Dairy Calf Management: *From Birth to Weaning*

MISSISSIPPI STATE UNIVERSITY EXTENSION

Raising calves on any dairy farm is a challenging job. However, starting calves off well is essential to minimizing death loss and improving health outcomes. Even when a calf survives a disease, negative economic impacts may occur, and the calf may never reach her full genetic potential.

Calves treated with antibiotics have been shown to produce less milk in their first lactation than calves that receive no treatment. This, along with increased public concern over antibiotic use, should encourage producers to look more to disease prevention than treatment of heifer calves. This publication is intended to summarize best management practices for dairy producers to successfully develop productive replacement animals.

Figure 1. Providing a clean, deep bedded, and dry environment as soon after birth as possible will help decrease disease occurrence in newborn calves.

Maternity Area

Upon birth, calves should be moved to a clean, dry, and deep-bedded hutch or pen. Removing newborn calves from the maternity area as soon after birth as possible will decrease the time they are exposed to their dam's environment, where they are more likely to come in contact with illness-causing pathogens. Repeated attempts to stand in a maternity pen creates a substantial risk for fecal-oral transmission of pathogens that naturally occur in an adult cow environment but that should not be present in a freshly cleaned and bedded calf area.

Most dairy operations in the U.S. have a separate maternity area, which is recommended by many industry personnel. A separate area allows workers to keep a close eye on pre-fresh cows, help with dystocia more quickly, and care for the newborn calf sooner after birth. Canadian researchers reported that calves born in a maternity pen had decreased mortality when compared to calves born in other areas.

Navel Disinfection

The umbilical cord of a newborn calf is a potential source of infection. During pregnancy, its main purpose is to attach the unborn calf to the dam to provide nutrients. Many blood vessels lead directly from the navel to a calf's organs. If bacteria enter, they have easy access to vital parts of the calf's body. Consequently, as soon as possible after birth, the navel should be dipped in a 7 percent iodine-based solution. Dipping the navel in a teat dip cup or other similar tool immediately after birth and again within 12 hours should keep navel infection rates as low as 5 percent.

Some producers use sprays to disinfect the navel. Although using a spray solution is better than not disinfecting the navel at all, sprays are not as effective as dip cups since sprays often do not cover the entire navel surface. Covering the entire navel area with the iodine solution will disinfect the navel and limit the potential of bacteria entering the calf's system. If more than 5 percent of calves develop navel infections, the calving pen and

calf facility may need some deep cleaning, and navel disinfection may need to occur more quickly after birth.

Check navels regularly for about a week after birth. They should be dry, soft, and not painful. When picking calves up, remember not to hold them around their abdomens because that can potentially hurt the navel and increase infection risk. Instead, try picking them up with an arm behind their back legs and an arm in front of their front legs.

Figure 2. Fully dipping the navel in a 7 percent iodine solution will help decrease infectious disease occurrence in calves.

Take-home message: As soon after birth as possible, dairy calves should have their navels fully dipped in a 7 percent iodine solution, which can help prevent dangerous bacteria from entering their bodies.

Figure 3. At birth, be sure to identify each calf with an ear tag and tattoo, and record the information in a notebook or computer.

Record-keeping

With food-safety issues at the forefront of consumer concerns, it is more essential than ever for dairy producers to keep careful and detailed records on their operations. Records are important for animal traceability in the event of a disease outbreak. Keeping appropriate records will help dairy producers and consultants evaluate management practices that can help producers achieve their goals.

Although good records do not ensure that a dairy farm will be successful, success is definitely more difficult without them. Remember: you can't manage what you don't measure. Some important areas to record for each calf include: ear tag number, date of birth, location of birth (if multiple pens or fields are available), sex, breed, calving ease, birth weight, dam's ear tag number, sire, any diseases and vital signs observed, and any treatments given. At the end of this publication, a record-keeping template is provided that you can print and use on your farm.

Take-home message: Keeping good records can help producers manage calves by detecting and solving problems early.

Colostrum

Immunoglobulins (Ig) are antibodies that help calves fight disease, and they are passed from the cow to the calf via colostrum. Calves are born with very little immunity, so these immunoglobulins from colostrum are the best and only way for calves to develop their own immune systems as newborns.

Remember the four in four rule: Calves should receive 4 quarts of high-quality colostrum within 4 hours of birth. After 6 hours of life, absorption of immunoglobulins is dramatically reduced, down to nearly no absorption 24 hours after calving. Colostrum containing 50 mg/mL or more of immunoglobulin is considered to be excellent-quality colostrum to feed newborn calves.

Measuring Ig concentrations in colostrum is very useful in managing colostrum quality and monitoring colostrum-feeding practices. A colostrometer, or a hydrometer that measures the specific gravity of colostrum, can provide specific information on colostrum quality and is a useful tool for producers to have on hand.

