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Finding the Balance—
Management of Calf Health Versus Cost of Production

Overview

Margins in the dairy industry continue to tighten. Dairy farms are seeking opportunities to control costs, but also maximize the health of their heifers as dairy replacements are the foundation for genetic progress and improvement of the herd.

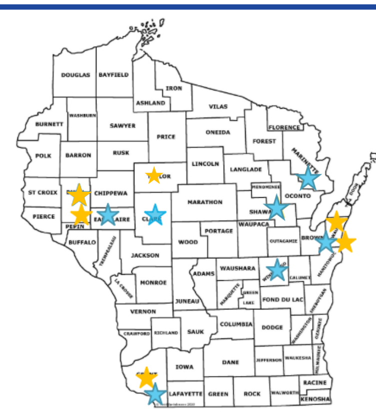
Since 1997, UW-Extension has sought to provide economic information on dairy replacements with four unique replications of the Intuitive Cost of Production Analysis (ICPA) for Pre-Weaned Calves. In 2017, the ICPA was completed with 26 farms to provide economic information comparing automated group and individual calf feeding systems. It was determined the cost to raise a calf on an automated group feeding system to be $6.35 per calf per day as compared to $5.84 per day to raise a calf on an individual feeding system. But what management practices do these numbers represent? To help correlate health and management practices to calf rearing costs, a Pre-Weaned Calf Health Management Survey was conducted simultaneously with 12 of the 26 ICPA participating farms.

This survey defined a calf as an animal from birth until movement into group housing, or movement out of the automated group feeding pen. Individual feeding was denoted as any form or use of bottle or bucket method of feeding pre-weaned animals. Seven of the farms participating in the health management survey utilized an automated group feeding system and five utilized an individual feeding system. Operations were matched by feeding system utilized, and represented various dairy farm sizes across Wisconsin.

The health management survey represented 12,224 total cows with an average herd size of 1,321 (range 135 to 4,500) cows for farms with an automated group feeding system, and an average herd size of 594 (range 140 to 1,100) cows for farms which utilized an individual calf feeding system. All farms averaged a 28 percent cull/replacement rate for the milking herd (range 22 to 35 percent).

Surveyed Farm Demographics:

- Total cows: 12,224 total cows
- Average herd size: 1,019 cows
- Range: 135-4,500 total cows
- Health Survey (n=12)
  - ★ 5 individual feeding systems
  - ★ 7 automated feeding systems



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Why Automated Group Feeding?

Pre-weaned group feeding/housing systems contradicts long-standing traditional methods and philosophies of calf feeding. Individual calf feeding/housing systems have been the industry "gold" standard. This type of management system leads to a trend of limit feeding milk or milk replacer, most often twice a day, which encourages starter intake and early weaning. Also, individual calf feeding/housing systems provide segregation to minimize calf-to-calf contact and disease transmission, but does not allow for normal calf behavior seen in group housed calves.

However, there is a growing trend for farmers to raise calves in a group setting. Automated group calf feeding systems are gaining popularity with farms of all sizes.

According to an recent Iowa State study by J. Bentley found in "Leave No Calf Behind Series", most who purchase the technology are investing for a specific reason-decrease labor or employees. The automated feeding systems farms participating in the Pre-Weaned Calf Health Management Survey indicated their top four reasons for switching from an individual feeding system to an automated group feeding systems were:

- Reduction of health issues
- Improved information on calf feedings
- Approximation to natural diet changes
- Closer to natural feeding behavior

Housing & Ventilation

Providing an excellent housing environment is a key component in successfully raising calves. Choosing the right one for your operation depends on many factors including the environment, capital, labor, and management resources available. Regardless if calves are housed individually or grouped, inside or outside, any housing should incorporate the following design principles: clean; dry, well-drained; ventilated appropriately for the current conditions; well-bedded; sheltered from inclement weather; and minimization of solar radiation. Of the five farms utilizing individual calf housing in this survey, three farms used outside, individual hutches. Two farms used indoor, individual pens with solid pen partitions on three of the four sides.

Of the seven farms using an automated group feeding system, there were on average 20 calves per group. The amount of space (resting and feed area) for calves was determined to be 47 square feet per calf. It is recommended to provide 35 square feet per animal, with 28 square feet devoted to resting area.

