

Calf and heifer topics: Birth through 12 months of age.

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An often overlooked group of animals on a dairy farm are the heifers. For many, as long as the heifers are alive and become pregnant in a 'timely' manner, success is assumed. These animals represent the future of the business though and the better job we do with them, the better they will perform once they calve.

Over time, we will be addressing all stages of heifer growth. In this document, we are going to focus on the most efficient period of growth in an animals life: birth through 12 months. This document is a combination of "best management practices" (BMPs) and theory.

Birth

This is the most stressful period for a calf. Between adapting to a new environment, the calf must learn to thermoregulate as well as eat. Death loss at calving should be less than 3% and is influenced by: size of calf, difficulty of calving, excessive force used at calving (human intervention too early in the process and/or too much force used), and prenatal nutrition. Another whole document will be dedicated to the dry cow. Additionally, cleanliness of the calving area can play a big role in early calf survival.

BMPs

- It is imperative that a clean, dry area (well bedded) be provided for calvings. This area should be cleaned with new bedding provided between calvings.
- Within one (1) hour of birth, the following should be done
 - naval dipped with iodine (7% iodine)
 - calf fed colostrum (approximately 10% of calf body weight. e.g. a 40 kg calf should receive 4 liters colostrum). A normal calf will drink this amount from a nipple bottle.
 - a calf that only consumes two (2) liters and weighs 40 kg should have the remaining volume administered via tube feeder
 - **WARNING:** improper use will result in calf drowning. Less than 10% of calves should require the use of tube feeder. Be patient with the calf with the bottle. She will consume it. Experience has shown that extensive use of tube feeders actually damage the esophagus resulting in high morbidity and increased calf treatments. Mortality also increases. Additionally, tube feeders should be replaced on a regular basis. The plastic tube that is inserted becomes rough and in addition to being impossible to keep clean, causes injury to the esophagus.
 - If a *e coli* preventative is being used (such as 'First Defense') it should be administered
 - an injection (1 ml) of Mu Se (Vitamin E plus Selenium) administered inter-muscular.
 - **WARNING:** MuSe is a commercial name. The MuSe product itself is formulated for horses. The bovine product (commonly BoSe) is lower in concentration in E and Se. Dosage should be adjusted to ensure equal E and Se are provided.
 - calf weighed
 - calf identified with permanent ear tag

Day 1 through Weaning

Historically, we've treated calves during this stage with the idea of "let's keep them alive". But, this is the most efficient stage of an animals life. The growth that occurs here is efficient and sets the stage for future production. Numerous studies have shown that increasing and improving growth during this period not only improves health, but also improves lifetime production.

Goal: Double birth weight in 50 to 60 days

BMPs

- Offer either a high quality milk replacer (milk based) or milk at least twice per day
 - If using whole milk, it should either come from healthy cows or (and in many cases regardless of where milk comes from) should be pasteurized.
 - **NEVER use severe (off colored) mastitic milk. This will cause the calves to become sick.**
 - Volume offered should be increased over time. For example:
 - 4 liters 2x per day week 1-4
 - 5 liters 2x per day weeks 5-8
 - OR increase to maintain intake of 10% of bodyweight on a weekly basis
 - this means that bodyweights need to be known weekly
 - from day 5 offer *ad libitum* water
 - clean all pails (milk and water) after every feeding. Water pails should be cleaned at least daily.
 - use a good manual soap cleaner and acid rinse just as if washing a milking system by hand
 - from day 5 begin offering calf grain
 - a high quality calf grain will contain 18-25% crude protein
 - calf grain should be offered in amounts the calf will eat
 - initially, offer a handful of grain. As the calf begins to consume that, increase the amount keeping grain fed *ad libitum*
 - replace unconsumed calf grain daily. Stale grain will discourage intake and can harm calves due to mold and mycotoxins.
- **Issues to address**
 - Housing calves can lead to a very long discussion. Several important issues are common though:
 - clean, dry housing
 - the ideal bedding material is long straw. This allows the calf to create a 'nest'. One must remember that during the first week of life, the calves thermoneutral zone is around 38 deg. C. Thus, with the exception of extreme hot seasons, most young calves will look for warmer areas to rest. As the calf grows, the thermoneutral zone shifts and the calf can thrive in cooler temperatures.
 - wet bedding quickly leads to sick calves.
 - draft free

