

# **The Missouri System of Dairy Heifer Production**

Prepared by

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## Executive Summary

Missouri has many resources conducive to profitably growing dairy heifers. The objective of this manual is to offer a production and financial plan that will utilize these resources to supply replacement heifers for a growing dairy industry.

This manual includes guidelines for site selection, animal flow, nutrition and feeding management, breeding and genetics, culling, health, marketing, and labor.

The Missouri Heifer Plan was designed to supply the replacement needs of a 1,000-cow dairy. This example operation develops heifers from newborn through 60 days precalving, requiring approximately 22 months. In the production plan, 38 newborn (less than one-week old) calves are purchased every month over the 10-year planning horizon. The example operation reaches steady state production by the end of the second year, producing 30.3 bred heifers, 2.2 open heifers, and 2.8 cull heifers (0-12 months of age) for sale each month. The average daily inventory of heifers at various stages of development is approximately 685 head. This inventory provides a trailer truck load of bred heifers per month (about 31 head weighing 1,350 pounds each) or approximately 364 bred heifers annually.

Total investments in land, facilities, machinery, equipment, and livestock for the first year of operation are \$842,550. It was assumed that the owner/operator(s) have 59 % of the first year investment as equity (\$498,075). The balance of the investment (41 %) would be financed with debt (\$344,475).

Equity capital is allocated as follows:

- \$352,000 owned as land.
- \$50,000 in cash is used for first year operating expenses.
- \$96,075 is used to purchase half of the facilities, machinery, and equipment.

Debt capital consists of:

- \$64,825 for term debt (9% with a 15-year payoff) used to finance the balance of the facilities.
- \$31,250 for term debt (9% with a 7-year payoff) used to finance the balance of the machinery and equipment.
- A line of credit is obtained to purchase livestock and cover remaining operating expenses.

The economic feasibility of the production plan was evaluated with a dynamic simulation model called the Dairy Replacement Heifer Model. This computer model has the ability to forecast production and financial information over a 10-year planning horizon. It consists of four modules:

Data Input; Rations; Heifer Flow; and Financial Reports.

Financial results are as follows:

- The plan does cash flow. Surplus cash flow is generated after year 7.
- The line of credit grows to a maximum of \$310,050 by 24 months, but is paid to zero by year 7.
- A positive profit is attained with steady state production in year 3.
- The level of equity grows to 96 % by the end of year 10.
- Profit per bred heifer sold is estimated to be \$189.
- Financial measures indicate that the return to assets rises from 8.9 % in Year 3 to 10.2 % by year 10. Working capital is limited during the first 3 years and is mainly provided by the line of credit. The operation is solvent due to the percent of the investment in land and animals. All relevant financial ratios show positive trends over the 10-year planning horizon.

This plan, as analyzed with the computer model, is feasible in a "start-up" operation provided that adequate financial resources are available. The operation would require a sizeable line of credit to supplement cash flow until "steady state" production and sales are realized. The operation is profitable following the two-year "start-up" phase.



## **Introduction**

Missouri has abundant natural resources and human capital which can provide key necessary inputs for an expanding dairy industry. Missouri has competitive land prices; a favorable tax structure; low power rates; and abundant hay, pasture, and feed grain production. The climate is favorable for livestock production, and a central location combined with an excellent transportation system are positive production factors. These factors plus dairy production and financial management expertise provide opportunities to dairy heifer growers.

The Missouri Heifer Plan was developed by the Commercial Agriculture Dairy Focus Team. This manual provides producers with the necessary production and financial information required to develop a successful dairy heifer business.

This plan describes a system designed to provide the dairy replacements needed for a 1,000-cow dairy unit. This example operation develops heifers from newborn to springers (60 days precalving) requiring approximately 22 months. The average daily inventory of heifers at various stages of development is approximately 685 head. This includes estimated death loss and cull heifers. This inventory supplies a trailer truck load of bred heifers per month (about 31 head weighing 1,350 pounds each) or 364 bred heifers annually.

Young calves (newborn to 6 months) are housed first in hutches and then calf freestall barns. Older calves (6 to 24 months) utilize pasture to take advantage of Missouri's economical forage base. Supplemental concentrates are provided daily to promote proper growth and development.

The Missouri Heifer Plan can be used to establish production goals, management procedures, and evaluate profit potential of a heifer enterprise. A complete financial analysis is provided to assess the economic feasibility of the plan. The Missouri Heifer Plan was designed for a specialized heifer growing operation. Components could be applied to existing dairy operations that produce their own replacements.

## Site Selection

Site selection is an extremely important aspect of a successful heifer operation. A critical and detailed evaluation of the "natural resource base" (land, water and topography) will dictate many of the animal facility needs. A favorable evaluation will reduce the requirement for facilities and associated construction costs.

The overall feasibility of a site for a heifer operation must evaluate positive for the following criteria:

1. A "year around" water supply of sufficient quantity and of adequate quality to support the growth potential of the heifers.
2. Adequate land to utilize the manure nutrients produced by the growing heifers in an environmentally sound manner.

Present Missouri environmental regulations do not require comprehensive manure nutrient management plans for animals that are produced on pasture. The land area to utilize manure nutrients in this plan is calculated on a heifer stocking rate of 800 head. This rate provides an additional 15% land area to allow for flexibility in managing the average number of heifers on hand (685) and to provide for unforeseen contingencies.

The land required to receive the manure produced in the heifer operation is estimated using two different methods:

1. An estimated average weight of 625 pounds per head for 800 head of heifers is compared to an equal number and size of beef animals. The equal number of beef animals require 187.5 acres of soil-plant filter.
2. Gestating sows are stocked at a rate of 2,000-2,800 pounds per acre in pasture production systems. The 800 head of heifers would weigh 500,000 pounds. Stocking the heifers at 2,000-2,800 pounds per acre would require 178-250 acres of pasture for distribution of the manure nutrients.

Based on these estimates, a minimum of 187.5 acres are needed to utilize the manure produced by 800 replacement heifers.

Grazable pasture acres required for this heifer operation is calculated as 619 acres. These pasture acres must have soil properties capable of producing high-quality forages. Terrain and slope characteristics must allow machinery access for pasture reseeding and maintenance.

The following is a summary of the minimum acreage requirements as described in this heifer production plan.

- 619 acres of improved pasture for grazing.
- 4 acres for calf hutches.
- 17 acres for farmstead, freestall buildings, and lagoon.
- Windbreak and natural shelter areas are needed in the winter pastures to provide heifers protection during inclement weather.

### **Birth to Two Months**

Calf hutches are used to house baby calves in this production plan. Hutches are set at a density of 20 hutches per acre. A coarse ground limestone base is used under the hutches. Sod must be maintained on more than 50% of the total area surrounding the hutches. Hutches are moved on a regularly scheduled basis to prevent disease buildup. Manure and bedding is hauled and spread on a regular basis. Areas that become devoid of vegetative cover will require reseeding.

(See Appendix A for hutch rotation.)

### **Two to Six Months**

This plan recommends that heifer calves between two and six months of age be raised in confinement buildings. An adequate manure management system is required for this production stage. An anaerobic lagoon is suggested. Lagoon size is based on the pounds of animal served. The 0.5 surface acre (104-foot X 208-foot) lagoon, with an assumed depth of 10 feet, is sized to accommodate 160 head of 300-pound per head average weight heifers housed in the free stall barns. The lagoon is sized for 365-day storage so that one pumpdown per year would be the expected pumping frequency. Lagoon effluent would be irrigated on 7.2 acres of soil-plant filter. Recycled lagoon water is used to flush and transport the manure from the buildings to the lagoon.

### **Six to Twenty-Four Months**

Site selection is especially important for the 6-24 month stage of the heifer production enterprise because these heifers are grown on pasture. Supplemental rations are fed daily to insure the desired growth of the heifers.

Winter pasture areas have specific site and facility requirements imposed by weather conditions and environmental concerns. Winter pastures and facilities for growing heifers must:

- Provide natural windbreaks and protection from adverse weather.
- Have a water system that can be protected from freezing.
- Be located and managed so that a vegetative cover is maintained on more than 50 % of the entire area.
- Provide a feeding area that is accessible to both wheel and animal traffic during muddy and inclement weather conditions.
- Have the feeding area located so that a sod buffer strip is maintained between any potential manure accumulation area and any environmentally critical location such as a stream bank or point where surface water concentrates.

Periodic renovation and reseeding of "high use" animal traffic areas will be required. Sufficient winter pasture will be required so that necessary renovation and maintenance can be accomplished without interrupting production schedules.

### **Biosecurity**

Biosecurity is the practice of managing the herd to minimize the potential for introducing disease via people, cattle, wildlife, insect vectors, or mechanical vectors (equipment, instruments, tools). Major disease risks are associated with animal contacts or the contamination of drinking water.

A location which prevents fence line contact or the possible intermingling of neighboring livestock is highly desirable. If water impoundments are utilized, it is important that operational control of the watershed be maintained.

Provisions must be made to dispose of dead animals in an environmentally acceptable manner. The Missouri Departments of Agriculture and Natural Resources accept rendering, burial, incineration, licensed landfills, and possibly composting for disposal of the bovine species.

## **Animal Flow**

The flow of animals through the operation at various stages of growth has a direct impact on the site requirements as well as the needed facilities and equipment. Animal flow can be either batch or continuous flow.

Batch flow conditions exist when a large number of animals (30-40 head) enter the operation at one time. This batch is handled as one group for the complete production cycle.

Continuous animal flow has a small group of animals enter the operation on a short, pre-determined schedule (weekly). A continuous animal flow management plan will minimize facility size and maximize facility use.

A continuous animal flow is assumed in the Missouri Heifer Plan. The projected animal flow in this plan was initially calculated based on the following assumptions. A 1,000 cow dairy with a 13.2 month calving interval, no death loss, and an even calving distribution would potentially produce 38 heifer calves each month or 454 heifer calves per year. Therefore, an equivalent of 38 baby calves enter the operation each month. The animals flow through the operation in stages based on age and size. These stages are divided into: Birth to 2 months, 2-6 months, 6-12 months, and 12-24 months. Estimated death loss and culling of heifers are included for each stage of development.

### **Birth to two months**

The baby calves are housed in individual calf hutches until weaned at approximately 2 months of age. Eight to 10 baby calves (newborn to one week old) are purchased weekly and brought into the operation.

### **Two to six months**

Calves are moved to freestall housing following weaning and initially housed in groups of 5. Calves are maintained in the freestall housing until they are 6 to 7 months old. During this period, calves are regrouped according to age and size. The maximum pen size is 20 calves per pen.

### **Six to twelve months**

Heifers are moved from the freestall facilities to pasture at 6 to 7 months of age. Based on death loss and culling assumptions, a projected 34 head of heifers enter this stage each month. Seven pasture sites are required for the heifer groups in this stage. Pasture sites are projected to need a minimum of 27 grazable acres to provide forage for the expected 34 head of heifers.

**Twelve to twenty-four months**

Heifers entering this stage of production are moved to another pasture system to accommodate increased pasture requirements and in preparation for entering the breeding herd. Based on death loss and culling assumptions, a projected 32 head of heifers enter this stage each month. Ten pasture sites are required for the heifer groups in this stage. Pasture sites are projected to need a minimum of 43 grazable acres to provide forage for the expected 32 head of heifers. Bred heifers are maintained in this stage until sold at approximately 60 days pre-calving. The average age at selling is 22 months.

Based on grazing and weather conditions, heifers in the pasture system may be regrouped by size and consolidated to effectively utilize pasture. Pastures are arranged around a central drinking water source. Fencing is designed to facilitate moving heifers into a portable corral system for breeding and health management.

## Facility Requirements

The health and growth of the heifer depends on appropriate housing given Missouri's weather conditions. The housing requirements and specifications used in the Missouri Heifer Plan are presented in Table 1.

**Table 1. Heifer Housing Specifications of Missouri Heifer Plan**

Age Group	Max.Head per group	Age spread in group	Area per head	Feed Bunk space length/hd	Freestall size
0-2 months	1		24 sq. ft.	individual	
2-3 months	5	1 week	28 sq. ft.	20 in	24 in X 48 in
3-4 months	10	2 weeks	28 sq. ft.	20 in	24 in X 48 in
4-6 months	20	3-4 weeks	37.5 sq. ft.	27 in	30 in X 60 in

### Birth to Two Months

A good calf raising facility must minimize environmental stress on the calves and be convenient for the operator. The latter encourages the operator to maintain a high level of calf care. Pre-weaned calves are provided individual hutches and isolated from older animals. The hutches need to be constructed with three solid sides to provide draft-free quarters, located on a well-drained surface and filled with ample bedding to provide a dry sleeping area. The hutches should be located to encourage regular and frequent observation of calves. Hutches must be rotated to new locations when calves are moved (See Appendix A for suggested hutch rotation plan).

#### Housing Management Check List: Birth to Two Months

- A. Individual, portable, 4' X 6' hutch and 4' X 4' outside pen.
- B. Hutches should be located on a well-drained and protected area with the open-front facing south.
- C. Adequate bedding must be used to provide a clean, dry surface inside the hutch.
- D. Clean and disinfect hutches or let them stand upright in the sun after each calf has been removed.

- E. Move the hutch to a new location and place fresh bedding under the hutch prior to reuse.
- F. Maintain a minimum separation of 4 feet between hutches.
- G. Keep calves in hutches until two weeks post weaning to minimize stress of weaning.

### **Two to Six Months**

Calves are moved into a freestall facility once they have been weaned for at least two weeks. The Missouri Heifer Plan utilizes different freestall barns to house calves from two to four months of age and four to six months of age. The buildings housing two to four month old calves measure 20 feet wide by 80 feet long. The facility contains 40 stalls (24 by 48 inches), a 10-foot wide flush alley, and a covered concrete feeding area 4.5 feet wide. The facility provides 28 square feet of housing space with about 20 inches of feed bunk space per calf. It is sectioned by gates to create pens for five head of calves. At three months of age, the divider gates that are used to separate calves into pens of five are removed to create pens of ten. Four frost-proof waterers are positioned in the facility to serve multiple groups. (See Appendix A for scaled drawing.)

At four months of age, the groups of ten calves are moved to a second freestall facility. This facility provides housing for calves four to six months of age. The building measures 20 feet wide by 100 feet long. This facility also contains 40 stalls (30 by 60 inches), a 10 ft. wide flush alley, and the covered concrete feeding area 4.5 feet wide. The facility provides 37.5 square feet of housing space with 27 inches of feed bunk space per calf. It is sectioned by gates to create pens of 10 head per pen. Divider gates are removed at five months of age to create pens of 20. Four, frost-proof waterers are positioned in the facility to serve multiple groups. (See Appendix A for scaled drawing.)

### **Housing Management Check List: Two to Six Months**

- A. Two weeks following weaning, calves should be moved from the hutches to freestall unit and placed in groups of five calves per pen.
- B. The stocking rate within pens is important for control of disease, group socialization, and acclimation to feed bunks.
  - 1. Minimum of 28 square feet of area per calf: 2 - 4 months of age.
  - 2. Minimum of 30 square feet of area per calf: 4 - 6 months of age.
- C. Minimum feed bunk length of 18 inches per animal.
- D. Minimum of one frost-proof waterer per 10 calves.
- E. Maintain freestalls and clean feed bunks and waterers on a regularly scheduled basis.



