Preparation of this presentation was supported by the Project 2021-1-EL01-KA220-HED-000023289 "Strengthening Key Competences in Agriculture for Value Chain Knowledge' (SKILLS)

Co-funded by the European Union

SKILLS

Project Result 5: Digital Course in Circular Agriculture

"SKILLS"

https://www.euskills.info/home

"Strengthening Key Competences in Agriculture for Value Chain Knowledge"

Preparation of this presentation was supported by the Project 2021-1-EL01-KA220-HED-000023289 "Strengthening Key Competences in Agriculture for Value Chain Knowledge' (SKILLS)

Co-funded by the European Union

SKILLS

Digital Course: Introduction to Circular Agriculture

Chapter 5: MEGATRENDS, CONCEPTS AND FACTORS OF CA
5.3. INTEGRATED FARMING SYSTEMS

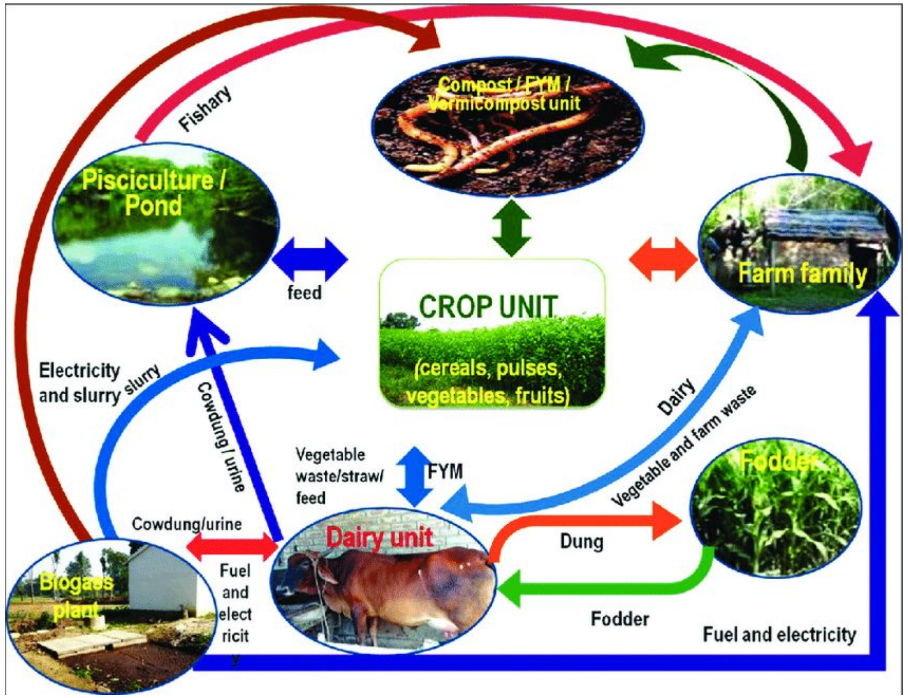
"SKILLS"

https://www.euskills.info/home

"Strengthening Key Competences in Agriculture for Value Chain Knowledge"

VYTAUTO DIDŽIOJO UNIVERSITETAS
HARGHITA COUNTY COUNCIL
IKY
Erasmus+
Co-funded by the European Union
SKILLS

Introduction to Integrated Farming Systems (IFS)



Integrated Farming Systems (IFS) integrate various agricultural components within a single operation to optimize resource use and minimize waste generation.

Importance in mitigating climate change impacts on agriculture: With climate change posing significant challenges such as increased temperatures, water scarcity, and extreme weather events, IFS offers a resilient approach to agriculture by enhancing sustainability and productivity.

Climate Change Challenges in Agriculture

- Agriculture is vulnerable to climate change impacts such as prolonged droughts, unpredictable rainfall patterns, and heat stress on crops and livestock. These factors threaten food security and livelihoods.
- Need for sustainable farming solutions: To adapt and mitigate these impacts, there's a pressing need for sustainable farming practices like IFS that reduce dependency on external inputs and promote ecosystem resilience.

Benefits of Integrated Farming Systems

- Lower reliance on external inputs: By integrating crops, livestock, and other components, IFS reduces the need for external fertilizers and pesticides, minimizing environmental impact.
- Enhanced nutrient cycling: Manure from livestock serves as a natural fertilizer for crops, enhancing soil fertility and reducing nutrient runoff into water bodies.
- Increased resource use efficiency: IFS optimizes water, land, and energy use, contributing to sustainable agricultural practices and improved farm profitability.