- away from other cattle groups
 - many diseases are spread via fecal to oral transmission. Keeping these calves (whose immune system is still developing) away from other animals not only can limit fecal oral pathways but also reduce the incidence of respiratory disease.
- plenty of fresh air
 - stale, damp air causes increases in respiratory disease.
- shade/protection from elements
- Calf respiratory diseases
 - poor ventilation, dampness, poor feeding/hygiene practices, and exposure to older animals can increase incidence of respiratory disease. This often leads to pneumonia, which, due to lung damage, decreases lifetime performance.
 - incidence greater than 1% should be considered excessive. Repeated coughing is a common symptom and action should be taken immediately.
 - work with a qualified veterinarian on treatment plans
- Hygiene
 - good hygiene is required when working with calves. Ideally, the people responsible for calf raising should enter the calf area first with clean clothing and footwear. To prevent disease introduction, people, other than calf care providers, should not be allowed in the calf area.
 - feeding equipment (pails, bottles, etc.) should be cleaned after each feeding.
 - for any injection, the 'one needle one animal use' should be followed. This is especially important in herds with leucosis.
- Calf scours
 - there are two types of scours:
 - nutritional. Some times calves will show some scours from over-consumption. This IS NOT a problem
 - disease
 - bacterial
 - viral
 - parasite
 - we will not discuss scours in this document other than to say the following
 - identify the source of the scours and develop a treatment/prevention plan with a qualified veterinarian
 - ***Under no circumstances should milk be removed from feeding during scours.***
 - The calf requires nutrients when sick. By removing milk, the calf is essentially being starved. The scours may 'go away' because there is nothing in the gastro-intestinal tract.

- after a severe case of scours where antibiotics were used for more than two (2) days, it may be beneficial to give the calf a probiotic to re-inoculate the GI tract.
 - while commercial products exist, live culture yogurt (approximately 50 ml) can be used. **We stress though that it must be live, active culture yogurt.**
- during the scouring period, an extra feeding providing electrolytes is required. The scouring calf quickly becomes dehydrated and loses electrolytes via scours. These need to be replaced to assist in recovery. It is important to note that scours themselves do not result in mortality. Calves die from dehydration and toxins produced by the infectious source. Most calves do not require antibiotics, rather supportive therapies (electrolytes) are adequate for recovery.
- You may notice that no mention of feeding dry hay is mentioned or recommended. During this time, the calf is primarily a mon-gastric animal (like a pig). The rumen must develop and it has been shown that rumen development is done via propionic acid. Propionic acid is a volatile fatty acid produced from the fermentation of starch supplied from grain. Hay fermentation produces acetic and butyric acids. The rumen develops more slowly from these two acids. Additionally, the total amount of nutrients available is higher for grains than hays. For example, maize TDN is >70% whereas a hay may be 50%. Thus, by strictly offering grain as a dry feed, the total nutrient intake is higher and calf growth can be further enhanced. Therefore, it is NOT recommended to offer hay to the pre-weaned calf.

Weaning

With proper nutrition and management, the calf can be weaned between 49 and 56 days of age. It is important to stress that age is not the critical factor. Rather, doubling birthweight is the optimum. This is the second most stressful period in a calves life. During this period, the calf must adjust from primarily a liquid diet to a dry diet. Additionally (and unfortunately), many producers also move calves from individual housing to group housing at weaning, a practice that places additional stress on the calf.

BMPs

- For 3-4 days, reduce milk feeding to once per day and increase grain availability. The calf will be expecting milk at the second feeding time. A trick to keep calves quiet is to offer additional grain and feed them water at this feeding.
- at weaning, calves should be weighed
- for at least one (1) week post-weaning, calves should remain in their original housing
- during this week, calves should be dehorned
 - It has been shown that dehorning at this age is less stressful on the animal. It is also safer to dehorn a young animal.
 - Dehorning: there are several options available for dehorning.
 - Caustic Pastes: applied to the horn bud.
 - If used correctly, this method can be successful. However, calves will rub their heads against each other, themselves, anything they can reach. This can spread the paste to other areas on the calf, other calves, posts, etc. resulting in caustic burns in unintended areas. Additionally, a calf may rub against people placing the person in potential danger of burns.