### **Six to Twelve Months**

This plan calls for 34 head of 6 to 7 month old heifers to be moved onto pastures each month. Feed is supplied through the use of portable feed bunks and hay rings. The water supply to the pastures is provided by frost-proof waterers either piped from a central well or from surface impoundments. During the winter months, a maximum stocking rate of five head per acre is recommended to maintain 50% vegetative cover over the entire pasture. Winter pasture should provide natural wind-breaks.

During the grazing season, heifers will be rotated between pastures in order to effectively utilize available forage. Conventionally grazed improved grass/legume pastures under normal Missouri growing conditions should yield five animal unit months (AUM) per acre.<sup>1</sup> During a seven-month grazing season, 0.8 grazable acres per head are utilized for 6 to 12-month old heifers.

#### **Facility Management Check List: Six to Twelve Months**

- A. Pasture stocking rate.
  - 1. Summer stocking rate is based on 5 AUM per acre of forage production (0.8 acres per head).
  - 2. Winter stocking rate is based on maximum of 5 head per acre to maintain sod base.
- B. Frost proof waterers - 15 to 20 animals per drinking hole.
- C. Minimum of 18 inches of feed bunk length per animal.
- D. Minimum of 1 hay ring per 20 head.
- E. Maximum of 40 heifers of similar size and age per group.
- F. Feed bunks and waterers should be cleaned on a regular basis.
- G. Feed bunks should be located on a well-drained area away from any environmentally critical location.

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<sup>1</sup>An animal unit month (AUM) is acreage required to supply the forage needs for 1,000 pounds of animal for one month.

### **Twelve to Twenty-Four Months**

This plan calls for 32 head of 12 to 13-month old heifers to be moved onto pastures each month. Feed is supplied through the use of portable feed bunks and hay rings. The water supply to the pastures is provided by frost-proof waterers either piped from a central well or from surface impoundments. During the winter months, a maximum stocking rate of three head per acre is recommended to maintain 50% vegetative cover over the entire pasture. In addition, the winter pasture should provide natural wind breaks.

During the grazing season, heifers will be rotated between pastures in order to effectively utilize available forage. Conventionally grazed improved grass/legume pastures under normal Missouri growing conditions should provide a yield of five animal unit months (AUM) per acre. During a seven-month grazing season, 1.33 grazable acres per head are utilized for 12 to 24-month old heifers.

#### **Facility Management Check List: Twelve to Twenty-Four Months**

- A. Pasture stocking rate.
  - 1. Summer stocking rate is based on 5 AUM per acre of forage production (1.33 acres per head).
  - 2. Winter stocking rate is based on a maximum of 3 head per acre to maintain sod base.
- B. Frost proof waterers - 15 to 20 animals per drinking hole.
- C. Minimum of 24 inches of feed bunk length per animal.
- D. Minimum of 1 hay ring per 20 head.
- E. Maximum of 80 heifers of similar size and age per group.
- F. Feed bunks and waterers should be cleaned on a regularly scheduled basis.
- G. Feed bunks should be located on a well-drained area away from any environmentally critical location.

## **Nutrition and Feeding Management**

### **Birth to Two Months**

Feeding young dairy calves is the first critical step in raising replacements. Dairy calves function primarily as a monogastric (simple stomached) animal during the first two months of life. By two months of age, they should begin to function more like a ruminant. The rumen, reticulum, and omasum of the newborn calf are relatively small in size and are inactive compared to the abomasum or "true stomach." Because these compartments are not fully developed, the milk-fed calf has special requirements for energy, protein, and vitamins.

Newborn calves cannot utilize vegetable protein before the rumen is functional due to limited secretion of digestive enzymes. Therefore, following colostrum feeding, whole milk, fermented colostrum, or a milk replacer containing milk protein or specially processed soy concentrates should be used.

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. Newborn calves also have little digestion of some starch and sugars such as sucrose (table sugar). This limited digestive capacity of starch is because certain digestive enzymes are not present. Calves 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. Supplemental fat in milk replacers must come from saturated fat sources. Due to these limitations in digestive function, major sources of energy for newborn calves should be derived primarily from lactose (milk sugars) and milk fat.

Within two weeks after birth, calves develop the ability to digest starch. Shortly thereafter, they develop the ability to digest complex carbohydrates. The extent of rumen development dictates how rapidly young calves can digest complex starches and carbohydrates. The greater the rumen development, the greater the dry feed intake, therefore, the sooner the calf may be weaned.

Vitamins required by calves include the water soluble B vitamins found in colostrum, fermented colostrum, whole milk, or high-quality milk replacers. Rumen microorganisms are able to produce these vitamins when the rumen begins to function. Calves require the fat soluble vitamins A, D, and E. Whole milk, fermented colostrum, or milk replacers plus exposure to sunlight will normally supply an adequate amount of the fat soluble vitamins to young growing calves.

Dairy calves require the same minerals for growth as do other animals. 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 the dam's dietary deficiency, therefore, mineral supplements are needed by young calves and should be provided in the grain.

Water makes up the majority of a young animal's body weight. A plentiful supply of clean, fresh,

good-quality water should be available at all times to all ages of heifers. Limiting water available to dairy calves and heifers may limit growth and also adversely affect health.

The requirements for large-breed calves are presented in Table 2. Each section contains the animal's weight, expected gain, dry matter intake, energy for growth, and protein requirements. By knowing the animal's requirements, diets can be evaluated to assure that feed intake meets these requirements.

**Table 2. Daily Nutrient Requirements of Young Dairy Calves.** <sup>1</sup>

BW, lb	Gain, lb	DMI, lb	Energy		TDN (lb)	Protein
			NEM (Mcal)	NEG (Mcal)		CP (lb)
Growing large-breed calves fed only milk or milk replacer						
90	.6	1.08	1.39	.37	1.32	.24
110	.8	1.32	1.61	.52	1.7	.29
Growing large-breed calves fed milk plus starter mix						
100	1.00	2.00	1.50	.64	2.24	.44
150	1.80	3.50	2.04	1.29	3.92	.77

<sup>1</sup> 1989 NRC (revised edition)

### Nutrition Management Checklist: Birth to Two Months

#### A. General

1. Maintenance of good health with minimum daily weight gains of 1.5 pounds.

#### B. Nutrition

##### 1. Milk replacers (See Appendix D for nutrient content)

- a. High-quality milk replacer can be fed in place of whole milk (use milk-based replacers, minimum of 20% fat during winter).
- b. Mix and feed as directed.
- c. Feed two times daily.

##### 2. Whole milk

- a. Feed daily at a rate of 8-10% of body weight.
- b. Feed two times daily.

### 3. Concentrates

- a. A calf starter ration with good digestibility, palatability, and composition should be fed free choice beginning at 3 days of age. (See Appendix D for nutrient content)
- b. Avoid contamination of concentrates with water or milk; clean pails daily.
- c. When daily consumption exceeds 1.5 pounds per day, calves can be weaned from milk.

### 4. Roughages

- a. Fine stem, high quality hay can be fed free choice beginning at one week of age. If chopped and added to starter, limit to less than 30% of diet.
- b. If good-quality hay is not available, wait until calf is 2-3 months old before feeding hay and provide long-grain feeds, such as whole oats, in starter to stimulate rumen growth and function.

## Two to Six Months

The fluid milk portion of the young calves' diet is reduced at weaning. Calves require a good-quality free-choice grain mixture and an ample supply of high-quality forage. A fresh, abundant, and clean supply of water must be available during weaning as inadequate water will reduce the grain and forage consumption. It is essential that calves are maintained on a high nutrition level so that growth will continue at a normal rate. In addition, dry matter intake and development of the digestive tract are closely related. Feeding practices that assist in developing a fully functional rumen are important aspects of early calf nutrition. A developed rumen allows calves to fully digest and utilize forages and dry grains, which results in a lower cost ration.

Calves should remain in the hutches for two weeks after weaning to promote grain intake and decrease the stress of weaning. Calves are moved from the hutches into small groups of five calves. Small groups ease the transition from individual housing to group competition. Both of these practices help decrease weaning stress and helps calves maintain weight gains. An average daily gain of 1.65 to 1.9 pounds is desired at this stage of growth.

During the period from weaning to six months of age, calves in transition should be fed the same high-quality feeds used before weaning. 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 four to six pounds of grain per day should be offered to weaned heifers up to age six months. The grain mixture should contain 16 to 18% crude protein. Immediately after weaning, young heifers consume a small amount of forage dry matter in comparison to the amount of grain mixture consumed. Therefore, a grain mixture that includes coarse grain products are important in maintaining good digestive health of the animals.

Carefully monitor forage quality during the period when heifer calves are age two to six months.

Fine stemmed, mold-free hay must be fed. A good-quality second or third-cutting legume-grass mixture hay is preferred. High-quality alfalfa containing protein greater than 18% can result in diarrhea. Poor quality, stemmy, or moldy hay reduces forage intake and reduces growth. As animals get older and larger, their forage intake increases. By age 4 to 6 months, it is important that heifers are eating 4 to 5 pounds of palatable, high quality forage.

Pasture is generally not recommended for calves less than four months old because the composition of pasture fails to supply adequate nutrients. Calves four to six months of age can utilize pasture with grain supplementation. The amount and blend of grain fed will depend upon the age of the animals and should be balanced to complement the quality of forage being fed.

Suggested ration specifications are shown in Table 3. This table can serve as a guide when balancing rations for growing heifers.

#### Nutrition Management Checklist: Two to Six Months

##### A. General

1. Maintenance of good health with average daily gains of 1.65 to 1.9 pounds.

##### B. Nutrition

1. Calf starter ration should be fed to calves from weaning until 3 months of age.
  - a. Allow a minimum of 18 inches of feed space per animal.
2. Grower ration is fed starting at 3 months of age.
  - a. Allow a minimum of 18 inches of feed space per animal.
3. Good-quality hay should be fed free choice.
  - a. If good-quality hay is not available, increase fiber content of calf starter to stimulate rumen function, control bloat, and avoid overfattening.
4. Fresh clean water should always be available.
5. Monitor growth and weight by comparing age and body weight to standard table (Figure 1).

**Table 3. Suggested Ration Specifications for Growing Holstein Heifers.<sup>1</sup>**

	Age (months)			
	3-6	7-12	13-18	19-22
	Average weight (lb, large-breed)			
	300	600	900	1100
Est. dry matter intake, lb/day	7-9	12-16	17-21	22-26
% of body weight	2.7-3.0	2.7	2.5	2.0
	Nutrient Specifications (% of dry matter) <sup>2</sup>			
Crude Protein	16	15	14 <sup>3</sup>	12 <sup>3</sup>
UIP, % of CP <sup>4</sup>	35-45	35-40	25-35	15-20
Total digestible nutrients	68-74	64-70	60-63	60-63
NE <sub>m</sub> , Mcal/lb	.78	.66	.65	.62
NE <sub>e</sub> , Mcal/lb <sup>5</sup>	.50	.44	.40	.40
Forage, % of diet	20-60	30-90	40-100	40-100
Calcium	.50-.60	.40-.50	.40-.50	.40-.50
Phosphorus	.35-.40	.32-.35	.28-.32	.28-.30
Trace mineral salt	.30	.30	.30	.30
Vitamin A (U/lb DM)	1,000	1,000	1,000	1,000
Vitamin D (U/lb DM)	140	140	140	140
Vitamin E (U/lb DM)	11	11	11	11

<sup>1</sup> Adapted from Raising Dairy Replacements, NCRE publication

Assumes ad-lib feeding; clean, dry environment; disease and parasite free; moderate temperature/humidity.

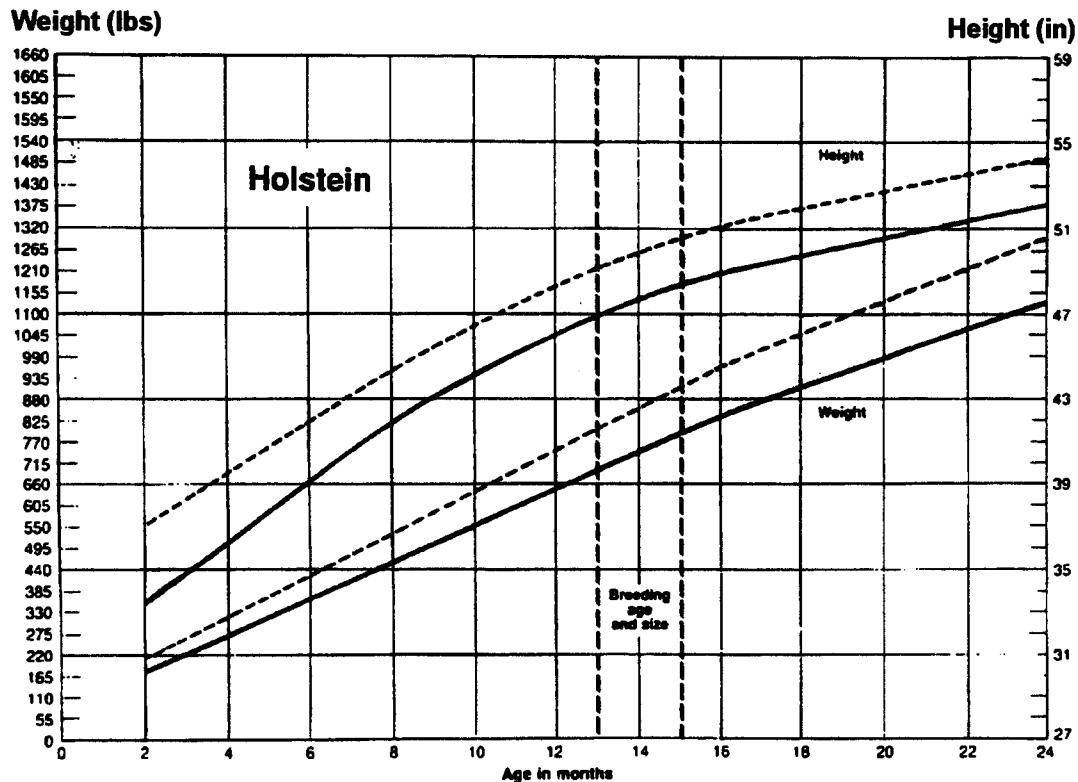
<sup>2</sup> Trace mineral salt, a high-calcium (15 to 25%) and phosphorous (10 to 20%) mineral mixture, and water should be available free choice at all times.

<sup>3</sup> Twenty to 30% of the total crude protein can be provided by nonprotein nitrogen sources for heifers weighing more than 800 pounds.

<sup>4</sup> UIP = Undegradable intake protein (bypass protein). Requirements are not well established.

<sup>5</sup> If ionophores fed, reduce NE<sub>e</sub> values by 10%.

Figure 1. Heifer Growth Chart



Adapted from Penn State Extension Circular 385



## **Six to Twelve Months**

Most forages, with the exception of silage, can be offered to heifers on a free-choice basis without causing an over-eating problem. Silage must be replenished at least once per day to avoid spoilage and reduced intake. Hay is most often available. Hay should be analyzed for nutrient composition to allow accurate balancing with concentrate supplement.

Pasture also makes an excellent forage for heifers. A large percentage of farmers use pasture for heifers during part or all of the year. During 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 to 2.2% of body weight.

