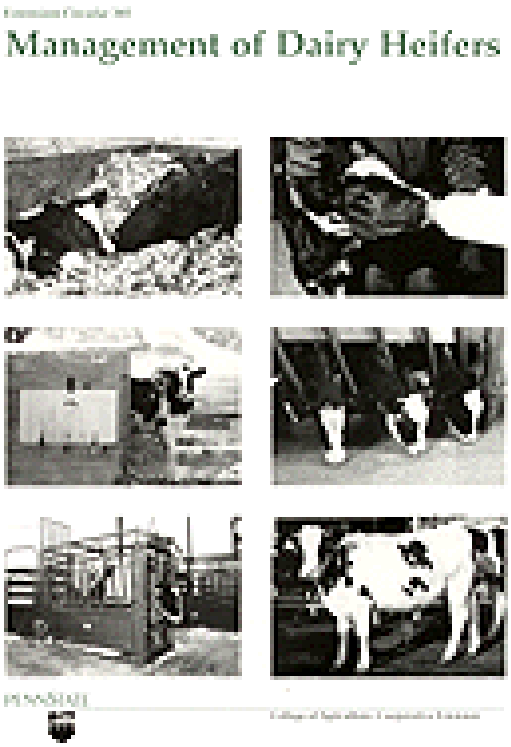
Extension Circular 385

Management of Dairy Heifers



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Dairy replacements are the foundation of any dairy enterprise. Improvement of a herd is possible when culled cows are replaced by well fed, healthy, genetically superior, and properly managed 2-year-old heifers. An excellent way to improve herd production is to mate cows to the best bulls available, then feed and manage replacement heifers so they reach their true potential in an optimal time period.

In most herds, dairy farmers are replacing 25 to 30 percent of the herd each year. This represents a large number of heifers that must be raised each year and a large investment of dollars. A successful calf raising program involves many aspects of genetics, as well as nutrition, housing, and overall management. No one specific program will work for everyone, yet all calf raising systems have many of the same sound components. This publication will outline a system of raising replacements that has been demonstrated to be successful throughout Pennsylvania.

Genetics and Breeding

Genetics and selection

A large number of proven and unproven bulls are available for many breeds. In reviewing sires, it is generally accepted that the higher the Predicted Transmitting Ability (PTA), the greater potential to transmit yield productivity to their offspring.

Criteria should be developed for purchasing semen to breed heifers. It is best to begin with the proven sires. Their records provide production, type, and calving ease data. The reliability of this information improves as the number of daughters increase.

A second mating option is to use the young, unproven sires. Although these bulls have no data for their own progeny, they are the sons of high PTA bulls and their dams had to meet certain genetic requirements. These young sires are selected for testing because of their estimated genetic value. From this group the proven bulls of tomorrow will be chosen.

Young sires should be randomly bred throughout the herd. Although some herds may use 100 percent young sires, geneticists agree that no more than 25 percent of the herd should be mated to young sires. Some caution should be exercised in mating virgin heifers to young sires because the bull's calving ease ability is not known. A benefit of using some unproven sires is the financial incentive. The initial semen cost is relatively low. In conjunction with this, most breeding organizations offer an incentive "cash return" program for information provided as the calf matures.

With seven out of every ten cows bred artificially, there are still many dairy farmers who consider natural breeding an essential reproduction tool. Natural service generally cannot provide the genetic advancement possible with proven sires. Breeding heifers to an unproven dairy or beef bull retards genetic improvements and reduces the number of herd replacements available. Bulls are dangerous; A.I. eliminates the need to have a potentially dangerous animal on the farm. Natural service bulls may be subfertile, delaying the age of a heifer's first calving and thus reducing milk production per day of herd life. On the other hand, semen quality and fertility of

A.I. bulls are monitored. Suboptimal semen is not distributed. Natural service bulls can also introduce venereal disease into a herd, whereas A.I. sires are disease-free.

Conformational type characteristics are generally unknown for natural service bulls. Furthermore, little information is available on size of calves sired by farm bulls or the incidence of difficult births. A.I. sires and calving ease summaries provide considerable information to the dairy farmer about production merit, type classification, and calving ease. With this information readily available, the risks involved in an A.I. program are much lower than those in natural service.

Additionally, there is a distinct financial advantage to merchandising A.I.-sired heifers. A.I. makes identification easier and promotes the use of more accurate breeding and health records. By using A.I., farmers can better control the time when heifers calve.

When planning a mating, it is important to avoid genetic defects. A defect can be present when both of the mated animals are carriers for that particular disorder. When both animals carry the recessive trait, it will appear in approximately 25 percent of the matings. Some of the genetic defects are mulefoot, limber leg, and DUMPS (Deficiency of Uridine Monophosphate Synthase). Bull studs and breed organizations identify bulls which are carriers of these genetic defects. These carrier animals should not be used when selecting the future genetics of your herd. Some of these genetic defects will cause early embryonic death, abortions, or stillborn calves. Others will produce a live calf, however, these animals will never achieve the same profitability as their herdmates.

One of the major decisions with regard to the future calf population is the selection of their parents. This choice is made when calves are either kept as replacements or culled from the herd.

Calves that are kept for replacements should be the result of a well thought-out mating with the best bull for a particular cow. The offspring of this mating will hopefully be a heifer that will have greater genetic potential for milk production. To know what kind of offspring will be produced, an Estimated Breeding Value of the heifer can be calculated. This will give the expected mature production of a heifer compared to herdmates in a breed average herd. The example below illustrates the simplicity of this calculation. It is a matter of adding the PTA of the sire and the PTA of the dam.

Example

For milk	Heifer A	Heifer B
Sire (PTA)	Sire A +1,749	Sire B + 649
Dam (PTA)	Dam A + 351	Dam A + 351
	+2,100	+1,000

This example shows that if Dam A was bred to Sire B instead of Sire A, a loss of 1,100 pounds of milk per lactation would be sacrificed genetically in her average offspring. This clearly points out the importance of doing a thorough job when selecting bulls.

To obtain the maximum benefit of selection, calf losses must be very minimal. Calving interval, competency of management in raising calves and heifers, and the method used to breed virgin heifers are three of the most important factors determining the number of quality replacement heifers available. Examples of the number of replacements available in a 100-cow herd for two calving intervals, three levels of management, and three methods of breeding heifers are listed in

Table 1.

Table 1. Influence of calf and heifer management, calving interval, and method of breeding heifers on availability of replacements.

	12-mos calving interval			13.5-mos calving interval		
Potential calves/100 cows/year	**100**			**90**		
Management conditions	**Good**	**Avg.**	**Poor**	**Good**	**Avg.**	**Poor**
Percent calf loss due to sterility, abortions, stillbirths, and death between birth and age 23 months	14	32	50	14	32	50
Number of calves remaining	86	68	50	77	61	45
Heifers remaining and genetically superior heifers available if heifers are bred A.I.	43	34	25	38	30	22
Replacements lost if heifers are bred to a beef bull or genetically superior replacements lost if heifers are bred naturally to a dairy bull[1]	13	10	8	11	9	7
Remaining replacements	30	24	17	27	21	15

[1]About 30 percent of the replacements born are out of first-calf heifers.
Source: G. Heersche, Proceedings of National Dairy Cattle Reproduction Workshop, Louisville 1982.

The average herd cull rate is 25 to 30 percent of the cows each year, so a 100-cow herd requires 25 to 30 replacements per year. For the examples in Table 1, sufficient replacements are available to maintain herd size if all heifers are bred to dairy bulls except under the "poor management" situation. If heifers are bred to a beef bull, sufficient replacements are available only with a 12-month calving interval and good management of the calf and heifer raising program. A successful calf raising program will have lower death losses and will provide greater opportunity to cull animals with a lower genetic potential. The lower 10 percent of the calves should be culled to allow for the maximum genetic advancement. However, if calf mortality has been high, all the available calves may be needed for replacements. In this situation, the genetic gain would be limited because inferior animals would not be removed from the herd. Table 2 shows how many replacements are needed for varying herd sizes and cow culling rates.

Table 2. Number of replacement heifers required for various herd sizes and several cow culling rates.

	Probable cull rate/year (%)					
Herd size	**15**	**20**	**25**	**30**	**35**	**40**
30	5	6	8	9	11	12
40	6	8	10	12	14	16
50	8	10	13	15	18	20
60	9	12	15	18	21	24
70	11	14	18	21	25	28
80	12	16	20	24	28	32
90	14	18	23	27	32	36
100	15	20	25	30	35	40
125	19	25	31	38	44	50
150	23	30	38	45	53	60
200	30	40	50	60	70	80
300	45	60	75	90	105	120

Table 3. Effect of calving interval on herd replacements in a 100-cow herd.

Calving interval (mos)	Average calves born per year (100 cows)	Bred heifers available for herd replacements (per year)
12	100	38
13	92	35
14	84	32
15	76	29

Assumes 75 percent of female calves born will survive to freshen as first-calf heifers.
Source: Illinois-Iowa Dairy Guide -1980, University of Illinois.

Poor reproductive performance in a herd will adversely affect selection opportunities. The potential number of calves available will decline as the calving interval increases. It is important, therefore, to maintain a sound reproductive management program in your entire herd, Table 3.

Accurate records of maternal performance are essential aids in determining which progeny should be raised for replacements. Use of Dairy Herd Improvement records is encouraged, along with records of identification, health, and reproduction. A newborn calf should be properly

tagged and identified as soon as possible. The sire and dam should be known and recorded for each calf. The introduction of farm computers and computerized DHIA systems have enabled producers to keep more accurate and up to date records with less time compared to manual records systems.

Heifer artificial insemination

Table 4. Method of breeding heifers.

Breeding method	Farms (%)
A.I. only	59.5
A.I. once, then bull	11.2
A. I. twice, then bull	8.5
Bull only	20.7

Source: Penn State Data; Journal Dairy Science 70:896, 1987.

Artificial insemination of virgin heifers can contribute the most to genetic progress within a herd. Progeny from heifers (first lactation) account for nearly 32 percent of all births. Table 4 shows, through a survey done in Pennsylvania, that 59.5 percent use A.I. only. Despite the disadvantages, potential problems, and safety involved, 40.4 percent of the farms surveyed still had one or more bulls to lessen the inconvenience involved in breeding heifers. Genetic progress is slowed when animals are not bred A.I. Studies have shown that the use of genetically superior A.I. sires results in genetic progress rates three to four times the rate of herds using natural service bulls.

The problems with calf delivery in heifers can be minimized if a common sense approach is taken. Well grown heifers should be mated to proven calving ease sires. Most sire organizations offer a list of calving ease bulls. Some producers use a beef bull either through A.I. or natural service. This also causes calving disorders because the beef breeds are selecting for larger birth weights and larger frame size. It is important to remember that using a beef breed is no substitute for well grown heifers. In addition, a large portion of the calf crop potential is lost. One of the major reasons that more heifers are not bred artificially is inconvenience. This can be resolved with adequate restraint facilities. When remodeling or building any heifer facility, include restraint and handling facilities for animals of all ages. The genetic potential available from using A.I. on heifers is well worth the time to catch heifers in heat and the investment needed for facilities.

