

Accelerated Replacement Heifer Feeding Programs

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■ Take Home Message

- A modified accelerated calf feeding program should be implemented on dairy farms.
- A specific milk replacer and calf starter are needed to achieve optimal frame growth and performance.
- Health status must be monitored to ensure healthy calves and minimize stress.
- An aggressive feeding and management program must be maintained to ensure early growth advantages are maintained after 12 months of age.

Replacement heifers provide the basis for profitable milking herds as a source of genetically superior cows, allow for culling of marginal cows, expand the dairy operation, and/or provide a source of added revenue by selling surplus animals. However, a recent survey from the U.S. dairy herd evaluation project (1702 dairy herds) demonstrated a need for improving heifer growth. Over 63 percent of dairy operations have an average age at first calving greater than 24 months of age with 23 percent over 27 months of age. Each month of delay beyond 24 months of age cost \$60 in added feed costs and lost milk potential. A second concern is 87 percent of the heifers freshened below 550 kg (1210 lb) of body weight with 25 percent below 500 kg (1100 lb). To meet these challenges, new approaches should be considered.

■ Traditional Calf Feeding Programs

On most dairy farms and calf ranches, calves receive colostrum for 24 to 48 hours followed by milk replacer or whole milk (waste milk, dilute soured colostrums, or marketable milk). Liquid diets are fed at 8 to 10 percent of the calf's body weight (0.45 kg or 1 lb of milk solids). Calves are weaned when they are consuming 0.7 kg (1.5 lb) of calf starter containing 16 to 18 percent

crude protein (tag or air dry basis). Calves may have gained 0.2 to 0.5 kg (0.5 to 1.1 lb) per day. Hay or other forage sources should not be offered until calves consume 2 to 2.3 kg (as fed basis). At three months of age, calves are shifted to a calf grower program and forages containing 16 percent crude protein (dry matter basis). Calves could be gaining 0.7 to 0.8 kg per day during this time period. Is this still the “right” strategy with high genetic potential heifers?

■ Accelerated Feeding Approaches for Young Calves

“Accelerated growth” is the new buzzword in calf feeding based on research reported by Cornell and Illinois workers. Calves were fed higher levels of a higher protein milk replacer to gain 0.9 to 1.4 kilograms a day. Early research in the 1950’s with milk replacers recommended 8 liters (two gallons) per day per calf to provide similar levels of milk solids intake compared to whole milk. Whole milk (Holstein) contains 29 to 30 percent fat and 25 to 26 percent protein on a dry matter or solids basis.

Using the new Dairy NRC 2001 guidelines, a 40 kg calf fed whole milk at eight percent of body weight would be predicted to gain 0.24 kg per day. Fed a traditional milk replacer, the calf would gain 0.13 pound per day. Illinois workers argued that current milk replacer and liquid milk diets restrict growth. This strategy is a management decision, not a growth potential limitation. The new “accelerated” growth program has been termed “normal growth”. Illinois workers illustrated the relationship of rate to gain to energy and protein requirements in Table 1.

Table 1. Effect of rate of BW gain with constant initial BW (100 lb) on protein requirements of pre-weaned dairy calves (adapted from Davis and Drackley, 1998).

Rate of gain (kg/d)(lb/d)	ME (Mcal/d)	ADP (g/d)	Required DMI ¹ (kg/d)	CP Required (% of DM)
(0)	1748	28	0.38	8.3
.23 (0.50)	2296	82	0.50	18.1
.45 (1.00)	3008	136	0.66	22.9
.68 (1.50)	3798	189	0.83	25.3
.91 (2.00)	4643	243	1.02	26.6
1.13 (2.50)	5532	297	1.21	27.2

¹ Amount of milk replacer dry matter (DM) containing 2075 kcal ME/lb DM needed to meet ME requirements.

ADP – Apparent Digestible Protein

As average daily gain increases, the required metabolizable energy intake and apparently digestible protein (ADP) also increased. The amount of protein required is driven by growth rate because maintenance requirements are small. As illustrated in Table 1, growth rates over two pounds per day requires a diet in excess of 27 percent crude protein. Earlier research resulted in mixed results when higher gains were targeted.

- Traditional milk replacers did not contain enough protein to support higher rates of lean tissue growth (true stature or lean tissue development).
- Calves were weaned to a starter feed or forage that did not contain sufficient nutrients to maintain optimal growth.
- High liquid milk or milk replacer intake reduced calf starter intake and raised the cost to feed young calves.