In this plan, 6 to 12-month old heifers utilize pasture when available and are supplemented with grain at 0.5-1% of body weight. The amount of grain fed and its concentration of nutrients are determined by the average forage quality (requires a forage test), forage consumption, and the average nutrient requirements of the heifers.

Dominant heifers can consume more than their proportionate share of grain mix resulting in variation of individual growth rates. Sorting animals into uniform groups by size or utilizing self locking head gates allows all animals the opportunity to receive the proper amounts of concentrates. Body weights within group should never vary more than 100 pounds. All heifers should be able to be at the feed bunk at the same time.

### **Nutrition Management Checklist: Six to Twelve Months**

#### **A. General**

1. Maintain good health with an average daily gain of 1.7 to 1.8 pounds per day.

#### **B. Nutrition**

1. Fresh, clean water should always be available.
2. Monitor growth rate (Figure 1).
  - a. Underdevelopment can result in delayed puberty and breeding.
  - b. Overconditioning during growth and puberty can cause decreased level of milk production in subsequent lactations.

## **Twelve to Twenty-Four Months**

Twelve to 24-month old heifers are fed and handled in the same manner as the 6 to 12-month old heifers. The amount of grain fed and the concentration of nutrients in it are determined by the average forage quality (requires a forage test), forage consumption, and the average nutrient requirements for the group of heifers. Concentrate mixtures should be formulated according to protein, energy, and mineral needs of the animal as shown in Table 3.

Over-conditioned or fat heifers often are the result of over-feeding high quality forages, especially corn silage. Over-feeding energy in proportion to protein will fatten a heifer at any growth stage.

**Nutrition Management Checklist: Twelve to Twenty-Four Months**

**A. Transition phase (12-14 months)**

**1. General**

- a. Maintenance of good health with minimum average daily gain of 1.8 pounds per day.
- b. Enter transition phase weighing 700 pounds, be 48 to 50 inches in hip height and have a body condition score of 3.0 to 3.5.

**2. Nutrition**

- a. Fresh, clean water should always be available.
- b. Monitor growth rate.

**B. Breeding phase**

**1. General**

- a. Maintenance of good health with minimum average daily gain of 1.8 pounds per day.
- b. Weigh 750 to 850 pounds, be 50 to 52 inches in hip height and 3.0 to 3.5 in body condition score.
- c. Exhibit normal estrus activity.

**2. Nutrition**

- a. Fresh, clean water should always be available.
- b. Monitor growth rate.

**C. Bred phase**

**1. General**

- a. Maintenance of good health with minimum average daily gain of 1.8 pounds per day.
- b. Calve at 24 to 26 months of age weighing 1,200 pounds post-calving, be greater than 55 inches in hip height and with a body condition score of 3.0 to 3.5.
- c. Less than 2% incidence of abortion in heifers greater than 120 days pregnant.

**2. Nutrition**

- a. Fresh, clean water should always be available.
- b. Monitor growth rate.

## Breeding and Genetics

The breeding program is a critical part of a successful heifer operation. The decision to use artificial insemination, natural service, or a combination of the two need careful consideration. This decision should be based on the use of the heifer, potential markets for merchandising, availability of labor, and breeding management skills. Estrous synchronization programs (Appendix B) can be used to improve labor efficiency on most operations.

Greater genetic progress can be made through the use of artificial insemination. On average, a first-lactation animal sired by an AI sire will produce \$200 more milk per lactation compared to an animal sired by natural service (Funk, 1994). Over the average life time of the cow (three lactations), the additional income from milk sales would total \$600. Heifers with known sire and dam identification carrying an AI-sired calf will likely bring the higher end of the current market price. On average, quality heifers within 60 days of calving sell for \$1,100 to \$1,300 per head in Missouri.

Production traits should receive highest priority when selecting AI sires for use with heifers. Conformation traits (udder, feet, legs) are also important. Select sires with calving ease scores less than the breed average (9% for Holsteins). Ideally, scores of 6% or less should be used if possible. Selection for calving ease is not a substitute for poor heifer management. Small heifers resulting from poor nutritional management will not benefit from calving ease sires.

When considering AI, the choice between unproven young sires and proven sires is an important decision. Although young-sire semen generally costs less, it involves more risk. Young sire usage may result in increased calving problems if the sire produces large calves. If one chooses to use young sires in heifers, use many different sires to reduce the risk of calving difficulties.

Thirty-five to 40% of most dairy herds are comprised of first-lactation cows. This means that 35 to 40% of the calves born on the farm will be from these cows. Genetic progress is slowed if the first lactation cows are bred to inferior bulls.

Before the decision is made to breed heifers using natural service, the disadvantages should be explored. Bulls are often difficult to handle, can become dangerous, and will increase wear and tear on facilities. They may be subfertile, infertile, and can carry venereal diseases. More importantly to the dairy producer, natural service sires are typically genetically inferior to proven AI sires.

The pregnancy rate and age at calving have tremendous impact on the financial success of a heifer operation. Developing heifers to the proper weight (minimum of 750 lbs) and height (48.5 inches at hip) by 14 months of age should be easily attained or exceeded. The earlier the animal reaches the optimum height and weight for breeding, the earlier she is ready for sale.

The breeding program for The Missouri Heifer Plan uses artificial insemination. The nutritional program in the plan is designed so heifers will reach or exceed the target weight of at least 750 pounds by 14 months of age. Each month heifers that have reached the target weight and age are placed in pastures with access to a corral for observation of estrus activity. Heifers are observed twice daily for 30 minutes. Heifers standing to be mounted are artificially inseminated 12 hours later. Heifers not observed in estrus after 25 days are examined for reproductive abnormalities. Breeding dates are recorded and heifers are closely observed for signs of return to estrus within 18 to 24 days. The breeding period used in the Missouri Heifer Plan was limited to 105 days or five estrus cycles. Sixty days after the end of the breeding period, heifers are examined for pregnancy. Open heifers are sold following the pregnancy exam. The plan assumes a 70% heat detection rate and a 60% conception rate.

#### Breeding Management Checklist:

- A. Minimum weight of 750 pounds, 48.5 inches in hip height.
- B. 95% of all heifers cycling at the start of the breeding period.
- C. Minimum 70% heat detection.
- D. Minimum 60% pregnancy rate.
- E. Less than 5% abortion in heifers.

#### **Culling**

Culling heifers is one of the most difficult and costly decisions facing the heifer grower. It is important to make this decision in a timely manner since delayed culling will increase expenses and lower returns. Respiratory diseases are often the major culprit that results in slowed growth and "poor doers". Failing to cull these heifers will result in delayed age at breeding, potential difficulty in calving, and poor cow performance.

The most common physical abnormalities encountered by heifer growers is freemartinism and white heifer disease. Freemartinism occurs when a heifer is born as a twin with a bull. Developmentally, the male gonads develop prior to the female reproductive organs. Since there is a shared blood supply, the male hormone prevents the proper development of the female reproductive organs.

White heifer disease is a genetic disorder that also results in the failure of the female reproductive organs to develop. Both conditions produce heifers that lack portions of their reproductive tract,

and therefore are infertile. A thorough rectal exam to evaluate the internal reproductive organs between 6 and 12 months of age should be performed to identify these problems.

Various injuries and disease processes can render a heifer unfit for the rigors of milk production. These injuries include conformational problems with feet, legs and the mammary gland. Upon diagnosis, heifers should be culled in order to minimize production costs.

## **Health**

The health program is designed to insure a high-quality health status for the herd, thereby minimizing death loss, introduction of new disease, and loss of production efficiency due to clinical and subclinical disease. The program addresses each of the various production stages comprising the dairy heifer enterprise. The routine health procedures and health performance monitoring of the Missouri Heifer Plan are established as guidelines for each stage of development. However, individual needs will dictate the complete health program.

A vaccination program is established based on the prevalence and impact of specific diseases. Minimum requirements are used unless a specific disease problem arises. Primary consideration is given to those infectious diseases which cause diarrhea, pneumonia, abortion, infertility, and sudden death. Timing of the vaccinations is established to maximize protection against the various disease entities.

Internal and external parasite control is established for each of the production stages based on a given locale. Monitoring the level of parasitism through routine fecal examination for internal parasites and clinical observation of animals for external parasites is used to refine the program as needed.

Epidemiologic procedures to monitor health performance are established for each stage. Results of the monitoring procedures are compared to performance goals and utilized to refine health procedures.

### **Birth to Two Months**

Many management, environmental, and physiologic factors have a profound effect on the health of the young calf. Calf health begins with prepartum cow care during the dry period. The prepartum cow should be fed a balanced diet and housed in a clean, comfortable environment. Proper vaccinations should be given to provide adequate immunization and enhance colostral antibody levels. The calving area should be maintained clean and dry. Cows should be monitored during the calving process and assistance provided when needed.

The newborn calf's navel cord should be dipped in strong tincture of iodine immediately following birth. Within six hours after birth, the calf should be separated from the cow and placed in a clean, dry, draft free environment. Calves should receive a minimum of one gallon of high-quality colostrum within the first 12 hours of life. Ideally, the calf should receive two quarts of colostrum within six hours of birth and an additional two quarts within the next six hours.

Colostrum quality should be monitored to insure that newborn calves are receiving high-quality colostrum. Antibody levels in colostrum from older cows are consistently higher than first lactation cows. A colostrometer is an excellent instrument for measuring colostrum quality. When using the colostrometer, make sure the colostrum is at room temperature. A frozen colostrum bank from mature cows should be maintained in the event high-quality colostrum is not available. Colostral antibody levels in the newborn calf can be evaluated using the zinc sulfate turbidity test or by measuring total serum protein. For the best results, a blood sample is taken after the calf is 36 hours old and prior to seven days of age.

During the first month, the most common cause of sickness and death is calf scours. Several pathogens, including *E. coli*, rotavirus, coronavirus, salmonella, coccidia, and cryptosporidia cause calf scours. These agents can be present at any time, but under conditions of crowding, cold stress, inadequate nutrition, and poor sanitation, calf scours can become a significant problem. The best cure for scours, regardless of the cause, is prevention. Adequate high quality nutrition and clean, dry, draft-free housing are essential components of a prevention program. Specific preventive and treatment measures may be required in specific situations.

Increased illness and mortality in the young calf tends to occur during cold, wet, windy weather. Maintenance energy requirements are much higher in a cold environment, therefore dietary changes should be made to adapt to the cold environment. Calves fed milk replacers with less than 20% fat are at greater risk during the winter months if housed in a cold environment. Young calves must be monitored on a regular basis, and the amount of liquid diet altered to sustain energy levels during cold conditions. Young calves should be offered a balanced calf starter as early as one week of age to increase the nutrient density of the total diet without inducing milk scours.

Two important health management practices that should be implemented during the preweaning period are dehorning and extra teat removal. Calves can be dehorned as early as two to three weeks of age or as soon as the horn button can be felt. To prevent injury to the calf or the operator, a restraint device, such as a calf cradle or table should be used. Local anesthetics can be used. Electric dehorning is a safe, humane method for dehorning young calves. Proper procedure calls for the surface of the dehorner to be "cherry red" before it is touched to the horn button. The dehorner should be applied to the horn button using steady pressure for approximately 10-15 seconds or until a continuous copper-colored ring is displayed around the base of the horn. This procedure results in minimal pain for the calf and provides rapid destruction of the horn button.

Each time calves are restrained the udder should be examined for extra teats. The four regular teats should be symmetrically arranged. Extra teats are usually smaller in size and located close to the main teats. They can be snipped off with a pair of scissors and the cut surface painted with a topical antiseptic. If you are not absolutely sure which teats are the extras, consult your veterinarian.

Vaccinations in the preweaning stage are usually not necessary provided the calf has received adequate colostrum protection and is maintained in a healthy environment. The calf's immune system does not respond to stimulation, either from disease exposure or vaccination, at the same degree as an adult animal until after three months of age. Colostrum antibodies can also interact with and render vaccines ineffective until the calf is past three months of age. Specific situations may require certain vaccinations in the preweaning stage. Any vaccine given preweaning should be boosted after the calf reaches three months of age.

The feeding of high-quality milk replacers and rapidly digestible calf starter rations predisposes the calf to "over-eating disease" which is caused by *Clostridium perfringens* type C & D. Vaccination against overeating disease should be routinely performed around one month of age.

#### Health Management Check List: Birth to Two Months

##### A. General health

1. Less than 5% death loss.
2. Sanitation, bedding, and ventilation extremely important for disease control.
3. Attend calves from youngest to oldest.
4. Feeding utensils.
  - a. Nipple pails or bottles can be used to feed milk to calves until weaning.
  - b. Maintain nipples in good repair and monitor nipple orifice size.
  - c. All utensils should be washed and sanitized between each feeding.

##### B. Health procedures

1. The newborn (1 to 10 days of age).
  - a. Inject vitamin E and selenium to prevent white muscle disease.
  - b. Inject vitamin A and D because calves are born with small reserves.
2. The month-old calf.
  - a. Vaccinate with clostridium toxoid/bacterin to prevent overeating disease.
  - b. Dehorn with electric dehorner.
  - c. Remove extra teats.

##### C. Fly control

1. Maintain clean bedding and surroundings.
2. Use insecticide ear tags, spray, or dust.

##### D. Record all procedures in records system

##### E. Disease monitoring

1. Early recognition of disease problems.
  - a. Lack of appetite.
  - b. Depression/stupor.



- c. Fecal consistency/character.
  - d. Dehydration.
  - e. Coughing, runny nose, noisy breathing.
2. Record all incidence of disease problems.

## **Two to Six Months**

Colostrum immunity begins to decline between the ages of two and six months. At the same time, the young calf begins to produce its own immunity. Calves can go through a period when they have an increased susceptibility to diseases during this transition.

Respiratory diseases are the most common health problem in this growth stage. Prevention starts with proper housing and nutrition. The calf requires housing that is clean, dry, and properly ventilated. Clean fresh water and adequate feed bunk space should be provided. Calves should also be grouped by size and age.

Calves should receive the first series of vaccinations or boosters to any vaccines given earlier. Many vaccines are available to protect dairy replacement animals from diseases. Vaccines commonly used provide protection from brucellosis, infectious bovine rhinotracheitis (IBR), parainfluenza (PI<sub>3</sub>), bovine virus diarrhea (BVD), bovine respiratory syncytial virus (BRSV), clostridia (blackleg), and leptospirosis. Vaccines are also available to provide protection against pasteurilla, hemophilus, and pinkeye. The specific needs of each farm should be discussed with the herd veterinarian.

Internal and external parasites can be serious problems affecting the growth and performance of dairy heifers. Calves two to six months of age have little or no resistance to internal parasites. Parasite control requires the establishment of good parasite management practices. Hutch calves are generally not at risk. However, once calves are grouped, parasite buildup generally occurs. Prevention requires that manure buildup be kept to a minimum. Calves should be on a routine deworming program starting at weaning.

Coccidiosis is another internal parasitic infection that can cause devastating losses in calves. Coccidia are single cell protozoa that live within the cells of the digestive tract. These organisms can cause extensive damage to the intestinal tract of calves two to 12 months of age. Severely infected calves may show signs of bloody diarrhea. Coccidiosis at the subclinical level (undetectable by usual clinical observations), reduces the growth rate of calves. Feeding concentrates or supplements that contain a coccidiostat will help prevent coccidiosis.