Culling

Herd improvement can be increased if animals are culled for genetic reasons. However, if animals are removed from the herd due to poor management, genetic improvement is severely limited. Table 5 relates calf mortality with the number of replacement heifers needed.

Table 5. Heifer calves needed for one herd replacement with varying mortality and culling rates.

Heifer calf mortality rate (%)	Heifer culling rate (%)				
	4	6	8	10	12
5	1.10	1.12	1.15	1.17	1.20
10	1.16	1.19	1.21	1.24	1.27
15	1.23	1.26	1.28	1.31	1.34
20	1.30	1.33	1.36	1.39	1.43
25	1.39	1.42	1.45	1.49	1.52

For example, with a 15-percent calf mortality rate and a 12-percent heifer culling rate, 1.34 calves must be started to provide one 24-month-old replacement heifer.
Source: Based on 1976 Dairy Update No. 22, R.D. Appleman, University of Minnesota.

Average culling rates range from 25 to 30 percent. If cull rates exceed 30 percent, all available heifers will be needed as replacements. Merely having sufficient numbers of heifers available for replacements is not satisfactory. In such situations, genetic advancement is limited because the genetically inferior heifers are not removed from the herd. Dairy farmers should breed heifers to

A.I. bulls with top production proofs and good calving ease ratings. This allows them to select which replacements will enter their herd and which ones will be sold to other farmers (needing additional heifers to maintain herd size).

Also, with plenty of genetically superior replacements available, some inferior cows could be culled that otherwise would have been tolerated.

In determining the number of herd replacements needed, it is necessary to consider the effect of age at first calving. For each month after 2 years, the herd requires an increase of 4.2 percent in the annual replacement rate (Table 6). By calving at the recommended age of 24 months, fewer replacements are needed.

Table 7 shows the availability of replacement heifers with relation to calf survival in a 100-cow herd. This is important to know if heifer merchandising or heifer culling is to be done.

Table 6. Effect of age at first calving on size of replacement herd.

Age at freshening (mos)	Change from 24 mos (%)
22	- 8.4
23	- 4.2
24	0
25	+ 4.2
26	+ 8.4
27	+12.6
28	+16.8
29	+21.0
30	+25.2

Each month after 24 months requires an increase of 4.2 percent (1.00/ 24 months = 4.2%).
For example, if 50 replacement calves and heifers are needed when freshening age is 24 months, then 58 replacements will be needed when the freshening age is 28 months (50 + (50 x 16.8%)).
Source: Raising Dairy Replacements, A1485, University of Wisconsin.

Table 7. Potential surplus heifers in a 100-cow herd with 20 heifers.

Heifers born[1]	Average[2] percent survival rate	No. heifers raised, birth to freshening	Replacement[3] rates of 15%	25%	35%
Calves saved from cows only					
45	90	40	25	15	5
45	80	36	21	11	1
45	75	34	19	9	1
Including calves from 20 freshening heifers[4]					
55	90	50	35	25	15
55	80	44	29	19	9
55	75	41	26	16	6

[1] In a 100-cow herd, about 90 calves are born per year, one-half are heifers.
[2] Average survival rate from birth to freshening.
[3] Extra heifers for voluntary culling, herd expansion, or sale.
[4] With 20 two-year-olds and 100 cows, total calf crop is 110 calves, one-half are heifers.
Source: Adapted from J. Hlubik and Penn State Dairy Science Extension Mimeo 88-21, Costs to Raise Dairy Heifers.

Calving Time

Precalving heifer-dry cow

Maternity pen with a cow and newborn calf.

The care and feeding of heifers or dry cows does affect their unborn calves. Size of the fetus and calving ease are determined by genetic factors, nutrition, age, and the size and condition of the cow or heifer at calving time. Dry cows should be fed separately from the rest of the herd and should be in good body condition. Calving problems can result when cows are thin or fat, heifers are undersized or oversized, or calving facilities are poor. The results include stillbirths, injured cows or calves, and postpartum reproductive complications.

Cows should be moved to a closed maternity pen or box stall a week or several days before their expected calving date. Cows and their newborns need protection from the other cows. Clean, dry maternity pens should be at least 12' x 12' in size. The stalls or pens should be well lighted and ventilated but free from drafts. It is best to clean the pens after each use and apply lime or other granular material to the floor before covering it with adequate amounts of dry bedding such as clean straw. A good nonslip base and adequate amounts of bedding can prevent injuries and udder trauma during calving. Wet sawdust, moldy hay, moldy, damp silage, or spoiled haylage should not be used for bedding. Many cases of infectious mastitis can be traced to contaminated bedding, especially green wood shavings and sawdust. Moldy hay and silage, and manure contaminated bedding contain organisms that can infect the uterus and udder. These organisms can also infect calves. During mild, dry weather, a well drained paddock or small pasture with shade can also serve as a good calving area.

Care at calving time

Approximately 2 to 5 percent of all calves are born dead (stillborn), many of which could have been saved if someone were present at birth to render proper assistance. Too often cows get assistance only after the cow or calf is in critical condition. The value of cows and calves makes it very profitable to observe the cows frequently prior to calving. Cows should also be attended to during calving. Monitoring the birth process ensures that cows and their unborn calves receive assistance if it is required. As shown in Table 8, calf mortality rates increase dramatically with the difficulty of birth. The average calf mortality in Pennsylvania is about 9 percent (Table 9).

Table 8. Calf mortality by difficulty of birth category.

	Calving percent in category		Calf mortality (%) within 48 hours	
Calving category	Heifers	Cows	Heifers	Cows
Unassisted	45	79	8	6
Easy pull	30	15	10	8
Hard pull	14	3	35	24
Jack needed	7	1	55	66
Veterinarian	4	1	48	65
Total	100	100	17	8

Source: North Carolina State University.

Table 9. Calf mortality on Pennsylvania dairy farms during 1984-85.

Calving category	
Average calves born dead, %	5.0
Average calves dead before 1 year of age, %	3.7
Total average calf mortality, %	8.7

Source: Penn State Data; Journal Dairy Science 70:896, 1987.

North Carolina University researchers estimate that each difficult dairy birth costs $40 to $75 due to increased calf and cow mortality, reduced milk production, rebreeding problems, and the cost of additional labor required in delivery. Proper management of dry cows and heifers, and using sires with good calving ease ratings can help reduce these losses.

Cows should be checked every 2 hours after the onset of labor to monitor progress. Some cows show noticeable signs of calving and will give birth in a few hours, while others may not calve until the next day or may calve earlier than expected. Signs of discomfort usually appear when the cervix has begun to dilate. Arching of the back is apparent at this time. Definite straining does not occur until the chorioallantois (outer placental sac) approaches the vulva. Pressure from the fetal fluids moisten this membrane and help to complete the dilation process. Contractions become more intense as the fluid sac ruptures. Then there is a temporary weakening of abdominal contractions until the ammion (inner fluid sac) enters the vulva. Once this membrane ruptures, regular contractions and straining begin to increase in frequency and duration until parturition.

Cows should deliver 30 minutes to 1 hour after the fetus appears in the pelvic inlet, and heifers should deliver within 2 hours. If the cow or heifer does not progress accordingly, she should be examined to check for abnormal fetal position or other problems. Cervical dilation must occur before assistance is provided.

After calving

The cow should get up and assist the calf within 30 minutes after giving birth. If she does not getup soon after birth seek advice and assistance from a veterinarian. The cow should pass manure and drink water within this time. A normal cow will be alert, have a normal body temperature, and be willing to eat and drink within an hour or two after calving. The cow should be allowed to lick the calf after delivery. Licking stimulates the calf's blood circulation and may increase absorption of immunoglobulins in colostrum. Figure 1 shows calf-care management tips.

Figure 1. Calf care tips.

1) After the calf is born, its nostrils should be checked for mucus and cleared to facilitate breathing.

2) The calf's navel should be dipped with a 2-percent tincture of iodine solution or some other suitable disinfectant to prevent any infection at this time. Since these umbilical vessels connect directly to various organs in the body, infection at this site can be very harmful to the newborn. This must be done shortly after birth and before the navel is dry.

3) It is critical that the calf receive colostrum as soon as possible after birth, preferably within 1 hour. Most healthy calves are on their feet within 30 minutes and nursing within an hour.

4) Before colostrum is milked from the cow and then fed to the calf, or the calf is allowed to nurse the mother, the cow's teats and udder should be washed and sanitized. The sanitizing solution should contain 200 parts per million of chlorine, or another approved sanitizing solution, to decrease the amount of bacteria transferred to the calf through the digestive tract.

5) In extremely cold weather and cold housing conditions, it may be necessary to use blankets or a heat lamp to keep the calf warm until it is dry.

All calves should receive colostrum soon after birth. Research shows that 25 percent of the calves left alone after birth do not nurse within 8 hours and between 10 to 25 percent do not get adequate amounts of colostrum. Calves should receive 4 to 6 quarts (8 to 12 pounds) of undiluted colostrum per day for the first 3 days. Total daily intake of colostrum should not exceed 10 percent of the calf's bodyweight. Because the newborn calf's resistance to

Dairy farmer feeding colostrum to calf.

diseases is greatly affected by the timing of the colostrum intake and its quality, colostrum should be fed within 1 hour of life. This will give the newborn calf a higher level of antibodies in the blood and a better chance of survival until weaning age.

Management after calving

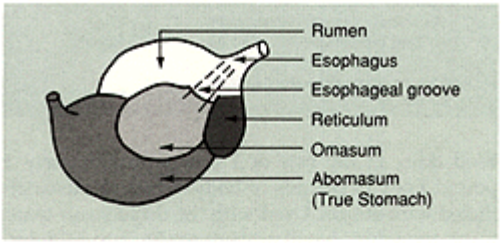
Each calf should be positively identified before it is removed from its dam. This is required if calves are to be registered and it is essential for good breeding program records. A neck strap or chain with a number or a metal or plastic ear tag can be used for identification. The ear tag or registration numbers of calves, sires, dams, and the birth dates should be entered in a permanent record book.

Permanent identification methods include photographs, sketches, tattoos, and freeze branding. The Holstein, Guernsey, and Ayrshire breeds require a photograph or sketch for registration. The other breeds, Jersey, Brown Swiss, and Milking Shorthorn, require tattoo markings inside the ear. The Ayrshire breed accepts both types of identification. The tattoo or freeze brand also provides permanent identification of dairy heifers of any breed for farm use.

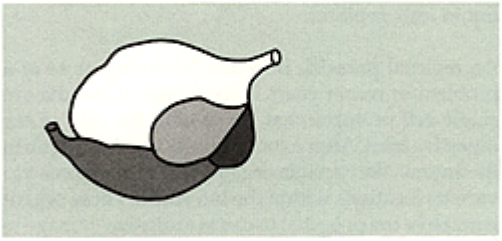
Feeding

Feeding young dairy calves is critical to raising replacements. During the first 2 months of life, dairy calves function primarily as a monogastric (simple-stomached animal). After about 2 months of age, they begin to function more like a full-fledged ruminant. During these first few weeks of life the rumen, reticulum, and omasum of the calf are relatively small in size and are quite inactive compared to the abomasum or "true stomach." For this reason, young dairy calves have special requirements for protein, energy, and vitamins.

