Agricultural Engineer Says

Electronic Era Will Improve Livestock Production

Integrating computer-assisted electronics devices into modern livestock production will go a long way toward improving livestock production efficiency, says Arthur J. Muehling, University of Illinois extension agricultural engineer.

In fact, Muehling says a very feasible possibility in the future will be the use of robots in livestock production. He says industrial robots are available that allow fast and easy programming to perform different tasks. Australian researchers, for example, have developed a robot to sheer sheep.

"The most significant changes in the future will not be in the reduction of physical effort but in improved techniques that will make the farmer a better manager," Muehling says. "We are truly in the information age. Only good managers are able to survive today in farming. Working hard is no longer enough to insure success."

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Providing a panoramic look into the future, Muehling says the way to begin is with electronic animal identification, a system that should be readable with accuracy and speed from 5 to 10 feet for animals in confinement and at much greater distances for animals in feedlots or on pasture.

"All animals should be identified soon after birth with a device that would last the life of the animal." Muehling says. "Positive identification would be helpful in all facets of management, including record keeping, individualized feed control, genetic improvement and disease control."

Muehling says research on automatic identification of animals, mainly dairy cows, has been in progress for some years. A transponder, worn in the ear or on a neck chain, has proven to be a popular electronic device. But, he stresses, an implanted permanent I.D. ultimately should be developed for all meat and brood animals.

Identification and feeding

The identification device can be useful in more efficient feeding, Muehling continues. A feed-dispensing device that could recognize individual animals by their identification device should be able to feed animals for maximum efficiency depending on their stage of production—dry, pregnant or lactating. It also would permit animals in different stages of production to be penned together and still be fed properly.

Muehling notes studies have confirmed it is virtually impossible to detect feed wastage up to the 10 percent level—if feed is detected on the floor, there is more than 10 percent wastage and probably as much as 15 percent wastage.

"Perhaps feeding systems should be developed that could detect outdoor temperature so production animals could be fed accordingly," Muehling says. "The amount of feed-energy an animal needs under various conditions and each stage of growth is known. Adding weather information could fine-tune diet preparation."

A rapid analysis of the feedstuff going into a ration should be available on site, maybe even done automatically, Muehling says. He points to a U of I study in which feed samples were collected and analyzed to see how well the actual composition agreed with what the producer thought he was feeding. Results showed as much as 33 percent error with a 12 percent average error for protein and 16.4 percent for calcium.

"If you were formulating a ration, it would be very helpful to get an instant, accurate reading on the calcium, phosphorus and lysine contents of the ingredients making up the ration," Muehling says. "This would permit feedback control to automatically adjust the mill and mixer to provide an optimum feed formulation.

Environmental controls essential

Environmental control of livestock production facilities is in dire need of improvement, Muehling says. Not only do the buildings present problems from odorous gases, but many of them have substantial air-borne dust problems originated from feed and the animals themselves. The problems can cause chronic illnesses in the livestock producer as well as the livestock themselves. While measures have been taken to improve this environment, Muehling says there is much room for improvement.

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"Most ventilation systems still are not totally satisfactory," Muehling points out. "The controls on the market do not do the job that is needed. We need better thermostats and reliable humidistat control. We need to insure that the cold air, or even tempered air, which leaves a slot inlet baffle, is moving at a proper velocity. A system that would monitor air velocity and adjust the inlet opening as necessary is a possibility. We need an interlocking control of fans and heaters to the inlets. Eventually, there will be a place for microprocessors to help control these factors."

Muehling encourages more use of natural ventilation and continued development of heat exchanges and other other types of heat recovery systems for livestock buildings.

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"Eventually, we may be able to use an integrated system that includes earth tubes, solar rock storages and heat exchangers to move heat from building to building, and heat pumps that transfer heat not only from room to room but also across the farmstead from buildings with high heat production to small-animal creep areas, grain-drying facilities and possibly even the farm home."

Muehling says this heat-transfer process is relatively straightforward compared to many of the methane-generation and other alternative fuel schemes currently in vogue. But it awaits development and implementation of the control and monitoring technology for optimum efficiency of such a system.

Reproduction and genetic improvement

The largest potential for improvement in livestock production efficiency is in the area of production and genetic improvement, Muehling says. With a good animal identification system, much progress could be made in selection of breeding animals for better efficiency.

Muehling says an inexpensive device that would detect estrus would prove profitable in the following ways: (1) getting animals rebred faster after weaning and increasing the number of litters per year would greatly improve efficiency; (2) feeding and breeding space would be saved if animals that did not settle could be culled from the herd; (3) the better information would result in saving time getting the breeding done; (4) knowing where a female animal is in her estrus cycle is important in making embryo transplants, as the animal must be in a given

stage of estrus for a successful implantation. Embryo transfers now are done routinely and often the embryos are extremely valuable, worth thousands of dollars, Muehling adds.

Muehling says in the future it may be possible to develop devices that would allow separation of X-carrying and Y-carrying sperm so that semen could be sorted to produce only males or only females. Rapid cost-effective techniques to accomplish this could revolutionize the livestock industry, he says.

Disease control and prevention

Disease control and prevention is critical to efficient livestock production, Muehling stresses.

"Along with a possible electronic identification system, parameters such as a drop in milk production, in feed and water intake and in animal activity might be combined in a computerized statistical analysis to predict problems," Muehling says. "It might be possible to monitor body temperatures of animals or even animal weight every day. We might see the day when electronic devices will be implanted in the animal safely to monitor blood nutrient levels. Only a few animals might need to be implanted in order to predict the overall herd health. Low levels of certain nutrients showing up in these animals might indicate potential problems."

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As a final glimpse into the future, Muehling offers robotics as a device that could reduce labor in the livestock industry. And, he stresses, the concept is not a "Star Wars" fantasy.

"We should stress labor reduction, not job elimination, in talking about robotics," Muehling says.

If technology were developed to allow voice communication with a robot and possibly the equivalent of olfactory sensing by a robot, Muehling says a number of applications may be possible such as: (1) checking lambing, calving and farrowing; (2) checking estrus; (3) managing feeding and other routine activities; (4) using of echo-analysis to determine if an animal is pregnant; (5) assisting in manure handling; (6) assisting in slaughter and the fabrication of carcasses; (7) administering of insecticides through dipping, spraying or the use of pour-on techniques. AJ