Figure 4. Colostrometer with accompanying measuring cylinder.

How to use a colostrometer

1. Allow colostrum to come to room temperature, around 72°F.
2. Gently shake colostrum for 30 seconds.
3. Place 250 milliliters of colostrum in the cylinder.
4. Insert the colostrometer in the cylinder containing colostrum and allow it to float freely.
5. Match the color on the top of the floating colostrometer to the rating on the colostrum quality color chart (see **Table 1**).

Table 1. Colostrometer readings assess colostrum quality.

Color	Rating	Measurement
Red	Poor	Less than 20 grams Ig per liter
Yellow	Fair	20–50 grams Ig per liter
Green	Good	50–140 grams Ig per liter

*Classification might vary between different brands of colostrometers, so be sure to read the manual.

Many factors can affect colostrum quality, such as length of dry period, breed, age, vaccination status, season of the year, and amount of colostrum produced. Some of these factors are beyond a producer's control; however, one very important component that a producer can control is the time colostrum is collected and fed to calves. Calves that do not receive an adequate amount of high-quality colostrum within the first 6 hours of life are 50 percent more likely to develop infectious diseases and have decreased milk production in their first lactation (18.5 pounds less for each mg of decreased serum Ig in their first lactation).

Approximately 49 percent of U.S. dairy producers freeze and thaw colostrum to feed newborn calves. Since Ig level decreases after the first milking, only the very first milk should be used for immune transference. Many cows will provide more than 4 quarts of colostrum during their first milking, which can be tested for quality and subsequently frozen and stored for later use.

Accumulating colostrum for later use is desirable, especially to compensate for times when a dam produces a low quantity of colostrum or low-quality colostrum. When this occurs, producers can use the low-quality colostrum to feed 2- or 3-day-old calves, and feed the high-quality colostrum to newborn calves in the first 4 hours of life.

Colostrum can be stored for up to 6 months in a freezer or up to 3 days in a refrigerator. Freezing colostrum in 1- or 2-liter bottles or in 1-gallon zip-closure storage bags is effective and will allow for quick thawing when needed. Extra attention must be given when thawing colostrum because high temperatures are capable of destroying Ig. The best way to thaw colostrum is to place the bottle or bag in warm water (100 to 120°F) and check periodically until thawed.

Figure 5. Colostrum containing 50 mg of Ig per liter or more can be frozen for later use. When thawing, do not place frozen colostrum in water that is over 120°F.

On the occasions when a newborn calf is unable to suck a bottle (in the case of illness, for example), the safest manner to get colostrum into her is via tube feeding. This should only be done when the calf refuses to eat from a bottle and should be done by someone who has been trained in tube feeding.

Figure 6. Stomach tubes (on the right) for feeding colostrum to newborn calves are commercially available and can be used if a calf struggles to nurse during his or her first feedings. However, take care not to force the stomach tube into the trachea.

Take-home message: Feed calves 4 quarts of colostrum within 4 hours of life. If a calf struggles to eat, tube feed to ensure they get the proper amount of colostrum. Use a colostrometer to test Ig levels in colostrum and use the highest quality available.

Milk

The goal of calf nutrition is to promote healthy, efficient, and rapid growth through milk and to enhance rumen growth and function by initiating grain intake. In their first week of life, calves consume negligible amounts of dry feed; therefore, they must rely almost entirely on milk or milk replacer for nutrients.

Milk is a highly digestible energy source with the correct balance of protein, vitamins, and minerals required for the first weeks of life. There are many viable milk feeding options available, including whole milk, waste milk, and milk replacer. The best option for each individual farm is generally determined by price, availability, and convenience.

Differences exist between different milk options and even within each option, particularly whole milk because components vary from day to day and from cow to cow. Therefore, it is essential to evaluate the quality of the milk or milk replacer being used and evaluate the growth of the calves.

No matter the feeding system, calves should grow adequately, remain healthy, and act satisfied. If there is room for improvement on any of these criteria, consider changing the type or amount of milk or the feeding frequency. Be sure to talk to your nutritionist and veterinarian before implementing changes, as they may not be the best option for your farm even if someone else has had success with them.

The 2012 National Dairy FARM (Farmers Assuring Responsible Management) Animal Care Reference Manual recommends that calves consume milk or milk replacer equivalent to 10 percent of their body weight. However, research now shows that feeding more milk allows for higher starter intake, leading to greater body weight gains and improved feed conversion efficiencies. Feeding greater levels of milk also benefits the calf by decreasing hunger.

In a 2008 study, researchers found that calves fed ad libitum milk gained more weight than calves that were fed restricted milk (1.72 pounds per day versus 1.06 pounds per day), with no difference observed on scour occurrence. On the other hand, calves that were fed restricted milk displayed signs of hunger, were more likely to displace other calves from the feeder and be more competitive, and spent more time at the feeder waiting for more milk.