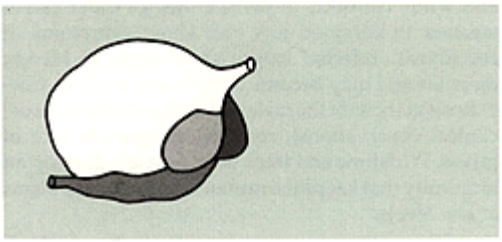
Sketch of a calf stomach versus a cow stomach: proportion of rumen versus abomasum.



First week



Three to four months



Maturity

Newborn calves cannot utilize vegetable protein before their rumen is functional because they have limited digestive enzymes. Therefore, following colostrum feeding, whole milk, fermented colostrum, or milk replacers containing milk protein or specially processed soy concentrates should be used. By the time calves are weaned, they can utilize most vegetable proteins very efficiently.

Young calves cannot digest starch or some sugars such as sucrose (table sugar), because certain digestive enzymes are not present. Calves are limited by the type of fat they can utilize but can digest saturated fats such as milk fat, coconut fat, lard, and tallow. They are less able to digest unsaturated fats such as corn oil and soybean oil.

Sample milk replacer.

Guaranteed analysis

Crude Protein	(Min.) 20.0%
Crude Fat	(Min.) 15.0%
Crude Fiber	(Max.) 0.15%
Vitamin A	Not less than 15,000 IU/LB.
Vitamin D3	Not less than 3,000 IU/LB.
Vitamin E	Not less than 10 IU/LB.

Ingredients

Dried whey, dried milk protein, dried skimmed milk, dried whey product, animal and vegetable fat (preserved with BHA, emulsified with polyoxy-ethylene glycol (400) mono and dioleates), lecithin, vitamin A supplement, vitamin D3 supplement, vitamin E supplement, vitamin B12 supplement, riboflavin supplement, thiamine mononitrate, choline chloride, niacin supplement, folic acid, calcium pantothenate, ascorbic acid, DL-methionine, dicalcium phosphate, calcium carbonate, sodium selenite, ferrous sulfate, copper sulfate, cobalt sulfate, zinc sulfate, manganese sulfate, magnesium oxide, ethylenediamine dihydriodide, silicon dioxide, artificial flavor.

Major sources of energy for newborn calves should be derived primarily from lactose (milk sugars) and milk fat. It is important that calves have adequate energy because the metabolic rate (rate at which energy is used) is greatest during the first two weeks of life. Within two weeks, the calves develop the ability to digest starch. Shortly thereafter, they develop the ability to digest complex carbohydrates. The rate of rumen development dictates how rapidly young calves can digest complex starches and carbohydrates.

Vitamins required by calves include the water soluble B vitamins (thiamine, riboflavin, niacin, choline, biotin, pyriodoxine, folic acid, B12, and pantothenic acid) found in colostrum, fermented colostrum, whole milk, or

good milk replacers. Rumen microorganisms are able to produce these when the calves' rumen begins to function. Calves require the fat soluble vitamins A, D, and E; they are in short supply at birth but are found in colostrum. Whole milk, fermented colostrum, or milk replacers plus some sunshine will normally supply an adequate amount of these vitamins to young growing calves.

Dairy calves require the same minerals for growth as do other animals. Milk, fermented colostrum, and milk replacers generally supply adequate amounts of minerals necessary during the first few weeks of life. A significant point to remember is the mineral content of colostrum and milk may be low or deficient depending on the mineral status of the lactating animal's diet. Selenium may be reduced in milk because of a dietary deficiency, therefore, mineral supplements are needed for young calves.

Water makes up the majority of a young animal's bodyweight. It is the media in which all chemical reactions in the body take place. A plentiful supply of water is needed for normal rumen fermentation and metabolism, digestion, and absorption of nutrients, as well as excretion of waste products. Water quality and it's availability to all animals are also equally important. Limiting good quality water to dairy calves and heifers may limit growth and also adversely affect the health of these animals. Table 10 shows the expected intakes of water for calves and heifers at various ages. Several factors which can influence intake of water are dry matter intake, water content of the diet, environmental temperature, and mineral-salt intake.

Table 10. Estimated total water intake of heifers.

	Gallons per day	
Bodyweight (lb)	40°F	80°F
100	0.7	1.1
200	2.0	3.3
400	3.7	6.1
600	5.0	8.4
800	6.3	10.6
1,000	7.3	12.3
1,200	8.0	13.4

Source: Adapted from Journal of Animal Science 15:722, 1956.

To better understand the nutrient needs of young calves it is necessary to know their nutrient requirements (Table 11). The requirements for large and small breed calves are presented and within each section are the animal's weight, expected gain, dry matter intake, energy for growth, and protein requirements.

Table 11. Daily nutrient requirements of young calves.[1]

Live weight (lb)	Gain (lb)	Dry matter intake (lb)	Energy			Protein
			NEM[2] (Mcal)	NEG[2] (Mcal)	TDN (lb)	CP (lb)
Growing large-breed calves fed only milk or milk replacer						
90	0.6	1.08	1.39	0.37	1.32	0.24
110	0.8	1.32	1.61	0.52	1.70	0.29
Growing large-breed calves fed milk plus starter mix						
100	1.00	2.00	1.50	0.64	2.24	0.44
150	1.80	3.50	2.04	1.29	3.92	0.77
Growing small-breed calves fed only milk or milk replacer						
60	0.40	0.80	1.02	0.23	1.03	0.18
75	0.50	1.20	1.21	0.36	1.55	0.26
Growing small-breed calves fed milk plus starter mix						
100	1.1	2.00	1.50	0.70	2.24	0.44
150	1.3	3.50	2.04	0.92	3.92	0.77

[1]1989 NRC (Revised edition)
[2]NEM-net energy, maintenance; NEG-net energy, gain

Health

Several management, environmental, and physiologic factors can affect young calves making their life more difficult. The first place where good management can contribute to good health care is at calving. A Pennsylvania survey indicated management factors do affect calf mortality (Table 12). The practice of washing udders after calving and before calves nurse or colostrum is milked, as well as the practice of using frozen colostrum and assisting the calf with its first feeding, influence calf mortality. It is apparent that proper management, feeding, and sanitation help ensure that baby calves have enough immunoglobulins to combat disease causing organisms.

Table 12. Management factors correlated with calf mortality on Pennsylvania dairy farms.

	Percentage of calf mortality			
	<5	5-10	10-20	>20
	Number of farms			
	111	131	86	21
	Percentage practicing the technique			
Wash dams udders after calving	62.6	56.6	55.3	47.6
Use frozen colostrum	29.8	25.2	23.3	16.7
Assist with colostrum feeding and use bucket or bottle	59.0	55.1	60.5	47.8

Source: Adapted from Journal Dairy Science 70:896 and 70:1952, 1987.

Calf scours during the first month of life are the most common cause of calf sickness and death. Several pathogens, including E. coli, rotavirus, coronavirus, salmonella, coccidia, and cryptosporidia, cause calf diarrhea. These agents can be present year-round, but under conditions of crowding, cold stress, inadequate nutrition, and less frequent manure removal, calf scours can become a herd problem. The best cure for scours is prevention. Calves should be fed correctly and housed in a clean environment. Calves with scours should be treated immediately with a homemade or commercial electrolyte solution to keep them from dehydrating (see Figure 2). Milk should not be fed when scours occur because milk may encourage growth of bacteria in the intestine and further complicate the scours. Milk or milk replacer should be replaced with an electrolyte solution for no more than 24 to 48 hours.

Figure 2. Sample electrolyte solution formula.

1 teaspoon low sodium salt
2 teaspoons baking soda
1 3/4 ounces (1 packet) fruit pectin
1 can beef consume

Add warm water to make 2 quarts

Feed daily at the rate of 1 pint (approximately 1 pound) per 10 pounds of bodyweight to calves afflicted with scours. Used with the usual scour treatment, the solution will prevent or alleviate dehydration. Feed three to four times daily during a 1-day or 2-day period as a substitute for the usual milk or liquid milk replacer.

An internal parasitic infection becoming more of a problem in recent years is coccidiosis. Coccidia are single cell protozoa that live within the cells of the digestive tract. After a coccidia infection has begun in the animal, the coccidia organisms can also spread to various locations within the intestines. These organisms have the potential to cause extensive damage to the intestinal tract of young animals. Calves often become infected when between 3 and 6 weeks of age and while confined in pens, although older calves weaned in confined lots also show

symptoms of coccidiosis. Infected calves show signs of bloody diarrhea and may become dehydrated and die. Coccidiosis at the subclinical level (undetectable by usual clinical observations), reduces the growth rate of calves. With time and treatment, animals develop an immunity that keeps the numbers of these organisms at low levels.

As calves get older they are still subject to diseases (Table 13). At 6 to 8 weeks of age, respiratory disorders seem to be the largest problem and are often associated with high population density and inadequate ventilation. In closed-up calf and maternity barns, germs, toxic gases, and moisture all accumulate. Respiratory disorders are accentuated with high relative humidity at low environmental temperatures.

Table 13. Major health management problems of preweaned calves in Pennsylvania.

Health	Problem	(%)
Problems No. 1	Scours	39.2
	Respiratory	9.8
	Coccidiosis	2.7
No problems		45.3

Source: Penn State Data; Journal Dairy Science 70:896, 1987.

Respiratory diseases, such as pneumonia, tend to be worse during winter and early spring. Under Pennsylvania conditions hot, dry weather rarely produces respiratory problems; but cold, wet weather does. Research has shown a high correlation between respiratory disease and calfhood morbidity, growth rate, as well as reproductive efficiency, and average age at first calving.

The immediate causes of pneumonia are bacteria and viruses, but of greater significance are the predisposing factors of dampness, drafts, chilling, and toxic gases. The accumulation of gases in confinement housing irritate the respiratory tract. Ammonia is one of the major irritants. When the smell of ammonia is noticeable, a high probability exists for damage to the lung defense mechanisms of these confined animals.

Calf mortality also tends to increase during cold, wet, and windy winter weather. This occurs because maintenance energy requirements are much higher in a cold environment; antibody absorption from colostrum is less efficient during winter; and lice, mange mites, and ringworm fungi prosper in a confined damp environment and under conditions of poor nutrition. Therefore, observation of young calves on a regular basis is critical so their diets may be altered, if necessary, to sustain energy levels during these types of conditions.

Health management for dairy calves during cold weather means more intense management procedures. Some tips to optimize the care of young calves during winter conditions are to pay closer attention to dry cow care, calving-time care, colostrum intake, feed quality such as a high-fat milk replacer (greater than 10 percent fat), environment, and checking calves at least twice each day. Keeping on top of health care management during this stressful period will increase the chances of producing healthy calves.

Two important health management practices that can be implemented during the preweaning period that will help alleviate some stress at weaning are dehorning and extra teat removal. Since horns and extra teats are of no value to dairy animals, they must be removed to help prevent injury, to improve their opportunities for continuing health, and to improve their appearance.

The ideal time to dehorn calves is between 2 and 3 weeks of age or as soon as the horn button can be felt. Calves need to be restrained to prevent the calves or the operator from being hurt. Heavy-duty electric dehorners are one of the most humane, effective, and safest tools to use. When electrical dehorners are used correctly, a continuous copper-colored ring will be displayed around the base of the horns. The surface of the iron should be cherry red before it is touched to the horns. This results in a very minimum of pain to the calves and provides very rapid destruction of the horn buttons. A second application of the iron may be necessary if a spot has been missed.