Growth must be skeleton and muscle resulting in tall heifers compared to fat heifers. Cornell and Illinois workers reported fat levels may be reduced resulting in higher lean growth without fattening (Table 2). The source of energy should also be considered (fat compared to lactose). When metabolizable energy is considered, Cornell workers concluded that 15 percent fat can be adequate to maintain lean growth with higher protein levels. Higher fat levels in liquid diets can suppress calf starter intake. Whole milk may contain higher levels of metabolizable energy than needed. Table 2 illustrated the relationship of nutrient concentration, dry matter intake, and gain based on energy and protein status based on nutrients provided.

Table 2. Nutrient balance as calculated by the 2001 Dairy NRC guidelines (Van Amburgh, 2001)

Milk replacer	%CP	%Fat	DMI (kg)	Energy gain (lb/day)	Protein gain (lb/day)
A	22	12	1.0	0.88	0.75
B	22	20	1.0	0.98	0.75
C	20	20	1.0	0.98	0.67
D	28	17	1.5	1.56	1.53
E	28	15	1.5	1.53	1.53

Another concern is higher growth rates could lead to fat deposition in the mammary gland reducing milk yield when heifers freshen. Michigan workers have shown that the plane of nutrition prior to three months of age will not have negative impact on mammary development.

■ Field Applications of An Accelerated Calf Program

The goal of the accelerated or intensive calf feeding program is to allow calves to allow higher rates of grow in heifers resulting in taller, growthy heifers than can enter the milk herd earlier and produce more milk. Accelerated growth is biologically normal growth controlled by the calf raiser. Illinois researchers list several advantages and disadvantages for accelerated calf feeding programs. Advantages are listed below.

- Decreased time to breeding and first calving could occur as heifers reach optimal size 20 to 30 days sooner if grow rates are continued. Potential savings could be \$40 to \$60 per heifer.
- Increased efficiency of gain occurs because maintenance is small and feed conversions were increased. Illinois workers increased gain to feed ratios from 0.25, 0.32, and 0.37 kg of gain per 0.45 kg of dry matter intake when growth rates were increased from 0.36, 0.70, and 1.03 kg per day, respectively.
- Improved health and immune system occurs when calves are gaining at higher levels due to lower mortality. Lymphocytes (white blood cells) from calves fed below maintenance had reduced proliferation responses compared to adequate fed calves.
- Enhanced milk production ability at calving has been reported by Israeli workers. Calves that were allowed to suckle cows three times a day were 5 centimeters (2 inches) taller, calved 30 days earlier, and produced 454 kg more milk.

Disadvantages of an accelerated program are outlined below.

- Increased feed costs during the milk feeding period (\$50 per calf) occurred as calves consume more milk replacer and less calf starter. The higher protein content milk replacer is six to eight dollars higher per 23 kg (50 lb) bag of milk replacer. Calf starter costs were also higher due to higher protein levels.
- Increased fecal looseness and rough-looking calves can occur as fecal material is less solid due to lower fiber intake from calf starter. While fecal scores are higher (softer feces), scour days were not different. However, field reports are mixed.
- Delayed rumen development and poor transition at weaning can occur if calf starter intake has been reduced. Researchers continue to determine optimal levels of milk replacer to achieve adequate calf starter intake avoiding “stalling out” of calves after weaning.

- Potential negative effects on mammary development should not be a problem as the mammary gland is not undergoing significant development prior to three months of age. Overfeeding of energy from 3 months of age to puberty can negatively impact mammary growth and milk production.
- Intensive management is required to avoid digestive upsets, maintain high levels of sanitation avoiding scours and wet bedding, and water must be available at all times. Increasing liquid diets must be monitored to avoid intake problems. Starter intake (0.7 to 0.9 kg per day) must be achieved before weaning can occur.

■ Field Questions About Accelerated Calf Programs

Based on studies conducted by Cornell, Illinois, and commercial companies; the following questions can be answered. As more field and university data are available, answers will be modified.

What are the best farms to use an accelerated calf program?

Dairies with intensive calf and heifer management systems who want to maximize genetic potential, raise taller heifers at an earlier age, and want bigger calves may consider this system. Calf raisers that feed large amount of whole milk or waste milk (over three quarts per feeding) have experienced this system. Management and calf raising skills must be excellent.

