What have we learned about automated milk feeders? M. Endres*, University of Minnesota, St. Paul, MN.

The majority of dairy farms in the United States house preweaned calves individually. However, group housing is growing in popularity and many farms choose to install automated milk feeders for raising these calves. We conducted an 18-mo cross-sectional longitudinal study on 38 farms with autofeeders to learn about best management practices for achieving good calf health when using autofeeders. A single observer scored a total of 10,185 calves for health using a modified health scoring system on all 38 farms and we also collected treatment and mortality rates based on farm records (from a subset of 26 farms). We found that the following factors were associated ($P < 0.05$) with better calf health scores and/or lower mortality/or treatment rate in autofeeder farms: reduced time to reach peak milk allowance (minimum peak allowance suggested is 8 L/d); feeding milk/milk replacer with low bacterial count (SPC less than 100,000 cfu/ml); use of positive pressure ventilation tubes in the calf barn; adequate amount of space/calf in the resting area (minimum suggested is 3.7 m$^2$); small number of calves per group (suggested less than 15 calves); adequate farm average serum total protein concentration (an indicator of passive immune transfer); use of drinking speed as a warning signal to identify potentially sick calves; practicing navel and pen disinfection between calf groups consistently; and having narrow age range within calf groups. We also observed that winter was the season with worst health scores and highest treatment rates. It appeared that cleaning of the autofeeder and its various components was one of the most important keys to making these systems work successfully. Other studies have shown similar results. Housing calves in groups allows calves to express natural behaviors that cannot be expressed when housed individually, but it can be more difficult to achieve good health. Studies indicate that good calf health is achievable when using autofeeders to raise preweaned calves in groups as long as appropriate management practices and maintenance of the feeding equipment are emphasized and implemented. The MN project was funded by USDA-AFRI-NIFA competitive grant no. 2012–67021–19280.

Key Words: automatic milking system (AMS), dairy economics

Successful feeding and nutrition in robotic herds. M. Brouk*, Kansas State University, Manhattan, KS.

Nutritional management of robotically milked dairy herds has presented the dairy nutrition world with a new challenge. For the last several decades, nutritionists have concentrated on feeding total mixed rations (TMR) and managing cows in groups primarily based on parity, nutritional requirements, and reproductive status. With the adoption of automatic milking systems (AMS), cows are now generally allotted to a group for the entire lactation. Parity may still be considered in some herds. Balancing nutrient intake from the partial mixed ration (PMR) and the pellet or concentrates fed in the AMS becomes an added challenge for the nutritional professional. In some cases, the AMS can dispense multiple feeds to individual cows. This can further complicate the equation, but also provided greater targeted nutrition for individual animals. This can create opportunities to feed certain groups of cows (early lactation) differently from other cows housed and managed within the same group. It could also provide a method of different feeding programs for cows differing in parity yet housed within the same group. An additional complicating factor is differences in designed cow traffic of the facility, free-flow or guided-flow. Goals for cow traffic (daily visits) may be associated with feed intake in the milking center and thus change the nutritional goals of the PMR. With all the choices and various feed settings available with AMS, often other items like forage quality, foot health, training and cow comfort are often forgotten. These factors have a major effect on cow movement and can alter the use of the AMS, negatively affecting the amount of feed obtained from the robot, forcing the animal to depend more on the PMR. This is especially critical to the proper nutrition of early lactation cows. Balancing the ration for the robotically milked herd is very similar to conventional milked cattle from a nutritional aspect. However, understanding and predicting how nutrient intake is altered by split feeding between the PMR and the robot feed or feeds is the challenge. Balancing nutrition becomes more complicated because with AMS, cow behavior (visits to the milking machine) become an important part of the nutrition equation.

Key Words: nutrition, management, milking

Economics considerations for automatic milking systems (AMS), L. Tranel*, Iowa State University Extension and Outreach Dairy Team, Ames, IA.

A partial budget tool was developed to compare a producer’s present milking system with an automatic milking system (AMS). One AMS can handle an estimated 55 to 65 milking cows or approximately a 72-cow herd. The milk price projected over the life of the AMS is an important variable as is the estimated cost per AMS and the expected years of useful life of the AMS, often ranging 10 to 15 years. The value of AMS after its useful life is not well defined at this time but an important consideration. Labor cost and availability tends to be the leading reason for adopting AMS. Current hours of milking needs to be compared with the anticipated hours of milking labor after the AMS is installed. The AMS herd management software often includes rumination, milk conductivity, and cow activity. This information can lead to labor and herd health savings from heat and mastitis detection and faster identification of sick cows. There will likely be an increase in records management with the AMS. In adopting AMS, producers may experience losses in milk production 6 to 9% from 3× milking. From 2× milking, one could confidently expect a 3 to 5% increase in milk production. However, this milk production response varies widely, depending on present system and has increased as high as 25% on certain herds. Somatic cell counts (SCC) and bacteria counts tend to increase in the first few months after adoption to the AMS but tend to drop to initial levels or even lower after the adoption period. Feed costs per pound of dry matter and feed intake level changes can also be significant. Use of pelleted feeds and more individually fed cows will alter feed costs. Most producers report little change in culling percent but reasons for culling may change. High repair costs tend to be the biggest concern of AMS owners. AMS systems may increase electrical and water usage along with chemical and supply costs. Teat dip costs have been reported to increase dramatically but dependent on the previous system used. Overall, AMS can be an economic improvement in many herds relative to present milking systems but not true for all who have adopted AMS technology.