Fly control is required during the fly season. Routine manure and bedding removal will help to eliminate fly larval development. The use of premise and livestock sprays provide additional control. Insecticide ear tags and dust bags along with systemic products may be included in the fly control program. Fly control should begin prior to the fly season to prevent a population

buildup and continue until the first hard freeze.

Animals housed in the winter are susceptible to lice infestations. In young calves, severe lice infestations can lead to poor performance and anemia. Control measures for lice include a variety of sprays, dusts, and pour-ons. Animals should be monitored closely for signs of lice and appropriate control measures instituted.

### Health Management Check List: Two to Six Months

#### A. General health

1. Less than 2% death loss.

#### B. Health procedures

1. Two to four months of age.
  - a. Start internal parasite control program.
  - b. Start external parasite control program.
    - 1) Fly control in warm season.
    - 2) Lice control in cool season.
  - c. Use coccidiostat to prevent coccidiosis and to promote positive weight gain.
  - d. Examine udder for abnormalities and extra teats.
2. Four to six months of age.
  - a. Vaccinate with Brucella abortus strain 19. (Depends on market.)
  - b. Vaccinate with IBR/PI3, BVD, BRSV.
  - c. Vaccinate with 5-way leptospirosis.
  - d. Booster with 7-way clostridial vaccine.
  - e. Maintain internal and external parasite control programs.
  - f. Examine udder for abnormalities and extra teats.
3. Record all procedures in records system.

#### C. Disease monitoring

1. Early recognition of disease problems.
  - a. Lack of appetite.
  - b. Depression/stupor.
  - c. Fecal consistency/character.
  - d. Dehydration.
  - e. Runny eyes.
  - f. Coughing, runny nose, noisy breathing.
2. Record all incidence of disease problems.

### **Six to Twenty-Four Months**

The major health problems of heifers on pasture are internal parasites, external parasites, and infections causing respiratory and reproductive problems. A deworming program should address

the inhibited larval form of *Ostertagia* (brown stomach worm). The number of inhibited larval forms increase in times of adverse weather such as dry hot summer and cold winter conditions. Appropriate timing and use of deworming products which are effective against the inhibited larval forms are necessary for adequate control. Both the summer and winter inhibited forms are found in Missouri. The major inhibited form will depend on your location in the state. Consult your veterinarian on the form most common in your area.

External parasites such as lice and grubs should be controlled in the fall. Coccidia can present a problem, especially during wet periods. Subclinical infections can be serious enough to affect growth rate and feed efficiency. Feeds containing an ionophore can be fed to reduce the effects of coccidia as well as enhancing feed efficiency and growth.

Fly control should be maintained during the fly season. Manure and bedding buildups around feeders should be kept to a minimum. Ear tags and dust bags along with systemic products can be added to the fly control program. Fly control should begin prior to the fly season to prevent a population buildup and continue up to the first hard freeze.

Booster vaccinations against respiratory and reproductive diseases (IBR, PI<sub>3</sub>, BVD, BRSV, and leptospirosis) should be administered. Ideally, these boosters should be given approximately 30 days prior to breeding during the prebreeding examination. A vibriosis vaccine should be considered if natural service is used. When administering vaccines, follow the label instructions.

#### Health Management Check List: Six to Twenty-Four Months

##### A. General health

1. Less than 0.5% death loss.

##### B. Health procedures

1. 6 to 24 months of age.
  - a. 30 days prior to breeding.
    - 1) Vaccinate for vibriosis if bulls are used.
    - 2) Booster with IBR/PI<sub>3</sub>, BVD, BRSV vaccine.
    - 3) Booster with 5-way leptospirosis vaccine.
  - b. Maintain internal and external parasite control programs.
  - c. Check udders for abnormalities.
  - d. Observe structural and conformational soundness.
  - e. Palpate for reproductive soundness.
  - f. Consult potential buyers for additional health requirements.
2. Record all procedures in record system.

##### C. Disease monitoring

1. Early recognition of disease problems.

- a. Lack of appetite.
  - b. Depression/stupor.
  - c. Fecal consistency/character.
  - d. Dehydration.
  - e. Runny eyes.
  - f. Coughing, runny nose, noisy breathing.
  - g. Vaginal discharge.
2. Record all incidence of disease problems.

## **Marketing**

Two major approaches are commonly used to market heifers. The first method is the traditional non-contract approach where the grower purchases the heifers and sells them on contract or through established marketing channels. The second method uses contracts where the grower acts as a custom feeder. The heifer supplier retains ownership and contracts with the grower to raise the heifers for an agreed period of time and price.

Regardless of whether a grower owns or contracts heifers for market, a complete set of records will increase the marketability of the heifers. One method of record keeping commonly used is DHI. Calf pages, annual heifer reports, and heifer management reports can be obtained on heifers from DHI herds.

These report pages contain a measure of expected genetic merit for heifers with no progeny of their own called the Estimated Transmitting Ability (ETA). ETA values are the best predictors available of how a heifer will produce when she enters the milking herd. These values may be used to compare animals within and across herds.

### **Non-contract Production of Dairy Heifers**

Successful non-contract heifer production requires knowledge and experience in buying, managing, and selling well-developed, healthy, dairy heifers. The risks for the grower can be greater than for a contract-grower because the selling price is less clearly defined. This method allows for a more diverse seller's market to include international markets.

The grower needs to understand and be willing to implement the best management practices for dairy heifer health and growth before entering this marketing approach. Success depends on the grower's reputation for selling high-quality, productive heifers.

### **Southwest United States**

The southwest United States offers marketing opportunities for growers using non-contract options. During the past several years, many large dairies that do not raise their own heifers have developed in Texas and New Mexico. A large demand for springing heifers has resulted with this rapid expansion and herd cull rates of 30 - 40%. Most producers require delivery of a springing heifer weighing at least 1,300 pounds and due to calve in 45-60 days.

Heifers marketed in the south/southwest should calve in either spring or fall to receive the best prices. The potential for growing heifers to meet the fall-calving demands of the south/southwestern market is enhanced because of the abundance of high-quality pasture available in Missouri. A grower could purchase 400-pound heifers in late March to utilize pasture from

April through September. Minimal supplementation will produce average gains of 1.75 lbs per head per day. Heifers produced in this system should reach a target breeding weight of 750-800 lbs by mid-November and would calve the following September and October to meet the fall calving demand.

Purchasing short-bred heifers (2-3 months bred) that weigh an average 900 pounds is an alternative to buying 6-month old, 400-pound heifers in March. There is a risk associated with handling short-bred heifers. Heifers that abort, acquire mastitis, develop an undesirable udder, or fail to develop properly will potentially lower the value of the group. Animals that fit this description should be culled at purchase. Likewise, before inviting a buyer to view the heifers, one should remove undesirable heifers from the group. Undesirable animals can be marketed through the livestock markets. Culling undesirable animals should result in a higher price for the premium group.

A third alternative for a grower is to sell breeding age heifers. While livestock auctions are an alternative, a grower would likely benefit from selling direct to individual buyers. It takes skill, experience, persistence, and a good reputation to develop a relationship with individual buyers. Selling direct avoids costs associated with livestock auction commissions and hauling to the market. Direct selling usually results in a higher price than selling at an auction market. Selling breeding age heifers means that the cost of non-breeders or abortions is borne by someone else.

### International Markets

International markets offer additional marketing opportunities. These markets require specific health regulations before heifers can be exported from the United States. The State Department of Agriculture International Marketing Office confirms the required regulations for the country of destination.

For example, dairy heifers exported to Mexico require specific vaccinations within 90 days and blood tests within 30 days of shipment. Written confirmation on a certified health certificate issued from an accredited veterinarian is required. Most importers to Mexico prefer Holstein heifers that do not have white coloration around the eyes. Animals with damaged eyes must be culled before shipment. Heifers having a level to slight slope from hooks to pins are preferred over heifers carrying a high tailhead. Individual animal identification, including calfhood photographs, vaccination and health records, as well as sire and dam identification is given preference for market to Mexico. Springing heifers carrying small-breed offspring in order to minimize potential calving difficulty are preferred.

### **Contract Production of Dairy Heifers**

Contract production of dairy heifers is another method of marketing. A written contract should be used for the protection of both the owner and the grower. Contracts should specify both the responsibilities of the custom feeder and the owner. Guidelines for growth, fee arrangements,

death loss, unthrifty animals, methods of payment, and risk reduction should be addressed in the contract. Effective contracts must be mutually beneficial to both the contract grower and the owner. Advantages and disadvantages and an example contract are found in Appendix C.

### Types of Contracts

*Gain:* Owner and grower agree upon a price per pound of gain for the contract period. Price per pound will vary based on the variation in cost of gain for different age heifers and the level of responsibility assumed by the grower. Growers that provide feed, breeding, veterinary services and assume the death losses, must receive a higher price per pound of gain than those growers that provide only feed.

Ease of calculation is an advantage to the gain-based contracts. The owner's cost of raising the replacement is set, regardless of changing feed prices. Adjustments for differences in receiving weight and breeding weights should be negotiated. Conlin and coworkers, University of Minnesota, suggest that some gain-based contracts use a "step wise" pricing scheme to compensate for receiving weights. For example, the contract price may increase \$.02 for each 50-pound increment above 450 pounds receiving weight.

*Per head per day:* A fixed fee per head per day provides easy planning for the owner and allows for simple billing. The grower should consider receiving weights and breeding costs before negotiating a price. Gains at heavier weights are more costly than at lighter weights. Contracts should specify rate of growth, body condition, breeding size, and age. Price per head per day is directly influenced by the allocation of management responsibility assumed by the grower.

*Feed plus yardage:* The owner pays for all feed plus a yardage fee to cover labor, facilities, and other operating costs (heat detection, breeding, veterinary costs, death loss, etc.). The yardage fee is usually in the range of \$0.15-0.25 per day. Contracts should include source of feeds, ration formulation, feed purchase and delivery plus other specific items to be included in the yardage fee. Growers purchase feed and sell it to the owner in some contracts. The owner bears the greatest risk in this contract because of varying feed prices and less control over rates of gain.

*Option to purchase:* The owner sells the heifer to the grower and reserves the right to buy the heifer back at current or a pre-determined price. This arrangement shifts most of the risk to the grower, including changes in feed prices, death losses, and other costs. Investment costs in animals can be substantial and the grower can expect uneven income flows, particularly during business start-up. The owner's risk is reduced when a predetermined purchase price is established.

## **Labor**

Labor required to operate a dairy heifer enterprise should be divided into areas based on skill requirements. Husbandry skills required to care for and manage baby calves are different from those required for older heifers. Production efficiencies are improved by using specialized and skilled labor.

A large-scale heifer operation requires management skills in heifer marketing to include procurement of heifers, feed and supplies. Personnel management skills are required to supervise both full and part-time labor.

Annual labor needs assumed in the Missouri Heifer Plan were derived from various sources including reported Missouri averages, results of national surveys, replacement heifer enterprise budgets reported in other states, and professional and personal experiences.

This plan determines labor needs for each stage of production. The labor needs are divided into feeding and management, health maintenance, and breeding. Feeding and management includes time to feed, clean, bed, move, and manage heifers. Health maintenance includes the time required to perform various procedures such as vaccinations, deworming, and dehorning. Labor needs for breeding include time for heat detection, gathering, insemination, and pregnancy checking of heifers. The annual labor requirements are calculated based on the annual production (head) for each stage. (See Tables 4, 5, 6)

### **Birth to Two Months**

Raising baby calves requires a caring and compassionate attitude toward animals. Employees need a "keen sense" of observation and the ability to recognize subtle changes that may occur in each calf's attitude and appetite. Patience and devotion are required to care for sick calves. Basic knowledge of disease processes that affect the young calf, and the ability to administer health products are necessary skills.

Annual labor needs for feeding and management in the birth to 2-month stage are 3,502 hours. Thirty-six hours are required for health maintenance procedures including vaccinations, dehorning, and teat removal.

### **Two to Six Months**

This period of growth and development reflects a transition period for the calf. The rumen is developing and the calf is adjusting to group housing. Employees caring for calves should have basic knowledge of the calf's digestive system, and a practical understanding of ruminant nutrition. Employees must understand calf behavior and be able to observe changes in attitude



and appetite. In addition, they should be aware of disease processes that affect the growing calves and be skilled in the administration of health products.

Annual labor needs for feeding and management in the 2 to 6-month stage are 1,268 hours. Thirty-one hours are required for health maintenance procedures. These hours are based on performing health maintenance procedures at a rate of 40 head per hour utilizing three people.

### **Six to Twelve Months**

The skills required to successfully raise heifers from six months of age up to yearlings are different from those required to raise younger heifers. Skills in the area of grazing management, recognition of forage quality, and animal behavior on pasture are needed. A basic knowledge of disease processes that affect developing heifers along with skills in the administration of health products are required.

Annual labor needs for feeding and management in the 6 to 12-month stage are 737 hours. Twenty hours are required for health maintenance procedures. These hours are based on performing health maintenance procedures at a rate of 60 head per hour utilizing three people.

### **Twelve to Twenty-four Months**

The skills required to care and manage heifers from 12 months of age up to prefreshening are similar to those needed in the 6 to 12-month stage. Skills in the area of grazing management, recognition of forage quality, and animal behavior on pasture are needed. A basic knowledge of disease processes that affect developing heifers along with skills in the administration of health products are required.

Special skills for managing the breeding herd are required in this stage. Employees will need to be skilled in breeding management, including heat detection, proper breeding technique, and record keeping.

Annual labor needs for feeding and management in the 12 to 24-month stage are 1,402 hours. Twenty-nine hours are required for health maintenance procedures. These hours are based on performing health maintenance procedures and a prebreeding evaluation at a rate of 40 head per hour utilizing three people.

Annual labor needs for breeding are 701 hours. These needs are based on one hour per day (365 hours annually) devoted to heat detection. Labor requirements for insemination of the heifers are based on 384 head being inseminated an average of 1.6 times for a total of 614 inseminations. Three hundred and seven hours are required for gathering and insemination of heifers based on 0.25 hours per head utilizing two people. Twenty-nine hours are required for pregnancy checking heifers based on a rate of 40 head per hour utilizing three people.

**Table 4. Annual Labor Requirements for Feeding and Management**

Stage of Production	Annual Production (hd)	Daily Labor Requirement (min/hd)	Annual Labor Requirement (hr)	Annual Labor per Head (hr/hd)
0-2 months	432	8	3502.1	8.1
2-6 months	417	1.5	1267.7	3.0
6-12 months	404	0.6	736.9	1.8
12-24 months	384	0.6	1401.6	3.7
<b>Total</b>		<b>10.7</b>	<b>6908.3</b>	<b>16.6</b>

**Table 5. Annual Labor Requirements for Health Maintenance**

Stage of Production	Annual Production (hd)	Working Rate (hd/hr)	Number of Workers	Annual Labor Requirement (hr)	Annual Labor per Head (hr/hd)
0-2 months	432	12	1	36.0	0.083
2-6 months	417	40	3	31.3	0.075
6-12 months	404	60	3	20.2	0.050
12-24 months	384	40	3	28.8	0.075
<b>Total</b>				<b>116.3</b>	<b>0.283</b>

**Table 6. Annual Labor Requirements for Breeding**

Event	Annual Production (hd)	Working Rate (hd/hr)	Number of Workers	Annual Labor Requirement (hr)	Annual Labor per Head (hr/hd)
Heat Detection	384	N/A <sup>1</sup>	1	365	0.951
AI Services <sup>2</sup>	614.4	4	2	307.2	0.500
Pregnancy Check	384	40	3	28.8	0.075
<b>Total</b>				<b>701</b>	<b>1.526</b>

<sup>1</sup> A total of 1 hour per day<sup>2</sup> Based on 384 head inseminated an average of 1.6 times

## **Application of the Missouri Dairy Replacement Heifer Model**

The Missouri Heifer Plan is designed as a template for developing a sound replacement heifer production plan. The plan is applicable for dairy producers raising replacements or heifer growers that raise heifers on contract or for sale.

