Beke	N2Y0TF	beke.dora@sze.hu		Tananyagszerkesztő, Teacher
Patrícia Honvári	S7NK2Y	honvari.patricia@sze.hu		Teacher
Melinda Krankovits	DHKSPS	kmelinda@sze.hu	Hungary	Manager, Teacher

After the grouping, the contents can be enabled by roles/groups to access:



The Regina-Moodle course available on the SzeLearning main page: [Regina Erasmus+ Platform (2021-1-HU01-KA220-HED-000027629)]

Or directly on this link: https://szelearning.sze.hu/course/view.php?id=13672

Module 1: Regenerative Agriculture Orientation	
Topics	Historical context, Definition of RA, The holistic approach: agricultural, social, economic, and ecological approach The first step to be completed in the module is to describe, define and place RA in the system of agricultural production through the introductory topics listed. Apart from highlighting the importance and impact of RA in the different areas concerned, this module is also used to arouse the interest of the students and to explain the importance of the topic. The interpretation and detailed explanation of the concept of RA defined in the project is carried out in this introductory module. The knowledge acquired here is used by the students elaborating the topic and to examine the different areas of agricultural production in the light of the principles acquired here.
Outcome	Having acquired the material covered in the module, students will be able to recognise the differences between the conventional and the regenerative approach. They will learn the principles of RA. They will be able to recognise the potentials and limitations of RA.
Activities	The teacher will use PowerPoint and/or video presentations to introduce the principles, definition, social and economic aspects of RA to the students and outline the potential ecological impacts. The students will use the basic knowledge acquired to create a knowledge map. During group work, they will create their questions they want to ask from the practitioners actually working in RA, thus extending their knowledge map with the elements of practical applicability. As a result of the group work, a questionnaire or a set of questions will be created, which can also form the basis for an interview. The questionnaire will then be filled in by the farmers or decision-makers visited during the field visits. As an extra activity, interviews may be carried out on the basis of the set of questions they have come up with. The answers given to the questions will be used to complete their knowledge map. The knowledge maps are presented and discussed by the groups.

	The teacher uses the means of a guided discussion/debate to point out any essential elements missed out and the students may incorporate these elements into their work. The result will be a knowledge map in the form of a poster, which summarises the students' knowledge and provides a good basis for understanding the topics covered in detail in the subsequent modules.
Duration	The completion of the module takes 2 weeks.
Assessment	Each topic will end with a maximum 10-question quiz to be completed by the students by the end of the module. The completed knowledge map posters will be assessed at group level.

Module 2: Agronomic aspects of Regenerative Agriculture	
Topics	Main topics of the module: Soil health and management, Crop selection and management, Integrated pest management, Integrated weed management, Integrated technology. In this chapter, the students of the REGINA course will learn about the impact of RA on soil, the crop production technologies applicable for RA, and the crop protection options that can be applied in RA. In the context of soil health, students will learn about soil structure, soil degradation and ways to prevent structural degradation. The issue of soil organic matter management and an overview of soil nutrient supply capacity are topics closely related to these ones. The changes of the organic matter content cause changes in the water, air, heat and nutrient management of the soil. Therefore, these processes should also be examined. On the one hand, all the aforesaid have an impact on the quality of soil tillage, and on the other hand, the tillage itself influences these processes. Discovering these interrelated connections, the students will gain a better understanding of this complex system. We will discuss the aspects of crop structure composition that should be considered in regenerative farming. We will analyse the cultivation technology of different arable crops, with the help of which we will reveal the main aspects causing problems or be well adaptable to regenerative farming. The main steps of how to control pathogens, pests and weeds will be outlined and traditional methods will be compared with solutions supported by regenerative agriculture. Particular attention will be paid to field crops that require more attention. The advantages and disadvantages of integrated systems will be discussed along with the adaptability of different technological elements. A critical evaluation of the opportunities and barriers of conventional and regenerative farming will also be included in the module.
Outcome	Having completed the module, students will be able to evaluate the main elements of soil fertility with appropriate weight. They will have the required knowledge on the principles of conservation tillage. They will understand the soil-plant system and be able to evaluate the impact of different crops on the soil and the environment through their cultivation techniques. They are aware of the concept of integrated systems and are able to manage crop production as a whole. They will have the required knowledge on the different types of crop protection and can distinguish intensive, extensive and integrated systems.
Activities	The teacher will introduce the topics of the module to the students over the course of the lectures using PowerPoint and/or video presentations.

	Since RA has already been defined in the first module, the discussion method - as a complementary means to frontal teaching - can also be used. The instructor will use guided, thought provoking questions to encourage students to form opinions. This method can also be used to introduce elements not yet covered during the frontal teaching, or to revise what has already been mentioned and start to deepen their knowledge. Similarly to the other modules, the students' involvement in the learning process through group work in order to achieve a more detailed mastery of the topics is also recommended. It is advisable to form as many groups as many major topics were covered in the theoretical sessions and to build the project tasks around these. Although choosing some of the topics and focusing on their detailed elaboration later is also viable. The number of students and the preferences of the teacher are the factors that will determine which of the two methods should be applied in the actual teaching environment. The student groups are given a problem (e.g. poor water management due to structural degradation of soil), the outline of which has already been discussed during the frontal teaching. The groups will look for and develop solutions to this particular problem. In their proposals they are expected to apply the RA guidelines. In their presentation of the projects, the students are required to apply a style as attractive and informative as possible, but sleek at the same time. At the end of the presentation of each project, the groups will ask questions from the other students to get feedback on their understanding of what has been perceived from the presentation. Throughout the development of the project assignment, the continuous consultation between the student groups and the instructor is assured, over the course of which the students also present their progress.
Duration	The completion of the module takes about 3 weeks.
Assessment	The main topics will end with a maximum 10-question quiz to be completed by the students by the end of the module. The finished projects will be evaluated by the teacher on the basis of the extent to which the answer/solution to the problem given in advance matches the RA guidelines. The students may also be involved in the evaluation, for example if the teacher organises a competition between the groups.