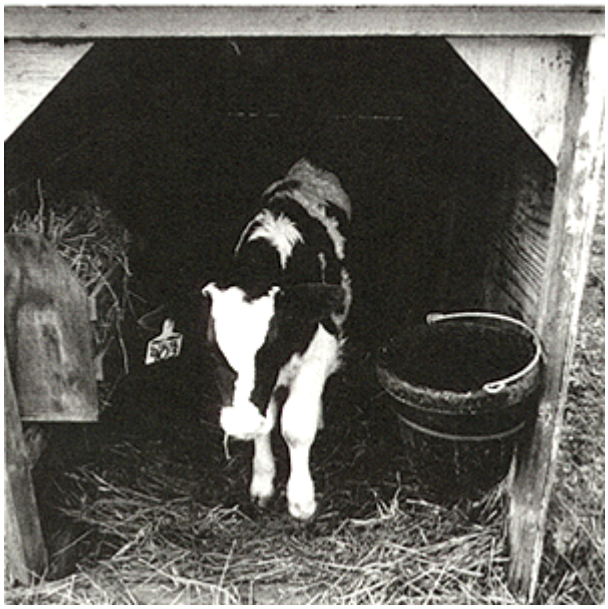
Dehorning.

When calves are restrained for dehorning, they are easily examined for extra teats. Examination and removal are easier when the calves are lying on the floor. The four regular teats should be symmetrically arranged with the two rear teats set slightly closer together. Extra teats are usually smaller in size and located close to the main teats. They can be snipped off with a pair of scissors. The cut should be made lengthwise with the body and painted with iodine or another topical antiseptic. If you are not absolutely sure which teats are the extras, do not remove any of them. Allow your veterinarian to make the decision.

Housing

Housing often is the weakest link in a calf and heifer operation. While a good calf raising facility must minimize environmental stress on the calves, it must also minimize environmental stress on the part of the operator. The latter encourages the operator to maintain a higher level of calf care. The calf raising facility should be comfortable for the calves and convenient for the operator. General housing requirements for preweaned calves are individual housing for each calf, isolation from older animals, well-ventilated but draft free quarters, dry pens with ample bedding, and a suitable location to encourage regular observation. These factors will help ensure that calves will start off strong and healthy.

Calf hutch.

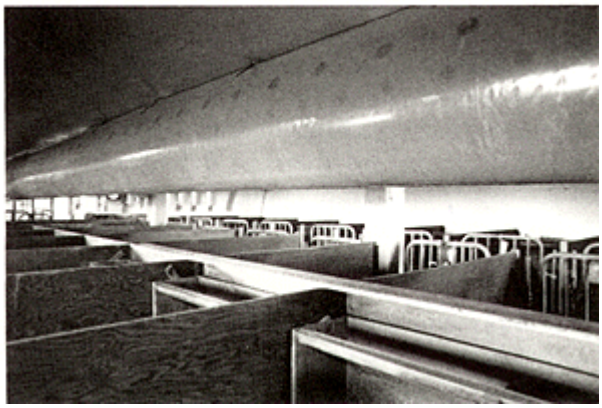


A proven housing system for dairy calves in all types of weather is the portable outside hutch located in a well-drained and protected area with the open-front facing south. A 4' x 8' individual hutch or similar sized solar-type calf hutch is recommended. Only one calf should be placed in each hutch. Use the equivalent of at least a bale of straw in each hutch. Clean and disinfect hutches or let them stand upright in the sun for a period of time after each calf has been removed. Move the

hutch to a new location and place fresh fill and bedding under the hutch prior to its reuse.

An alternative to outside portable hutches is to use a new or existing cold, but well ventilated, barn with pens at floor level. Pens should be 4' by 8' with three solid sides and a slatted opening on the feeding end. Pens should be removable to allow for their cleaning, disinfection, and the cleaning of the floor between pens. If smaller pens are used, it is necessary to clean the pen during the grow-out period (month 0 to 2) to prevent buildup of manure and associated gases and odors. Portable pens can be used in more than one building or area of a building as a way to break disease cycles.

Ventilation used in a barn with calf pens at floor level.



Calf-hutch type structure in a building with three of its sides enclosed.

Another popular housing method is to incorporate calf-hutch type structures in a building with three sides enclosed. This method can be modified to allow calves to have outside runs. This type of housing allows the operator to be under cover when feeding and working with the calves.

Table 14 lists the varied types of calf housing as well as the large number of calf hutches currently used by Pennsylva nia dairy farmers. Forty-four percent of farmers use calf hutches for all or part of the year. The number of farmers using calf hutches is almost equal to those keeping calves in dairy barns with older animals.

Table 14. Types of calf housing in current use.

Housing type[1]	(%)
Calf hutches	44.7
Year round use	33.4
Summer only	9.7
Winter only	1.6
Elevated stalls (wood or metal) in dairy barns	4.5
Elevated stalls (wood or metal) not in dairy barns	4.8
Individual pens in dairy barns	12.4
Individual pens not in dairy barns	13.7
Tied (not penned)	28.2
Group pens	14.3

[1]Includes combinations when more than one type of system is used on a farm; therefore, percents do not equal 100.
Source: Penn State Data; Journal Dairy Science 70:1952, 1987.

Effectiveness of ventilation in baby calf and weaned calf housing influences calf mortality (Table 15). A good ventilation system should allow adequate air movement, eliminate the accumulation of gases such as ammonia, and keep humidity levels at a minimum. For these reasons, natural ventilation is recommended for baby calves. Isolated, heated, mechanically ventilated calf barns are not recommended. In addition to their building and operating costs, they tend to predispose calves to increased sickness.

Table 15. Factors influenced by ventilation effectiveness in calf housing areas.

	Vent. in preweaned calf housing				Vent. in weaned calf housing			
Item	VP	P	Ade.	Sup.[1]	VP	P	Ade.	Sup.[1]
Number of farms	12	28	149	58	10	33	169	36
Calf mortality birth to 1 year of age	7.1	4.3	4.3	3.7	5.6	7.1	4.1	2.1
Average age at first calving, (mos)	28.1	28.2	26.6	25.6	27.7	27.7	26.6	25.7

[1]VP - very poor; P - poor; Ade.- adequate; Sup.- superior
Source: Adapted from Journal Dairy Science 70:896 and 70:1952, 1987.

Table 16. Ventilation components on farms.

	Baby calves	Weaned calves
Number of farms	329	329
	(%)	(%)
Mechanical ventilation	48.3	42.2
Natural ventilation	51.7	57.8
Fan	43.2	39.5
Thermostat	31.6	26.4
Thermometer	9.7	8.9
Supplemental heat	3.3	-
Air inlets	25.8	28.6
Sidewall opening of 25 percent	19.5	26.4
Ridge opening	4.9	9.7

Source: Penn State Data; Journal Dairy Science 70:1952, 1987.

Through a survey done in Pennsylvania, an effort was made to describe the ventilation systems on farms by noting the components required for ventilation (Table 16). The number of farms that reported mechanical ventilation systems was greater than those that reported having a fan. Fewer farmers reported having the basic components of a natural ventilation system than reported having a natural ventilation system. Many farms had no planned or functioning ventilation system but still referred to it as a natural ventilation system.

Weaning dairy calves

Weaning time is a critical and stressful period in the life of dairy calves. Management practices and changes made at the time of weaning can have major impacts on their immediate and possibly long-term future. Situations do exist where weaning day consists of a complete change from some milk, grain, and hay to a ration of all grain, hay, and possibly silage; a move in location; progressing from being pampered to fending for themselves, and even fighting to get to the feed bunk. Add to this being dehorned, vaccinated, having extra teats removed, and getting one or more new ear tags; it is easy to see that problems could develop. Calves often lose weight for several days following weaning.

Small-group housing facility.

Figure 3. Housing management needs.

Clean, dry, and draft free where the animal resides.

Animals between ages 0-3 months should be isolated from milking herd and the older replacement animals.

Convenient location and arrangement to encourage quality care and observation.

Require as little manual labor as possible.

Always provide adequate ventilation for calves.

Management situations often make it necessary to implement many of these changes within a short period of time. However, the following practices can help reduce the stress placed on these calves before, during, and after this weaning period.

A small-group housing facility for three to five calves should be used for at least a month immediately after the postweaning period. This postweaning area should be similar in housing type and environment compared to the grow-out facility, and located in a similar area. This allows for regular feeding and observation of the 2-to-3-month-old group while feeding the younger calves. Large super hutches located adjacent to a calf hutch area, or an open front shed with an outside yard adjacent to the calf hutch area, can be used in conjunction with small hutches. Buildings with inside individual pens should also provide for a group pen at least 12' x 12' for three to five calves. Pens should have a continuous

supply of frost-free water. At least 18 inches of bunk space should be provided for each calf, with stanchions or dividers to define the eating positions. See Figure 3 for other good housing management needs.

Delay moving calves until 2 to 4 weeks after weaning. Calves will be under less stress at this time and suckling problems are less likely to occur. Calves should not be moved from a warm to a cold environment or from a cold to a warm environment at weaning. Other management procedures to avoid stressful conditions at weaning are making sure that calves are drinking 8 to 10 quarts of water each day. Feed the same type of forage and grain before weaning as calves will get after weaning, and make sure they are eating adequate amounts of these before weaning.

Calves should be eating at least 1.5 pounds of calf starter per day before they are weaned. Those who are slow in adapting to grain could be kept on liquid feed for a longer time. Also make sure that calves are eating some forage so their systems are adapted to dry forages. Because forage should be offered at 7 to 10 days of age, most calves will be eating enough by weaning time. Water is important to increase intakes of dry grain and forage, and these are important to increase the development of the rumen.

An optimum situation is weaning three to five calves of similar ages, moving them to a location of similar environment with adequate feed bunk space and easily accessible water, maintaining the same forages and grains as were fed before weaning, and invoking little if any other change in management practices during that time. The best situation does not always exist, however, the closer it is achieved, the less stress the calves will undergo.

Observation of recently moved and weaned calves should be done frequently during the first few days after weaning. It is essential each calf be eating feed and drinking water. Some calves that are shy and easily pushed out of the way may need some extra care to get them through this critical period.

Weaning Through Six Months of Age

Feeding

When weaning time arrives and the liquid feed portion of the young calves' diet is reduced, it is necessary to provide them with adequate substitutes. Those substitutes should be a good quality free choice grain mixture and an ample supply of high quality forage. A fresh, abundant, and clean supply of water also must be available before, during, and after weaning because inadequate water will reduce the animals' grain and forage consumption. It is essential that calves and older heifers are maintained on a high plane of nutrition so that growth will continue at a normal rate.

Calves are able to function as full-fledged ruminants after 4 and 6 months of age. Developing a fully functional rumen is an important part of early calf nutrition. A developed rumen allows calves to fully digest and utilize forages and dry grains, and to be fed a lower cost ration than was previously possible. This creates the need to begin grain and forage feeding very early.

