

A high-angle, wide shot of a crowded exhibition hall. The floor is a light-colored wood or laminate. In the background, a large green tractor is on display. To the left, a yellow combine harvester is partially visible. The crowd consists of people of various ages and backgrounds, many looking towards the machinery. The lighting is bright and even.

Agricultural Machinery Engineers Meet in Germany

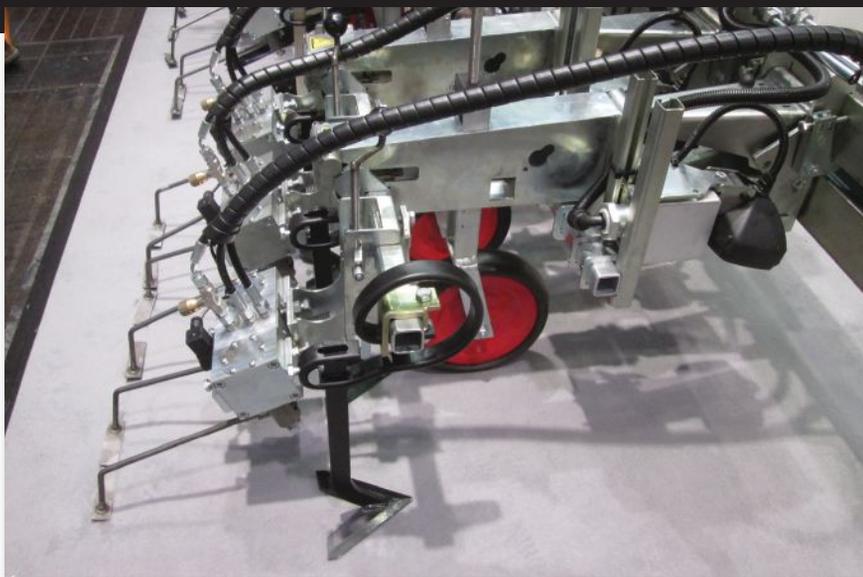
John Schueller and Markus Demmel

“E”lectrification” and “digitalisation” (with an “s” instead of a “z,” as this was in Europe) were the buzzwords at the biennial gathering of the agricultural machinery industry in Hannover, Germany. Every two years, agricultural engineers from Europe and elsewhere brave overcast skies and short November days to attend the Land.Technik-AgEng conference, the Agritechnica trade show, and the Club of Bologna.

Agritechnica

Agritechnica is billed as the leading global gathering for the agricultural machinery industry. This year, 450,000 visitors attended the weeklong show to see displays by 2,800 exhibitors. The internationalization of the attendees was obvious. The registrants for Agritechnica came from 138 different countries. The internationalization was also seen in the exhibitors, with the majority from outside of Germany, and in what they were displaying. For example, the Mahindra & Mahindra booth included a tractor sold in Europe under the Indian Mahindra & Mahindra brand that was built in Japan by Mitsubishi and equipped with a U.S.-made loader. One of the two gold medal winners was a corn stalk crusher to reduce corn borer overwintering. It was developed by Kemper, a German company owned by Illinois-based John Deere.

The gold and silver medal innovation awards given at Agritechnica were selected from 320 approved applications by an independent expert committee and are a good indication of where the industry is heading. The other gold medal was awarded to CLAAS for its autonomous threshing system for combines. This auto-learning system adjusts the combine, and the controllers communicate with each other in a digitalization of large harvesting machines. CNH’s New Holland, one of CLAAS’s competitors, won a silver medal for a system that uses GPS and proactively considers previous yields and field topography in its automation of settings. The 29 silver medal winners included many innovations that used sensors and automation to improve the performance of a wide range of equipment. Many years of research and development to computerize agricultural equipment are now leading to increasing commercialization of these technologies. One area of innovation that has emerged after much university and industry research is the use of cameras and imaging systems to support such varied activities as vehicle guidance, seedbed preparation, blossom thinning, and mechanical hoeing.



Robotic weeders, such as this one, were popular at Agritechnica.

The advances in electrification were fewer but still significant. One of the new products of interest was the battery-powered e100 Vario tractor from AGCO Fendt. Using the powertrain of a 50 kW conventional tractor, it replaces the internal combustion engine, the air, fuel, and exhaust systems, and the radiator with a battery block, a compact electric motor, and the necessary electric control system. Substantial engineering was required for practical charging, thermal management, etc.

Another example of electrification was an electric traction drive on a plow that was developed through cooperation by the tractor (John Deere), plow (Pöttinger), and drive train component (ZF) manufacturers. The PTO-driven Smart Power Generator Module, mounted on the three-point hitch on the front of the tractor, generates power and has controlled inverters to vary the frequency. The ZF GPE50 eTrac mounted to the plow has a high-speed asynchronous motor with a high gear ratio. This plow drive system reduces the tractive force that the tractor needs to supply, as well as the tractor’s tire slip.

Another trend was small autonomous robots. AGCO Fendt won a silver medal for its “Xaver” planting robot, which will work in herds of machines from a few to dozens. Other manufacturers concentrated on mechanical weed control or spot spraying in specialty crops. Naïo’s “Oz” small weeding robot has already been sold to 70 growers of herbs and spices in France. The purported advantage of herds of small robots is the wide range of scalability and adaptation to small plots or large fields.