Module 3: Sustainability Concepts of Regenerative Agriculture	
Topics	Main topics of the module: Sustainable water management, Biodiversity enhancement, Reduction of GHG emissions, Rural development aspects. In the first two modules, the students have learned the fundamentals of RA and had an insight into the relationship between soil and crop management. In this module, knowledge considered to be more specific is imparted. Water management is one of the most important pillars of agricultural production, as water supply disruptions fundamentally change the potentials for agricultural production. In order to store sufficient water in the soil, it is essential to improve water retention and reduce water loss. As far as possible, efforts should also be made - even in large-scale production - to increase biodiversity, or at least not to reduce it even further. It is important from many aspects, let's just think about pollinating insects. Another big question is reducing greenhouse gas emissions. From the point of view of arable crops, reducing CO2 seems to be the most important viewpoint. Due to the fact that C in crop residues is easily converted into carbon dioxide during aerobic decomposition and released into the atmosphere it is converted into GHG, this phenomenon is also a major carbon loss for the soil, which negatively affects its fertility. Concerning rural development, it should be noted that without agriculture it is an activity difficult to be interpreted, and therefore it is closely connected. Moreover, most of the times there is a higher demand for live-labour in RA, so it can also be of interest in terms of creating jobs.
Outcome	By completing this module, the students will acquire the knowledge required for soil water management and the range of activities having an influence on it. The students will be able to design a tillage system and crop structure that will have a positive impact on soil water management and will contribute to optimal water use. The students will learn about the impact of greenhouse gases on the climate. They will know the role of agricultural production in GHG emissions. Students will understand the relationship between rural development and agriculture, with a special focus on regenerative agriculture.
Activities	The teacher will introduce the topics of the module to the students over the course of the lectures using PowerPoint and/or video presentations.

	The involvement of students in the learning process may be achieved by the teacher assigning them a literature research task related to the topics. It is also useful to form small groups of students for this task. As for the literature research, it is advisable to give the groups a larger topic (e.g. soil water management) and to divide the given large topic into smaller parts as a first step. Dividing the topic, the students present it to the teacher. If necessary, the tutor refines and improves the division of the topic made by the students. The next step in the learning process is to find the necessary literature, which also needs to be discussed with the teacher in order to eliminate the irrelevant literature. Next, the students are asked to process the remaining sources of literature . Writing an essay is the most obvious form of processing literature.
Duration	The completion of the module takes about 4 weeks.
Assessment	The main topics will end with a maximum 10-question quiz to be completed by the students by the end of the module. The essay submitted will play the most pronounced part in the evaluation. The students will upload their essays into Moodle's REGINA platform and the teacher will evaluate them.

Module 4: Insights on specific crops and livestock	
Topics	The main topics of the module: Cereal cultivation, Industrial crops, Horticultural crops, Grassland management, Agroforestry, Livestock management. In this module, students will gain an insight into how the cultivation technology of different crops can be adapted with a regenerative approach. The module will cover the technological and crop protection issues involved in the production of the most important cereals, industrial crops and horticultural crops. The module will also address the question of grassland management, particularly regarding extensive technologies, which have a major role to play in enhancing biodiversity and are closely linked to livestock production, markedly, to cattle and sheep farming. The module also covers the fundamentals of forestry and afforestation.
Outcome	After completing the module, students will be able to integrate the RA approach into the cultivation technology of the most important cereal, industrial and horticultural crops. Students will be able to apply the guidelines and knowledge presented in the sessions. They will be able to apply a regenerative approach to farming. The students will know and apply the basics of grassland management and be able to plan for the regeneration of grassland. The students will know the basics of regenerative livestock production.
Activities	The teacher will introduce the topics of the module to the students over the course of the lectures using PowerPoint and/or video presentations. As this module covers a very wide range of knowledge, the emphasis on frontal teaching is much higher than in the previous modules. However, the students need to be given the opportunity to engage. Completing individual tasks in this module seems to be an efficient way of the students' engagement. Randomly, a plant species is assigned to each student and the student works independently to develop a regenerative cultivation technology for that plant species. Alternatively, they can design an intrazonal forest community or a pasture for an animal species.
Duration	The completion of the module takes about 4 weeks.
Assessment	The main topics will end with a maximum 10-question quiz to be completed by the students by the end of the module. The essay submitted will play the most pronounced part in the evaluation process. The students will upload their completed plans into Moodle's REGINA platform and the teacher will evaluate them.

HORIZONTAL MODULE: Field visits & external activities	
Topics	The main objective in this module is: Practical work/assignment (incl. involvement of stakeholders) Apart from participating in field trips, the students meet farmers and representatives of various professional organisations.
Outcome	The students will get to know the farms having been introduced to them in the case studies. Besides having discussions with the experts working in the field, they can gain experience and start to build their professional network.
Activities	During their field trips and meetings with the representatives of the professional organisations, the students are required to make interviews and/or photo documentaries.
Duration	The completion of the module takes 1 week.
Assessment	The interviews and photo-documentaries will be used to produce a publication (leaflet) promoting RA. The completed work is uploaded to the moodle's REGINA platform and evaluated by the teacher.