It is estimated 12.4 percent of pre-weaned heifers are treated for respiratory diseases, the second leading cause of death of dairy heifers of all age groups (National Animal Health Monitoring Survey, 2011). Lack of proper air movement within barns is a major contributor to respiratory issues. Ventilation, without a draft, is necessary for providing fresh air and removing moisture, animal heat, pathogens, and air contaminants. Ventilation should not be confused with circulation, which does not incorporate fresh air, but only moves air from one area to another. Farm respondents used a variety of methods to ventilate calf housing. In automated group feeding systems, one farm used natural ventilation, four used natural ventilation with positive pressure tubes, and two indicated mechanical ventilation. Regarding the two farms utilizing indoor, individual pens, one used natural ventilation and one used mechanical ventilation.


Photo credit: A. Bjurstrom

Keeping calves warm and dry are key considerations for housing as they are unable to consistently maintain their body temperature, and have limited amount of fat reserves to metabolize for energy requirements. Access to ad libitum liquid nutrition through milk and milk replacer, as found with automated feeding systems, leads to greater amounts of urine and feces. Bedding costs were slightly higher in the automated group feeding system as compared to the individual calf feeding systems, $0.19 as compared to $0.16 per calf per day ($14.45 as compared to $12.30 per calf), respectively. For bedding source, one-half of all surveyed farms used straw, while the remainder used a combination of straw and shavings. Automated group feeding systems used an average 280 pounds of bedding per calf from birth to the time until moved out of the automated group feeding pen, while individual feeding systems used an average 174 pounds of bedding per calf from birth to time moved to group housing. Because of the differences in method and amount of liquid feeding, addition and removal of bedding differed among farms. Two of the automated group feeding systems and two of the individual feeding systems added bedding on a weekly basis. All other farms added bedding as needed. Removal of bedding occurred weekly for two of the farms within each management system, all other farms removed bedding as needed.

Feed and Nutrition

Providing adequate liquid nutrition to pre-weaned calves is critical for growth and development. Of all surveyed farms, four farms utilized milk replacer with a labeled protein range of 24 to 27 percent, six farms used whole/waste milk, and two farms used a combination of both milk replacer and whole/waste milk. The farms who responded as using whole/waste milk also pasteurized their milk.

Table 1. Pre-weaned Calf Feeding & Nutrition

	Individual n=5	Automated n=7
Milk replacer	2	2*
% protein	24.0	26.5
% fat	18.0	14.5
Powder fed (ounces per calf)	14.0	9.7
Volume of water (quarts)	3.0	2.0
Cost (per calf)†	$102.69	$177.17
Whole/waste milk	3	3*
Pasteurized	3	4
Bacteria counts	3	4
Cost (per calf)†,‡	$91.10	$94.30
Balancer	$11.76	$36.31
Additives		
Acids/preservative	0	0
Coccidostats	2	1
Other	4	3
Balancer	1	1
First offerings (days)		
Water	1.6	5
Calf starter	4.2	7
Hay§	67.2	61.6
Automated calf feeding system	n/a	7.4
Cost (per pre-weaned calf)†		
Calf starter	$58.09	$77.27
Forage§	$0.00	$0.53

**Two farms reported using a combination of milk replacer and whole/waste milk for feeding program and is not reflected in these values.*

†Derived from ICPA Economic data for pre-weaned health surveyed farms

‡For the survey, an assumed price of $8 per cwt unsaleable milk and $17 per cwt saleable milk was used for whole/waste milk across all farms

§Two farms indicated feeding of forages to pre-weaned calves

All seven farms utilizing pasteurized milk evaluated bacteria counts. Bacteria counts were performed either weekly (n=3), every other week (n=1), every other month (n=1), every three months (n=1), or every six months (n=1). Eight farms fed calves twice a day (individual calf feeding system, n=4, automated group feeding systems, n=4), one individual feeding system fed calves three times a day, and three automated group feeding systems fed calves four to six times per day.

Water and starter are important components for rumen development. It is recommended to offer water daily beginning on day one of age, and

refresh or replenish daily. On surveyed farms, water was provided on average by six days of age and ranged from one to thirty days. Calves should be offered a small amount of starter beginning on day one of age. Surveyed farms indicated calves were offered calf starter on average by day six, ranging from one to 14 days of age. Sixty percent (n=9) of the surveyed farms managed the fed calf starter by removing old, uneaten starter and adding fresh starter, while three of the farms added fresh starter to the top of old, uneaten starter.

