“Agricultural Mechanization: Urgency for Food Security”

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Key Note Reports Extended Abstracts

1.1 – AUA and world population increase: present and future situation

Riccardo Valentini (University La Tuscia - Italy)

The increasing population, food consumption and greenhouse gas emissions are pushing our Planet through a transformation never experienced before. By 2050 more than 9 billion of people will be in search of food and most of them (80%) will be living in Mega-Cities. The food supply chain has to be completely reinvented since new urban poors will be exposed to food scarcity and accessibility. At the same time in some regions of the world (i.e. tropics and part of temperate regions) increasing of climate extremes will produce adverse effects on agriculture, forestry and fisheries sectors with yield reduction of 35% in African countries and 2% globally per decade, despite the increasing food demand. It is time to act urgent and fast pushing high level governmental agenda (SDGs, Climate Paris agreement) as well as food industry sector and citizens in the most difficult and challenging transformation of our society to feed the new 2 billion of people expected by 2050 and at same time stabilize climate below 2.0° (possibly 1.5°) and reducing the pressures on natural resources. Agriculture should become an important element of climate mitigation and adaptation strategies. How food systems *from farm to fork* will adapt to the new scenarios? What systemic and/or technological solutions should we put in place to increase our resilience? These questions will be analyzed and links with the current European Agricultural policies will be highlighted.

1.2 – Climate change and agriculture: from challenges to solutions

Monia Santini (Centro Mediterraneo Cambiamenti Climatici – CMCC Foundation)

Addressing challenges posed by climate change to agriculture requires a multi-faceted approach, combining scientific advancements, sustainable practices, and policy initiatives and incentives. Challenges include, but are not limited to: i) altered climate regimes, due to unpredictable weather, extreme temperatures, and irregular rainfall affecting crop growth, yields and quality; ii) water scarcity, due to combined drought episodes and raising water demand across sectors, limiting both rainfed and irrigated agriculture and impacting crop development; iii) expanded range of pests and diseases, due to periods of combined extraordinary thermal and moisture conditions; iv) soil degradation due to erosion, leading to loss of soil fertility and physical damages to cultivated fields. Solutions should consider climate adaptation efforts. Farmers can adopt drought-resistant crops, improve irrigation, and benefit from weather and climate predictions. Moreover, crop diversification could be promoted to mitigate risks associated with crop failures. Finally, sustainable practices like conservation tillage, crop rotation, and organic farming can enhance soil health and resilience. Technological innovation can support adaptation pathways while also meeting mitigation needs: precision agriculture, remote sensing, and genetic engineering can increase crop resilience and optimize resource use, by supporting practices like e.g., reduced fertilizer uses and enhance methane capture.

1.3 – Food-waste, food-loss and new bio-economy models to solve the problem

Gianluca Brunori (University of Pisa - Italy)

(Author/s did not send the requested Extended Abstract).

1.4 – Agricultural mechanization, one of the solutions making it possible to reconcile the scarcity of agricultural land, a decline in the number of farmers and an increase in the world population in a context of climate change

Emmanuel Hugo (INRAe – France)

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Key Note Reports Extended Abstracts

SESSION 2 – PREDICTIVE AND LONG DISTANCE MAINTENANCE
2.1 – **Soil tillage: predictive maintenance in the Agritech world** *Andrea Ruffin (Maschio-Gaspardo - Italy)*
2.2 –**Combined physical and AI-based predictive maintenance for components** *Walter Lehle (Robert Bosch – Germany)*
2.3 - The human factor in a data-driven service process: Support vs. supervision for CLAAS tractors *Axel Holtkotte (Claas GmbH– Germany)*

2.1 – Soil tillage: predictive maintenance in the Agritech world

Andrea Ruffin (Maschio-Gaspardo - Italy)

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2.2 – Combined physical and AI-based predictive maintenance for components

Walter Lehle (Robert Bosch – Germany)

Classical predictive maintenance approaches are based on either indirect load counters (e.g. mileage) or direct load counters (e.g. load counter). As soon as the load counter exceeds the limit value defined in the design or testing, the component is replaced. With the help of AI based evaluation of field data the limit value can be optimized over runtime. Furthermore, pure AI solutions are offered that are based on training pure AI models, based on more or less many signals and damage events. This has the consequence that a statement is only possible with enough damage events of similar systems. Innovative predictive maintenance uses the possibilities of the combination of the evaluation of signals with the help of physical models in combination with AI-based methods. In this process, the signals are selected which degeneration of the component leads to a change in the signal. Using a physical model, an initial assessment of the component's health is determined, which can be sharpened using AI-based methods over runtime, among other things. Based on the physical model of the damage mechanism, supported by AI methods, the expected remaining lifetime is predicted. Advantage of this procedure is a use of the predictive model from the first specimen and directly after SOP. The informative value can be sharpened via the number and runtimes. The method is illustrated using the high-voltage battery for the electric drive as an example.