Lesson plans

Lesson Topic: Soil Tillage Errors **Number of Students: All**

Duration (90 min)	Phases	Content	Objectives	Competencies	Applied Methods	Teacher's Activities	Student Activities	Materials and Equipment
2 min	**Greeting Students**	Greeting students ang getting ready for the lesson	Making the students feel comfortable and welcome, starting the lesson	Communication skills	Coaching	Starting conversation, asking questions	Getting ready for the lesson, answering questions	no
3 min	**Introduction**	Introducing the topic: Today's topic is Soil Tillage Errors	Raising interest toward the topic	Acquisition of new knowledge, crtical thinking	Frontal Teaching	Presenting the material	Taking notes, paying attention	PPT/video, projector
10 min	**Phase 1 - Explore**	Definition of soil tillage errors	Students learn about what soil tillage errors mean	Acquisition of new knowledge, crtical thinking	Frontal Teaching	Presenting the material	Taking notes, paying attention	PPT/video, projector
10 min	**Phase 2 - Learning**	Types of soil tillage errors	Students get familiarised with the various types of soil tillage errors	Acquisition of new knowledge, crtical thinking	Frontal Teaching	Presenting the material	Taking notes, paying attention	PPT/video, projector
10 min	**Phase 2 - Learning**	Possible consequences of errors (soil)	Students learn about the consequences of the soil related errors	Acquisition of new knowledge, crtical thinking	Frontal Teaching	Presenting the material	Taking notes, paying attention	PPT/video, projector
10 min	**Phase 2 - Learning**	Possible consequences of errors (plant)	Students learn about the consequences of the plant related errors	Acquisition of new knowledge, crtical thinking	Frontal Teaching	Presenting the material	Taking notes, paying attention	PPT/video, projector
10 min	**Phase 2 - Learning**	Possible consequences of errors (yield)	Students learn about the consequences of the yield related errors	Acquisition of new knowledge, crtical thinking	Frontal Teaching	Presenting the material	Taking notes, paying attention	PPT/video, projector
15 min	**Phase 2 - Learning**	Techniques of avoiding errors	Students learn about how to avoid the errors	Acquisition of new knowledge, crtical thinking	Frontal Teaching	Presenting the material	Taking notes, paying attention	PPT/video, projector
10 min	**Phase 2 - Learning**	Role of RA in conserving soil structure	Students learn about the role of RA in soil conservation	Acquisition of new knowledge, crtical thinking	Frontal Teaching	Presenting the material	Taking notes, paying attention	PPT/video, projector
10 min	**Phase 3 - Closure**	Summarising the topic	Synthesize gained knowledge	Communication skills	Group Discussion	Ask and answer questions	Ask and answer questions, give there own ideas	no

Lesson Topic: Soil Tillage Errors **Number of Students: max 20**

Duration (90 min)	Phases	Content	Objectives	Competencies	Applied Methods	Teacher's Activities	Student Activities	Materials and Equipment	Notes
2 min	**Greeting Students**	Greeting students ang getting ready for the lesson	Making the students feel comfortable and welcome, starting the lesson	Communication skills	Coaching	Starting conversation, asking questions	Getting ready for the lesson, answering questions	no	
3 min	**Introduction**	Introducing the topic	Getting feedback on the lecture, clarifying problematic areas	Being able to express their uncertainties, communications skills	Conversation	Attentive listening and answering questions	Taking notes, paying attention, asking questions	no	
5 min	**Phase 1 - Warming-up (Competition Task)**	Collecting and describing the types of soil tillage errors	Students revise the definition of soil tillage errors and their types	Applying new knowledge, crtical thinking, organizing ideas, communication skills	Co-operative Group Work (5 Students/group) Gamification	Giving instructions	Creating a detailed list of the errors and their characteristics	whiteboard/ laptop/ tablet	***TASK*** : Each group collects all the possible problems and characterises them briefly. ***GAMIFICATION:*** The group carrying out the task the most precisely will gain **1 gamification point**.
5 min	**Phase 1 - Warming-up (Competition Task)**	Presentation of the types of soil tillage errors	Students be able to organise their thougths and present them	Improving presentation skills	Group Work (5 Students/group), Gamification	Attentive listening and giving feedback	Presenting their work	whiteboard/ laptop/ tablet	
5 min	**Phase 2 - Research Work**	Allocation of the task to the groups and giving instructions	Students fully understand the task	Communication skills, critical thinking	Coaching	Giving instructions	Taking notes, paying attention	projector, laptop, paper slips, bag	***TASK:*** **Step 1** Teacher makes one person from each group to choose a problem by drawing a piece of paper with the name of the problem from a bag. (Problems: soil compaction, dust formation, clod formation, soil cracking) **Step 2** Each group collects practical examples (videos, pictures, descriptions) of the problem allocated to their group. **Step 3** Applying their findings and the knowledge they gained in the lecture, they are required to make their own conclusions. **Step 4** Students are required to develop and recommend solutions for their specified problem by implying techniques used in RA and traditional agriculture. **Step 5** Students compile a PowerPoint presention on their specific topic.
15 min	**Phase 2 - Research Work**	Collecting the characteristic features of the problems, their possible consequences	Students learn about and be able to realize the characteristic features and the effects of the problem	Acquisition of new knowledge, critical thinking, interpersonal/teamwork skills, leadership skills, activiting existing cognitive structures, organizing new information	Group Work (5 Students/group), Coaching, Conversation, Searching for information on the Internet, Gamification	Assisting the students, answering their questions if needed	Collecting information, Taking notes, Prioritizing information	laptop, tablet, mobile phone	
15 min	**Phase 2 - Research Work**	Compiling the content of the presentation	Students improve their prioritization skills (analyzing, categorizing) and presentation skills, learn how to assign a task to a peer, how to work together, improve their self awareness (strengths and weaknesses)	Communication skills - asking and answering politely, Critical thinking, Prioritization skills, Decision making skills, Leadership skills	Group Work (5 Students/group), Coaching, Planning and Structuring, Conversation, Gamification	Assisting the students, answering their questions if needed	Taking notes, paying attention, asking and answering questions, prioritize the collected information, compile the content of the presentation	laptop, tablet, mobile phone	
10 min	**Phase 2 - Research Work**	Creating the presentation	Students improve their communication skills, prioritization skills, decision making skills and their aesthetic skills	Applying existing knowledge, Critical thinking, Decision making, Communication/interpersonal skills	Group Work (5 Students/group), Coaching, Planning and Structuring, Conversation, Gamification	Assisting the students, answering their questions if needed	Taking notes, paying attention	laptop, tablet, mobile phone	
20 min	**Phase 3 - Presentation**	Delivering the presentation	Students be able to express their findings and ideas effectively and with clarity	Oral presentations skills, controlling body language, managing nervousness, projecting confidence	Group Work (5 Students/group), Presentation, Gamification	Attentive listening, Evaluates Groups' presentation (content and layout), Decides ranking of the groups	Presenting, Taking notes, paying attention, Take constructive criticism, Vote for the best presentation	PowerPoint, projector, laptop	***GAMIFICATION:*** The groups gain gamification points according to their placement. (1st/best presentation - 5 points), 2nd - 4 points etc.) The groups also vote for the best presentation, the winner gets 1 extra gamification points.
10 min	**Phase 4 - Closure**	Summarising the topic	Synthesize gained knowledge	Communication skills	Group Discussion	Ask and answer questions	Ask and answer questions, give there own ideas	PowerPoint, projector, laptop	