- These pastes are not recommended.
- Gouging: small tube to 'scoop' the horn bud out.
 - A sharpened tube is used to cut the skin around the horn bud and then the bud is 'scooped' off the skull. Blood vessels must then be manually pulled to limit bleeding.
 - potential for disease transmission is very high.
 - potential for fly infestation (resulting in maggots) is very high.
 - generally considered less humane than other methods
 - this method is not recommended
- **Burning:** electric or gas powered burners are used to kill the cells responsible for horn development.
 - A high temperature (greater than 550 deg. C) burn is used
 - Does not leave an open wound
 - If used in conjunction with a local anesthetic, has been shown to be the most humane method for dehorning.
 - post-dehorning, calves will begin to eat and exhibit normal behavior immediately if local anesthetic was used. If no local anesthetic, calves will shake their heads as if trying to shake off a fly for about one hour.
- **This is the method recommended as a regular management practice.**
- if a plastic ear tag is to be used by the farm, this is also the time to tag the heifer
- Observe calves at least twice daily post-weaning. Watch for:
 - general health
 - eating and drinking adequate amounts
 - infection around any wound sites (e.g. dehorning areas, ear tag insertion points, etc.)
 - overall well-being of the calf
- After one to two weeks, calves can be moved to group housing.

Nutrition of the weaned calf

The first week post-weaning, many calves will lose weight as they adjust to a milk-free diet. This, coupled with the management actions that must occur, are more than enough changes for the calf. There is much debate regarding what to feed calves at this stage.

The rate of gain of heifers from weaning until six months can be as high as 1.25 kg/d if fed adequately. Altering this period's gain rate is the best method to change the age of first calving. These young heifers utilize protein very efficiently and, given adequate protein supply, frame growth can be maximized. Underfeeding protein at this stage has been shown to limit size and lifelong productivity.

Determining the required rate of gain is quite easy if one follows the target growth system developed at Cornell University and adopted by the 2001 Dairy NRC. In this method, target body weights are calculated based upon the body weight of mature cows (4th and greater lactation). If the mature size

has been compromised due to previous management practices, add 50 kg body weight to the measured mature body weight. As an example:

Stage	% Mature Size
Breeding	55
First calving	82-85
Second calving	92
Third calving	96
Fourth calving	100

Data required to do calculations:

- Desired age of first calving
- Mature body weight
- Weight at weaning
- Age at weaning
- Inter-calving period

Now for our example.

- Desired age of first calving = 24 months
- Mature body weight: measured 500 kg, + 50 kg to compensate for previous practices = 550 kg
- Weight at weaning = 90 kg
- Age at weaning = 56 days
- Inter-calving period = 13.5 months

Calculations

Stage	% Mature Weight	Calculation	Body weight, kg
Breeding	55	55% x 550 kg	303
First calving	82-85	85% x 550 kg	468
Second calving	92	92% x 550 kg	506
Third calving	96	96% x 550 kg	528
Fourth calving	100	100% x 550 kg	550

Stage	Body weight, kg	Calculation	kg Gain
Breeding	303	Breeding BW - Wean BW	213
First calving	468	First calving BW - Breeding BW	165
Second calving	506	Second calving BW - First calving BW	38
Third calving	528	Third calving BW - Second calving BW	22
Fourth calving	550	Fourth calving BW - Third calving BW	22

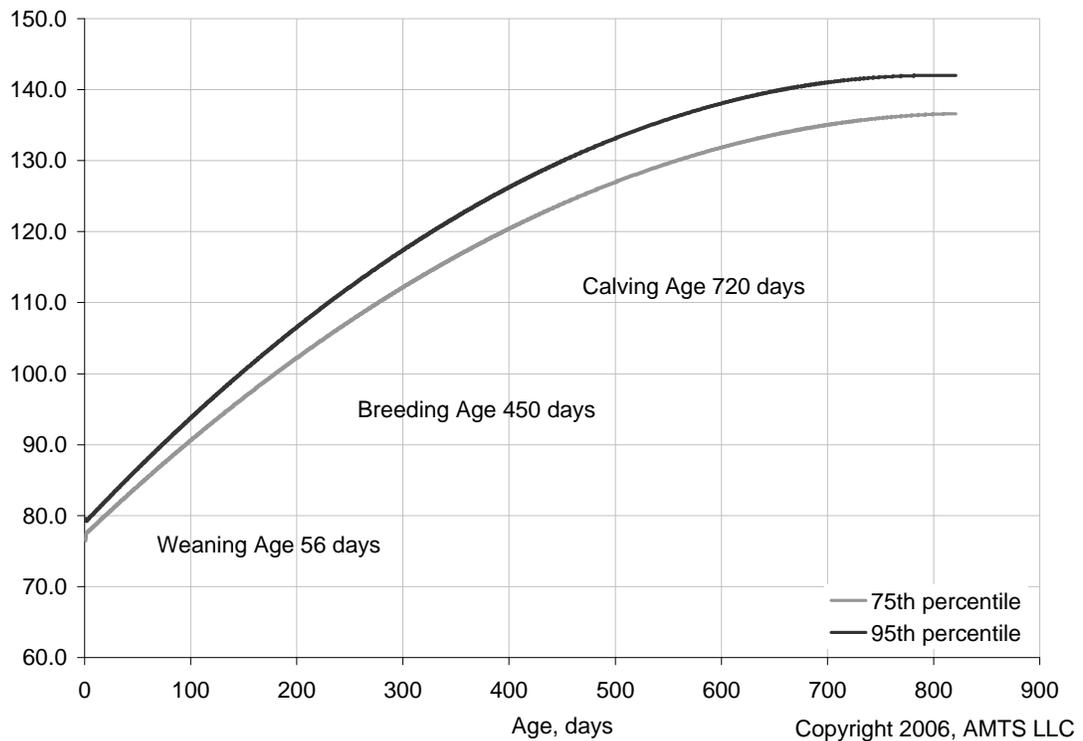
Stage	kg Gain	Age, mo	Days to Gain	Calculation	ADG g/d
Breeding	213	15.0	394	kg Gain / (Breeding age x 30 - Weaning age) x 1000	541
First calving	165	24.0	279	kg Gain / ((First calving age - Breeding age) x 30) x 1000	591
Second calving	38	37.5	410	kg Gain / ((Second calving age - First age) x 30) x 1000	93