Of course, the farm equipment industry changes slowly, and many of the exhibits were dominated by traditional machinery. In addition to the equipment manufacturers, whose customers are farmers, Agritechnica has seen an

increasing presence of component manufacturers and suppliers, whose customers are the equipment manufacturers. This trend is also seen at other trade shows, such as the EIMA show that's held in Bologna, Italy, in even-numbered years.

Land.Technik-AgEng

Because so many machinery engineers are already in Hannover to promote their company's products and examine the competition, the Land.Technik-AgEng conference is held two days before the opening of Agritechnica under the sponsorship of VDI, the German engineering society, and EurAgEng. This conference concentrates on the engineering of farm equipment, with some of the presentations explaining the innovations presented at Agritechnica. A sampling of session titles includes "Automation Technologies," "Combine Harvesters," "Electric Drives," "Traction," and "Communication and Information Technologies."

There is also more involvement by industry, especially to demonstrate product engineering, than at similar conferences in North America. For example, 52 of the 75 presentations had at least one author from industry, while only 38 had an author from a university or government institution. Although many presentations were on traditional topics, there is an increasing emphasis on automation, communications, and data management with each subsequent conference. Unfortunately, due to the venue's limited capacity of about 1,100, the Land.Technik-AgEng conference sells out quickly, and not everyone interested could attend.

Immediately prior to Land.Technik-AgEng, there was a meeting of the Agricultural Engineering and Technologies group of ManuFuture to discuss European Union research funding. Although there is some uncertainty due to the

upcoming Brexit, there needs to be preparation for when FP8, the current Framework Programme for Research and Technical Development (commonly known as Horizon 2020), ends in 2020 and will presumably be replaced with FP9. The trend seems to be toward digitizing the agri-food sector, with research topics on digital transformation, connectivity, automation/robotics, new machine concepts, and integrated energy. The inclusion of farming in the Alliance for the Internet of Things Innovation (AIOTI) and EIT Food from the European Institute of Innovation and Technology supports the concepts of "smart farming" and "smart food."

The Club of Bologna

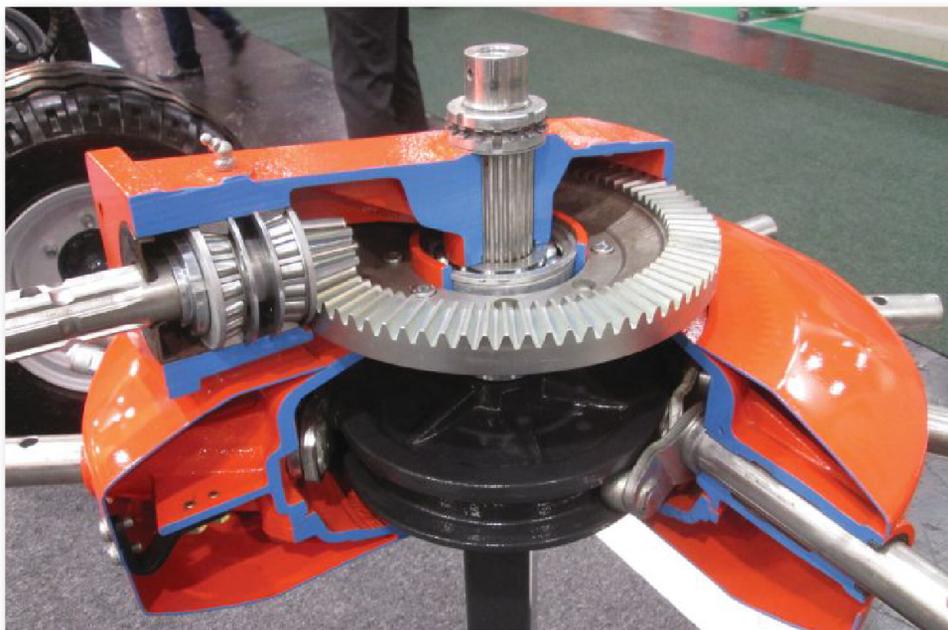
After the Land.Technik-AgEng conference, 57 invited members of the Club of Bologna met, representing 19 countries. The first day's morning session dealt with Industry 4.0 and its impact on Agriculture 4.0. The widespread networking of Industry 4.0 in the manufacturing sector will surely have an analog in agriculture.

The afternoon session dealt with ISOBUS's (ISO 11783) present and future. The standardization of equipment communications is even more vital in Europe than in North America because Europe has a larger number of agricultural equipment manufacturers, and tractors often have mounted powered equipment on both front and back. The next day, there were presentations and discussions on forestry machines and the Nairobi Conference on Agricultural Mechanization.

The common thread through all these events in Hannover is that agricultural machinery engineering is still a dynamic field. With good engineering, the equipment is becoming

much more precise and dynamically capable. The new equipment can optimize its performance to improve productivity and efficiency while maximizing crop production and quality, and it can supply useful data to the overall farm management system. With the globalization and evolution of the agricultural machinery industry, agricultural engineers need to remain up-to-date on worldwide trends through ASABE and other sources.

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Cutaway models are a familiar feature of equipment shows.