Key Words: automatic milking system (AMS), preweaned calf, group housing

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Incorporating technologies in nutrition and transition management. E. A. Eckelkamp* and J. M. Bewley. 1University of Tennessee Institute of Agriculture, Knoxville, TN, 2CowFocused Housing, Bardstown, KY.

Precision dairy technology is being incorporated in several areas related to nutrition, ration management, and even health disorders. Through automation, feeding consistency can be assured through feed kitchens, in-line ration analysis, and individualized feeding programs. Continuous access to feed can be accomplished with automated feed pushers. Fresh, individualized group rations can also be provided through monitoring the feed-way. Automated milking systems (AMS) have incorporated the benefits of electronic stand-alone feeders with milking information. This allows producers to manage based on production, ramping cows up at the start of lactation and down toward dry-off. In the future, producers may be able to incorporate other information, such as automated body condition scoring, to better inform ration decisions. Incorporation of all of these technologies could result in a completely autonomous system. The result being a single producer could coordinate rations specialized for several groups. Some technology companies are already embracing coordinated technology. A producer can purchase a technology with a TMR mixer on top with a feed pusher on the bottom. The technology also incorporates a laser-sight to determine when new feed is needed, and an interface with a feed arm for forages incorporated into a PMR. The forage fed complements the pellet fed through either an AMS or standalone electronic feeders. Automated milking systems may incorporate electroconductivity and SCC. Some AMS also incorporate β-hydroxybutyrate for in-line hyperketonemia monitoring. Wearable technologies can currently measure rumination time and eating time, allowing producers to monitor individual cows. Wearable technologies can also identify changes in behavior to detect or predict hyperketonemia, hypocalcemia, and metritis. Future directions may include incorporating machine-learning techniques to narrow the window of detection to 24 h before an event and create disease-specific alerts. The future is full of possibility for nutrition and disease management.

Key Words: precision dairy technology, precision farming, automated systems

Opportunities and limitations in farm data integration and analytics for strategic decision-making. M. J. Jerred*, G. F. Schroeder, R. A. Daura, and C. Van Der Meijde, Cargill Animal Nutrition, Minnetonka, MN.

Data analytics has become a key driver for decision making in many businesses. Although the dairy industry is typically collecting enough real time data, it lags other industries in the ability to access, integrate, and utilize that data for making strategic decisions that will optimize the business to improve animal productivity and return on investment. It is easy to envision the opportunities that exist if we apply modern data analytics and visualization tools to farm data. For instance, an integrated data platform connecting animal performance, feed management data, diet formulation systems, and animal sensors (e.g., feeding time, rumination, activity, rumen pH) will create new opportunities to optimize farm diets, provide field data to validate technologies and decisions, and create farm-specific prediction models. During the development of an integrated data platform, we identified many data access and collection issues that must be overcome. Farm-level challenges include obsolete hardware, out of date software and operating systems, and inconsistent data collection. In addition, there is a lack of integration with off-farm data such as ration information, lab analysis, farm advisor data collection, and milk sales. Analytics opportunities include the creation of integrated reporting and dashboards using data visualization tools, alert systems to indicate management intervention opportunities and “what if” decision and management recommendation support. Dashboards and reports can present high value information but most farm managers have limited time to integrate it into strategic decision-making. One approach is to use the data platform and analytics to enhance the farm manager – dairy advisor relationship. As we move to a data driven approach new skills will be required. Farm managers need to ensure data collection on farm is organized, consistent, and accurate. Dairy advisors need to understand how to integrate ever-increasing amounts of information into strategic recommendations. This will improve the quality and timeliness of nutrition and management decisions.

Key Words: data, analytics, decision-making

Technology, automation, and dairy industry: How far can we go? A. D. Aguiar* and N. Charlton, DeLaval, Bannockburn, IL.

Automation on dairy farms began in the late 19th century. Gustaf de Laval invented the cream separator to aid in the process of collecting cream for dairy products. Refrigeration followed in the same period and refined the dairy industry. Recently, several devices have become available to producers, from vacuum systems that support stable milk extraction, automatic take-offs and heat detection systems, automatic calf feeders, rotary parlors, and, more recently, robots. Automation can be used in daily activities to increase productivity, food safety, time management, and animal welfare. Automation collects numbers, which are converted to data that has the potential to help producers make better decisions. Data-acquiring technologies are still in their infancy. Companies are using more scientific research to create reports to analyze the data and turn it into information. Software is one of the most powerful tools. Reports can help farmers make decisions to act on cows that need attention. In addition to change management to improve health, production and reproduction. Dairy farmers and advisors rarely utilize software to its full potential. Support and training from software companies are essential to ensure the full understating of the system. Moreover, the dairy community and scientific community need to work closer to develop benchmarks and key performance indicators (KPI). Indicators should be available to dairy farmers, and advisors to improve the overall health and time management for each dairy farm. Each farm should have their own goals, and a plan to get there. KPIs need to be applicable to each dairy farm to create a plan to what needs to be monitored. Recently 3D image technology has been used to identify and manage animals. Technology is here to stay; the scientific and dairy community needs to provide data back to producers and advisors to provide information that leads to actions. Cows and calves must benefit from the information. Technology needs to be reliable so the dairyman can have conviction in the results as false positives waste people’s time and efforts. Technology will never replace the skills of a very good herdperson but is a tool in the toolbox to add to the success of the dairy farm.

Key Words: technology, automatization, management