	Lesson topic: Field trip		max 20 student	4 group	5 student/group				
Duration (360 min)	**Phases**	**Content**	**Objectives**	**Competencies**	**Applied Methods**	**Teacher's Activities**	**Student Activities**	**Materials and Equipment**	**Notes**
2 min	**Greeting Students**	Greeting students ang getting ready for the field trip	Making the students feel comfortable and welcome, starting the field trip	Communication skills	Coaching	Starting conversation, asking questions	Getting ready for the field trip, asking and answering questions	no	
3 min	**Introduction**	Introducing the topic: Field trip	Raising interest toward the topic	Acquisition of new knowledge	Frontal Teaching	Presenting the material	Taking notes, paying attention	no	
max 60 min	**Phase 1 - Travelling**	Travelling	Getting to the farm	Communication skills, People skills	Coaching, Conversation	Travelling, Engaging with the students	Travelling, Engaging with the teacher and the peers	coach, car, train, bicycle	
30 min	**Phase 2 - Planning**	Arriving at the venue of the field trip. A short presentation of the farm by the owner. Distribution of the form containing interview questions to the Students. Obtaining permission to take photographs from the owner of the farm.	Students get familiarised with the farm and the task	Acquisition of new knowledge, Interpretation skills, Communication skills	Frontal Teaching	Distributing the task and the interview questions	Taking notes, paying attention, clarifying misunderstandings	laptop, notebook	**Questions for: Group 1:** Size of the farm (ha), What is/are the main products of the farm? Can you describe the RA practices you use in the farm? **Group2**: What were the initial steps of launching RA? Did you/the farmer receive any training about RA? Who provided the training? Are you/the farmer generally satisfied with applying RA techniques? **Group 3**: Benefits? Obstacles & difficulties? How have you overcome the difficulties? **Group 4**: Does the farm implement any regenerative agriculture (RA) practices? Do they feel that they have thorough knowledge on RA? Or would they like to know more about RA? For how long have you been using RA practices? For the photo documentation, each group is required to take a minimum of 5 photos.
60 min	**Phase 2 - Group work**	Make the interview with the farmer 15 min/group	Students be able to ask their questions in regard their topic, maintain conversation with an expert in the field and to assess whether they received a relevant answer to their questions.	Asking relevant questions, prioritization skills, critical thinking, teamwork, decision making skills	Coaching, Guided Conversation, Attentive listening	Assists the students when they require help	Taking notes, paying attention, sharing ideas, brainstorming with their group members, start and maintain conversation with the farmer	laptop, notebook, mobile phone	
45 min	**Phase 2 - Group work**	Guided tour in the farm, taking photos	To improve students' ability to concentrate, capacity to identify key points and reaction time	Communication skills, ability to concentrate	Presentation, making photo documentation	Actively listens, assists students when needed	Taking notes and photos, paying attention, collecting ideas and questions	notebook, mobile phone	
45 min	**Phase 2 - Group work**	Groups making their brochures on the farm	Students be able to create a short, informative and eye-catching brochure applying the program called Publisher.	Communication skills, computer skills, organisational skills, prioritizational skills, teamwork	Coaching, Conversation techniques, Co-operative group work	Actively listens, assists the students when needed	Making their brochure presenting the farm. The brochure is illustrated with texts and photos and created in Publisher.	PPT,laptop, notebook, cell phone	
10 min	**Phase 2 - Relax**	Getting ready for leaving	Students getting ready for leaving the farm.	no	Coaching	Assists the students when they require help	Packing their belongings and getting ready for the journey back.	no	
max 60 min	**Phase 2 - Travel**	Travelling back	Coming back to the University	Communication skills, People skills	Coaching	Converses with Students	Starting and maintain conversations, exchanging their experiences	bus, car, train, bicycle	
45 min	**Phase 3 - Closure**	Presenting the brochures, their discussion Evaluation	Students be able to synthesize recently gained knowledge and present its key points in a professional way	Communication skills, Presentation skills, Expressing your ideas, Controlling body language, Managing nervousness	Group Presentation, Group Discussion, Gamification	Asks and answers questions, Evaluates presentations	Present their brochures, Ask and answer questions, Express their own ideas	PPT, projector	**GAMIFICATION**: The groups gain gamification points according to their placement. (1st/best presentation - 5 points), 2nd - 4 points etc.) The groups also vote for the best presentation, the winner gets 1 extra gamification points.