The financial feasibilities of this plan were tested in a computer model that evaluates production, investments, costs, and revenue streams that are generated on an actual farm. This model, the Dairy Replacement Heifer Model (DRH), simulates production and financial information that generates the appropriate financial statements and measures. The model can analyze an existing heifer enterprise or generate results of a start-up operation. In addition, the model has the flexibility to analyze the various stages of the heifer production enterprise described in the plan. The DRH model provides the flexibility to reflect "real world" operations. The Missouri Heifer Plan was analyzed with the DRH model and the results are reported in this section.

### **The Model**

The Dairy Replacement Heifer Model is a dynamic simulation model for use in the financial planning of heifer raising operations. The model forecasts a 10-year planning horizon. It consists of four modules: Data Input, Rations, Heifer Flow, and Financial Reports.

The Data Input module provides the framework to input information into the DRH model necessary to complete a production and financial analysis. The production section of the input module contains the information required to simulate heifer flows, purchases and sales of heifers at different stages of growth, death and culling rates, and other relevant inputs. The financial section of this module has the information needed to estimate production expenses, investments, financing, and to generate appropriate financial statements and ratios.

The Ration module estimates the annual cost of feed for the heifer enterprise. This module does not balance rations or estimate annual feed requirements. The user inputs the daily cost per head of rations by stage of growth and the DRH model estimates annual feed costs. Ration costs vary depending on the stage of growth of the heifer and change seasonally as heifers receive alternative feeds and utilize pasture. The DRH uses rations for the following stages of growth: 0-2 months, 2-6 months, 6-12 months, and 12-24 months of age. The ration module allows the user to input days on each ration, rates of gain, and the average daily costs per head.

The Heifer Flow module is the heart of the DRH model as it keeps monthly inventories of heifers by stage of growth for the first five years. Heifers enter the operation via birth or purchase and leave the operation via sales, death loss, or culling. This module also models pregnancy rates

which impacts open heifer sales and date of sale for bred heifers. A breeding season of approximately 100 days was assumed to allow for a maximum of five breedings per heifer. The analysis assumes that 42% of the heifers conceive in each breeding cycle. This conception rate is based on a 70% heat detection rate and a 60% conception rate. Those heifers that do not conceive by the fifth cycle are sold as open heifers.

The analysis assumes the enterprise will ultimately produce 364 bred heifers for sale each year. The operation is designed to have a total capacity of 456 calves per year. To reach these goals, 38 one-week old heifers are purchased every month over the 10-year horizon. In addition to these purchases, 200 6 to 7-month-old heifers and 200 12 to 13-month old heifers were purchased in April of the first year to use available pasture and improve cash flow the following year. The model reaches a steady state level of production by the end of the second year. Steady-state production sales include 30.3 bred heifers, 2.2 open heifers, and 2.8 cull heifers (0-12 months of age) for sale each month.

The Financial module develops financial statements and ratios used to analyze various heifer production scenarios. The financial planning horizon for these financial statements is 10 years. The DRH model projects monthly cash flows for the first three years, a 10-year cash flow, a 10-year balance sheet (cost basis), a 10-year profit/loss statement, and financial measures averaged over years 3-10.

### **Assumptions**

#### **Investments**

Major investments for a dairy heifer enterprise include land, buildings, machinery, equipment, and livestock purchases during the first year. The real estate and building investments are in Table 7. A total of 640 acres was assumed for the dairy heifer enterprise in order to provide for a building site, pasture, buffer strips, and other uses. Assuming a per acre cost of \$550, a total investment of \$352,000 for land is required. Additional real estate and building investments total \$129,650 for housing, water supply system, lagoon, fencing, and feed storage. The total investment in real estate and buildings is \$481,650.

Investments for machinery and equipment are shown in Table 8. The major investments include pickup trucks, equipment for the freestall barns, tractor, trailer, portable feed bunks, and flush system for the freestall housing. Total investments in machinery and equipment are \$62,500.

Investments in livestock purchases during the startup year are assumed as a cost of \$150 for 0 to 1-month old calves, \$450 for 6 to 7-month old heifers, and \$700 for 12 to 13-month old heifers. These prices include delivery costs.

The livestock investments reflect purchase of 38 calves per month for a total of 456 one-week old calves. Two-hundred 6 to 7-month old heifers, and 200 12 to 13-month old heifers were purchased during the first year to stimulate cash flow. The total livestock costs were \$298,400 during the first year of operation. Total first year investments for the dairy heifer enterprise are \$842,550.

**Table 7. Real Estate and Building Investments for the Dairy Heifer Enterprise**

ITEM	UNITS	NO. UNITS	\$/UNIT	COST
<b>Real Estate:</b>				
Land	acres	640	\$550	\$352,000
Site preparation			\$5,000	\$5,000
Lagoon			\$8,000	\$8,000
Water impoundments	each	4	\$3,500	\$14,000
Well/pipe/pump	each	1	\$10,000	\$10,000
<b>Real Estate Subtotal:</b>				<b>\$389,000</b>
<b>Buildings:</b>				
Hay storage (40' X 100')	each	1	\$12,000	\$12,000
Freestall barn (20' X 100')	each	2	\$10,000	\$20,000
Freestall barn (20' X 80')	each	2	\$8,000	\$16,000
Office/storage (24' X 30')	each	1	\$3,900	\$3,900
Calf hutch	each	85	\$100	\$8,500
Fencing (5 strand barbed wire)	miles	7	\$3,000	\$21,000
Corrals	each	1	\$3,000	\$3,000
Supplement bin (3 ton)	each	1	\$1,650	\$1,650
Supplement bin (12 ton)	each	1	\$6,600	\$6,600
<b>Building Subtotal:</b>				<b>\$92,650</b>
<b>REAL ESTATE &amp; BUILDING TOTAL</b>				<b>\$481,650</b>

**Table 8. Machinery and Equipment Investments for the Dairy Heifer Enterprise**

ITEM	UNITS	NO. UNITS	\$/UNIT	COST
<b>MACHINERY &amp; EQUIPMENT:</b>				
Pickup (0.75 ton)	each	1	\$20,000	\$20,000
Pickup (0.75 ton, 4X4, used)	each	1	\$5,000	\$5,000
Tractor (40 hp, used)	each	1	\$4,000	\$4,000
Livestock trailer	each	1	\$5,500	\$5,500
Livestock chute	each	1	\$2,200	\$2,200
Utility trailer (5' X 7')	each	1	\$400	\$400
Blade/scrapper	each	1	\$500	\$500
Mower/brush hog	each	1	\$700	\$700
Bale spike	each	1	\$500	\$500
Flush system tank (1000 gal)	each	4	\$1,000	\$4,000
Flush system pump & line	each	1	\$2,400	\$2,400
Freestall barn equipment (gates, waterers, loops, curtains)			\$8,250	\$8,250
Hay ring	each	19	\$125	\$2,375
Feed bunk (11' portable)	each	45	\$100	\$4,500
Bulk tank (200 gal, used)	each	1	\$400	\$400
Milk/water/feed buckets	each	170	\$2.50	\$425
Office furnishings			\$500	\$500
H.W. heater (50 gal)	each	3	\$150	\$450
Refrigerator (used)	each	1	\$400	\$400
<b>MACHINERY &amp; EQUIPMENT SUBTOTAL:</b>				<b>\$62,500</b>

## Production

Management, housing, and nutritional requirements for dairy heifers vary depending on the stage of growth and development. Therefore, dairy heifer development is typically divided into stages based on age or size. The stages in this plan are as follows: birth to two months, two to six months, six to twelve months and twelve to twenty-four months. The operation described in this plan was designed to accommodate a continuous flow of heifers.

Production assumptions used in the plan are presented in Tables 9 and 9a. A total of 38 calves are purchased each month. Death losses and cull rates are assumed for each stage of development. The total number of dead and cull heifers are determined by applying death loss and cull percentages during each stage of development.

The annual production is the number of animals that pass through a production stage during a 12-month period. This is determined as the average monthly inventory in each stage of production multiplied by the number of cycles for each production stage in the 12-month period. Six cycles are completed for the 0 to 2-month stage while three cycles are completed for the 2 to 6-month stage and two cycles are completed for the 6 to 12-month stage.

The 12 to 24-month stage includes a breeding season of about 100 days or approximately 5 estrous cycles. Pregnancy examination is performed approximately 60 days following breeding and open heifers are sold. The number of open heifers is determined in this analysis based on a 70% heat detection rate and 60% conception rate over the 5 estrous cycles. The number of services required per bred heifer is 1.67. Following these assumptions, the average length of time a heifer remains in this stage is 8.5 months. Therefore, 1.42 cycles of this production stage are completed in a 12-month period.

**Table 9. Production Assumptions**

<b>Production Stage</b>	<b>Death Loss (%)</b>	<b>Cull Rate (%)</b>	<b>Average Daily Gain (lbs.)</b>
0-2 months	5	2	1.5
2-6 months	2	2	1.9
6-12 months	0.5	4	1.8
12-24 months	0.5	2	1.8

**Table 9a. Average Annual Production**

<b>Production Stage</b>	<b>Avg. Monthly Inventory</b>	<b>No. of Annual Production Cycles</b>	<b>Avg. Annual Production</b>
0-2 months	72	6	432
2-6 months	139	3	417
6-12 months	202	2	404
12-24 months	272	1.42	384

The DRH model estimates heifer flows each month for the first five years. The enterprise reaches a steady state level of production by the beginning of the third year as noted in Table 10. Steady state operation shows monthly sales of 30.3 bred heifers, 2.2 open heifers, and 2.8 cull heifers. Death loss averages 2.8 heifers per month. The average monthly heifer inventory is 685 head in all stages of production from 0 to 24 months of age.

### Monthly Sales

The unit of sale in the dairy heifer operation is a bred heifer 60 days prior to calving. The heifer flow module simulates a total monthly production of 30.3 bred heifers and assumes a sales price of \$1,100 per head. In addition, 2.2 open heifers are sold each month for \$800 per head. The model simulation also assumes heifers are culled at various stages from 0 to 12 months of age. A total of 2.8 cull heifers are sold each month at various prices depending on stage of growth. Average sales at steady state are \$33,353 for bred heifers, \$1,704 for open heifers, \$887 for cull heifers for a total of \$35,944 per month.

### Labor

Labor is computed using full time equivalents (FTE's). One FTE equals 2,080 hours annually. The analysis assumes that two FTE's will be hired to share the major responsibilities for the care and management of the heifers. One of these FTE's is represented by the owner/operator. The two FTE's receive benefits estimated to equal 25% of the base hourly wage. The balance of labor required will be hired as needed on a part-time basis with no benefits provided.

One FTE will be responsible for the care and management of baby calves. This person will supervise the additional part-time labor required for feeding, care, and health needs of the calves 0 to 2 months of age. The second FTE will be responsible for heifers 2 to 24 months of age and will supervise the feeding, breeding, and health requirements for these animals. The total annual labor required for the operation is 6,908 hours for feeding and management, 701 hours for breeding, and 116 hours for health care, for a total of 7,725 hours (Tables 4, 5, 6). Source of labor will be 4,160 hours from the two FTE's and 3,565 from part-time labor. Labor expenses include \$8 per hour for the FTE's, \$4.50 per hour for the part-time labor, and \$8,320 per year for benefits (Social Security and medicare co-payments, etc.). Total annual labor costs (including co-payments and benefits) are \$57,643.



Table 10. Monthly Animal Inventories/Flows

Beginning Inventory----- 685

ANIMAL INVENTORIES/FLOWS (Months 25-36)

	25 Jan-96	26 Feb-96	27 Mar-96	28 Apr-96	29 May-96	30 Jun-96	31 Jul-96	32 Aug-96	33 Sep-96	34 Oct-96	35 Nov-96	36 Dec-96
<b>INVENTORY ON HAND</b>												
0 - 2 months	72.1	72.1	72.1	72.1	72.1	72.1	72.1	72.1	72.1	72.1	72.1	72.1
2 - 6 months	139.1	139.1	139.1	139.1	139.1	139.1	139.1	139.1	139.1	139.1	139.1	139.1
6 - 12 months	202.1	202.1	202.1	202.1	202.1	202.1	202.1	202.1	202.1	202.1	202.1	202.1
12 - 24 months	272.1	272.1	272.1	272.1	272.1	272.1	272.1	272.1	272.1	272.1	272.1	272.1
24+ months	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>TOTALS</b>	<b>685.3</b>	<b>685.3</b>	<b>685.3</b>	<b>685.3</b>	<b>685.3</b>	<b>685.3</b>	<b>685.3</b>	<b>685.3</b>	<b>685.3</b>	<b>685.3</b>	<b>685.3</b>	<b>685.3</b>
<b>HERD ADDITIONS</b>												
<b>Purchases</b>												
0 - 2 months	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0
2 - 6 months	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 - 12 months	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 - 24 months	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24+ months	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Births	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>TOTALS</b>	<b>38.0</b>	<b>76.0</b>	<b>114.0</b>	<b>152.0</b>	<b>190.0</b>	<b>228.0</b>	<b>266.0</b>	<b>304.0</b>	<b>342.0</b>	<b>380.0</b>	<b>418.0</b>	<b>456.0</b>
<b>DEATH LOSS</b>												
0 - 2 months	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
2 - 6 months	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
6 - 12 months	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
12 - 24 months	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24+ months	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>TOTALS</b>	<b>2.8</b>	<b>5.6</b>	<b>8.3</b>	<b>11.1</b>	<b>13.9</b>	<b>16.7</b>	<b>19.5</b>	<b>22.2</b>	<b>25.0</b>	<b>27.8</b>	<b>30.6</b>	<b>33.4</b>
<b>SALES</b>												
<b>Helpers for Breeding Purposes</b>												
0 - 2 months	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2 - 6 months	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 - 12 months	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 - 24 months	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24+ months	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bred Helpers	30.3	30.3	30.3	30.3	30.3	30.3	30.3	30.3	30.3	30.3	30.3	30.3
<b>Culls</b>												
0 - 2 months	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
2 - 6 months	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
6 - 12 months	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
12 - 24 months	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
24+ months	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>TOTALS</b>	<b>35.2</b>	<b>70.4</b>	<b>105.7</b>	<b>140.9</b>	<b>176.1</b>	<b>211.3</b>	<b>246.5</b>	<b>281.8</b>	<b>317.0</b>	<b>352.2</b>	<b>387.4</b>	<b>422.6</b>

## Expenses

Expense data is difficult to obtain and varies widely depending on a number of factors. Annual expenses assumed in the Missouri Heifer Plan were derived from various sources including reported Missouri averages, results of national surveys, replacement heifer enterprise budgets reported in other states, and professional and personal experiences.