2.3 - The human factor in a data-driven service process: Support vs. supervision for CLAAS tractors

Axel Holtkotte (Claas GmbH– Germany)

Digitalization is one of the key drivers of modern agriculture. Data logging, including remote data transfer, is a common standard today. Data is the backbone for smart farming, but also essential for proactive service offers. When proactive measures are taken to avoid machine downtime, the already complex service process is under additional time pressure and highly dependent on the participation of all involved stakeholders. But these involved parties - from customer to manufacturer - have different motivations in a service case, especially when the machine support shall be performed proactively. A machine owner might not see the necessity to stop his machine as long as it is doing its job. Continuing the work, even though the machine produces error codes already, is quite common. External factors like changing weather conditions make the situation even worse, as the harvest periods with optimal harvest conditions are severely limited. Consequently, machine uptime is a key factor, but farmers also do not want to be controlled and monitored too closely by the manufacturer of the machine. However, they want as low repair costs as possible and a minimal repair time if required. Workshops need skilled technicians, but the shortage of skilled employees is nowadays a common problem. Reactive repairs (when the machine is already down or inoperable) is the daily business for todays’ technicians. Immediate reactions (when an algorithm identifies a topic and sends a notification) are a challenge, as they represent a new way of working, which is currently not accepted or executable by all workshop managers. Finally, manufacturers are interested in satisfied customers, excellent product quality and low after-sales cost. So, quick interceptions that are done proactively to repair small issues are more welcome than reactive repairs of any big consequential damages which mostly cause excessive costs and massive customer dissatisfaction. But how to deal with so many contradictory needs in a digital service process (packed with data and algorithms) without losing the acceptance of the people, who must execute it? Where does support end and supervision start when a machine gets continuously monitored? To be upfront about it: CLAAS does not have the final answers to all these questions... but started to deal with them!

Key Note Reports Extended Abstracts

SESSION 3 – SPECIFIC MECHANIZATION: MACHINES FOR SUGARBEET AND POTATOES
3.1 – Global sugar beet cultivation, sugar market, sugar companies *Ulf Wegener (World Association of Beet and Cane Growers - WABCG)*
3.2 – European market, mechanization and postharvest processing of potatoes *Rolf Peters (Potato Research Station Munster - Germany)*
3.3 - Harvest quality, soil conservation and costs in the potato harvesting - where is the journey heading? Potato harvest trends *Rupert Geischeder (ROPA Sittelsdorf – Germany)*
3.4 - Technology and mechanization of sugar beet harvest *Michael Gallmeier (HOLMER Schierling/Eggmühl, group EXEL – France)*

3.1 – Global sugar beet cultivation, sugar market, sugar companies

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3.2 – European market, mechanization and postharvest processing of potatoes

Rolf Peters (Potato Research Station Munster - Germany)

The potato is the world's fourth most important arable crop and is grown on all continents. Temperature and precipitation distribution have so far favoured yield- and quality-oriented cultivation in Western Europe, but climate change is now leading to noticeable cuts here as well. In addition, changing political conditions at European and national level are influencing the procedure of cultivation and mechanization technology. For example, a return from chemical to mechanical weed control will not only have a direct impact on potato growth, but will also require more intensive deviner equipment at harvest due to the expected increase in weed infestation, which will also increase the risk of damage to the tubers. Climate change is also affecting storage, especially as a greater proportion of potatoes now spend longer in storage than in the field. For seed and table potatoes, this has increased the need to use mechanized refrigeration systems, which has noticeably increased storage costs. For processing potatoes, which can only be stored with the help of sprout inhibitors, the more far-reaching restrictions on the new or re-approval of chemical agents in the EU are leading to new challenges in meeting the steadily growing demand for raw materials for the processing industry. This trend from fresh potatoes for consumption to processing potatoes can be observed worldwide and is accompanied by an increase in the prosperity of the population.

3.3 - Harvest quality, soil conservation and costs in the potato harvesting - where is the journey heading? Potato harvest trends

Rupert Geischeder (ROPA Sittelsdorf – Germany)

The trend towards pulled tow row harvest technology continues. Overloading hopper and new separation systems improve this segment more powerful. Digital controls and assistance systems offer the possibility for a more simple operation from the tractor and improved automation for the upper performance range of two row segment. In addition, also basic base models are offered in the two row hopper harvester segment which eases the transition from one to two row technology. At self-propelled harvester especially four-row models are in demand. Over loading stations and potato piles on headlands enable further optimization of efficient harvesting procedures. Modern high volume radial tires and rubber belt tracks are used in new undercarriage concepts or run in combinations. High price and income fluctuations caused by extreme weather conditions, as well as the intensification of the phytosanitary requirements make big challenge on development of future harvesting technology.

3.4 - Technology and mechanization of sugar beet harvest

Michael Gallmeier (HOLMER Schierling/Eggmühl, group EXEL – France)

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