Heifer nutrition is all too often neglected between weaning and 6 months of age. During this time period, calves are in a transition from high quality feeds used before weaning, to forages and grains that are of a lesser quality, especially in terms of protein (Table 17). High-quality forages (alfalfa hay or other legume/grass hays) and sufficient amounts of a grain mixture need to be offered to young calves. A maximum of 4 to 6 pounds of grain per head per day should be offered to young heifers up to age 6 months. This grain mixture should contain 16 percent crude protein in most situations. Immediately after weaning, young heifers consume a very small amount of forage dry matter in comparison to the amount of grain mixture consumed.

Table 17. Daily nutrient requirements of young dairy calves.[1]

Live weight (lb)	Gain (lb)	Dry matter intake (lb)	Energy			Protein	
			NEM[2] (Mcal)	NEG[2] (Mcal)	TDN (lb)	UIP[3] (lb)	CP (lb)
Large-breed growing females							
200	1.30	5.43	2.53	1.16	3.81	0.71	0.87
200	1.50	5.80	2.53	1.35	4.07	0.77	0.93
200	1.70	6.17	2.53	1.54	4.33	0.83	0.99
300	1.30	7.15	3.43	1.36	4.93	0.64	1.14
300	1.50	7.60	3.43	1.59	5.24	0.69	1.22
300	1.70	8.06	3.43	1.81	5.56	0.74	1.29
400	1.30	8.90	4.25	1.55	6.02	0.58	1.39
400	1.50	9.44	4.25	1.80	6.38	0.62	1.50
400	1.70	9.98	4.25	2.06	6.75	0.66	1.60
Small-breed growing females							
200	0.90	4.99	2.53	0.89	3.47	0.57	0.80
200	1.10	5.42	2.53	1.11	3.76	0.62	0.87
200	1.30	5.84	2.53	1.32	4.06	0.67	0.93
300	0.90	6.79	3.43	1.07	4.59	0.51	1.09
300	1.10	7.33	3.43	1.32	4.95	0.55	1.17
300	1.30	7.87	3.43	1.58	5.32	0.60	1.26
400	0.90	8.63	4.25	1.22	5.68	0.46	1.14
400	1.10	9.29	4.25	1.52	6.12	0.50	1.24
400	1.30	9.97	4.25	1.82	6.56	0.53	1.34

[1]1989 NRC (Revised edition)
[2]NEM-net energy, maintenance; NEG-net energy, gain
[3]UIP-undegradable intake protein

Carefully monitor forage quality during the period when heifer calves are age 2 to 6 months. Fine stemmed, mold-free hay should be fed. A good quality second or third cutting legume grass

mixture hay is preferred. Poor quality, stemmy, or moldy hay reduces forage intake and holds back growth. As animals get older and larger, their forage intake increases. By age 4 to 6 months, it is important that heifers are eating palatable and high quality forage.

Pasture is not recommended for very young calves. However, it can be used for part of the feed for calves that are between 4 and 6 months of age. Careful monitoring of the pasture and ample grain supplementation is necessary. It is beneficial to keep a supply of free-choice hay on hand in an area where calves may seek shelter on hot days or when flies become a problem. Regardless of the type of forage fed, young heifers need a supplemental feeding of grain. The amount of grain fed will depend upon the age of the animals and on the quality of forage being fed.

Total mixed rations can also be fed to heifers after 2 months of age. Feeding complete rations encourages heifers to consume several small meals during the day and leads to better feed digestion and utilization. These feed rations need to be carefully balanced and they normally need to have mainly dry feed components. The advantages of total mixed rations for these heifers are that all the needed ingredients are in the desired proportions, time and labor are reduced, and competition among animals is minimized.

In addition to the quality and amounts of forage and grain being fed at this time, it is also essential to know these calves' nutrient requirements (Table 17, above). Within each weight classification for these growing animals, the requirements are listed for three rates of gain to allow for variable growth rates under different environmental and economic situations. Table 18 con tains the recommended nutrient content of diets for growing heifers, and can serve as a guide when balancing feed programs for growing heifers.

Table 18. Recommended nutrient content of diets for young dairy heifers.[1,2]

	3-6 mos
Energy	
NEM, Mcal/lb	0.77
NEG, Mcal/lb	0.49
TDN, % of DM	69
Protein equivalent	
Crude protein, %	16
UIP, %	8.2
Fiber content, minimum	
Crude fiber, %	13
Acid detergent fiber, %	16
Neutral detergent fiber, %	23
Minerals	
Calcium, %	0.52
Phosphorus, %	0.31
Magnesium, %	0.16
Potassium, %	0.65
Sulfur, %	0.16
Sodium, %	0.10
Chlorine, %	0.20
Iron, ppm	50
Copper, ppm	10
Manganese, ppm	40
Zinc, ppm	40
Cobalt, ppm	0.10
Iodine, ppm	0.25
Selenium, ppm	0.30
Vitamins	
A, IU/lb	1,000
D, IU/lb	140
E, IU/lb	11

[1]1989 NRC (Revised edition).
[2]The approximate weight for growing heifers at 3 to 6 months is 331 pounds; the approximate average daily gain is 1.543 pounds per day.

Health

Many vaccines are available for Pennsylvania dairy farm replacement animals. Some of the most commonly used vaccines are for brucellosis, IBR (infectious bovine rhinotracheitis), PI3 (parainflu enza-3), Roto-corona, and colibacillosis. Some other available vaccines protect against pasturella, pinkeye, haemophilus, leptospirosis, vibriosis, and clostridia. The specific needs of each farm should be discussed with the herd veterinarian.

All heifer calves should be vaccinated for brucellosis when they are 4 to 8 months of age. It is also a good idea to vaccinate all replacement heifers against IBR, PI3, BVD (bovine virus diarrhea), and BRSV (bovine respiratory syncitial virus). Six to 8 months of age is a good time to do this because maternal immunity has diminished by this age. In herds with widespread respiratory infection in young calves, a nasal vaccine to protect against IBR-P13 may be given to calves as early as 2 weeks of age.

Internal and external parasites can be serious problems affecting the growth and performance of dairy heifers at any age. The control of internal parasites in young calves requires careful attention to clean housing and management practices. Young calves should be housed individually to eliminate contact with infested animals or manure until at least a week after weaning. Calf facilities should be kept free of manure buildup. Most herds require a routine treatment program for young calves from weaning to 8 months of age. Serious internal parasite problems are most likely to occur during the animals' first season on pasture. Young animals have little or no resistance to digestive tract parasites. Parasite eggs overwinter on pastures in Pennsylvania. These eggs hatch into larvae in the spring and are ingested by calves and heifers. Heifers on pasture can be heavily infested with parasites by early to mid-summer. Parasitized heifers grow more slowly, have lower feed efficiency, may develop diarrhea, and become anemic. Strategic worming at 3 and 6 weeks after turnout on pasture, and in the fall after confinement again, will greatly reduce the degree of internal parasitism.

Post-weaning housing.

External parasites of concern to dairy farmers in Pennsylvania are lice, mange mites, and flies. These can all reduce growth and performance of calves and heifers. The spread of all parasites should be limited by preventing direct contact between age groups of heifers and by cleaning all pens thoroughly before putting a new group of animals in a pen. Sanitation and good management are just as important as drugs in a calf and heifer parasite control program.

Housing

Once weaned calves have adjusted to their group pen and are growing, they can be moved into the first stage of a multi-stage calf grow-out facility such as a gated free stall facility, a counter slope facility, a

gated bedded pack facility, or a combination of these. This move might be made when the calves are as young as 4 months or as old as 6 months. They may be placed in groups of 10 to 12 with age and size spreads no more than 2 months or 100 pounds within each group. Allow about 25 square feet per calf, 18 inches of feed space, and a continuous supply of water. If calves are located in a multi-age facility, their contact with older animals should be minimized by use of a solid partition. These requirements are best met by a series of free stall areas, bedded packs, or pens along a feed bunk.

Figure 4 summarizes important features of a housing facility for young stock from age 4 months to freshening. Table 19 lists the housing requirements for calves from birth to weaning. The listing emphasizes the maximum number of animals as well as weight and age of calves and heifers that are recommended per group.

Figure 4. Housing management.

Group by age and size for three to five animals per group.

Ease of movement of animals from group to group.

Ease of observation.

Feeding by age groups as necessary.

Restraint facilities for treatment and breeding.

Convenient manure removal and access to bedding supplies as necessary.

Continually available frost proof water.

Good natural ventilation.

Table 19. Calf and heifer housing requirements.

Group[1]	Age	Maximum animals per group	Maximum age spread in group	Maximum weight variation in group	Minimum pen or pack area per animal	Minimum feed bunk length per animal[2]	Suggested free stall size width x length	Water	Restraint facilities
1	0 to 2 months	1			24 to 32 square feet	Individual grain pail Hay rack	Not recommended	Individual pail	
2	2 to 4 months	3 to 5	3 weeks		30 square feet	18 inches with dividers	Not recommended	Continuously available frost proof water	Stanchion
3	4 to 6 months	6 to 12	2 months	75 pounds	30 square feet	15 inches	27 x 48 inches		Self-closing fence-line or chute and stanchion or headgate
4	6 to 9 months	10 to 20	3 months	150 pounds	30 square feet	15 inches	30 x 54 inches		
5	9 to 12 months	10 to 20	3 months	200 pounds	30 square feet	18 inches	34 x 60 inches		
6	12 to 18 months	10 to 20	6 months	300 pounds	40 square feet	20 inches	38 x 72 inches		
7	18 months to calving	10 to 20	6 months	300 pounds	40 square feet	22 inches	42 x 84 inches		

[1]Groups 4 to 7 may be combined in one form or another when the total number of heifers is small. When selecting which groups to combine, consider feeding requirements, management needs, and size or age of animals.
[2]Feed bunk space per animal may be reduced approximately 20 percent in groups over 6 months of age if total mixed rations are fed.

Proper ventilation, especially control of humidity, ammonia, and other odors is recommended for animal comfort and health. High relative humidities have been associated with poor performance and high incidences of respiratory diseases in confined calves.

Feeding

Most forages, with the exception of silage, can be offered to heifers on a free-choice basis without causing an overeating problem. For this reason many dairy farmers keep forages available for their heifers at all times. Hay is most often available, while silage must be replenished at least once per day to avoid spoilage and reduced intake. The inconvenience associated with daily silage feeding can be reduced with a bunker silo equipped with a moveable electric fence or self feeder. With corn silage, anhydrous ammonia can be added at the time of silo filling to reduce the mold growth and increase the bunk life of this feed. Anhydrous ammonia treated corn silage can be fed on an every-other-day basis with less concern about the silage heating or spoiling.

Older heifers on pasture.

Pasture also makes an excellent forage for heifers when an adequate amount is available. A large percentage of Pennsylvania farmers use pasture for heifers during all or part of the year (Table 20). In the hot dry parts of summer, supplemental forages must be fed to provide adequate amounts of dry matter. Forage intake for heifers should be 2.0 to 2.2 pounds of dry matter per 100 pounds of bodyweight.

Table 20. Pasture usage and management.