Forages are not necessary for rumen development. Forages are recommended to be offered at a time when calves can consume four to five pounds of high-quality starter per day, which is typically after weaning. The surveyed farms first offered hay to calves on average at 64 days of age (range 21 to 120 days of age).

Automatic group feeders are beneficial because they standardize the feeding procedure (less room for human error in regards to amount of milk or milk replacer, mixing, water temperature, etc.). They also let calves eat smaller meals more frequently without requiring extra labor to do so. Some farmers allow for calves to transition slowly to the automated feeder by providing milk/ milk replacer individually for the first few days of life. All surveyed farms allowed calves to transition slowly to the automated group calf feeder by providing liquid feed individually for the first few days of life. On average, farms allowed calves to be fed individually from a bottle or pail for the first seven days of age before accessing the automated feeder (range 4.5 to 14 days of age).

Weaning can depend on many factors. Five of the 12 surveyed farms weaned based on age, one farm weaned based on starter intake, one farm weaned calves based on starter intake and age, and the remainder of the farms weaned based on a combination of three or more different criteria: starter intake, size, lack of space, and age. Weaning occurred, on average, on day 56 for individual feeding systems as compared to 59 days for automated group feeding systems. Movement to transition housing (or in case of automated group feeding system, moved to next management group) occurred on days 74 and 75, respectively.

Table 2. Weaning Management

	Individual n=5	Automated n=7
Weaning:		
Age (days)	56	59.1
Criteria		
-Starter intake	5	2
-Ager	4	7
-Space	2	0
-Size	3	1
At time of weaning:		0
Preventative treatments	1	6
Vaccinations	4	
Moved to post-weaned housing (days)	74.2	75.0
Days on feed	74.2	75.0

Derived from ICPA Economic data for pre-weaned health surveyed farms

Labor Efficiency

Automatic group feeders can add flexibility of farm labor as there would be a reallocation of time to other farm duties. They also are an efficient tool for delivering a good nutrition program to calves by allowing the calves to consume more milk, bolstering their average daily gain.

However, automatic feeding systems do increase the need for intense management. A farm does not need to feed each calf by hand, but someone with a keen sense of calf health needs to be watching over those calf pens for sick calves. The automatic group calf feeder also needs to be monitored to make sure it is working properly, and someone needs to check the data to make sure all calves are eating when they should. It is not an answer for poor calf management nor for individuals who do not want to spend any time managing calves.

The number of hours for labor and management for each calf in an automated group feeding system was 8.1 hours (7.4 hours labor and 0.67 hours management) as compared to 15.1 hours (13.57 hours labor and 1.55 hours management) per calves in an individual feeding system, from birth to the time she was moved out of group feeding pen, or in the case of individual calves, moved to group housing. On average, an individual could manage 10.47 calves per hour in an automated group feeding system as compared to 5.31 calves per hour in an individual feeding system. Paid and unpaid labor and management costs were determined to be $111 per calf ($1.48 per day) in an automated group feeding system, and $210 per calf ($2.81 per day) in an individual feeding system.

Table 3. Labor & Management

	Individual n=5	Automated n=7
Calves raised (per month)	134	730
Labor		
Number of calf employees	3	4
Hours per employee feeding (per week)	14.7	28.7
Number of different employees caring for calves	3.6	4.4
Cost (per calf per day, paid only)	$1.81	$0.99
Management		
Number of different employees, management decisions	1.2	1.6
Number of different employees, treatment decisions	1.6	3.1
Cost (per calf per day, paid only)	$0.29	$0.12

**Derived from ICPA Economic data for pre-weaned health surveyed farms*

Colostrum Management

The importance of colostrum for the long-term health, immunity, and growth of calves cannot be emphasized enough. Feeding high-quality colostrum immediately after birth is the single most important management practice in calf nutrition and health. Colostrum allows the calf to achieve immediate immune protection from infectious disease, often referred to as passive immunity, until it's own immune system begins to produce antibodies at four weeks of age.

Ideally, colostrum should be fed within the first two hours of life. All surveyed farms used colostrum and administered it on average 2.4 hours after birth for individual feeding systems (range one to six hours) and an average of 1.9 hours after birth on automated group feeding systems (range one to two hours).

