

## SESSION 2

### AGRICULTURAL MACHINERY NEW TECHNOLOGIES: CHALLENGES AND LIMITS FOR USERS

by the Session Coordinator and Chairman: Hermann Auernhammer (Germany)

## CONCLUSIONS

### Chairman Session Conclusions

After a short introduction by the Session Chairman, three appointed and one further oral presentation were brought forward in this Session:

1. Trends and new technologies for agricultural machinery, by *Benno Pichlmaier*, AGCO FENDT, Germany;
2. New technologies for agricultural machinery: the contractors' point of view, by *Max Schulman*, Copa-Cogeca, Finland;
3. New technologies for agricultural machinery: the farmers' point of view, by *Josef Bosch*, Germany;
4. New technologies for agricultural machinery: Focus on situation in P.R. China, by *Minli Yang*, CAU Beijing, China (further presentation).

After the presentations a general discussion took place. The main results are summarized in the following:

**Machinery size:** It seems that the growth of machinery may now approach a limit. Depending on farm size, plot size, farming type, cropping system and farm topography the large units will have no alternative in many farming regions worldwide in the future.

At the same time, small farms, difficult climate conditions, topographical conditions as well as social constraints regarding chemical plant protection – in particular organic farmers – ask for specialized, low cost alternatives where field robots may be very promising. But besides the fascination of such a paradigm change new challenges arises: Cost of technology including maintenance and logistics, power with energy supply and power train technology, new and/or adopted farming practice, sustainability, others.

**Machinery use:** First of all, contractors ask for new, powerful and highly reliable technologies. But as electronics evolves fast and is prevalent in more and more equipment it becomes very difficult to combine this new technology with older available machinery. On-Farm problems with ISOBUS still creates trouble and timeliness before or during the execution of work.

All this is true for existing machinery systems while less or even no information and knowledge is available for the upcoming small field robots. Which mechanization form will be possible and fit to

a specific farm type or to the machinery owner? What will be the most beneficial robot design realized either in a multi-purpose platform principle or in more simplified specialized, cheaper and all-time available unit? Does operation fit to the farm management and the available knowledge and expertise?

**Farming practice:** In a worldwide perspective even tomorrow farming will be done from smallest households, smaller and larger family farms up to huge to giant farming properties owned by private persons, holdings or governments. Also the cropping systems will range from specialized ones to multi-crop rotations. But in all farming types increasing yields, reduced labor input, precise operation with less material input, reduced losses and higher product quality is required.

Plant breeding first of all may contribute with new varieties in a “machinery friendly crop design”. From all field operations, crop husbandry is the key element in any farming practice (“the eyes of the lord fatten the animals”). More and more precise data generating comprehensive real-time information will be another key for better farming practice while internet and electronic handheld-devices will create some sort of “artificial brain”.

Finally there is an increasing influence from society to farm practice and management.

Monoculture on the one hand results in a negative perception of farming over all. Traceability on the other hand requires information on plant variety, production origin, production method, use and dosing of agents entering into a documentation of the entire production chain from farm to fork.

**Education and training:** Without any doubt electronics will increasingly be present in new machinery and mechanization. Farmers have to deal with it and have to take maximize the benefit from it. But still only a small number of farmers are able to make the best from the new technologies, data and information usage. Main gaps are:

- Not enough education and training in the use of data handling, data storage, software engagement, information retrieval and decision making.
- Lack of data standardization in the whole scenario of data acquisition, data handling and production control.
- Inadequate as well as non-farm-specific human interfaces at the hardware of the machinery and also at the available farm software.
- Insufficient laws regarding the ownership and privacy of farm-owned data: Data capturing in farm-owned machinery and equipment by manufacturers for product improvement as well as manifold use of data by contractors, other stakeholders and governments.

**All-in-All:** New technologies in farm equipment, machinery and farm management systems enable farmers to provide more and better food for the world-population of tomorrow. Besides physical labor reduction, soil and crop specific treatment it offers a huge potential in nature conservation and sustainability. But still there is a gap between the dreams and promises of equipment suppliers and service providers on hand when it comes to the use at farm-level and the experience of the farmers. Research, standardization, advanced development of new technology, education and training may overcome existing problems.