Reward Chart				
	Groups			
weeks	G1	G2	G3	G4
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
Total points	0	0	0	0

Participants				
Students	Group 1	Group 2	Group 3	Group 4
Studnet 1				
Student 2				
Student 3				
Student 4				
Student 5				

Lesson plan supplement

The time schedule of the REGINA course:

In tertiary education, over the 14 weeks of a semester, the total number of lessons of the course per week is:

1 lecture (45 min),

2 seminar/classroom lessons (90 min)

For practicality reasons, **the lectures** are held **every two weeks for 90 minutes** (which means **7 occasions / semester**) and **the seminar lessons** (90 minutes a week) are held only **for 12 weeks** because they also include **2 field trips of 8 lessons each** (12 + 2 occasions).

In total, the number of lessons per semester is 42 lessons divided as follows:

- 7*90 min lecture
- 12*90 min seminar
- 2*8*45 min field trip

The framework of the lessons and the applied methods

A lesson/ an occasion (lectures, seminars and field trips) has several phases:

Greeting the students and **Introduction**

Phase 1: Exploration of the topic / Warming-up activity

Phase 2: Where the actual learning takes place.

Phase 3/4: Students presenting their findings/ Summary of the material covered over the lesson.

Satisfying the requirements of the topic covered during the lesson, the teacher can choose from various methods listed in this document and see below to match the phases described in the lesson plans. The methods we primarily recommend for the individual phases are the following:

Phase	Method
Phase 1 - Warming-up, Explore	Frontal Teaching
	Conversation techniques
	Group Work
	Four corners method
	Group mirror
	Passport method
Phase 2 - Learning, Research Work, Planning, Group work	Frontal Teaching
	Coaching
	Group Work
	Guided Conversation
	Conversation techniques
	Conversation techniques
	Now - then - later
	Group Idea-mix
	Gamification
	Mind map
Phase 3 - Presentation	Group Work
	Presentation
	Gamification
	Case study
Phase 4 - Closure	Group Discussion
	Group Presentation
	Gamification

Parts of the methodology and their elaboration:

Duration: is the time delegated for each task during the lesson

Phase: see above

Content: is the topic covered in that particular phase of the lesson

Objectives: What is the goal of that particular phase of the lesson? What does the Teacher want to achieve?

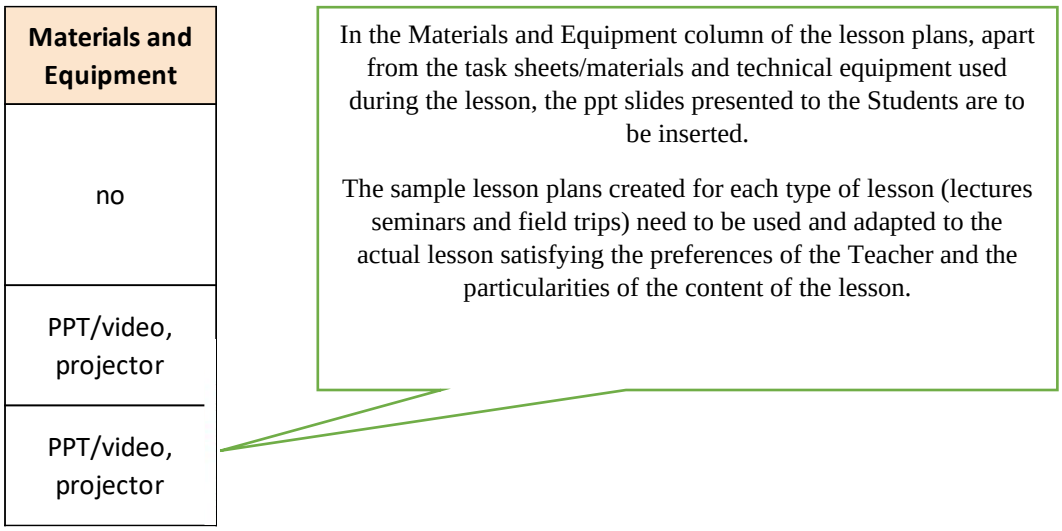
Competencies: the abilities required to perform that particular task

Applied Methods: the range of methods and activities applied to achieve the objectives (see above)

Teacher's Activities: it describes the Teacher's tasks, what they do or say during the particular task

Students' Activities: it describes the Students' tasks, what they do or say during the particular task

Materials and Equipment: task sheet, materials, relevant ppt slides, the necessary technical equipment that are used during the task



In our detailed lesson plans we refrain from including information regarding the exact words of the Teacher's instructions and the presumed answers of the Students, which is a quite common element of lesson plans for primary and secondary education.