Two-thirds of all farms tested colostrum quality by either a Brix refractometer or a Colostrometer™ with an average of 24 percent IgG (range of 22-31 percent). Target colostrum levels should be ≥22 with a Brix refractometer or ≥50g/L with a Colostrometer™.

Exactly half of the farm respondents (three of seven individual feeding systems and three of five automated group feeding systems) pasteurized colostrum to an average temperature of 144 degrees Fahrenheit. Consult your pasteurizer owner manual to determine the proper temperature setting for your specific pasteurizer. Farms should periodically measure bacteria count of the pre– and post-pasteurized colostrum as it is fed to calves.

Colostrum replacement products that provide 150 to 200 grams IgG are sometimes utilized on farms when there is not enough quality colostrum available for newborn calves. Colostrum replacement products were given as part of the farm protocol according to five farm respondents due to a lack of quality or quantity of colostrum, or for biosecurity.

All calves should receive at least ten percent of their body weight (four quarts) of colostrum within the first two hours of life, with a second feeding repeated ten to 12 hours later. Calves in either feeding system were given, on average, 3.8 quarts of colostrum at the first feeding. Seven farms used bottles and four farms incorporated esophageal tube feeders for colostrum administration.

Table 4. Colostrum Management

	Individual n=5	Automated n=7
Use of pasteurized colostrum	3	3
Time given after birth	1.5 hrs	2.4 hrs
Volume First feeding (avg) First 24 hours (avg)	 3.8 quarts 5.2 quarts	 3.9 quarts 4.5 quarts
Number of feedings first 24 hrs	1.6	1.8
Fed Bottles Esophageal tubes	 3 2	 4 2
Test for passive transfer	2	3
Cost (per calf, colostrum only)*	$5.05	$4.22

**Derived from ICPA Economic data for pre-weaned health surveyed farms*

Health Management

Disease prevention depends on reaching optimum high levels of immunity and low levels of pathogen exposure. Every farm has different calf health management practices due to the differences of disease prevalence on individual farms. Dipping navels is an important calf health practice as it discourages the colonization of bacteria from the environment through the umbilical cord (umbilical vein and artery). Over 90 percent of the surveyed farms dipped calf navels, and 75 percent of the surveyed farms used an iodine-based product.

Calves in individual feeding systems were removed from the dam earlier (50 minutes, range of ten to 120 minutes) than those on automated group feeding systems (71 minutes, range of 10 to 240 minutes).

Overall, seven of the twelve farms did not test calves for passive transfer. Of the farms testing for passive transfer, they defined their minimum standard as 5.5 g/dL of IgG. When assessing passive transfer success, the goal is for 80 percent of a group of 12 calves two to seven days of age to have an immunity level of 5.5 g/dL and 90 percent of the calves 5.2 g/dL.

Newborn calf vaccinations were administered on seventy-five percent of the surveyed farms. Five farms exclusively used a vaccination product for respiratory disease, while the remaining four farms who vaccinated utilized a combination of vaccination products to protect against respiratory pathogens and intestinal viruses and bacteria such as rotavirus, coronavirus, *Escherichia coli, and Clostridium perfringens types C and D.*

It is recommended to disbud horns before eight weeks of age using hot-iron cauterization with an anesthetic and/or analgesic therapy, if buds are not removed with preferred method of dehorning paste within the first day of birth. All surveyed farms disbudded or dehorned calves, six farms disbudded at one day of age, three farms disbudded at two to three days of age, one farm disbudded at 30 days of age, and one dehorned at 56 days of age. Of the farms who disbudded before three days of age, all utilized caustic paste and three of the farm respondents included pain medication during the procedure. The two farm respondents that dehorned later in the life of the calf both utilized pain mitigation either through lidocaine or a combination of lidocaine and xylazine.

Calves undergoing weaning are stressed. This stress may lead to disease being induced as they are commingled with additional animals. Overall, ten of the 12 farms administered vaccinations before animals were weaned. The majority of the vaccinations administered were for respiratory diseases.

Veterinary and medication costs were determined to be $18.81 per calf ($0.26 per day) in an automated group feeding system, and $13.90 per calf ($0.28 per day) in an individual feeding system based on birth until movement into group housing, or movement out of the automated group feeding pen.

Biosecurity

Allowing pens and hutches to remain idle for a period of time is important to break the cycle of disease, and for the health of naïve newborn animals who have not been exposed to disease-causing organisms. Over 90 percent of the surveyed farms allowed for pens or hutches to remain idle before adding new animals. On average, hutches were idle 14 days and group pens were not used for five days.