Total annual expenses for the dairy heifer enterprise are shown in Table 11. Building, machinery, and equipment maintenance expenses are estimated as a percentage of the initial investment for these items. Utilities are estimated on the rated usage of the well system and the water recycle pumps for the flush systems in the freestall barns. Electric rates are assumed to be six cents per kilowatt hour.

Fuel and oil expenses are estimated on truck and auto usage at 10 cents per mile for 20,000 miles per year. Operating costs of other machinery include fuel and oil costs.

Veterinary services and products are assumed at \$15 per head for health maintenance procedures such as vaccinations, dewormings, and other services. A 20% "morbidity rate" was assumed (20 percent of the animals became ill and required treatment and/or veterinary consultation) with an average cost of \$10 per head. The total annual veterinary expense was calculated from the average annual production (Table 9a). The average annual production for all stages is 409 head.

Breeding expenses are assumed at \$15 per head for semen and breeding supplies. Services per conception is 1.6 with an assumed 60% conception rate. Therefore breeding expenses are \$24 per head.

Straw bedding was utilized in the hutches and the freestalls at a rate of two pounds per head per day. A total of 76 tons was required annually. The purchase price of the straw was assumed at \$40 per ton.

Marketing and transport costs were assumed to be \$30 per head for sales commissions and hauling fees. This expense is against open and cull animals which are sold at local markets.

Farm real estate and personal property taxes are due each December on the assessed value from the previous year. In year one, the tax assessed on the land from the previous year is assumed to be based on Grade 6 real estate as defined by the Missouri Tax Commission, a 12% Missouri assessment rate for agricultural property taxation, and a 6% average local assessment rate for agricultural property taxation. Grade 6 land is described as soils not suitable for cultivation--primarily pastures and woodlands with an 8 to 20% slope. Grade 6 land is assigned a use value of \$130 per acre. Therefore, in year one, the farm taxes computes as:  $\$130/\text{ac} \times 640 \text{ ac} \times 12\% \times 6\% = \$599$ . Improvements to the property in the form of buildings and other permanent structures in year one increases the assessed value which is paid in December of the following year (Year 2) and succeeding years.

Farm insurance was estimated at 0.15 percent of the initial investments for buildings, equipment, and livestock.

Waste management expense is based on an annual cost to custom hire the pump down of the lagoon.

Pasture maintenance cost includes annual seeding; application of fertilizer, lime, and chemicals; machinery use; and labor. Costs are estimated from pasture budgets reported in the Missouri Grazing Manual # M157 for a grass-legume pasture with a yield of five animal unit months (AUM) per acre. Based on this pasture yield, 6 to 12-month old heifers require 0.8 acres per head and 12 to 24-month old heifers require 1.33 acres per head. A total of 619 grazable acres is required for the 6 to 24-month old heifers. The remaining acreage is utilized for the building sites, water impoundments, lagoon, roadways, and additional pasture acreage.

**Table 11. Total Annual Expenses for the Dairy Heifer Enterprise**

<b>ANNUAL EXPENSES</b>	<b>TOTAL</b>
Building maintenance <sup>1</sup>	\$1,853
Machinery & Equipment maintenance <sup>2</sup>	\$1875
Utilities <sup>3</sup>	\$600
Phone	\$1,200
Fuel & Oil <sup>4</sup>	\$2,000
Veterinary Services and Products <sup>5</sup>	\$6,953
Breeding Costs <sup>6</sup>	\$9,216
Bedding Supplies <sup>7</sup>	\$3,040
Marketing/Production Transport <sup>8</sup>	\$1,764
Truck/Auto Costs <sup>9</sup>	\$3,200
Farm Taxes (real estate & personal property) <sup>10</sup>	\$599
Farm Insurance (bldgs, equip, animals, etc.) <sup>11</sup>	\$692
Record-Keeping System <sup>12</sup>	\$1,140
Waste Management <sup>13</sup>	\$3,500
Pasture Maintenance Costs <sup>14</sup>	\$28,474

<sup>1</sup> 2% of initial investment cost for buildings (Table 7).

<sup>2</sup> 3% of initial investment for machinery and equipment (Table 8).

<sup>3</sup> Estimated well system and freestall flush recycle pumps usage @ \$0.06/kwh.

<sup>4</sup> 20,000 miles annually for truck/auto use @ \$0.10 per mile.

<sup>5</sup> Based on \$15 per head for health maintenance and a 20% morbidity @ \$10 per head treatment cost for average annual production of 409 head.

<sup>6</sup> \$15 per head for semen and supplies @ 1.6 conception rate for 384 head.

<sup>7</sup> 76 tons used annually @ \$40 per ton.

<sup>8</sup> \$30 per head for commisions, hauling fees, etc. for open and cull animals.

<sup>9</sup> 20,000 miles annually @ \$0.16 per mile.

<sup>10</sup> Use value of \$130/acre - Grade 6 real estate as defined by Missouri Tax Commision.

12% Missouri assessment rate for agricultural property taxation - MO. State Tax Commission.

6% average local assessment rate for agricultural property taxation

<sup>11</sup> 0.15% of initial investment for buildings, equipment, animals.

<sup>12</sup> All animals identified and record started at receiving. Average cost \$2.50 per head.

<sup>13</sup> Annual pump down of lagoon.

<sup>14</sup> Includes costs of seed, fertilizer, chemicals, machinery use, and labor for 619 grazable acres.

## **Financial Analysis**

The financial feasibility of the Missouri Heifer Plan will depend on the financing of the operation. It is assumed that the owner/operator(s) will provide equity capital of 59% of the initial start-up investments (\$498,075). The balance will be financed with debt capital (\$344,475).

It is assumed that the owner/operator(s) will own all of the land and will have some cash to invest in buildings, machinery, and equipment. In addition, they will have a total of \$50,000 to pay for a portion of the operating expenses in Year One (Table 12). The balance of the building, machinery and equipment costs not covered with equity capital (\$96,075) is financed with term notes at a 9% interest rate over the payoff period. The rest of the debt, most of which is the initial cost of the purchased livestock and the balance of the operating expenses, is financed with a line of credit (LOC).

The cash flow for the operation is sufficient in all years due to the LOC which provides the necessary cash when cash sales fall short of business expenses (see Table 13). The LOC is large the first three years due to the time it takes to reach steady state production. The LOC grows to a maximum of \$310,050 by 24 months of operation. The LOC, however, is paid down to zero by year 7. Surplus cash flow is only generated after the LOC is paid to zero.

The profit/loss statement for the operation is presented in Table 14. Depreciation is calculated for buildings by using the straight line method over an average useful life of 15 years, while depreciation is calculated on machinery and equipment by using the straight line method over an average useful life of seven years. The proposed operation will not have a positive profit until it reaches steady state production in Year 3.

A cost-based balance sheet is presented in Table 15. Buildings, machinery, and equipment are reduced in value each year by the amount of depreciation applicable to each. Current assets reflects the amount of cash and feed inventory on hand, as well as the market value of livestock at each stage of growth. The current liabilities section reflects the LOC balance, interest accrued, and the current portion of the term debt. The non-current liabilities reflects the balance owed on the term debt. The operation starts out with 59% equity and grows to 96% equity by the end of Year 10.

The estimated costs and returns of raising one dairy heifer replacement is presented in Table 16. This table summarizes all of the income streams and costs associated with bringing one bred heifer to market. The income section reflects income for the bred heifer as well as income for open heifers and culls. The analysis indicates that for each bred heifer sold, there are 0.07 open heifers and 0.09 cull heifers that are sold as well. The expenses for raising a bred heifer are prorated by stage of growth. Over 40% of the total costs of raising a replacement heifer is associated with feed, followed by labor (15.9%). The profit per head is estimated to be \$189 after considering the relevant income and expenses of producing one bred heifer.

The financial measures presented in Table 17 indicate numerical measures of the financial feasibility of the project. The return to assets rises from 8.9% in Year 3 to 10.2% by Year 10. The average return to assets over Years 3-10 is 9.6%. The liquidity measures indicate that the operation is short of working capital the first few years. The LOC is, however, intended to provide this working capital. Liquidity improves beyond Year 5. The solvency measures indicate the business is solvent enough to withstand adverse market conditions. The debt-to-asset ratio never rises above 40% after reaching steady state by the end of year 2. The enterprise is solvent because a large portion of the assets are tied up in the value of land and livestock. Finally, the financial efficiency measures show positive trends, indicating that expenses decrease relative to income over the 10-year time horizon.

Financial analysis indicates that this operation is financially feasible. The major strength is an adequate return to assets. The major weakness is the financially weak position of the business during the three-year start-up phase. The financial results look reasonable beyond Year 3.

**Table 12. Initial Investments and Financing for the Dairy Heifer Enterprise**

<b>INVESTMENTS:</b>			<b>TOTAL</b>
<b>Real Estate and Buildings</b>			
Land			\$352,000
Buildings			\$92,650
Building Site Preparation			\$5,000
Lagoon Construction			\$8,000
Well System/Water Supply			\$24,000
<b>R. E. &amp; Bldg Subtotal</b>			<b>\$481,650</b>
<b>Machinery &amp; Equipment</b>			
Equipment			\$33,500
Tractor/Pickup			\$29,000
<b>M. &amp; E. Subtotal</b>			<b>\$62,500</b>
<b>Livestock</b>			
birth - 1 month	456 head @	\$150 /hd	\$68,400
6 - 7 months	200 head @	\$450 /hd	\$90,000
12 - 13 months	200 head @	\$700 /hd	\$140,000
<b>Livestock Subtotal</b>			<b>\$298,400</b>
<b>TOTAL INVESTMENT</b>			<b>\$842,550</b>
<b>FINANCING:</b>			
<b>Startup Equity Allocation</b>			
Land			\$352,000
Buildings, Machinery, Equipment			\$96,075
Line of Credit			\$50,000
<b>Startup Equity Subtotal</b>			<b>\$498,075</b>
<b>TERM DEBT FINANCED</b>			<b>\$96,075</b>
<b>LOC DEBT FINANCED</b>			<b>\$248,400</b>
<b>PERCENT STARTUP EQUITY</b>			<b>59.%</b>

Table 13. CASH FLOW BUDGET (10 year - Annual)

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
<b>CASH INFLOWS</b>										
Heifer Sales	\$119,097	\$201,070	\$400,239	\$400,239	\$400,239	\$400,239	\$400,239	\$400,239	\$400,239	\$400,239
1 month Heifer Sales	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
2 - 3 month Heifer Sales	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
6 - 7 month Heifer Sales	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
12 - 13 month Heifer Sales	\$138,600	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Open Heifer Sales	\$10,493	\$10,224	\$20,448	\$20,448	\$20,448	\$20,448	\$20,448	\$20,448	\$20,448	\$20,448
Cull Heifer Sales	\$6,603	\$10,649	\$10,649	\$10,649	\$10,649	\$10,649	\$10,649	\$10,649	\$10,649	\$10,649
Cash Contribution to Equity	\$96,075	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$10,000	\$10,000
Cash Contribution to LOC	\$50,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Proceeds-Intermediate Term Loans	\$31,250	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Proceeds-Long Term Loans	\$64,825	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Other Income	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>TOTAL INFLOW</b>	<b>\$516,943</b>	<b>\$221,943</b>	<b>\$431,335</b>	<b>\$431,335</b>	<b>\$431,335</b>	<b>\$431,335</b>	<b>\$431,335</b>	<b>\$431,335</b>	<b>\$441,335</b>	<b>\$441,335</b>
<b>CASH OUTFLOWS</b>										
Feed	\$72,644	\$107,110	\$127,605	\$127,605	\$127,605	\$127,605	\$127,605	\$127,605	\$127,605	\$127,605
Pasture	\$20,094	\$20,563	\$24,036	\$24,036	\$24,036	\$24,036	\$24,036	\$24,036	\$24,036	\$24,036
Building maintenance	\$1,853	\$1,853	\$1,853	\$1,853	\$1,853	\$1,853	\$1,853	\$1,853	\$1,853	\$1,853
Machinery & Equipment maintenance	\$1,875	\$1,875	\$1,875	\$1,875	\$1,875	\$1,875	\$1,875	\$1,875	\$1,875	\$1,875
Utilities	\$600	\$600	\$600	\$600	\$600	\$600	\$600	\$600	\$600	\$600
Phone	\$1,200	\$1,200	\$1,200	\$1,200	\$1,200	\$1,200	\$1,200	\$1,200	\$1,200	\$1,200
Fuel & Oil	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
Supplies	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Travel	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Veterinary Fees	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Products (all non-feed medicines)	\$6,953	\$6,953	\$6,953	\$6,953	\$6,953	\$6,953	\$6,953	\$6,953	\$6,953	\$6,953
Breeding Costs	\$9,216	\$9,216	\$9,216	\$9,216	\$9,216	\$9,216	\$9,216	\$9,216	\$9,216	\$9,216
Bedding Supplies	\$3,040	\$3,040	\$3,040	\$3,040	\$3,040	\$3,040	\$3,040	\$3,040	\$3,040	\$3,040
Marketing/Production Transport	\$1,057	\$1,380	\$1,764	\$1,764	\$1,764	\$1,764	\$1,764	\$1,764	\$1,764	\$1,764
Land Rent	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Hired Labor (incl benefits)	\$57,643	\$57,643	\$57,643	\$57,643	\$57,643	\$57,643	\$57,643	\$57,643	\$57,643	\$57,643
Truck/Auto Costs	\$3,200	\$3,200	\$3,200	\$3,200	\$3,200	\$3,200	\$3,200	\$3,200	\$3,200	\$3,200
Farm Taxes (R.E. & personal property)	\$599	\$6,601	\$6,601	\$6,601	\$6,601	\$6,601	\$6,601	\$6,601	\$6,601	\$6,601
Farm Insurance (bldgs, equip, etc.)	\$692	\$692	\$692	\$692	\$692	\$692	\$692	\$692	\$692	\$692
Interest Payments-Term Debt	\$6,011	\$5,770	\$5,511	\$5,230	\$4,927	\$4,599	\$4,243	\$3,876	\$3,500	\$3,088
Contract Fees	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Professional Fees (non vet)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Record-Keeping System	\$1,140	\$1,140	\$1,140	\$1,140	\$1,140	\$1,140	\$1,140	\$1,140	\$1,140	\$1,140
Asset Management	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500
Miscellaneous	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>Capital Purchases:</b>										
<b>Livestock Purchases</b>										
0 - 1 month Heifers	\$68,400	\$68,400	\$68,400	\$68,400	\$68,400	\$68,400	\$68,400	\$68,400	\$68,400	\$68,400
2 - 3 month Heifers	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
6 - 7 month Heifers	\$90,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
12 - 13 month Heifers	\$140,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Site Prep, lagoon, wells, etc.	\$37,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Buildings & Equipment	\$155,150	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Land Acquired	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Other New Capital Purchases	\$0	\$0	\$0	\$0	\$0	\$0	\$25,000	\$0	\$0	\$0
Principal Payments-Term Debt	\$6,487	\$6,728	\$6,987	\$7,268	\$7,571	\$7,899	\$8,255	\$4,014	\$4,390	\$4,802
Income Tax - federal	\$0	\$0	\$0	\$19,504	\$14,433	\$14,433	\$14,433	\$14,433	\$14,433	\$14,433
Income Tax - state	\$0	\$0	\$0	\$5,851	\$4,330	\$4,330	\$4,330	\$4,330	\$4,330	\$4,330
Other (overwrite this)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Other (overwrite this)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>TOTAL OUTFLOW</b>	<b>\$690,354</b>	<b>\$309,464</b>	<b>\$333,816</b>	<b>\$359,171</b>	<b>\$352,579</b>	<b>\$352,579</b>	<b>\$377,579</b>	<b>\$347,971</b>	<b>\$347,971</b>	<b>\$347,971</b>
<b>NET CASH FLOW (+ OR -)</b>	<b>(\$173,411)</b>	<b>(\$87,521)</b>	<b>\$97,519</b>	<b>\$72,164</b>	<b>\$78,757</b>	<b>\$78,757</b>	<b>\$53,757</b>	<b>\$83,365</b>	<b>\$93,365</b>	<b>\$93,365</b>
<b>LINE OF CREDIT ACTIVITY</b>										
LOC Borrowing	\$396,079	\$143,509	\$806	\$14,717	\$8,124	\$8,124	\$7,318	\$0	\$0	\$0
LOC Repayment - Principal	\$198,953	\$40,472	\$65,641	\$64,564	\$70,250	\$76,741	\$62,058	\$0	\$0	\$0
LOC Repayment - Interest	\$23,715	\$15,516	\$32,685	\$22,318	\$16,631	\$10,140	\$3,110	\$0	\$0	\$0
<b>ENDING CASH BALANCE</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$10,000</b>	<b>\$10,000</b>	<b>\$10,000</b>
LOC Ending Balance - Principal	\$197,126	\$300,163	\$235,328	\$185,482	\$123,356	\$54,740	\$0	\$0	\$0	\$0
LOC Ending Balance - Accr. Intere	\$0	\$9,887	\$1,961	\$1,546	\$1,028	\$456	\$0	\$0	\$0	\$0
<b>CUMULATIVE EQUITY DRAW</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$73,365</b>	<b>\$156,729</b>	<b>\$240,094</b>