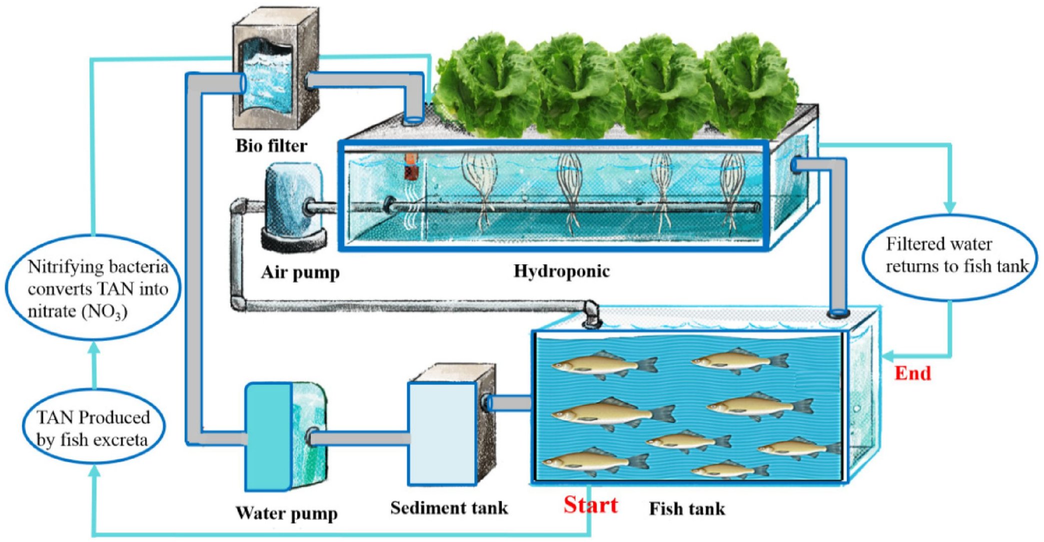
Examples of Integrated Farming Systems

- Crop-Livestock Integration: Utilizes crop residues as feed for livestock and returns manure as fertilizer for crops, creating a symbiotic relationship between agricultural components.
- Aquaponics: Integrates fish farming with hydroponics, where fish waste provides nutrients for plants grown in water-based mediums, reducing water usage and chemical inputs.
- Aquaculture-Agriculture Integration: Uses fishpond effluents to irrigate crops and incorporates aquatic plants for additional food sources, promoting resource efficiency.
- Agroforestry: Integrates trees with crops to improve soil fertility, provide shade, and diversify farm products like fruits and nuts, enhancing ecological balance and income generation.

Crop-Livestock Integration

- **Use of manure as fertilizer:** Composting livestock manure enhances soil organic matter and nutrient content, reducing the need for synthetic fertilizers.
- **Crop residues as animal feed:** Feeding crop residues to livestock reduces feed costs and enhances nutrient cycling within the farm system, supporting sustainable agriculture practices.
- Crop production: Maize and soybeans are grown in rotation to optimize soil nutrients and reduce pest and disease pressure.
- Livestock rearing: Dairy cattle are raised for milk production and manure generation.
- Manure management: Manure is composted and applied to crop fields as organic fertilizer, improving soil structure and fertility.

Aquaponics: A Sustainable Farming Innovation



- Aquaponics combines aquaculture (fish farming) and hydroponics (soilless plant cultivation) in a closed-loop system where fish waste provides nutrients for plants, and plants filter water for fish.
- Apart from reduced water usage and natural fertilizer, aquaponics systems are known for early harvests and higher yields due to optimal nutrient availability and controlled environment.
- Integration of fish farming and soilless plant cultivation in a closed-loop system.
- Importance of sustainable agriculture: Addressing climate chang impacts through resource-efficient farming practices.

Case Study: Aquaponics in Lithuania

- "Ateities Lysvės" farm in Molėtai district: A pioneering example of aquaponics in Lithuania, replicating NASA-inspired technology for sustainable agriculture.
- Utilizing space-efficient aquaponic systems to grow strawberries and vegetables, maximizing resource efficiency and productivity.
- Growing strawberries in aquaponic systems: Producing strawberries using fish waste as natural fertilizer, demonstrating significant water savings compared to conventional methods.
- Goals: Implementing space-efficient farming practices to maximize productivity and sustainability.

Case Study: Aquaponics in Lithuania: Technology and Setup

Components:

- Fish tanks: Housing fish species suitable for aquaponics (e.g., tilapia, trout).
- Grow beds: Filled with inert medium (e.g., expanded clay) where strawberries are planted.
- Water circulation system: Facilitates nutrient exchange between fish and plants.

Controlled environment: Greenhouse setup for optimal temperature and light conditions.

