Key Note Reports Extended Abstracts

SESSION 1 – VALUE CREATION BY PUBLIC FUNDING OF RESEARCH, DEVELOPMENT AND INNOVATION
1.1 – International trends for the European RD&I landscape *Andrew Lynch (Irish Manufacturing Research, IMR - IRE)*
1.2 – EIT Food – Catalyst for the transformation of our food system *Elvira Domingo (European Institute Innovation&Technology Food, EIT - GER)*
1.3 – R&D opportunities for industrial companies with US grants *Brij N. Singh, (IEEE and JOHN DEERE Fellow - USA)*

1.1 – International trends for the European RD&I landscape

*by Andrew Lynch (Irish Manufacturing Research, IMR - IRE)*1500 characters (spaces included)

Manufacturing is a critical sector within the European economy. It provides €7.1tr in turnover, 29.4 million direct jobs (98% in SMEs), and accounts for 80% of all EU exports (by value). It also has a crucial role to play in the future sustainability of this planet.

However, manufacturing is undergoing one of the most disruptive revolutions in human history. The emergence of a myriad of advanced technologies including additive manufacturing, digital tools, big data, augmented reality and advance robotics, which are evolving in an AI enabled world and providing significant challenges (and opportunities) for the manufacturing sector.

Dr Lynch will outline the role of manufacturing in this new world order, the emerging trends on the international stage and provide insight to European policies and priorities in this exciting landscape.

1.2 – EIT Food – Catalyst for the transformation of our food system

Elvira Domingo (European Institute Innovation&Technology Food, EIT - GER)

In this presentation, we will explore the transformative efforts led by EIT Food, Europe's primary innovation community for the agrifood sector. This session aims to provide a comprehensive view of EIT Food's role in fostering a sustainable and resilient food system in Europe, aligning with the United Nations Sustainable Development Goals (SDGs). Key topics include our mission-driven approach, project examples, and the strategic engagement of partners in accelerating food system transformation.

1.3 – R&D opportunities for industrial companies with US grants

Brij N. Singh, (IEEE and JOHN DEERE Fellow - USA)

In this presentation Brij will cover end-to-end processes including timeline involved in successful acquisition of federal grants in the US followed tech to market strategy. This presentation will include high level descriptions of a high visibility successful completed project. This project allowed John Deere to accelerate silicon carbide (SiC) inverter technology for electrification of agriculture, construction, mining, and road building equipment/vehicles. Usually success feeds successes, therefore it would be necessary to briefly go over federally funded projects presently underway in John Deere. Brij intends to share over a decade of experiences from collaborative relations with universities and national labs in the US. These relations have become a mechanism in bringing business and technical values to John Deere through execution of projects that are/were strongly supported by research grants awarded by federal agencies in the US.

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SESSION 2 – BIODIVERSIT AND REGENERATIVE AGRICOLTUREY: IMPACT AND RELEVANCE FOR FARMING. CHALLENGES AND OPPORTUNITY FOR AG-MECHANIZATION AND TECHNOLOGY
2.1 – Moving towards the preservation and improvement of biodiversity in agricultural ecosystems *Gottlieb Basch, Emilio Jesús González-Sánchez Julio Román-Vázquez (European Conservation Agricultural Federation, ECAF - BEL)*
2.2 – Initial steps to consider biodiversity and ecosystem services in a sustainability strategy *Gianluca Feligini (CNH)*
2.3 – Navigating the transition to regenerative agriculture with digital solutions *Peter Fröhlich (Agricircle - CHE)*

2.1 – **Moving towards the preservation and improvement of biodiversity in agricultural ecosystems**

by Gottlieb Basch, Emilio Jesús González-Sánchez & Julio Román-Vázquez (European Conservation Agricultural Federation, ECAF - BEL)

Biodiversity conservation and enhancement is one of European policies premises as expressed in the: European Green Deal, Common Agricultural Policy, Biodiversity Strategy and Farm to Fork Strategy. With around 40% of the EU's land area used for agriculture, agricultural ecosystems management has a major impact on achieving the proposed goals in terms of preserving and enhancing biodiversity.

Soil management plays a key role in restoring, preserving and improving biodiversity both below and above-ground. This contribution seeks to shed light on the importance of soil management based on the principles of Conservation Agriculture (CA) for the preservation and improvement of biodiversity in agricultural ecosystems. The core principles of CA are: 1) Continuous no or minimum mechanical soil disturbance, 2) Permanent organic soil cover through mulch/residues and living biomass, 3) Diversity of plants and crop rotations. These soil management features apply to both annual and permanent cropping systems.