Table 14. PROFIT OR LOSS STATEMENT (10 Year Annual)

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
<b>GROSS REVENUE</b>										
Bred Heifer Sales	\$119,097	\$201,070	\$400,239	\$400,239	\$400,239	\$400,239	\$400,239	\$400,239	\$400,239	\$400,239
0 - 1 month Heifer Sales	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
2 - 3 month Heifer Sales	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
6 - 7 month Heifer Sales	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
12 - 13 month Heifer Sales	\$138,600	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Open Heifer Sales	\$10,493	\$10,224	\$20,448	\$20,448	\$20,448	\$20,448	\$20,448	\$20,448	\$20,448	\$20,448
Cull Heifer Sales	\$8,603	\$10,649	\$10,649	\$10,649	\$10,649	\$10,649	\$10,649	\$10,649	\$10,649	\$10,649
Other Income	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>TOTAL GROSS REVENUE</b>	<b>\$274,793</b>	<b>\$221,943</b>	<b>\$431,336</b>	<b>\$431,336</b>	<b>\$431,336</b>	<b>\$431,336</b>	<b>\$431,336</b>	<b>\$431,336</b>	<b>\$431,336</b>	<b>\$431,336</b>
<b>LESS COST OF PURCHASED FEED</b>	<b>\$72,644</b>	<b>\$107,110</b>	<b>\$127,605</b>	<b>\$127,605</b>	<b>\$127,605</b>	<b>\$127,605</b>	<b>\$127,605</b>	<b>\$127,605</b>	<b>\$127,605</b>	<b>\$127,605</b>
<b>VALUE OF FARM PRODUCTION</b>	<b>\$202,149</b>	<b>\$114,833</b>	<b>\$303,730</b>	<b>\$303,730</b>	<b>\$303,730</b>	<b>\$303,730</b>	<b>\$303,730</b>	<b>\$303,730</b>	<b>\$303,730</b>	<b>\$303,730</b>
<b>OTHER OPERATING EXPENSES</b>										
Livestock Purchases										
0 - 1 month Heifers	\$68,400	\$68,400	\$68,400	\$68,400	\$68,400	\$68,400	\$68,400	\$68,400	\$68,400	\$68,400
2 - 3 month Heifers	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
6 - 7 month Heifers	\$90,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
12 - 13 month Heifers	\$140,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Pasture	\$20,094	\$20,563	\$24,036	\$24,036	\$24,036	\$24,036	\$24,036	\$24,036	\$24,036	\$24,036
Building maintenance	\$1,853	\$1,853	\$1,853	\$1,853	\$1,853	\$1,853	\$1,853	\$1,853	\$1,853	\$1,853
Machinery & Equipment maintenance	\$1,875	\$1,875	\$1,875	\$1,875	\$1,875	\$1,875	\$1,875	\$1,875	\$1,875	\$1,875
Utilities	\$600	\$600	\$600	\$600	\$600	\$600	\$600	\$600	\$600	\$600
Phone	\$1,200	\$1,200	\$1,200	\$1,200	\$1,200	\$1,200	\$1,200	\$1,200	\$1,200	\$1,200
Fuel & Oil	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
Supplies	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Travel	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Veterinary Fees	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Products (all non-feed medicines)	\$6,953	\$6,953	\$6,953	\$6,953	\$6,953	\$6,953	\$6,953	\$6,953	\$6,953	\$6,953
Breeding Costs	\$9,216	\$9,216	\$9,216	\$9,216	\$9,216	\$9,216	\$9,216	\$9,216	\$9,216	\$9,216
Bedding Supplies	\$3,040	\$3,040	\$3,040	\$3,040	\$3,040	\$3,040	\$3,040	\$3,040	\$3,040	\$3,040
Marketing/Production Transport	\$1,057	\$1,380	\$1,764	\$1,764	\$1,764	\$1,764	\$1,764	\$1,764	\$1,764	\$1,764
Land Rent	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Hired Labor (incl benefits)	\$57,643	\$57,643	\$57,643	\$57,643	\$57,643	\$57,643	\$57,643	\$57,643	\$57,643	\$57,643
Truck/Auto Costs	\$3,200	\$3,200	\$3,200	\$3,200	\$3,200	\$3,200	\$3,200	\$3,200	\$3,200	\$3,200
Farm Taxes (R.E. & personal property)	\$599	\$6,601	\$6,601	\$6,601	\$6,601	\$6,601	\$6,601	\$6,601	\$6,601	\$6,601
Farm Insurance (bldgs, equip, animals, etc.)	\$692	\$692	\$692	\$692	\$692	\$692	\$692	\$692	\$692	\$692
Interest on Debt	\$29,726	\$21,286	\$38,196	\$27,548	\$21,559	\$14,739	\$7,352	\$3,876	\$3,500	\$3,088
Contract Fees	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Professional Fees (non vet)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Record-Keeping System	\$1,140	\$1,140	\$1,140	\$1,140	\$1,140	\$1,140	\$1,140	\$1,140	\$1,140	\$1,140
Waste Management	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500
Miscellaneous	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Other (overwrite this)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Other (overwrite this)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>TOTAL OTHER OPERATING EXPENSES</b>	<b>\$442,787</b>	<b>\$211,142</b>	<b>\$231,909</b>	<b>\$221,261</b>	<b>\$216,271</b>	<b>\$208,452</b>	<b>\$201,065</b>	<b>\$197,589</b>	<b>\$197,213</b>	<b>\$196,801</b>
<b>DEPRECIATION</b>										
Buildings, Machinery, and Equipment	\$15,105	\$15,105	\$15,105	\$15,105	\$15,105	\$15,105	\$15,105	\$9,748	\$9,748	\$9,748
<b>NET FARM INCOME FROM OPERATIONS</b>	<b>(\$266,744)</b>	<b>(\$111,416)</b>	<b>\$58,716</b>	<b>\$67,364</b>	<b>\$73,364</b>	<b>\$80,173</b>	<b>\$87,660</b>	<b>\$96,393</b>	<b>\$96,769</b>	<b>\$97,181</b>

Table 15. Balance Sheet ( 10-Year Annual)

	START OF YEAR 1	END OF YEAR 1	END OF YEAR 2	END OF YEAR 3	END OF YEAR 4	END OF YEAR 5	END OF YEAR 6	END OF YEAR 7	END OF YEAR 8	END OF YEAR 9	END OF YEAR 10
<b>CURRENT ASSETS:</b>											
Cash	\$50,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$10,000	\$10,000	\$10,000
Feed On Hand	\$0	\$1,397	\$2,060	\$2,454	\$2,454	\$2,454	\$2,454	\$2,454	\$2,454	\$2,454	\$2,454
Supplies On Hand	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>Livestock</b>											
0 - 2 month Heifers	\$0	\$13,492	\$13,492	\$13,492	\$13,492	\$13,492	\$13,492	\$13,492	\$13,492	\$13,492	\$13,492
2 - 6 month Heifers	\$0	\$47,830	\$47,830	\$47,830	\$47,830	\$47,830	\$47,830	\$47,830	\$47,830	\$47,830	\$47,830
6 - 12 month Heifers	\$0	\$112,798	\$112,798	\$112,798	\$112,798	\$112,798	\$112,798	\$112,798	\$112,798	\$112,798	\$112,798
12 - 24 month Heifers	\$0	\$75,568	\$226,358	\$226,358	\$226,358	\$226,358	\$226,358	\$226,358	\$226,358	\$226,358	\$226,358
24+ month Heifers	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>TOTAL CURRENT ASSETS</b>	<b>\$50,000</b>	<b>\$251,085</b>	<b>\$402,538</b>	<b>\$402,932</b>	<b>\$402,932</b>	<b>\$402,932</b>	<b>\$402,932</b>	<b>\$402,932</b>	<b>\$412,932</b>	<b>\$412,932</b>	<b>\$412,932</b>
<b>NON-CURRENT ASSETS (BV):</b>											
Land	\$352,000	\$352,000	\$352,000	\$352,000	\$352,000	\$352,000	\$352,000	\$352,000	\$352,000	\$352,000	\$352,000
Buildings	\$92,650	\$86,473	\$80,297	\$74,120	\$67,943	\$61,767	\$55,590	\$49,413	\$43,237	\$37,060	\$30,883
Machinery & Equipment	\$62,500	\$53,571	\$44,643	\$35,714	\$26,786	\$17,857	\$8,929	\$5,357	\$2,786	\$23,214	\$19,643
Other Misc. Assets	\$37,000	\$37,000	\$37,000	\$37,000	\$37,000	\$37,000	\$37,000	\$37,000	\$37,000	\$37,000	\$37,000
<b>TOTAL NON-CURRENT ASSETS</b>	<b>\$544,150</b>	<b>\$529,045</b>	<b>\$513,940</b>	<b>\$498,834</b>	<b>\$483,729</b>	<b>\$468,624</b>	<b>\$453,519</b>	<b>\$443,770</b>	<b>\$459,022</b>	<b>\$449,274</b>	<b>\$439,526</b>
<b>TOTAL ASSETS</b>	<b>\$594,150</b>	<b>\$780,130</b>	<b>\$916,478</b>	<b>\$901,767</b>	<b>\$886,661</b>	<b>\$871,556</b>	<b>\$856,451</b>	<b>\$846,703</b>	<b>\$871,955</b>	<b>\$862,207</b>	<b>\$852,458</b>
<b>CURRENT LIABILITIES:</b>											
Line Of Credit Interest Accrued	\$0	\$23,715	\$15,516	\$32,685	\$22,318	\$16,631	\$10,140	\$3,110	\$0	\$0	\$0
Line of Credit (Principal Balance)	\$0	\$197,126	\$300,163	\$235,328	\$185,482	\$123,356	\$54,740	\$0	\$0	\$0	\$0
Term Debt Interest Accrued	\$0	\$6,011	\$5,770	\$5,511	\$5,230	\$4,927	\$4,599	\$4,243	\$3,876	\$3,500	\$3,088
Term Debt Principal Due Next 12 Mo.	\$0	\$6,728	\$6,987	\$7,268	\$7,571	\$7,899	\$8,255	\$4,014	\$4,390	\$4,802	\$843
<b>TOTAL CURRENT LIABILITIES</b>	<b>\$0</b>	<b>\$233,579</b>	<b>\$328,436</b>	<b>\$280,792</b>	<b>\$220,601</b>	<b>\$152,814</b>	<b>\$77,734</b>	<b>\$11,366</b>	<b>\$8,266</b>	<b>\$8,302</b>	<b>\$3,931</b>
<b>NON-CURRENT LIABILITIES:</b>											
Term Debt - Unpaid Principal	\$0	\$89,588	\$82,860	\$75,873	\$68,605	\$61,034	\$53,135	\$44,880	\$40,866	\$36,476	\$31,674
Portion Due Next 12 Mo.	\$0	(\$6,728)	(\$6,987)	(\$7,268)	(\$7,571)	(\$7,899)	(\$8,255)	(\$4,014)	(\$4,390)	(\$4,802)	(\$843)
<b>TOTAL NON-CURRENT LIABILITIES</b>	<b>\$0</b>	<b>\$82,860</b>	<b>\$75,873</b>	<b>\$68,605</b>	<b>\$61,034</b>	<b>\$53,135</b>	<b>\$44,880</b>	<b>\$40,866</b>	<b>\$36,476</b>	<b>\$31,674</b>	<b>\$30,831</b>
<b>TOTAL LIABILITIES</b>	<b>\$0</b>	<b>\$316,439</b>	<b>\$404,309</b>	<b>\$349,397</b>	<b>\$281,635</b>	<b>\$205,949</b>	<b>\$122,614</b>	<b>\$52,232</b>	<b>\$44,742</b>	<b>\$39,976</b>	<b>\$34,762</b>
<b>NET WORTH</b>	<b>\$594,150</b>	<b>\$463,691</b>	<b>\$512,168</b>	<b>\$552,370</b>	<b>\$605,026</b>	<b>\$665,607</b>	<b>\$733,837</b>	<b>\$794,470</b>	<b>\$827,212</b>	<b>\$822,231</b>	<b>\$817,697</b>
<b>PERCENT EQUITY</b>	<b>100%</b>	<b>59%</b>	<b>56%</b>	<b>61%</b>	<b>68%</b>	<b>76%</b>	<b>86%</b>	<b>94%</b>	<b>95%</b>	<b>95%</b>	<b>96%</b>
<b>WORKING CAPITAL</b>	<b>\$50,000</b>	<b>\$17,506</b>	<b>\$74,102</b>	<b>\$122,141</b>	<b>\$182,332</b>	<b>\$250,118</b>	<b>\$325,198</b>	<b>\$391,566</b>	<b>\$404,666</b>	<b>\$404,630</b>	<b>\$409,001</b>