Case Study: Aquaponics in Lithuania: Nutrient Cycling Process

Fish waste breakdown: Ammonia produced by fish excretion.

Bacterial conversion: Nitrosomonas and Nitrobacter bacteria convert ammonia into nitrites and then nitrates.

Plant nutrient absorption: Strawberries absorb nitrates as essential nutrients for growth.

Water filtration: Plants filter and purify water, which is recirculated back to fish tanks, maintaining water quality.

Case Study: Aquaponics in Lithuania: Advantages of Aquaponic Strawberry Cultivation

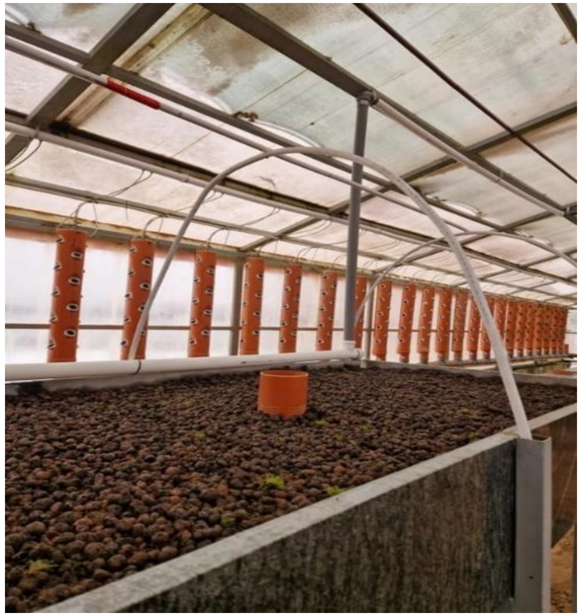
Reduced water usage: Up to 90% less water compared to traditional cultivation methods.

Natural fertilization: Fish waste eliminates the need for chemical fertilizers, promoting organic farming practices.

Disease resistance: Soilless cultivation reduces exposure to soil-borne diseases, enhancing plant health.

Early harvests: Controlled environment accelerates strawberry growth, allowing for early market entry and higher profitability.

Case Study: Aquaponics in Lithuania: Strawberry Cultivation Methods



Vertical tubes with expanded clay: Efficient space utilization and easy nutrient access for plants.

Automatic irrigation: Regular water supply with necessary nutrients delivered directly to plant roots.

Comparison with conventional methods: Highlighting benefits of aquaponics in terms of yield, resource efficiency, and sustainability.

Case Study: Aquaponics in Lithuania: Production and Output

Annual production capacity: Approximately 5,000 strawberry plants in the aquaponic system.

Output metrics: Yield per plant, harvest frequency, and market readiness compared to traditional methods.

Economic viability: Cost savings on water, fertilizers, and pesticides, alongside increased product value due to organic certification.

Case Study: Aquaponics in Lithuania: Environmental Impact and Sustainability

Conservation of natural resources: Minimized water usage and reduced environmental footprint.

Soil preservation: Elimination of soil degradation and erosion risks associated with conventional agriculture.

Biodiversity promotion: Integration of fish and plant ecosystems fostering biodiversity in the farm environment.

Case Study: Aquaponics in Lithuania: Challenges of Aquaponic Strawberry Cultivation

Initial investment: High setup costs for infrastructure and equipment, potentially limiting adoption by small-scale farmers.

Technical expertise: Requirement for specialized knowledge in aquaponic system management and operation.

Nutrient management: Balancing nutrient levels to optimize plant and fish health, requiring ongoing monitoring and adjustments.

Case Study: Aquaponics in Lithuania: Future Prospects and Innovations

Expansion opportunities: Scaling up aquaponic operations to meet increasing demand for sustainable food production.

Technological advancements: Research and development in aquaponics for improved efficiency and scalability.

Education and training: Promoting knowledge-sharing and skill development in aquaponic farming practices.

Case Study: Aquaponics in Lithuania: Community Impact and Outreach

Local engagement: Sharing knowledge and experience with neighboring farmers and communities.

Educational programs: Workshops, demonstrations, and partnerships with educational institutions to promote sustainable agriculture.

Economic benefits: Contribution to local economy through job creation, sustainable food supply, and market diversification.

Methods of Growing Strawberries

- Outdoor beds: Traditional method with weather-dependent yields requiring frequent weeding and pest management.
- Raised beds: Offers convenience and aesthetics, but necessitates more intensive watering due to faster evaporation.
- Greenhouse cultivation: Provides early harvests but requires space and ongoing maintenance like weeding and watering.
- Bags in greenhouse: Ensures clean berries and minimal pests but involves environmental concerns like plastic waste and nutrient depletion.
- **Hydroponics vs. Aquaponics:** Contrasts soilless hydroponic cultivation with aquaponics' closed-loop system using fish waste as a nutrient source.