Conditions and habitats enabled through CA soil and crop management create and maintain nature-like conditions that allow soil organisms and above-ground fauna to thrive and help biodiversity to be built up. The contribution of CA to enhance edaphic and epigean fauna, the quality and variety of pollinating insects, the improvement of small mammal biodiversity, and the enhancement of the avifauna biodiversity will be presented and discussed.

2.2 – Initial steps to consider biodiversity and ecosystem services in a sustainability strategy

by Gianluca Feligini (CNH)

Within the agricultural equipment industry, biodiversity and nature considerations are of growing importance to the technology strategies of companies like CNH. With Biodiversity, we refer to the variability among living organisms in the natural world. This variability is an essential characteristic of Nature and enables ecosystems to be productive, resilient, and able to adapt. The dynamic interconnections between plant, animal and microorganism communities that make up ecosystems also produce benefits to people and the economy, referred to as "ecosystem services". Water plays a vital role in climate, hydrological and biochemical cycles, and offers an important ecosystem service to Agriculture. Groundwater provides 43% of all agricultural irrigation while the rest of the water is withdrawn from Freshwater sources. Water-efficient agricultural practices can reduce water use while simultaneously enhancing soil health and promoting carbon sequestration. CNH's technology portfolio provides growers an extensive number of applications that support them in their daily operations through big data/AI solutions and advanced technologies. We present two examples of technology designed with water conservation and protection in mind: a data analytics solution blending machinery and water management intelligent systems. Both solutions support the saving of water in terms of quantity and quality and contribute to the preservation of water-related ecosystem services.

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2.3 – Navigating the transition to regenerative agriculture with digital solutions

by Peter Fröhlich (Agricircle - CHE)

The AgriCircle presentation outlines the company's commitment to transforming agriculture through a regenerative approach. Emphasizing the critical role of biomass, it addresses current challenges in soil degradation and biodiversity loss due to deforestation and unsustainable farming practices. AgriCircle promotes a shift from top-down, institution-led agricultural management to a bottom-up, farmer-centric model that empowers farmers with data-driven tools to improve soil health, maximize efficiency, and ensure sustainable farm productivity.

The presentation highlights AgriCircle's regenerative principles, such as minimizing soil disturbance, maintaining soil cover, and integrating animal activity to enrich biodiversity. Challenges to implementing regenerative practices are noted, such as lack of incentives, high costs, and limited accessible data. AgriCircle addresses these with automated data collection, outcome-based measurements, and streamlined processes that simplify data gathering and improve farm management efficiency. Their approach includes innovative technologies like satellite-defined soil sampling, which provides farmers with insights to enhance soil vitality and optimize resource use.

AgriCircle's solutions promise a faster, cost-efficient transition to regenerative agriculture, with measurable and manageable outcomes. The vision extends beyond economic gain to a holistic, life-enhancing model that balances productivity, environmental stewardship, and resource efficiency. This regenerative journey is described as a cooperative venture involving equal participation from farmers, industry, nature, and employees to foster healthy soil, plants, and communities.

The entire approach is equally valuable to machinery producers to better understand reached outcomes by customers with their machines, as well as to understand machinery innovation needed to contribute to the improvements to be made in order to tackle the climate and the biodiversity crisis.

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SESSION 3 – SPECIFIC MECHANIZATION: MACHINERY FOR HAY MAKING AND SILAGE
3.1 – Introduction into permanent grassland management *Stefan Thurner (Bavarian State Research Centre for Agriculture - GER)*
3.2 – The frontiers of forage mechanization at the service of efficient livestock systems in climate smart agriculture strategy's *3.2A - Challenges in relation to smart farming tech - Fabrizio Mazzetto, (Free Univ. Bolzano – ITA)* *3.2B - Technology for the hot spots in future forage production - Andreas Gronauer (Free Univ. Bolzano – AUT)*
3.3 – Forage implements solutions, trend and vision *Joseph Tard (KUHN)*

3.1 – Introduction into permanent grassland management

by Stefan Thurner (Bavarian State Research Centre for Agriculture - GER)