Notes: includes any comments, notes, instructions that help the Teacher's work and necessary for delivering that particular task

Notes
TASK : Each group collects all the possible problems and characterises them briefly. ***GAMIFICATION:*** The group carrying out the task the most precisely will gain **1 gamification point**.
TASK: **Step 1** Teacher makes one person from each group to choose a problem by drawing a piece of paper with the name of the problem from a bag. (Problems: soil compaction, dust formation, clod formation, soil cracking) **Step 2** Each group collects practical examples (videos, pictures, descriptions) of the problem allocated to their group. **Step 3** Applying their findings and the knowledge they gained in the lecture, they are required to make their own conclusions. **Step 4** Students are required to develop and recommend solutions for their specified problem by implying techniques used in RA and traditional agriculture. **Step 5** Students compile a PowerPoint presention on their specific topic.

The Notes column contains any remarks, notes or instructions that are not mentioned in the previous ones, but which help the teacher in their work.

The instructor can list the details of the task given to the students, or describe the rules of the games, competitions or reward systems used in the lessons.

Although filling this column with content is optional, it can help other teachers adapt the lesson to their students' needs and level.

It bears less relevance to lesson plans in tertiary than secondary education, where a more sophisticated design is the standard.

The Reward System:

Apart from providing the Students new and practical information on RA, another main goal of the course is to involve the Students as much as possible in the tasks during the lessons. Therefore, we have decided to apply gamification and developed a reward system to encourage them to participate more actively in the classroom.

We use group work for most of the tasks. For this purpose, we have calculated 20 participants per class. In each class the students are divided into groups before their first task at the beginning of the semester and remain unchanged until it ends, so we work with permanent groups. The number of groups is 4, and 5 people form a group.

Participants				
Students	Group 1	Group 2	Group 3	Group 4
Studnet 1				
Student 2				
Student 3				
Student 4				
Student 5				

Delivering tasks (e.g. short presentations, brochures) in Phase 1 and Phase 3 in the seminars, and in Phase 3 in the field trips, the groups can earn points as follows:

Reward Chart				
	Groups			
weeks	G1	G2	G3	G4
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
Total points	0	0	0	0

The groups gain **gamification points** according to their placement (1st/best presentation - 5 points, 2nd - 4 points, 3rd - 3 points, 4th - 2 points). The groups also vote for the best presentation and the winner gets 1 extra gamification point.

The gamification points gained over the course of the whole semester will count in the final evaluation of the course.

Evaluation:

As for the **lectures**, each module is evaluated based on the result of a **10-question quiz**. The Students are required to complete the quizzes by the end of the semester. Each **correct answer** is worth **2 points**, giving the Students **20 points per mod**ule and **80 points in total**.

Over the course of the **seminars**, a **minimum of 10 points** must be earned by the completion of the tasks to successfully complete the course.

The gamification points earned may range from 10-70 depending on the number of tasks assigned.

The System of Evaluation - applying a 5-grade scale:

The **final grade** is the arithmetic mean of two elements: the grades given for the theory (quizzes) and the practice (seminar - including the field trip).

Theory:		**Practice:**	
90-100%	excellent	90-100%	excellent
80-89%	good	80-89%	good
70-79%	satisfactory	70-79%	satisfactory
60-69%	sufficient	60-69%	sufficient
< 60%	insufficient	< 60%	insufficient

Although the modules may be completed in an arbitrary order, in order to have a better understanding, we suggest completing them in the prescribed order.

After completing the course, the university students shall earn their credits according to the regulations of their University.

Adapting the System

The methodological recommendations developed herein are primarily tailored to the needs of university students, particularly to the ones studying at the Széchenyi István University. Naturally, the educational system of the institutions participating in the programme may vary from this, so we highly recommend each institution to adapt the suggested methods according to their own needs, thus providing the opportunity to learn in a way that suits their normal course of studying.

The secondary schools participating in the programme are not required to include all the modules. They are allowed to select individual modules from the Regina course and to integrate some smaller parts into the curriculum of the relevant subject.

Application possibilities for different learning tiers

Applicable methods of teaching regenerative agriculture in agricultural secondary schools

The introduction and teaching regenerative agriculture to secondary school students enables them to understand and learn about the more sustainable ways of food production which support environmental renewal. The following methods demonstrate how to teach regenerative agriculture in secondary schools in a fruitful way:

1. **Lectures and presentations:** Lectures and presentations seem to be a good way to introduce students to the basics and principles of regenerative agriculture. Inviting experts and agricultural organisations gives the students the opportunity to learn about first-hand information on sustainable agricultural practices and the conservation of natural resources.

2. **Field visits:** They provide an excellent opportunity for students to visit farms and organic farms. They allow them to gain personal experience, learn about agroecological methods and discuss the advantages and disadvantages of regenerative agriculture practices with the farmers.

3. **Project work:** Students have the opportunity to participate in project work, through which they can learn more about the different aspects of regenerative agriculture. For example, they could do projects on soil regeneration, permaculture, organic farming or food waste reduction. This hands-on approach also helps students develop creative thinking and problem-solving skills.