Pasture usage[1]	(%)
Use pastures for heifers	
Summer only	62.5
Year round	23.8
Use supplemental feed while on pasture	
Forage	17.1
Grain	9.4
Combination	55.3
Use supplemental minerals on pasture	64.4
Use fly control on pasture	54.1

[1]Values listed here are based on the number of farms using pastures, not the total number of farms responding to the survey.
Source: Penn State Data; Journal of Dairy Science 70:896, 1987.

Abundant pasture that is kept young and actively growing may provide most of the nutrients needed by heifers more than 9 months old. Pastured heifers should be provided with a minimum of free-choice dicalcium phosphate and trace mineral salt. If grass tetany or sudden deaths are a problem on pasture, supplemental magnesium should be provided in a manner to ensure intake of at least 1 ounce per head per day. Supplemental forage should be provided only when necessary to help control bloat on legumes or to make up for a lack of pasture. Limited grain feeding is necessary to provide a vehicle for bloat or tetany-control additives, to increase energy intake when pasture is scant or overmature, and to serve as a way to incorporate needed minerals, vitamins, and other feed additives, such as ionophores (monensin or lasalocid), into the diet.

Priorities for feeding young stock during this time are to supply a balanced diet on which they can grow and stay healthy so they can be bred at 13 and 15 months of age and maintain their pregnancy. To ensure heifers are receiving their required nutrients, it is advisable to test the forages that are being fed and to balance a ration for animals 6 through 12 months and those over

12 months of age (Tables 21, 22). The effort put into feeding a balanced diet will pay off when these heifers eventually freshen and enter the milking herd.

Table 21. Daily nutrient requirements of dairy heifers after age six months.[1]

Live weight (lb)	Gain (lb)	Dry matter intake (lb)	Energy			Protein	
			NEM[2] (Mcal)	NEG[2] (Mcal)	TDN (lb)	UIP[3] (lb)	CP (lb)
Large-breed growing females							
500	1.30	10.68	5.03	1.72	7.08	0.52	1.37
500	1.50	11.31	5.03	2.01	7.49	0.56	1.48
500	1.70	11.95	5.03	2.30	7.92	0.60	1.58
600	1.30	12.54	5.76	1.89	8.13	0.48	1.50
600	1.50	13.27	5.76	2.20	8.61	0.51	1.59
600	1.70	14.00	5.76	2.52	9.09	0.54	1.68
700	1.30	14.49	6.47	2.05	9.20	0.44	1.74
700	1.50	15.32	6.47	2.39	9.73	0.47	1.84
700	1.70	16.17	6.47	2.74	10.27	0.49	1.94
800	1.30	16.56	7.15	2.20	10.30	0.42	1.99
800	1.50	17.52	7.15	2.57	10.89	0.44	2.10
800	1.70	18.48	7.15	2.95	11.49	0.46	2.22
900	1.30	18.79	7.81	2.35	11.43	0.40	2.26
900	1.50	19.88	7.81	2.75	12.08	0.41	2.39
900	1.70	20.97	7.81	3.15	12.75	0.43	2.52
1,000	1.30	21.22	8.45	2.49	12.61	0.39	2.55
1,000	1.50	22.44	8.45	2.92	13.33	0.40	2.69
1,000	1.70	23.68	8.45	3.34	14.07	0.41	2.84
1,100	1.30	23.87	9.08	2.64	13.86	0.38	2.86
1,100	1.50	25.26	9.08	3.08	14.66	0.39	3.03
1,100	1.70	26.67	9.08	3.53	15.48	0.40	3.20
1,200	1.30	26.81	9.69	2.77	15.20	0.39	3.22
1,200	1.50	28.39	9.69	3.24	16.09	0.40	3.41
1,200	1.70	29.99	9.69	3.72	17.00	0.40	3.60
1,300	1.30	30.10	10.29	2.91	16.65	0.42	3.61
1,300	1.50	31.90	10.29	3.40	17.65	0.42	3.83
1,300	1.70	33.73	10.29	3.90	18.66	0.42	4.05
Small-breed growing females							
500	0.90	10.58	5.03	1.37	6.77	0.42	1.27
500	1.10	11.38	5.03	1.71	7.28	0.45	1.37
500	1.30	12.19	5.03	2.05	7.80	0.48	1.4
600	0.90	12.68	5.76	1.51	7.88	0.40	1.52
600	1.10	13.63	5.76	1.88	8.47	0.42	1.64
600	1.30	14.60	5.76	2.26	9.07	0.44	1.75
700	0.90	14.99	6.47	1.65	9.05	0.38	1.80
700	1.10	16.11	6.47	2.05	9.72	0.40	1.93
700	1.30	17.26	6.47	2.46	10.41	0.41	2.07
800	0.90	17.57	7.15	1.78	10.28	0.38	2.11
800	1.10	18.90	7.15	2.22	11.06	0.39	2.27
800	1.30	20.25	7.15	2.66	11.85	0.40	2.43
900	0.90	20.50	7.81	1.91	11.62	0.39	2.46
900	1.10	22.08	7.81	2.38	12.52	0.40	2.65
900	1.30	23.68	7.81	2.85	13.42	0.41	2.84
1,000	0.90	23.75	8.45	2.03	13.06	0.42	2.85
1,000	1.10	25.61	8.45	2.53	14.09	0.42	3.07
1,000	1.30	27.50	8.45	3.04	15.13	0.42	3.30

[1]1989 NRC (Revised edition).
[2]NEM-net energy, maintenance; NEG-net energy, gain
[3]UIP-undegradable intake protein

Growing heifers often requires some grain. The amount of grain fed and the concentration of nutrients in it are determined by the average forage consumption and the average nutrient requirements for the group of heifers. This grain mixture is usually offered daily and the entire amount is consumed within a short period of time. Heifers being fed good-to-excellent quality forage need 1 to 3 pounds of concentrate per day, while those on poorer quality forages require 3 to 5 pounds of concentrate each day. The percentage of protein and other nutrients vary according to the forage being fed.

Under many management conditions, dominant heifers consume more than their proportionate share of concentrate, resulting in an excessive variation of individual growth rates within groups.

Table 22. Recommended nutrient content of diets for dairy heifers after age six months.[1,2]

	6-12 mos	>12 mos
Energy		
NEM, Mcal/lb	0.72	0.63
NEG, Mcal/lb	0.44	0.37
TDN, % of DM	66	61
Protein equivalent		
Crude protein, %	12	12
UIP, %	4.3	2.1
Fiber content, minimum		
Crude fiber, %	15	15
Acid detergent fiber, %	19	19
Neutral detergent fiber, %	25	25
Minerals		
Calcium, %	0.41	0.29
Phosphorus, %	0.30	0.23
Magnesium, %	0.16	0.16
Potassium, %	0.65	0.65
Sulfur, %	0.16	0.16
Sodium, %	0.10	0.10
Chlorine, %	0.20	0.20
Iron, ppm	50	50
Copper, ppm	10	10
Manganese, ppm	40	40
Zinc, ppm	40	40
Cobalt, ppm	0.10	0.10
Iodine, ppm	0.25	0.25
Selenium, ppm	0.30	0.30
Vitamins		
A, IU/lb	1,000	1,000
D, IU/lb	140	140
E, IU/lb	111	11

[1]1989 NRC (Revised edition).
[2]The approximate weight for growing heifers at 6 to 12 months is 559 pounds and at more than 12 months is 881 pounds; the approximate average daily gain is 1.543 pounds per day.

These problems can be reduced by sorting animals into more uniform groups by size and/or having some form of locking head gate to allow all animals the opportunity to receive their proper amounts of concentrates. All heifers should be able to be at the feed bunk at the same time.

Total mixed rations are ideal for heifers during this age group. When fed this way, heifers are allowed to consume rations free-choice with the fiber and/or bulk of the ration used to regulate intake. Since rations are available at all times, all animals are able to obtain adequate dry matter.

Health

The major health problems of young stock are internal parasites, external parasites, and infections causing respiratory problems and abortions. Any of these disease problems may cause significant damage before detection. It is definitely more cost-effective to prevent the problems than trying to contain the damage.

Most dairy farms have a routine treatment program for young stock. Worming should be started soon after calves are put into group pens. Manure samples from each group or pen can be examined by the herd veterinarian for presence of worm eggs or coccidia oocysts. This helps determine the need for worming and monitors the success of the worming program. External parasites should be treated in fall or early winter. Several drugs are available for treatment of stomach and intestinal worms. Lungworms, when present, can be treated with levamisole. Coccidia are not affected by wormers, but can be controlled by one of several available coccidiostats.

External parasites, like the internal parasites, will cause serious production losses in young stock. The major external parasites of concern in Pennsylvania dairy herds are lice, mange mites, stable flies, house flies, face flies, horn flies, and heel flies. Any of these can be serious enough to affect growth rate and feed efficiency. As mentioned earlier, pastured heifers should be wormed and confined heifers may also need regular worming due to parasites that may be picked up in the dry lot, manger, and from other animals. Manure samples should be checked by a veterinarian for recommendations on a worming schedule.

Vaccines against diseases such as pinkeye and haemophilus may need to be considered in some herds. Heifers should be vaccinated against leptospirosis at least 30 days prior to breeding age. A vibrio vaccine should be considered if natural service is used.

An important element of a heifer health program is to have restraint facilities (chutes, corrals, self-locking stanchions) for all heifers, especially those of breeding age.

Heifer reproductive management

Table 23. Suggested breeding size for dairy heifers.

Breed	Bodyweight (lb)	Heart girth (inch)
Jersey	500 to 600	58 to 60
Ayrshire and Guernsey	650 to 700	61 to 63
Swiss and Holstein	750 to 800	64 to 66

Heifers have reached puberty when normal sexual behavior is exhibited and ovulation occurs. Onset of puberty more closely relates to bodyweight than to age. Heifers reach puberty when bodyweight is 30 to 40 percent of the average adult weight, and should be ready to breed around 13 to 15 months of age. Table 23 gives more details about suggested sizes and weights at time of breeding.

Puberty is delayed if growth is slowed by underfeeding, disease, or parasites. Low dietary energy levels can lead to ovarian inactivity. Inadequate protein intake and nutritional problems leading to anemia can cause silent or irregular heats. Deficiencies of phosphorus, vitamin A, and vitamin E may also affect reproduction. Heifers approaching breeding age should be watched closely for heat to ensure that they are cycling. A veterinarian can examine heifers to determine those that are cycling and also identify those with congenital reproductive abnormalities.

A successful A.I. program involves routine heat detection and timely insemination. Considerable variation exists between animals. The average interval between heats for heifers is 20 days. All heat dates should be recorded on a chart so that future heats can be anticipated. To monitor heats accurately, dairy farmers must clearly identify heifers with neck chains, large ear tags, or freeze brands, and check animals for heat behavior twice a day. If heat detection is routine and frequent, heifers should be inseminated 12 hours after the beginning of standing heat. When the onset of heat cannot be accurately determined because of infrequent heat detection, heifers should be bred soon after standing heat is noticed. Keeping accurate records of the breedings is important for predicting calving dates.

A heifer ready to breed 13 to 15 months old in good shape.

Dairy farmers who cannot routinely check for heats may consider using heat synchronization and a concentrated A.I. breeding program for selected months during the year. Heat detection can be made easier and more efficient by use of heat mount detectors, crayon or chalk markings, surgically altered bulls, and/or androgenized heifers equipped with chin-ball markers.