The agricultural land area of the world amounted for 36.8 % of the total land area in 2022 and was slightly shrinking (-1.9 %) since 2001 (FAO, 2024). More than two thirds (67.1 %) of the agricultural land was used as permanent meadows and pastures that lost area mainly to cropland (-3.5 %) (FAO, 2024). Additionally, 8.7 % of the cropland was used for temporary meadows and pastures and this area was also reduced by 3.0 % compared to 2001 (FAO, 2024). Grassland is crucial when it comes to carbon storage and biodiversity and multiple other ecosystem services. Grassland is used for grazing as natural or semi-natural grassland, whereas the semi-natural grassland is often grazed and mowed. Furthermore, the intensively managed grassland and temporary sown grass and grass-clover mixtures on cropland is mainly used for mowing to produce feed. Generally, grassland is situated on marginal land, where e. g. inclination, soil parameters or water availability (in both ways: dry or wet) limit the land use for cropping. Therefore, using the heterogeneity between single grassland plots on a farm but even on a site-specific base for optimizing grassland management saves costs (e. g. reducing number of cuts, optimizing reseeding and fertilizing) and is a key to enhance multifunctionality of grasslands (e. g. restoring biodiversity). Therefore, modern yield determination techniques on forage harvesters or based on satellite images can bring grassland management to a new level.

3.2 – The frontiers of forage mechanization at the service of efficient livestock systems in climate smart agriculture strategy's

by Andreas Gronauer and Fabrizio Mazzetto, University of Bozen - ITA)

Climate Smart Agriculture matches the need to develop technological innovations focusing on low costs, reduced environmental impacts, and adopting advanced management to improve product quality and work efficiency by Farm Management Information Systems (FMIS), including forage production. It also ensures reasonable production transparency (product and process certification). Innovating technologies must differ between flat and steep land mechanization and production intensity.

Furthermore, there are high differences between the sectors like industry, crop production, animal husbandry, and contractors like financial and economic solidity, work contexts in contained, limited, and highly controllable spaces, repeatable production processes, professional staff, and highly skilled technicians and Internal availability of ICT skills.

The entire production chain of forage production is interlinked with animal production and waste management systems. It's crucial to take this into account to fulfill environmental and efficiency-related requirements.

The process steps within basic feed production alone are very complex. Around 50% of losses demonstrate the importance of optimizing the entire process chain.

Consequently, monitoring tools (continuous or punctual) are required for the quality of intermediate and final products and production process steps. Even methods for optimizing the planning, implementation, and management of

constructions with the help of IT infrastructures (BIM) and the integration of functional buildings into the FMIS are required.

Some examples of evolving innovations can be seen, like

- smooth treatment with lower losses in fodder management at the field per treatment (< 2%), like belt rakes developed originally for mountain harsh terrain are available nowadays also for flat lands.
- Improving environmental issues technologies for wild animal and insect protection are on the market.
- Innovations for spot management of grassland are ongoing like the increasing use of optical sensors, pattern recognition, and computer vision technology.
- Balers equipped with a rich array of sensors include the implementation of bales origin refer to traceability objectives.

Robotics in grassland management are available at a TRL of 8 to 9, but only suitable for gardening and/or small confined environments. In fodder production many of them are still working in a remote-controlled mode (teleoperated), with TRL = 5..7. Further developments like autonomous raking and baling are at an earlier stage (TRL<5).

FMIS must open to the expected evolutions towards large land-distributed systems, with increasing use of robots and (IoT) distributed sensor networks for wireless (fixed or portable) monitoring tasks. In relation to this, a radical innovation could be the development of new international standards to foster the adoption of digital solutions, with analytical functions to be supported by external services via cloud computing approaches.

3.3 – Forage implements solutions, trend and vision

by Joseph Tard, (Product Manager Hay & Forage KUHN - FRA)

The last few decades have brought significant changes to the harvest of hay and forage products, introducing new parameters to consider. The types of forage have multiplied, each tailored to different goals in terms of yield, quality, and harvest timing.

Forage is no longer used solely for feeding animals; it is increasingly utilized for energy production or as biomass, which has a direct impact on the entire harvest chain and the equipment involved. As a specialized manufacturer of hay and forage equipment, we must address these new challenges in our product development to support our customers.

Climate change and the shrinking weather windows for harvesting demand larger, more efficient machines. Simultaneously, the increasing size of the fields being harvested adds to the need for larger equipment. These factors push us to innovate, producing machines that can cover more ground in less time while maintaining the highest standards of forage quality.

Moreover, user comfort is a growing concern, especially given the long hours operators must work during harvest periods. In many European countries, labor shortages are exacerbating this issue, making it essential that machines not only be efficient but also more comfortable and intuitive to operate.

In addition to size and comfort, the future of agriculture will increasingly rely on technology. Telemetry and traceability are becoming critical components of modern farming practices, allowing farmers to track and optimize their operations with greater precision. Our equipment must integrate these digital tools to ensure full visibility across the harvest chain, helping farmers meet the growing demand for sustainability and efficiency….