4. **Practical sessions:** In secondary schools, there are opportunities for doing gardening and farming in practical classes on the farm and in school gardens. Students work together to cultivate a small garden or even create a community garden on school

grounds. This not only provides hands-on experience, but also helps students to learn about growing plants, the importance of soil life and sustainable irrigation methods in a practical way.

5. **Supporting local initiatives:** Students can be encouraged to support local agricultural initiatives. For example, they can participate in programs that help support local farmers or sell at community markets. Thus, the students will have a deeper understanding of local food chains, the impact on the community of sustainable agriculture and how to get involved in and become an integral part of local community life.

It is important that teaching about regenerative agriculture needs to be practical and interactive. Students should be given the opportunity to gain first-hand experience and develop their problem-solving skills. This way, they can acquire skills that will help them to have a better understanding of and support sustainable agricultural practices, and when they leave school, in their work.

A detailed explanation of the methods.

1. Lectures and presentations

Lectures and presentations seem to be an effective way to teach about regenerative agriculture. In this case, the teacher or invited experts give lectures on the principles and practices of regenerative agriculture.

During the lectures, the students learn about sustainable agricultural techniques, such as agroforestry, organic farming or ways to preserve soil life. Speakers demonstrate the importance of proper nutrient management, the benefits of soil life conservation and the role of biodiversity in regenerative agriculture.

In addition, experts will share their own experiences, success stories and challenges related to sustainable agricultural practices. This can provide inspiring examples for the students and highlight the impact that regenerative agriculture practices can have on the environment, society and food security.

The presentations can also provide an opportunity for students to ask questions about regenerative agriculture. They will also have the opportunity to discuss how these practices can be applied in their own regions and farms. Case studies and research findings presented in the presentations can provide students with further evidence of the effectiveness and sustainability of regenerative agriculture.

Plus, students can be involved in the lectures and presentations through interactive activities. Group work, discussions or even short simulations can be used to increase student participation and develop critical thinking.

Lectures and presentations can be outstandingly useful in introducing students to regenerative agriculture and help them understand the principles and importance of sustainable agricultural practices.

2. Field visits

The field visits mentioned in section 2 play a key role for students to gain first-hand experience on regenerative agriculture. This allows them to see in practice how these sustainable agricultural practices work and how they transform farms and the environment.

During the field visits, students can visit different farms, such as organic farms, different initiatives in agriculture or regenerative farms. They can experience first-hand sustainable agricultural practices such as ecosystem-friendly farming, agroforestry, how to support soil life or biodiversity conservation.

These visits give students the opportunity to ask their questions from the farmers or professionals, learn about the benefits and challenges of regenerative agriculture. Farmers can demonstrate the results of sustainable practices, soil quality improvements, crop health and biodiversity impacts. They can also share their experience on the difficulties resulting from the switch to regenerative agriculture and how they have overcome them.

These visits allow the students to compare the differences and benefits between conventional and regenerative agriculture. The direct experience help the students to develop a real, personal relationship with farmers.

During the field visits, the students' involvement in the process is of key importance. They should be given the opportunity to actively participate in activities such as farm work, soil testing or food processing. It provides a deeper understanding for the students and allows them to apply the theoretical knowledge they have learned in school in practical lessons.

Field visits allow students to meet real-life situations and enable them to experience sustainable practices and understand their impact.

3. Project work

The project work mentioned in section 3 gives students the opportunity to learn more about and study different aspects of regenerative agriculture. The projects allow students to gain practical experience and deepen their understanding of the subject.

The topics of the projects can vary widely. For example, students can develop projects on soil regeneration, permaculture, agroforestry, organic farming or food waste reduction. Through these projects, students can learn about the principles and impacts of regenerative agricultural practices.

Doing their project work, students are required to carry out their own research, collect data, carry out analyses and present their findings. These tasks develop the students' research and analytical skills and they can apply the knowledge they have already acquired to real problems and challenges.

In addition, project work can support the development of students' creative thinking and problem-solving skills. Students can develop ideas and innovative solutions in the field of sustainable agricultural practices. For example, they can design and create their own small garden on school grounds, or develop ways to reduce food waste at school or in their own homes.

It is important that projects encourage co-operative and collaborative work among students. Group work and team activities teach students how to learn from each other, share experience and ideas, and develop innovative solutions together.

One of the primary aims of project work is to give students the opportunity to present and share their projects. Thus, other students and teachers learn about the projects and can draw inspiration from them. This experience also helps the students to improve and develop their presentation and communication skills.

Project work gives students the opportunity to immerse in the topic of regenerative agriculture and gain personal experience of sustainable agricultural practices, which helps them think critically and find innovative solutions to agricultural challenges, and build their interest and commitment to sustainable agriculture in the future.

4. **Practical sessions:**

The horticulture and field programmes give students the opportunity to get directly involved in hands-on activities that teach them about the fundamental aspects of regenerative agriculture. This hands-on experience helps students learn the basic concepts of crop production, the importance of soil life and sustainable irrigation methods.

In secondary schools, these programmes allow students to work together to grow a small garden or even a community garden on their own experimental farm. These programmes allow students to gain direct experience of growing, tending, maintaining and harvesting plants.

The practice of planting encourage students to observe plant growth, study soil structure and its quality and its changes. Above these, they also learn the important aspects of crop care and nutrient supply.