In another study conducted in 2007, researchers from Pennsylvania reported that feeding once versus twice daily had no effect on growth or health, indicating that both management systems can be successful when combined or used independently.

Take-home message: Feeding only 10 percent of body weight per day of milk or milk replacer might not allow calves to meet their nutritional requirements for growth and development and is associated with hunger behavior. Therefore, consider feeding calves 15 percent to 20 percent of their body weight to achieve greater growth rates.

Weaning

Weaning age varies from 4 to 10 weeks of age, depending mainly on feeding strategies. However, age should not be the only criteria for weaning calves. Instead, consider making that decision based on daily dry matter intake. Try weaning calves when they are eating 2 to 2.5 pounds of starter daily for 3 days in a row. At that point, they are likely consuming enough nutrients to maintain their weight and growth without milk.

Abrupt weaning is no longer recommended because it can lead to harmful consequences, including increased cross-sucking, signs of hunger, and reduced weight gains. Instead, consider reducing milk allowance over a 7-day period leading up to weaning. Try reducing milk consumption by 50 percent per day starting 7 days before the desired weaning date, and feed milk only once a day in order to stimulate starter intake and minimize weight loss during this transition. Hay is not recommended for calves until weaning (when grain intake is adequate) because hay is less energy-dense per unit than grain, which may limit weight gain.

Take-home message: Instead of weaning calves when they reach a certain weight or age, wean when they are consuming 2.5 pounds of starter per day for at least 3 consecutive days.

Water

Water is the single most important nutrient to any animal. Nevertheless, water is often not provided for young calves. Calves that are being fed milk still need water. Milk bypasses the rumen into the abomasum; therefore, it does not help stimulate the growth and development of rumen bacteria like water does. Rumen bacteria need water to ferment dry calf starter feeds and, later, forage. Water provides moisture to rumen microbes, which, together with calf starter intake, creates a desirable

environment for rumen fermentation and subsequent development of rumen papillae.

The National Dairy Health Monitoring System estimates that the average age of calves when they first are offered water in the United States is 17 days. This is 17 days too late. By 4 weeks of age, calves with restricted water access consume 31 percent less feed and have 38 percent lower weight gain compared to calves provided free-choice water. Therefore, in order to maximize feed intake and growth rate, calves should be provided with free-choice water starting at birth.

Not providing water is even more detrimental during hot weather. To maintain adequate body temperature, calves will increase their respiration rate and sweat more. Water is lost through both these processes, which calls for greater water intake in order to restore what was used for cooling purposes.

Water also is of great importance in helping sick calves heal. Calves can lose a great deal of water in a short period of time when they are sick and scour. To avoid dehydration, monitor these calves closely and provide extra water. Electrolyte solutions are commonly used to restore fluids and many minerals, like potassium and chloride, which are lost during diarrhea. These minerals are necessary to keep blood pH at an adequate level and to allow muscles to function properly. There are many commercially available brands of electrolytes. In mild cases of dehydration, the electrolyte powder can be dissolved in water and provided in a clean bottle. In more severe cases, tube feeding the electrolyte solution might be appropriate.

Keep water buckets full and clean. One study found that calves that had their water buckets cleaned every day gained 1.55 pounds per day, whereas calves that had their buckets cleaned every other week gained only 1.40 pounds per day and required more treatment for illnesses. Cleaning water buckets with diluted bleach and a scrub brush daily is a good management practice to help promote water consumption.

Take-home message: Providing free-choice water in a clean bucket from day one will increase body weight gain and decrease heat stress.

Calf Starter

The purpose of calf starter is to transition the calf from the milk-feeding period to the dry-feeding period. Calf starter should be offered to calves starting at 3 days of age. In the first week, calf starter intake is likely to be low, but consumption should increase by week two. Instead of putting a lot of starter out at once, start offering small handfuls at each feeding until they begin to eat it. This will waste less feed and may help pique their curiosity to try a few bites each time. Remove leftovers frequently so that starter will not accumulate on the bottom of the bucket and get compacted. Wet and compacted feed may prevent intake and can become contaminated with mycotoxins, which can make calves sick and can even be fatal.

Adequate calf starter intake will help calf development as dry feed in the rumen will lead to rapid growth of desirable microorganisms. This, in turn, will optimize feed fermentation and lead to faster development of a fully functional rumen. To encourage calf starter intake, avoid starter that is dusty, moldy, wet, or off-flavor. Wet or high-moisture starter is more likely to get mold, especially in hot weather.

Calf starter needs to be formulated to incorporate palatable ingredients and a satisfactory amount of protein, minerals, and vitamins to help calves reach target growth goals. **Table 2** lists the recommended nutrient content of a calf starter.