Stage	kg Gain	Age, mo	Days to Gain	Calculation	ADG g/d
Third calving	22	51.0	410	$\text{kg Gain} / ((\text{Third calving age} - \text{Second age}) \times 30) \times 1000$	54
Fourth calving	22	64.5	410	$\text{kg Gain} / ((\text{Fourth calving age} - \text{Third age}) \times 30) \times 1000$	54

It is important to point out that these target gains assume:

- **a body condition score of 3.0 (1-5 scale)**

- over-feeding energy and/or under-feeding protein resulting in obese heifers is unacceptable. Results of obese heifers:
 - decreased first lactation performance
 - increased calving difficulties and metabolic disease at first calving
 - decreased second lactation performance
 - overall decreased lifetime and decreased lifetime performance
- measuring hip height as well as body weight is a good indicator of frame growth. The calculations to predict hip height recommendations are complex. A spreadsheet was developed to do these (and the weight calculations). Using the data from above, the following graph illustrates the hip height required.



Our experience leads us to these recommendations:

- offer calf grain (starter or grower) containing 20-25% crude protein *ad libitum* until the calf is consuming 2.5 kg per day
 - there is no need to offer hay
 - if hay is offered, it should be either a soft texture grass hay (NDF<55%) or an immature lucerne (<37% NDF). The hay should be dry, dust free, mold free, and free from any impurities.
 - this is the same quality hay as the highest producing cows should be receiving. These calves have a high growth requirement and, to be able to maximize intake, the palatability needs to be very high.
- when calves begin consuming 2.5 kg grain per day, the diet can be changed. The easiest method for feeding these calves (which should weigh approximately 100 kg for Holsteins) is to feed them the same diet as the highest producing cows.
 - given the small rumen volume, the diet must be highly digestible. Everything must be of the highest quality as rumen fill quickly occurs in these young heifers.
 - these young animals (up through six (6) months of age) require approximately 18% crude protein. The protein sources should be plant based with no urea (or other non-protein nitrogen sources) used. The rumen is still developing at this stage and can not utilize NPN.
 - at six (6) months of age, the heifers can be switched to a growing diet. This diet should consist of approximately 16% crude protein.
 - the heifers can continue to be fed this diet through breeding.

- under no circumstances should the heifers be protein limited. Using a model, all of these diets should predict MP allowable gain to be 200 to 500 g/d then ME allowable gain. Actual rate of gain will be somewhere in the middle. IF ME gain > MP gain, the heifers will grow such that frame and muscle growth will be according to MP gain AND fat will be deposited to the ME gain level.
 - e.g. if ME gain = 1,000 g and MP gain = 900 g
 - Frame/muscle gain = 900 g
 - Additional fat deposition = 100 g (1,000 ME - 900 MP)
- clean water should be available to ensure *ad libitum* intake
- given that ionophores (e.g. monensin) can not be fed in Ukraine, a high quality yeast may be used to improve nutrient use.
 - Work from France has shown that feeding a live bakers yeast in beef cattle (feedlot cattle) during the entire growth period increased average daily gain with an improvement in feed efficiency