Photo credit: T. Kohlman

Surveyed farms were asked the technique that best described their management of milk feeding equipment. Six of the seven automated group calf feeding systems cleaned and disinfected equipment two to three times per day, and one automated group feeding system cleaned and disinfected once a day. In individual feeding systems, one farm cleaned and disinfected two to three times a day, one farm cleaned and disinfected after the calves were moved for weaning. Three individual feeding systems used a combination of cleaning methods, but all three noted they rinsed the feeding equipment after each feeding and cleaned and disinfected two to three times a day.

Because of the purchase of adult replacements or calves, four of the eight farms surveyed were open herds with two individual feeding systems and two automated group feeding systems.

Recordkeeping Management and Training/Treatment Decisions

Recordkeeping is important to track health events and associated factors of animal performance. Records provide important information especially in regards to the effectiveness or response of treatment, level of disease incidence in certain ages, and overall lifetime health. All the surveyed farms recorded individual treatments of sick calves, and eight of these farms tracked information through a computerized recordkeeping system. The records were kept on eight farms for the lifetime of the animal and two and one half years on average for the other four farms.

Across all surveyed farms, on average, four different individuals cared for calves (range one to 12) with one person making the calf management decisions (range one to three). On average, two and one-half individuals (range one to nine) made treatment decisions for calves across all surveyed farms. Calves are a large investment, and having employees who can spot the nuances of calf behavior signaling the start of disease is important.

Protocol modifications and drift occur regardless of the best intentions as circumstances on farms change in relation to employees, seasons, and number of calves needing care. Eight of the surveyed farms trained employees in calf management when needed, three trained employees at hire, while one farm did not train their employees. It is recommended to train employees with the most current protocols and basic knowledge to understand the importance of the task at hire with continued education one to two times a year.

Dairy veterinarians, nutritionists, extension agents, and consultants seek to educate their farm clients and assist to create and evaluate protocols on dairy farms to maximize the success of their calf programs. Farms were asked who they worked or consulted with on a regular basis regarding calf management. Most farm respondents worked with their veterinarian and nutritionist (n=5); veterinarian exclusively (n=3); veterinarian, nutritionist, and extension agent (n=2); veterinarian and extension agent (n=1); and none (n=1).

Photo credit: S. Mills-Lloyd

The achievement of successfully raising quality dairy replacements is the goal of every operation. As you consider the type of management system (individual feeding system versus automated group feeding system), remember to focus on these criteria:

- lowering morbidity mortality
- maximize growth
- labor efficiency, and
- growth and productivity.

Acknowledgements

This separate (optional) survey was awarded Human Subjects Protection through UW-Extension, and provided to farmers who also completed the 2017 Intuitive Cost of Production Analysis (ICPA) in order to give insight into their precise calf health and management. The survey was developed by UW-Extension Oconto County Agriculture Agent Sarah Mills-Lloyd and UW-Extension Fond du Lac County Dairy & Livestock Agent Tina Kohlman. Survey questions were adapted from:

- *USDA Heifer Calf Health Card, NAHMS Dairy, 2014 (https://www.aphis.usda.gov/animal_health/nahms/dairy/downloads/dairy14ques/CalfHealth.pdf)*
- *USDA NAHMS 2011 Heifer Raising Study (https://www.aphis.usda.gov/animal_health/nahms/dairy/downloads/dairyheifer11/NDHRS%20questionnaire.pdf)*
- *Calf Sanitation Audit Survey, Sarah Mills-Lloyd, DVM, 2014*
- *University of Wisconsin School of Veterinary Medicine Food Animal Production Medicine Colostrum History (https://www.vetmed.wisc.edu/dms/fapm/fapmtools/8calf/coloshist2007.pdf)*
- *Producer Questionnaire: Management of Automated Feeding Systems, University of Minnesota Extension Dairy Scientist Marcia Endres, DVM, PhD, 2016*

Because this was an optional survey, a low number of ICPA farms (54.2 percent) completed and submitted their information. Despite the lack of survey response, useful data was garnered to provide an overall picture of the differences in calf health and management among the two different feeding practices. This report is derived from the farm responses (n=15). Data from three farms was intentionally removed from the data set due to lack of financial information in the ICPA study.

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