Information and Electrical Technologies

Transforming ag and bio engineering

According to the Computing Research Association, "Information technology has amplified our intellectual and physical abilities more than anything since the development of the written word ... We are hard-pressed to think of change of comparable magnitude in human history." While you may argue that other historical advances, such as the development and mechanization of agriculture, rival the advances currently seen in information and electrical technology (IET), you cannot deny the effects that these ongoing technological developments are having on our lives today.

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Coincident with these advances in IET are the challenges that we face in sustainably providing the food, water, fiber, and energy needed for our growing global population. While IET by itself will not solve these problems, it represents a big piece of the puzzle. With advances in IET, agricultural and biological engineers have access to low-cost data acquired from biological systems, algorithms to transform that data into information and subsequently into knowledge, models to simulate highly complex living systems, advanced controls to improve agricultural machines and machine system performance, and even agricultural robots that mimic intelligent behavior.

Many of these advances are well established in industry, such as the controlled environment of the factory floor. However, until recently, their application to agriculture has lagged. The reasons for this lag include the tremendous spatial, temporal, climatic, and geographic variability that is characteristic of agriculture; the economics of agriculture, with its low profit margins or low volumes; and the low number of people who are trained to work with both IET and agricultural systems.

Nevertheless, IET is transforming our profession by enhancing our ability to measure, monitor, and characterize the processes, parameters, and relationships of agricultural and biological systems. Before IET, this ability was limited. A generation ago, when low-cost computing power first started to become available, modeling and simulation programs made a big impact by providing unprecedented insight into how agricultural systems work, and how they change with changing conditions. Today, the costs of sensor technology and data processing are lower than ever, and we can better characterize highly uncertain parameters that vary in time and space. With this ability comes new knowledge and insight, new tools and technology, and safer, more efficient, more sustainable systems. This is an exciting time to be an agricultural or biological engineer!

In this special issue of *Resource,* we explore several examples of how ASABE members are enhancing our profession through IET research and applications. In the first article, Kelly Thorp and his colleagues discuss field-based, high-throughput phenotyping experiments for cotton in Arizona that use a variety of information technologies. This article provides a good example how

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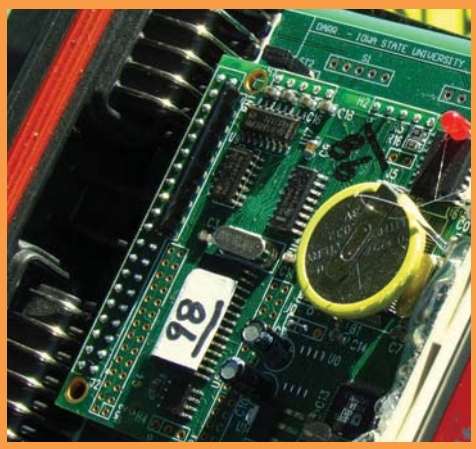
geneticists are relying on the skills of agricultural engineers to acquire the plant knowledge necessary to develop genetic improvements.

Similarly, the development of viable biomass production systems requires cost optimization. One important way of controlling production cost is effective management of the agricultural machinery. Traditionally, agricultural machinery management has been based on limited data collected manually in field studies. Now with the availability of vehicle data networks, onboard sensors, and GPS, machinery management data can be collected continuously and automatically. In the second article, Matt Darr explains how this is being done in the Midwest United States for corn stover production.



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Agricultural extension has been a key component of the U.S. land grant university system, and it has played a major role in the development of U.S. agriculture. Extension experts have always been eager to use the latest technology to share their knowledge with their clients. IET, in the form of personal computers, the internet, and now social media, has completely transformed ag extension. Jiannong Xin shows how ASABE members are at the forefront of developing technologies for the dissemination of Extension knowledge.

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Substantial progress has been made in the development and commercialization of precision agriculture and field automation technologies for major commodity grain crops. However, despite the need to reduce production costs, specialty crops have not yet benefited substantially from these new technologies. Several research groups around the world are working on IET for specialty crops. The last article, by Manoj Karkee and Qin Zhang, highlights work in the Pacific Northwest on automated pruning processes in orchards.

These articles represent only a small sample of the ongoing work of ASABE members in developing IET for agricultural and biological systems. While IET activities cut across all technical divisions within ASABE, the IET Division serves as ASABE's focal point for the organization of IET technical sessions, Standards activities, and publications. All ASABE members are encouraged to get involved in this exciting area.

It has been exciting for me to learn about this important work, and I'm eager to learn more. In addition, it has been a pleasure to serve as the guest editor of this special section of *Resource*. Special thanks to all of the authors, and to Sue Mitrovich, Glenn Laing, and Melissa Miller at ASABE.

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Some IET work in the Pacific Northwest focuses on automated pruning processes in orchards.