Aquaponic Setup and Operation

- Components: Includes fish tanks, grow beds, and a water circulation system that facilitates nutrient exchange between fish and plants.
- Nutrient cycling process: Fish waste breaks down into ammonia, converted by bacteria into nitrites and nitrates, which plants absorb for growth.
- Water management and benefits: Recirculating water minimizes usage and ensures efficient nutrient distribution, essential for sustained plant and fish health in the system.

Advantages of Aquaponics

- Natural ecosystem creation: Establishes a self-sustaining ecosystem where fish waste supports plant growth, reducing reliance on chemical inputs.
- Disease resistance: Protects strawberries from soil-borne diseases and pests, enhancing product safety and reducing pesticide use.
- Low water usage: Utilizes up to 90% less water than traditional cultivation methods, crucial for regions facing water scarcity.
- Early harvests: Controlled environment accelerates plant growth, enabling early market entry and potentially higher profits.
- Higher yields: Optimized nutrient availability and reduced stress result in healthier plants and increased productivity, supporting sustainable food production.

Challenges of Aquaponics

- Nutrient balancing: Requires precise monitoring and adjustment of nutrient levels to sustain healthy fish and plant growth.
- Disease and pest management: Despite reduced risks, occasional monitoring and preventive measures are necessary to safeguard plant and fish health.
- High initial costs: Investments in infrastructure and specialized equipment may present financial barriers for small-scale farmers.
- Technical knowledge: Operational expertise is essential to manage aquaponic systems effectively and optimize production outcomes.

Conclusions

- Summary of benefits of Integrated Farming Systems: Emphasizes sustainable practices like IFS and aquaponics for resilient agriculture amidst climate change challenges.
- Encouragement for sustainable farming practices: Calls for adoption of innovative farming techniques to enhance productivity, reduce environmental impact, and secure future food security.
- Importance of innovation and adaptation in agriculture: Highlights the role of technology and knowledge-sharing in driving agricultural sustainability and resilience.

References

1. Bastos, T., Teixeira, L. C., Matias, J. C. O., & Nunes, L. J. R. (2023). Agroforestry Biomass Recovery Supply Chain Management: A More Efficient Information Flow Model Based on a Web Platform. Logistics, 7(3), 56-. https://doi.org/10.3390/logistics7030056

2. Braškių auginimas skirtingais būdais: sužinokite ir pasirinkite. https://geltonaskarutis.lt/braskiu-auginimas-skirtingais-budais-suzinokite-ir-pasirinkite/;

3. FB „Ateities lysvės“: https://www.facebook.com/profile.php?id=100063625985909

4. Goddek, S. (2019). Aquaponics food production systems : combined aquaculture and hydroponic production technologies for the future (1st edition 2019.; Simon. Goddek, Alyssa. Joyce, Benz. Kotzen, & G. Burnell, Eds.). Cham: Springer Nature. https://doi.org/10.1007/978-3-030-15943-6

5. Kakamoukas, G., Sarigiannidis, P., Maropoulos, A., Lagkas, T., Zaralis, K., & Karaiskou, C. (2021). Towards Climate Smart Farming—A Reference Architecture for Integrated Farming Systems. Telecom (Basel), 2(1), 52–74. https://doi.org/10.3390/telecom2010005

6. Martin, G., Moraine, M., Ryschawy, J., Magne, M.-A., Asai, M., Sarthou, J.-P., … Therond, O. (2016). Crop–livestock integration beyond the farm level: a review. Agronomy for Sustainable Development, 36(3), 1–21. https://doi.org/10.1007/s13593-016-0390-x

7. Mugwanya, M., Kimera, F., Madkour, K., Dawood, M. A. O., & Sewilam, H. (2023). Influence of salinity on the biometric traits of striped catfish (Pangasianodon hypophthalmus) and barley (Hordeum vulgare) cultivated under an integrated aquaculture-agriculture system. BMC Plant Biology, 23(1), 1–417. https://doi.org/10.1186/s12870-023-04422-5

SKILLS

"Strengthening Key Competences in Agriculture for Value Chain Knowledge"

Co-funded by the European Union

Programme: Erasmus+
Key Action: Cooperation among organisations and institutions
Action Type: Cooperation partnerships in higher education (HED)
Call: 2021 – Round: 1
Grant Agreement No.: 2021-1-EL01-KA220-HED-000023289
Project Duration: 28/02/2022 – 27/08/2024 (30 Months)
Total Budget: 138.158,00€

https://www.euskills.info/home