Other management considerations from one week post-weaning through six months of age

- when moving calves from the individual housing to group housing, a single injection of a long lasting antibiotic has been shown to be extremely effective in preventing respiratory disease.
 - at 4-6 months, if heifers are moved to a different stable, an oral antibiotic for 4 days prior to moving and 7 days post-move prevents respiratory problems as well.
- housing should ensure a clean, dry, draft-free environment that provides plenty of fresh air. Within housing, the minimum number of air turnovers per hour should be:
 - Winter: 6x per hour
 - Summer: 12-15x per hour
 - tunnel ventilation may be utilized during the summer especially in older stables with concrete walls and a narrow construction (<15 meters wide)
 - HINT: if the stable has an odor ('barn' smell, ammonia, etc.) (or if upon leaving your clothes have an odor), the number of air exchanges per hour is too low
 - the best housing for heifers is loose housing (free-stalls and/or bedded pack). Ideally, the heifers will have access to an outside exercise lot.
 - this freedom of movement allows for better muscle development as well as assists in maintaining a desired body condition score.
- from birth through the first few months of life, the calf's immune system is developing. She is surviving on the immunoglobulins (IgG) she received from colostrum with the hope that her system develops normally.
 - Many farms begin vaccinating at approximately four (4) months of age. This is typically a multi-disease vaccine. Speak with a qualified veterinarian about selecting a vaccine.
- sometime between four (4) and six (6) months of age, body weight should be recorded. Weighing at this time ensures that the heifers are meeting (or exceeding) the required ADG to meet the target breeding weight.
- if loose housing is being used (free-stalls) at 4-6 months of age, heifers are easily trained. Prior to four (4) months, it is not as easy to train heifers.

- if moving the 4-6 month old heifer from loose housing (bedded pack) to free-stalls, it is important that the diet NOT be changed for at least two weeks post-moving. The move, learning to use stalls, and meeting new heifers is a stressful event. On farms that also change the diet at the same time, we often witness outbreak of ringworm and respiratory diseases.
- at 9-10 months (and as early as 5-6 months) of age, the heifers will begin cycling. Heifers should be observed for estrus from about nine (9) months of age.
 - estrus detection is one of the most critical tasks on the farm. A minimum of one hour per day should be spent in with the heifers for estrus detection. At the same time as estrus detection, the heifers should be observed for illness, lameness, coughing, and general health/thriftiness. Heifers needing additional attention should be recorded and addressed as soon as possible.
 - these early estrus cycles should be recorded to prove that the heifer is fertile.
 - depending upon the desired age of first calving, about one (1) month prior to breeding, when the heifer exhibits estrus, a body weight should be recorded.
 - if the body weight is equal to, or exceeds the desired target weight, the heifer can safely be inseminated
 - if body weight is 10-15 kg less than the target weight at this estrus, the estrus recorded and the heifer watched 19 days later
 - NOTE: the normal estrus cycle varies between 19 and 22 days. DO NOT JUST ASSUME THAT 21 DAYS LATER SHE WILL BE IN ESTRUS. Many times, heifers have a 19 day cycle.
 - if body weight is >15 kg less than target weight, record the estrus and at the next estrus, re-weigh the heifer.
 - NOTE: if heifers are routinely under weight one month prior to insemination, have the nutritionist review the diets immediately.
 - once a heifer begins exhibiting estrus, her metabolism begins to change due to hormone changes. This hormone changes result in more fat deposition. Heifers not bred by 17 months typically are obese and will most likely never conceive. This should represent less than 1% of all heifers. If the farm is routinely finding breedings per conception on heifers greater than 2.0, feeding and management practices must be reviewed.
 - under normal circumstances, heifers should show limited feet and leg problems.
 - it is possible that the 'toes' will show excessive growth. Trim feet as required.
 - some sort of foot bath should be used. Depending upon observed foot health, there are two options
 - normal feet with no symptoms of hoof rot, laminitis, etc.
 - a dry foot bath of hydrated lime 2-3x per week
 - lameness for any reason >5% of heifers within an age group
 - 10% formalin solution 2-3x per week
 - typically, formalin comes in a 37% concentration. THE 10% SOLUTION DOES NOT MEAN 10% FORMALIN. RATHER, IT IS A 10% FINAL DILUTION USING THE 37% FORMALIN PRODUCT AS IS.

- e.g. for 100 liter foot bath, you would use 10 l of 37% formalin solution + 90 l water