Facilities should be provided where heifers can be confined for close observation or until they are individually restrained for breeding or examination. For a relatively small investment in time and money, most heifer facilities can be upgraded and equipped to provide convenient restraint and efficient handling of heifers. Such facilities can also be used for prebreeding examinations, vaccinations, worming, pregnancy examinations, estrous synchronization, and possibly embryo transfers.

Restraint facility for heifers.

Precalving

Bred heifers can be fed and handled in the same manner as other yearling heifers until about the last 3 months of pregnancy, when the unborn calf makes nearly two-thirds of its growth. During the final 3 months, bred heifers may need extra nutrients to maintain proper body condition for their first lactation and support for their growth plus that of the fetus.

Undersized heifers.

Heifers being fed excellent-to-good quality forages (forages containing 60 percent or more TDN on a dry matter basis) should receive 2 to 4 pounds of concentrate per head per day. This should be balanced according to the protein and mineral needs of the animal. Those heifers being fed fair-to-poor quality forages (those containing less than 60 percent TDN on a dry matter basis) should be given 4 to 6 pounds of concentrate per head per day.

Improper feeding and management practices often result in undersized heifers. The common cause is underfeeding forages as well as feeding

an unbalanced grain mixture, especially in the areas of protein and minerals. The problem often is solved by access to better pasture and to supplemental feeds.

Slowing growth below recommended levels is unprofitable because it eventually shortens the production portion of the heifers' lives. The result of underfeeding heifers is reduced growth and delayed first calving (greater than 26 months). Stunted growth will also result in smaller and less productive cows. More calving difficulties are encountered with undersized heifers than with those that are well grown.

Accelerating the growth of heifers to the extent that they become fat is also undesirable because lifetime milk production and longevity decrease. Studies have shown that excessive intakes of energy (140 percent of recommended levels) before breeding result in fatty infiltration of the mammary gland and reduction of the number of alveolar cells available for milk synthesis. Overconditioned or fat heifers often are the result of overfeeding high quality forages, especially corn silage, and in some cases is caused by excessive feeding of concentrates.

About 30 days before calving, bred heifers should be moved to a clean and dry environment. Lack of this clean environment can cause heifers to have mastitis and high somatic cell counts. If possible, it is a good idea to house these heifers with the milking herd. Permitting heifers to become accustomed to the new surroundings of the milking herd as well as the milking parlor, if that is the case, will enable them to deal with some of the new stresses they will have to face in their early weeks of lactation.

It is important to avoid high intakes of either corn silage or legume forage during this time. Grain intake should be gradually increased to reach a level of about 0.5 percent of bodyweight daily. If lactating cows receive nonprotein nitrogen (NPN) in their diets, heifers should also receive it throughout the prefreshening period. This practice ensures that their digestive system will be well adapted to this source of protein. It may be important to limit minerals, especially salt, if caked or congested udders are a major herd problem. Balancing and evaluating the overall ration may be necessary in such cases.

Monitoring Growth in Dairy Heifers

Much can be learned about the success of a calf and heifer rearing program by measuring height and weight of these animals. Most dairy farmers, extension agents, feed industry people, and veterinarians are able to recognize underconditioned or overconditioned animals. However, few can judge by sight whether a heifer's height or weight is normal for her age. Measuring and weighing allow a comparison to standards or breed averages and can indicate some problem areas that should receive attention.

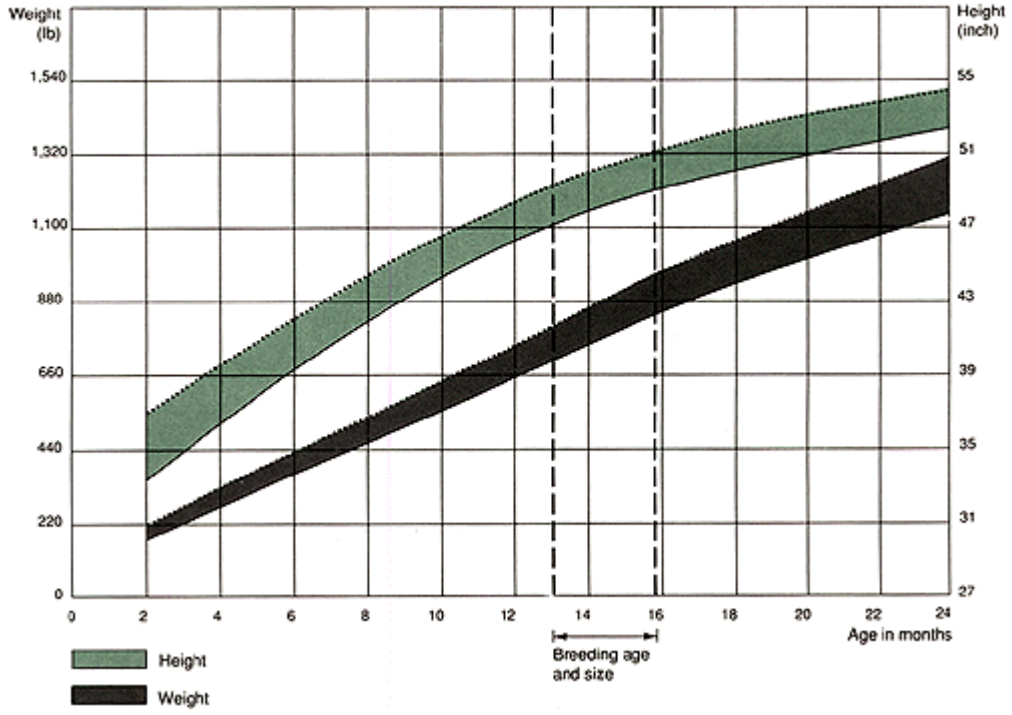
Table 24. Range of recommended Holstein heifer weights and heights developed from Penn State measurements.

Age (mos)	Weight range (lb)	Height range (inch)
1	133-155	31.7-33.2
2	178-209	33.5-35.2
3	225-263	35.2-37.1
4	272-319	36.9-38.8
5	320-374	38.4-40.4
6	368-430	39.8-42.0
7	417-486	41.1-43.3
8	466-541	42.3-44.5
9	514-597	43.4-45.7
10	563-652	44.5-46.7
11	611-707	45.4-47.6
12	659-761	46.3-48.5
13	706-814	47.1-49.3
14	752-866	47.8-50.0
15	798-917	48.5-50.6
16	812-966	49.1-51.2
17	885-1014	49.7-51.7
18	926-1061	50.2-52.1
19	966-1106	50.6-52.6
20	1005-1148	51.0-53.0
21	1041-1189	51.4-53.3
22	1075-1227	51.7-53.7
23	1107-1263	52.0-54.0
24	1137-1296	52.2-54.3

Source: Journal of Dairy Science 70:653-660, 1987.

Figure 5 [below] depicts the results of measuring a large number of heifers in Pennsylvania. The graph lists the average of all heifers measured and represents good growth ranges for the breed. Holstein breed standards developed from the measurements are listed in Table 24 [left]. The graph in figure 5 points out that the variability of height at the withers is greatest in the younger heifers. In general, the variability of weight increases with age. The overall goal of a heifer raising program should allow for a relatively constant rate of growth. Holstein heifers should reach 750 to 800 pounds and 48 to 50 inches by the desired breeding age of 13 to 15 months. Beyond this, heifers should be calving at 1137 to 1296 pounds and measuring 52 to 54 inches tall when they are 24 months of age.

Figure 5. Holstein calf and heifer growth chart.



The accompanying growth charts should represent the type of Holstein heifers that are being raised today in many parts of the United States. While every heifer may not conform to these standards, the majority of heifers should be somewhat near these standards in order to be large enough to breed at 13 to 15 months of age and, subsequently, to calve at 24 months of age. The only real way to tell how heifers are growing is to weigh and measure them several times a year. Once or twice a year is better than not at all.

Measuring height.

Measuring weight.

The materials needed to weigh and measure calves and older heifers are a weight tape, a measuring stick, a piece of paper, and a pencil. It works best with three people: two to do the weighing and measuring and one to do the recording of numbers. Twenty animals per hour can be done in any reasonable restraining facility.

Some important points to remember when taping animals:

- Make measurements with the animal standing straight on a level hard floor surface and with weight equally balanced on all feet.
- Watch for excess manure and dirt on the underside of the heifers which could bias the tape measurements.

Growth charts should be used to evaluate the performance of a heifer management program and to spot any major problems that may be occurring. These charts will show problem areas where whole groups of animals are either undersized, underweight, or overweight–all good indicators of improper feeding or poor overall management.

Costs of Raising Dairy Heifers

Dairy Replacement Costs

Raising heifers for replacements is an expensive item on dairy farms. Often many homegrown items are not considered in the actual costs involved in raising heifers, although they should be. Few farmers realize the true costs of raising heifers. Table 25 lists expenses that are incurred when raising replacements and indicates the significance of prices paid. These values are based on an actual Pennsylvania survey with average costs based on heifers calving at 24 months and a range of 20 percent above or below the average. Feed costs make up over one-half of the total variable costs (average feed costs of $567.20 compared to average nonfeed costs of $390.07). Cutting back on feed costs can be a big savings. Hay is listed as the only forage for heifers age 6 to 24 months, but the hay can be partially or completely replaced with corn silage or haylage to help reduce feed costs. Feed program evaluations can help find the least expensive route to follow without jeopardizing the daily requirements of rapidly growing heifers.

Table 25. Costs to raise replacements.

	$ Low	$ Avg	$ High
Expenses[1]	892.53	1225.27	1514.52
Variable costs	686.53	957.27	1184.52
Variable, nonfeed costs	296.31	390.07	460.80
Value of calf	80.00	100.00	120.00
Build. & equip. repairs	19.20	24.00	28.80
Vet. & med.	8.00	10.00	12.00
Breeding	19.20	24.00	28.80
Supplies	28.80	36.00	43.20
Utilities	13.60	17.00	20.40
Bedding (1 ton @ $50.00)	25.00	50.00	75.00
Other	2.00	2.50	3.00
Labor (27 hr/heifer @ $4.00/hr)	86.40	108.00	129.60
Average interest (on variable nonfeed costs)	14.11	18.57	23.00
Variable, feed costs	390.22	567.20	723.72
Birth-weaning			
milk or replacer	0.00	30.00	40.00
starter (80 lb @ $.08/lb)	5.12	6.40	7.68
forage (40 lb @ $.05/lb)	1.60	2.00	2.81
Weaning-6 months			
hay (.45 tons @ $70.00/ton)	25.20	31.50	37.90
grain (600 lb @ $.07/lb)	33.60	42.00	50.40
6-14 months[2]			
hay (1.7 tons @ $65/ton)	88.40	110.50	132.60
grain (960 lb @ $.07/lb)	53.76	67.20	80.64
14-24 months			
hay (3.1 tons @ $60.00/ton)	148.00	186.00	223.20
grain (300 lb @ $.06/lb)	14.40	18.00	21.60
Additional months' feed costs			
hay ($60/ton/month) 0,2,4 mos	0.00	37.20	74.40
grain ($.06/lb/month) 0,2,4 mos	0.00	7.20	14.40
Average interest on feed costs	20.14	29.20	37.70
Fixed costs[3]	206.00	268.00	330.00
Housing	120.00	160.00	200.00
Equipment	86.00	108.00	130.00

[1] Low costs are estimated as 80 percent of average and high costs as 120 percent of average except for milk replacer costs, bedding costs, and additional months of feed cost.
[2] Forage may be dry hay, silage, or pasture. If pasture contributes a significant amount of the total forage, (a) estimate the amount of dry hay that it replaces and (b) substitute the cost of pasture for the fraction of the dry hay cost it replaces.
[3] These values are the average costs charged against the value of housing and equipment, considering depreciation, interest, rent, property taxes, and insurance for two years (birth to freshening). It is important to use your own estimate of fixed costs because these will vary substantially from farm to farm and will depend on the level of investment in heifer housing and facilities.
Adapted from J. Hlubik and Dairy Science Extension Mimeo# 88-21, Costs to Raise Dairy Heifers.