What changes occur when using an accelerated calf program?

- The liquid diet should be more concentrated (14 to 17 percent dry matter) compared to 13 percent solids in whole milk or traditional milk replacer programs.
- The milk powder should contain higher levels of crude protein (26 to 28 percent crude protein) with 15 percent fat. Higher fat levels (20 percent) may be needed during cold weather and stress periods.
- Mix one batch of liquid for all calves to avoid errors in weighing powder and reconstituting the liquid feed.
- For large breed heifers, feed 2.5 liters per feeding for week one (twice a day).
- Feed 3 to 4 liters per feeding from week two to weaning (twice a day).
- Cap the maximum amount of powder to two percent of calf birth weight (40 kg calf would get a 0.8 kilograms of powder per day). Do not increase the powder as the calf grows to encourage calf starter intake.

- Limit liquid intake for the week of weaning to stimulate starter intake (0.9 kg per day prior to weaning).
- Water must be available free choice at all times starting at day two.
- Calves over 14 days of age on a traditional program should not be placed on the accelerated program.

Should every calf get the same feeding approach?

Each calf is unique and calf managers should monitor calf response to the accelerated program. Twins, calves from difficult calving, and weak calves may not consume the amounts listed above. Reduce the amount by one liter increments until the calf can consume it. Do not force feed with an esophageal feeder.

Will manure consistency change?

Industry workers report that the number of treatable disease did not increase, but the calf's manure will be looser in consistency. During clinical illness and heat stress, the color of the manure may appear creamy white. If the manure becomes too loose, check for dehydration and add an electrolyte to the free choice water. Good management is a must, do not crowd calves, and provide adequate bedding to keep calves dry. Calves may appear dirtier with looser feces.

Is my current calf starter adequate?

The calf starter should be higher in protein containing 20 to 22 percent on an air dry or feed tag basis (22 to 24 percent on a dry matter basis). Calves eat about half of the normal level due to higher liquid intake before weaning. Calves must be consuming 0.9 kg of calf starter before weaning or calves will "stall out". Reducing liquid intake before weaning encourages starter intake. The starter should be palatable (course texture, sticky with molasses, and not contain fines or dust). By week 12, starter intake on accelerated calves may surpass normal calf starter intake on traditional programs.

What is the typical timetable of calves on accelerated calf program?

- Weaning occurs at 6 to 7 weeks after birth with adequate starter intake.
- Feed the higher nutrient calf starter up to 10 to 12 weeks of age as a complete starter offering forage if starter intake exceeds 2.2 to 2.7 kg per calf.
- Over 10 to 12 weeks of age, shift heifers to a balanced heifer feeding program to maintain 1 kg of gain per day with forage and a calf grower grain mix. Do not fatten calves which can lead to fatty udder development.

■ Feeding From Three to Six Months of Age

The goal for this three-month period is to achieve growth rates of 0.8 to 1.0 kg per day while maintaining skeleton and lean tissue growth. Illinois guidelines are 17 percent crude protein, 35 percent rumen undegradable protein (RUP), and 71 percent TDN (NRC 1989 values). Fattening should be avoided as mammary gland development is occurring. Feeding 2.2 to 2.7 kg of a grain mix to compliment forage quality can optimize growth. Forage quality is important (RFV > 150 for legume and grass forages). Avoid wet forage high in soluble protein and forage with a poor amino acid profile. One approach is to feed the high group TMR free choice until 6 to 8 months of age or until heifers begin to gain excessive body condition.

■ In Summary

An accelerated calf program requires top-notch management, unique milk replacer and calf starter feeds, and an extra \$50 investment in this phase of the calf program. To recover this investment, calves must continue to grow, be bred 20 to 30 days earlier than traditionally raised heifers based on size (not age), and avoid fat heifers. An accelerated calf program is not “right” for everyone, just like TMR does not work for everyone.

Consider the accelerated calf approach as a “new” method to achieve genetic growth potential. Some dairy managers report poor results and have abandoned the system. Each producer will need to evaluate how this system works on her or his farm. Feeding heifers from 3 to 6 months of age must maintain optimal growth patterns. Measure heifers at six months of age to insure growth targets are achieved. Holstein heifers should weigh 200 to 230 kg (450-500 lb), have body condition scores of 2.25, and measure 95 to 99 cm (40 to 42 inches) at the withers.

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