Table 2. Recommended nutrient composition for calf starter.

Nutrient	Amount
Crude protein (%)	16–20
Calcium (%)	0.7
Phosphorus (%)	0.45
Potassium (%)	0.65
Cooper (ppm)	10
Zinc (ppm)	40
Manganese (ppm)	40
Cobalt (ppm)	0.1
Selenium (ppm)	0.3
Vitamin A (IU/lb dry matter)	1818
Vitamin D (IU/lb dry matter)	270
Vitamin E (IU/lb dry matter)	12

Take-home message: The growth rate of young heifers depends strongly on starter intake. Hence, unpalatable, poor-quality, or moldy starter will decrease calf development. Starter buckets should be emptied and refilled at least once each day to help encourage adequate intake and prevent disease.

Housing

Newborn calves should be housed in a clean, dry, and deep-bedded facility. The facility should be draft-free but provide good ventilation. Too much air movement can chill the calf and rob it of energy needed for growth. The right amount of ventilation helps to decrease body

Figure 7. Keep starter and water buckets clean to encourage intake. Both should be emptied and refilled once or twice a day, especially during hot weather.

temperature in hot weather, and it can also help diminish dust, pathogens, and manure gases.

Calves spend approximately 18 hours a day lying down, so the depth and type of bedding used are important. Most bedding materials can work well if properly managed. Quality, consistency, availability, cost, and handling of bedding materials will be on-farm factors to consider. However, avoid using dusty materials, like very finely ground sawdust, because it can cause or worsen respiratory problems.

According to the Agriculture Food Development Authority, calves require up to 44 pounds per head per week of straw bedding in order to maintain dry conditions on concrete floors. Using slats under the straw can decrease this quantity by half. For calf hutches, 19 to 25 pounds per head per week are required. The amount of bedding material varies depending on the type of bedding, size of animal, and nutrition.

Bedding must be kept dry and clean. Bacteria needs moisture to grow, so once bedding gets wet with manure, urine, or spilled water, bacteria will multiply rapidly, increasing the chances of calf illness. Even beds that look dry could actually be wet. To check, kneel with all your weight on the bedded floor. If the knees of your pants get wet, then the facility is not sufficiently bedded. Remove the wet bedding and replace with dry.

Calves should be housed individually for at least 2 weeks, until their immune systems are better developed. Group-housing calves after 2 weeks, especially in groups larger than eight, is associated with an increase in respiratory disease and more severe cases of scours. Individual housing allows you to observe individual calf behavior, health, and feed intake, which can make weaning more successful.

On the other hand, calves that are housed in groups have displayed greater starter intake and, consequently, greater average daily gains. Group-housed calves may have a 16 percent greater average daily gain than individually housed calves. However, if group-housing calves, do not exceed nine per group before weaning. Also, do not mix calves of 3 or more weeks' age difference to reduce feeding competition.

Calf hutches are an efficient way to house calves and prevent disease spread from one calf to another. Hutches can be purchased commercially or built on the farm. Each calf hutch should have a functional window to allow air to move through and cool calves during hot and dry periods. During summer, calf hutches should be shaded to decrease heat stress. Trees or portable shade structures can work well, as long as enough shade is provided to cover all hutches during as many daylight hours as possible.

To restrict disease spread within your herd, hutches should be cleaned and sanitized between calves. Thoroughly scrub the inside and outside of the hutch with bleach, then allow it to dry in the sun for 24 to 48 hours before a new calf is placed in the hutch. Be sure to also remove all bedding between calves, not just what appears dirty. Disease can spread rapidly through calf crops if hutches are not properly cleaned between uses. For this reason, wood or other material that cannot be easily sanitized is not recommended as a calf housing option.

Take-home message: Calves should be housed in a clean and dry facility that has adequate shade and ventilation in order to keep them cool and healthy.

Final Considerations

Animal welfare is important throughout the entire life of a dairy animal. However, the newborn dairy calf needs extra attention because they are born with little to no immune response and, therefore, are at a greater risk of developing disease. Well-managed calves may have improved lactation performance, reduced disease incidence, and decreased culling rate. Well-managed calves may also be able to express their full genetic potential.

When questions or problems arise, be sure to work closely with your herd veterinarian, nutritionist, and Extension professionals to come to a solution that works for your specific needs.

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Example recording sheet to be used at each calving.									
Ear tag number[1]	Date of birth	Sex[2]	Breed	Calving ease category[2]	Dam	Sire	Disease I	Treatment I	Disease II

[1]Ear tag number assigned to the newborn calf.
[2]Calving ease category (ranging from 1 to 5, where: 1= no problem; 2 = slight problem; 3 = needed assistance; 4 = considerable force; 5 = extreme difficulty).

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