School garden programmes not only provide students with practical experience, but also help them to understand the wider context of sustainable agricultural practices. They can discover the importance of soil life from concerning the health of plants and soil, and learn about the benefits of composting or natural organic fertilisation.

Besides, these programmes also help students understand the concepts of food production and food safety. They learn about the benefits of shortening the food supply chain and the difficulties of growing and producing their own food in a sustainable way.

Overall, these hands-on lessons are important for students to gain practical, hands-on experience in the field of regenerative agriculture.

5. Supporting local initiatives

The method described in section 5 covers how to help students get involved in local agricultural initiatives and community projects. This activity helps students to develop a real relationship with the local food producers and to understand how local food systems and food chains work.

Students can be encouraged to get involved in local agricultural initiatives such as community gardens, farmers' markets or supporting the work of local farmers. Thus, they can experience sustainable agricultural practices first hand, to learn about local farmers and the food they produce.

Participating in these activities gives students the opportunity to see both the benefits and challenges of local agricultural production. They can learn about the work of the local producers, the process of food production and the importance of food safety. It also helps them to understand the economic and social importance of local communities and how they can contribute to sustainable agriculture.

The active participation of students in these initiatives helps them to gain a more comprehensive understanding of how local food systems work. They are given the opportunity to talk to local producers, understand and learn about production methods.

In addition, students are encouraged to start their own community projects, such as local small gardens or classroom gardening. By which they are encouraged to apply the principles of regenerative agriculture in their own environment and contribute to local food production.

Supporting local agricultural initiatives and participating in community projects provides students not only with theoretical knowledge, but also with real-life experience that will help them become active participants in sustainable agriculture in the future.

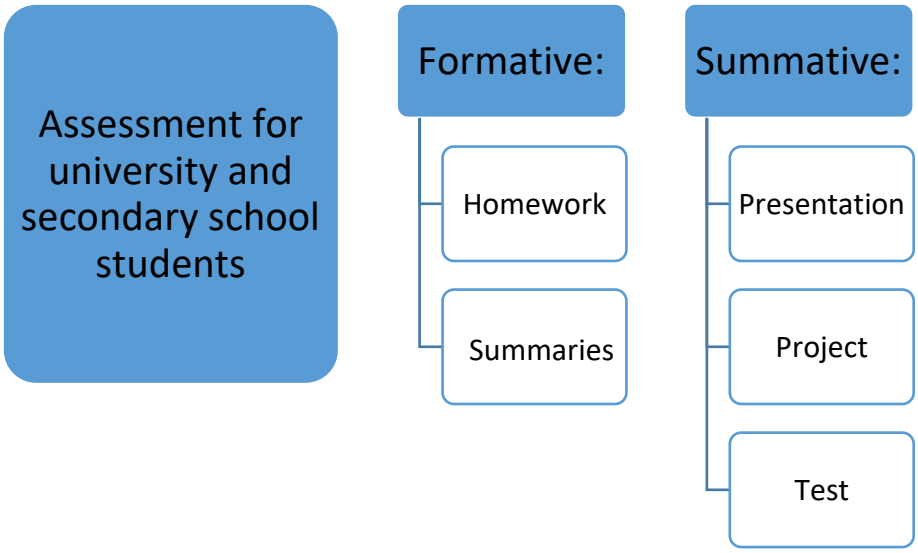
A brief summary of the applied methods

In secondary schools, there are numerous methods to teach regenerative agriculture. Lectures and presentations allow students to learn about the principles and practices of sustainable agriculture. Farm visits to local, neighbourhood farms allow students to experience sustainable good practices first-hand and talk directly to farmers. Through project work, students will have a deeper understanding and study of the different aspects of regenerative agriculture. During the programmes organised on the farm, students can directly participate in hands-on activities and learn the basics of sustainable crop production.

Teaching regenerative agriculture in a school encourages students to make responsible choices and become active participants in sustainable agricultural practices in the future.

Evaluation of the REGINA Course

Assessments



As for university students, the formative assessment can be that they answer a few follow-up questions at the end of each course element. Secondary school students, however, can be perfectly assessed with pieces of homework during the course.

End-of-course summative assessment for university students can be a presentation, completion of a project assignment, or a test on the course material. It is recommended to give preference to the presentation and the project solution, since this will help students to develop their other skills as well.

Summary

By completing the course, university students, secondary school students, farmers:

- Can understand and correctly apply the basic concepts related to regenerative agriculture, and are able to define RA.
- Understand the concepts of regenerative agriculture and can critically evaluate different soil management practices and methods. They can select the methods fitting into the RA approach and to plan preparation or the soil for different crops (taking climatic and soil conditions into account).
- Understand the principles of plant nutrition. He/she applies a critical view on the questions of nutrient management and can develop a nutrient management plan in line with the RA approach. He/She could analyse soil test results and make recommendations for fertiliser selection.
- Can plan the crop structure of a farm based on RA guidelines, to set up crop rotations. They bear the ability to select cover crops, green manure crops, catch crops and to integrate them into the crop structure. They can critically evaluate the elements of a crop rotation and make improvements where necessary.
- Can identify steps towards sustainable water management, to apply guidelines for soil cultivation and crop structure to conserve moisture.
- Know and understand the role of biodiversity growth, which to be accomplished, they can plan and implement changes in crop production.
- Understand the role of RA in reducing GHG emissions, recognise the economic, environmental, and social benefits and bearing these elements in mind, they can plan farming processes.
- Understand the role of RA in rural development.

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