Reducing replacement costs

The largest expense incurred when raising calves and heifers is feed costs. Feeding for optimum growth accounts for about 53 percent of the rearing cost. Starting with the baby calf, some ways to lower these costs include feeding discarded or surplus colostrum and milk replacers instead of saleable milk. Colostrum is often wasted and it can be fed to calves. Overfeeding of liquids can also be costly as this tends to keep the calves full and inhibits their desire for forage and grain.

Grain mixes containing byproduct ingredients can be fed to calves and heifers without sacrificing quality. Examples of byproduct ingredients include bran, corn gluten feed, or dried brewers grain. Ear corn tends to be a better buy than shell corn, and using some oats or barley can lower the cost of a grain mix.

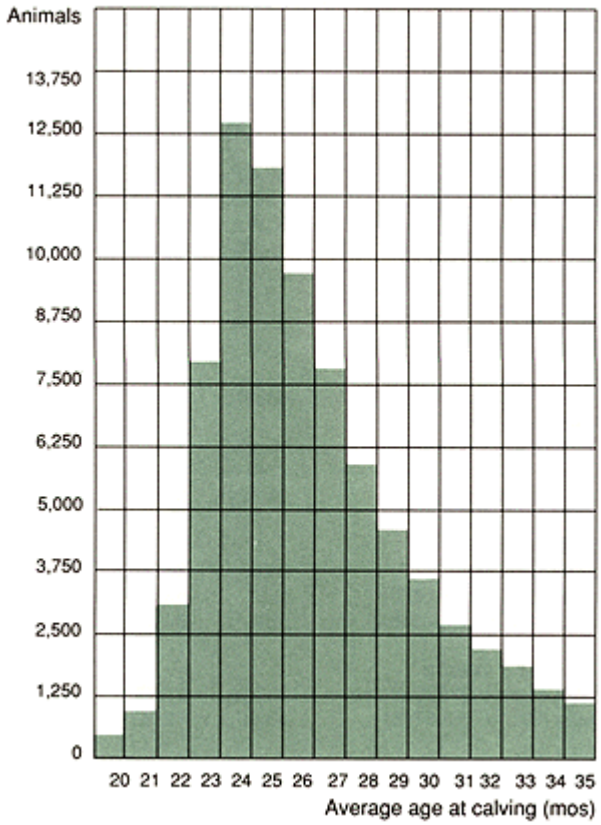
Forages fed to all age groups should be of the appropriate quality and cost. Fine, stemmy hay should be fed to preweaned calves with good quality forages being fed to calves until 12 months

of age. Poorer quality forages can be utilized beyond 12 months; but only if proper grain rates are maintained. In addition, feed refusals from lactating cows can be incorporated into a heifer ration.

Forage testing and feed programs need to be examined for all heifer groups, ranging from 0 to 6 months, 7 to 11 months, and 12 to 24 months. This helps ensure that heifers are not going to become overconditioned or underconditioned. Excessive fattening of dairy heifers is detrimental to conception rates, calving ease, production, and longevity–all of which add up to lost dollars. Underfeeding of bred heifers results in calves only slightly smaller than those from well-fed heifers. More calving difficulties are encountered with undersized heifers than with those that are well grown. Heifers fed a balanced ration will be able to reach about 85 percent of mature weight by 24 months. To reach this goal, calves need an average daily gain of about 1.7 pounds to weigh 1,200 pounds at 24 months.

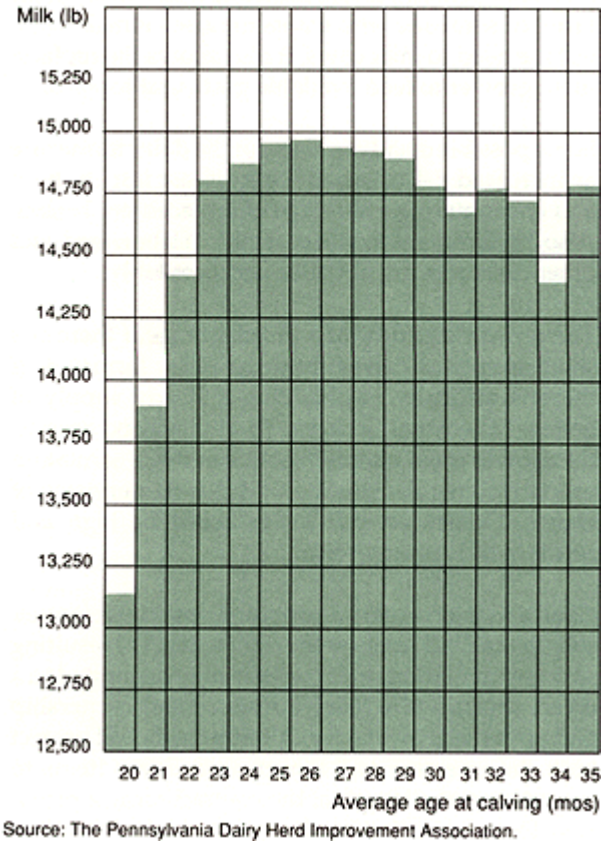
Data taken from the Pennsylvania DHIA indicate that nearly two-thirds of first-calf heifers calve past 24 months of age (Figure 6). This indicates that not enough farmers put their attentions to growing heifers properly. There is the general rule that the older the animals, the more actual milk and fat they will produce during their first lactation. These data show that increases in milk production from month to month are negligible.

Figure 6. Number of Holstein heifers calving at various ages, Pennsylvania DHIA,1989.



Source: The Pennsylvania Dairy Herd Improvement Association.

Figure 7. Actual milk production of Holstein heifers calving at various ages, Pennsylvania DHIA, 1989.



Source: The Pennsylvania Dairy Herd Improvement Association.

Figure 7 illustrates actual milk production according to when these heifers calved. The gradual increase in actual milk production from 23 to 27 months generally runs less than 100 pounds per month increase in age. The actual average milk production for heifers calving at 24 months is 14,881 pounds, while those calving at 25 months had an average production of 14,966 pounds.

The following analysis considers the profit that is lost by raising these older heifers. It is not easy to determine all additional costs involved in raising older heifers. To simplify this analysis, it is easier to consider feed costs as the only added cost involved in raising heifers for a month. In a ration with 2 pounds of grain and mixed hay, the total cost would be close to $.87 per day or $26.10 per month per heifer.
Finding what profit, if any, milk from 27-month-old heifers would bring, determine the feed cost for the 3 extra months ($26.10 x 3 = $78.30), then the value of the increase in milk produced (27 lbs./month x 3 months = 81 lbs. at $12.00/cwt = $9.72). Finally, subtract these values. The loss is $68.58 per heifer by not calving them at 24 months of age. This $68.58 cost is based on a simple feed program.

On a typical 70-cow farm with 25 percent of the milk herd as two-year-olds, this amounts to about $1,200 of extra costs per year just to feed those heifers to 27 months rather than 24 months of age. Addition of the extra housing costs, equipment costs, and interest costs would increase the amount lost per heifer. To alleviate this type of loss, heifers must calve at an average of 24 months. Since a few will go beyond 24 months for one reason or another, some should calve at 22 and 23 months. The 24-month calving goal will require a high level of feeding and management.

Other expenses for raising replacements which should be noted are operating and ownership costs. Operating costs include labor, veterinarian, medicine, breeding, bedding, utility, interest, and death losses. Calf mortality and death loss represent major economic losses associated with raising dairy replacements. Calf mortality means the loss of genetic improvement for the herd. If calf mortality is high, then calf morbidity usually runs high. This in turn affects the growth rate of dairy heifers and their age at first calving. In the long run, calf mortality inhibits these animals to develop their full lactation potential.

Contract heifer raising

Many situations exist when facilities or other components of a farm operation are limited whereby contract heifer raising, or having someone else raise the heifers is a viable option. Contracts need to be fair to the farmer and grower and flexible to accommodate cost changes and needs of both parties.

Contracts offer a number of advantages and disadvantages for both the operator and the dairy replacement grower. The advantages to the operator include the possibility of expanding herd size by 25 percent or more with existing facilities. Another advantage is the opportunity to specialize in milking cows and raising crops. The present breeding program can be continued; but if the calf and heifer part of the operation is costly and/or inefficient, contract heifer raising may be less expensive.

The advantages to the grower are that facilities inadequate for grade A milk production may be sufficient for raising heifers; but these facilities must have proper ventilation, water supply, and allow animal grouping. Contracting can provide part-time employment for a semiretired person, someone who works off the farm, or someone who wants to raise animals without the need to milk cows. It also allows the replacement grower to feed available grain and forages.

Some possible disadvantages for the dairy farmer are an increased risk of introducing disease into the herd and encountering a shortage of replacement heifers. Also, replacements could cost more if labor, feed, and other resources are not allocated profitably.

The grower could be at a disadvantage if there is a short supply of calves from the dairy farmer or if there is difficulty in obtaining a steady supply of heifers from other sources. To obtain good results, the grower must maintain above average sanitation practices, a regular routine, and close supervision of chores. Otherwise, calf losses could be high and result in little or no profit.

Contracts may contain an option-to-purchase (owner sells the calf but reserves the right to buy the resulting springer at market price) or they may be limited to a direct contract (the dairy farmer retains ownership and pays the grower a fee). Contracts should protect both the operator and the grower. Some items to consider are the length of the contract term, a provision for termination, and a method of arbitration. Health requirements such as calfhood vaccinations need to be taken care of as well as how death losses are handled and who assumes the necessary veterinary costs. It must be decided who assumes the responsibility for breeding the heifers and paying the cost of breeding. The responsibility for transportation to and from the grower must also be decided.

Contracts drawn on a year-to-year basis provide flexibility in establishing fees and other cost figures that parallel the general farm economy. Contracts should be written to permit the addition and deletion of animals as conditions dictate.

Conclusions

Healthy, productive herd replacements are the result of good management before the calves are conceived and continue to the time when they enter the milking herd. Accurate records must be kept so a sound breeding program can be followed. The total process ensures that genetically superior animals will enter the herd.

Once calves are born, the manager must make sure they will have a healthy environment with proper facilities, water, high quality feeds, daily observations, and health care. This kind of attention should extend beyond the baby calves. A carefully managed, well-planned facility enables dairy farmers to efficiently use their time and labor while rearing healthy replacements that freshen at 24 months of age.

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