Table 16. Estimated Cost and Returns of Raising a Replacement Heifer

Income per Bred Heifer	0-2 Months	2-6 Months	6-12 Months	12-24 Months	0-24 Months
Bred heifer	\$0.00	\$0.00	\$0.00	\$1,100.00	\$1,100.00
Open Heifer	\$0.00	\$0.00	\$0.00	\$56.20	\$56.20
Cull	\$2.44	\$4.88	\$7.32	\$14.63	\$29.27
<b>Total Income per Bred Heifer</b>	<b>\$2.44</b>	<b>\$4.88</b>	<b>\$7.32</b>	<b>\$1,170.83</b>	<b>\$1,185.46</b>
<b>Operating Expenses</b>					
Feed	\$36.60	\$58.80	\$61.27	\$194.03	\$350.70
Pasture	\$0.00	\$0.00	\$16.51	\$49.54	\$66.06
<b>Total Feed Expense</b>	<b>\$36.60</b>	<b>\$58.80</b>	<b>\$77.79</b>	<b>\$243.58</b>	<b>\$416.76</b>
Labor	\$66.85	\$26.98	\$17.32	\$47.27	\$158.42
Vet Medicine	\$3.82	\$3.82	\$3.82	\$7.64	\$19.11
Breeding	\$0.00	\$0.00	\$0.00	\$25.33	\$25.33
Bedding	\$2.79	\$5.57	\$0.00	\$0.00	\$8.36
Supplies	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Utilities, Phone	\$0.41	\$0.82	\$1.24	\$2.47	\$4.95
Marketing/Transport	\$0.40	\$0.81	\$1.21	\$2.42	\$4.85
Vehicle/Fuel/Oil	\$1.19	\$2.38	\$3.57	\$7.15	\$14.29
Records/Travel/Other fees, etc.	\$0.26	\$0.52	\$0.78	\$1.57	\$3.13
Waste Management	\$0.00	\$9.62	\$0.00	\$0.00	\$9.62
Miscellaneous	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Interest on LOC	\$2.84	\$5.69	\$8.53	\$17.06	\$34.11
Initial Value of Heifer	\$187.99				\$187.99
Death Loss	\$10.63	\$7.25	\$2.88	\$4.50	\$25.25
<b>Total Operating Expenses</b>	<b>\$313.78</b>	<b>\$122.26</b>	<b>\$117.13</b>	<b>\$358.99</b>	<b>\$912.17</b>
<b>Ownership Expenses</b>					
Depreciation - Buildings & Equip	\$3.46	\$6.92	\$10.38	\$20.76	\$41.51
Interest - Buildings & Equip	\$0.02	\$0.04	\$0.06	\$0.12	\$0.23
Interest - Real Estate	\$0.96	\$1.93	\$2.89	\$5.79	\$11.57
Maintenance - Buildings & Equip	\$0.85	\$1.71	\$2.56	\$5.12	\$10.25
Property Taxes - Buildings, Real Esta	\$1.51	\$3.02	\$4.54	\$9.07	\$18.14
Insurance - Buildings & Equip	\$0.16	\$0.32	\$0.48	\$0.95	\$1.90
<b>Total Ownership Expenses</b>	<b>\$6.97</b>	<b>\$13.93</b>	<b>\$20.90</b>	<b>\$41.80</b>	<b>\$83.61</b>
<b>Total All Expenses</b>	<b>\$320.75</b>	<b>\$136.20</b>	<b>\$138.04</b>	<b>\$400.79</b>	<b>\$995.78</b>
<b>Net Return per Bred Heifer</b>					<b>\$189.69</b>

## Allocation of Costs per Bred Heifer

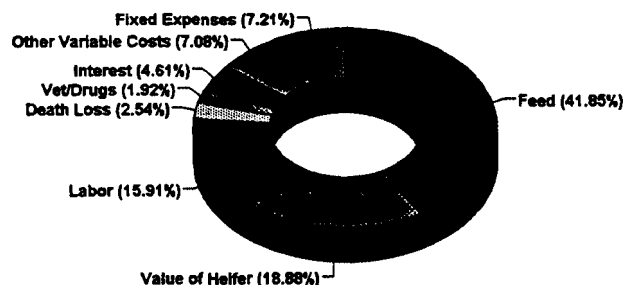
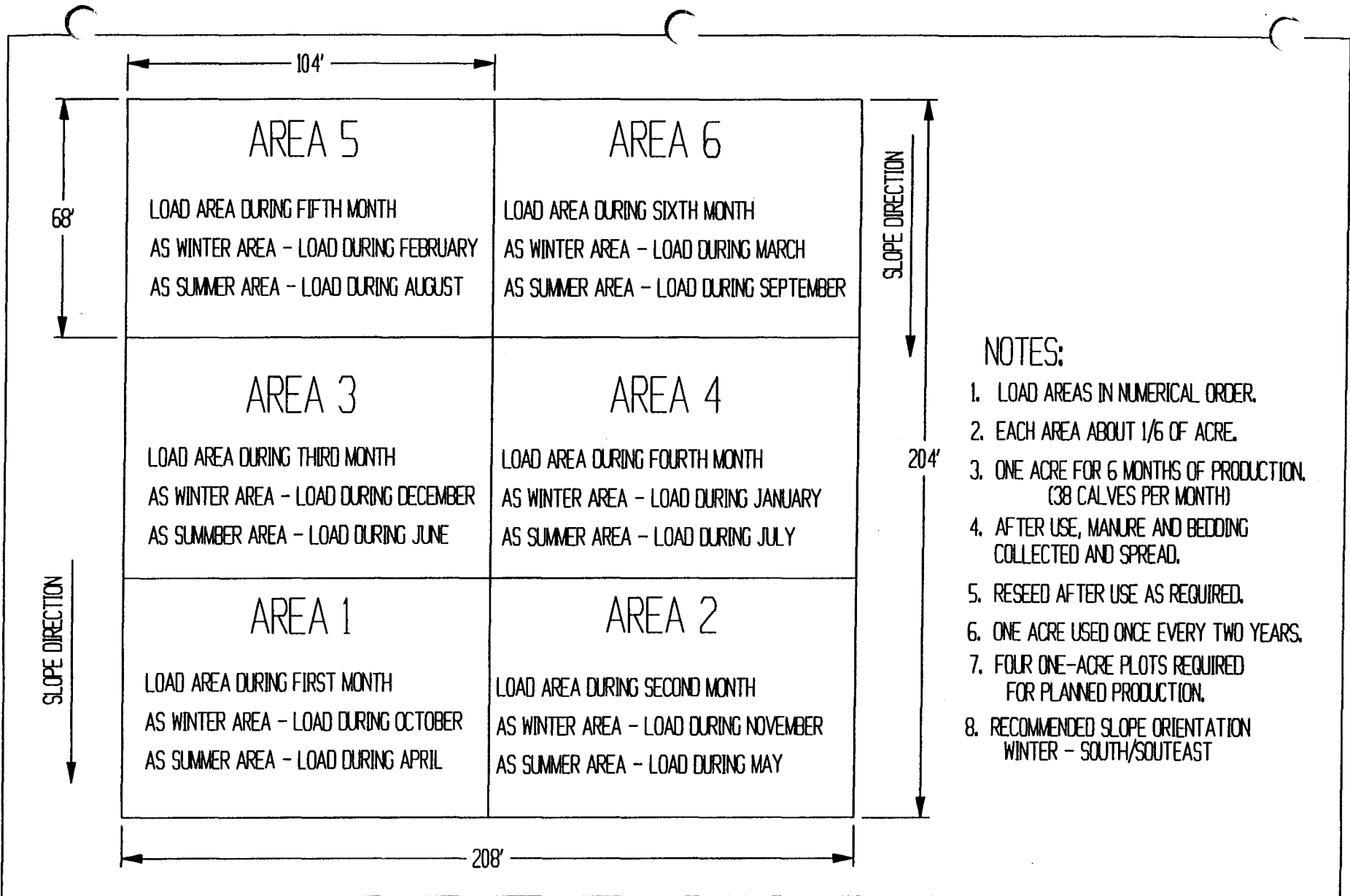


Table 17. FINANCIAL MEASURES (10 Year)

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YR 3-10 7 YR AVG
<b>PROFITABILITY MEASURES:</b>											
Rate of Return to Farm Assets	-34.4%	-12.1%	8.9%	9.1%	9.3%	9.5%	9.6%	10.2%	10.1%	10.2%	9.6%
Rate of Return to Farm Equity	-50.3%	-25.4%	8.1%	9.3%	9.5%	9.6%	9.8%	10.3%	10.2%	10.3%	9.6%
Operating Profit Margin Ratio	-86.0%	-46.3%	18.8%	18.9%	18.9%	19.0%	19.0%	20.3%	20.2%	20.3%	19.4%
Net Farm Income	(\$255,744)	(\$111,415)	\$56,716	\$67,364	\$73,354	\$80,173	\$87,560	\$96,393	\$96,769	\$97,181	\$81,939
<b>LIQUIDITY MEASURES:</b>											
Current Ratio (XX:1)	1.1	1.2	1.4	1.8	2.6	5.2	35.5	50.0	49.7	105.0	31.4
Working Capital (\$)	\$17,506	\$74,102	\$122,141	\$182,332	\$250,118	\$325,198	\$391,566	\$404,666	\$404,630	\$409,001	\$311,207
<b>SOLVENCY MEASURES:</b>											
Debt-to-Asset Ratio	40.6%	44.1%	38.7%	31.8%	23.6%	14.3%	6.2%	5.1%	4.6%	4.1%	16.1%
Equity-to-Asset Ratio	59.4%	55.9%	61.3%	68.2%	76.4%	85.7%	93.8%	94.9%	95.4%	95.9%	83.9%
Debt-to-Equity Ratio (XX:1)	0.7	0.8	0.6	0.5	0.3	0.2	0.1	0.1	0.0	0.0	0.2
<b>FINANCIAL EFFICIENCY:</b>											
Asset Turnover Ratio	0.40	0.26	0.47	0.48	0.49	0.50	0.51	0.50	0.50	0.50	0.49
Operating Expense Ratio	155.64%	88.33%	50.26%	47.79%	46.41%	44.83%	43.11%	43.55%	43.46%	43.37%	45.3%
Depreciation Expense Ratio	5.50%	6.81%	3.50%	3.50%	3.50%	3.50%	3.50%	2.26%	2.26%	2.26%	3.0%
Interest Expense Ratio	10.82%	9.59%	8.86%	6.39%	5.00%	3.42%	1.70%	0.90%	0.81%	0.72%	3.5%
Net Farm Income from Operations Ratio	-93.07%	-50.20%	13.15%	15.62%	17.01%	18.59%	20.30%	22.35%	22.43%	22.53%	19.0%
<b>REPAYMENT CAPACITY:</b>											
Term Debt & Capital Lease Coverage Ratio	-16.88	-6.00	8.80	6.77	7.30	7.30	7.30	11.57	11.57	11.57	9.02
Capital & Term Debt Replacement Margin	(\$247,366)	(\$103,297)	\$64,554	\$49,543	\$61,797	\$68,261	\$79,888	\$82,988	\$82,953	\$87,324	\$72,164

# **Appendices**

**Appendix A**  
**Facilities Designs**

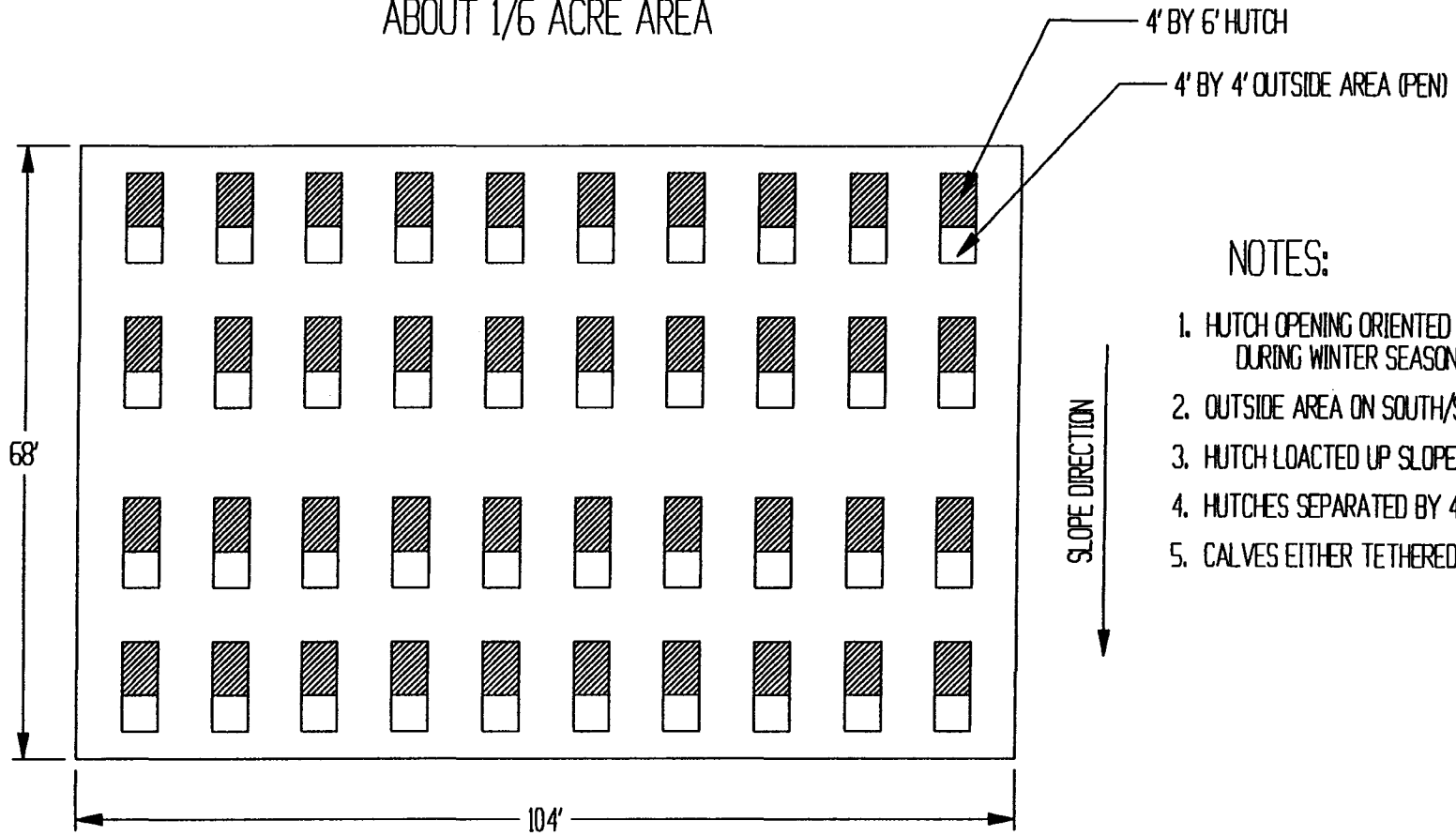


**NOTES:**

1. LOAD AREAS IN NUMERICAL ORDER.
2. EACH AREA ABOUT 1/6 OF ACRE.
3. ONE ACRE FOR 6 MONTHS OF PRODUCTION.  
(38 CALVES PER MONTH)
4. AFTER USE, MANURE AND BEDDING COLLECTED AND SPREAD.
5. RESEED AFTER USE AS REQUIRED.
6. ONE ACRE USED ONCE EVERY TWO YEARS.
7. FOUR ONE-ACRE PLOTS REQUIRED FOR PLANNED PRODUCTION.
8. RECOMMENDED SLOPE ORIENTATION  
WINTER - SOUTH/SOUTHEAST

<p><b>ONE ACRE HUTCH AREA LAYOUT &amp; LOADING SCHEDULE</b></p> <p>COOPERATIVE EXTENSION SERVICE</p> <p>AGRICULTURAL ENGINEERING DEPARTMENT-UNIVERSITY OF MISSOURI-COLUMBIA</p> <p>UNIVERSITY EXTENSION - COMMERCIAL AGRICULTURE PROGRAM</p> <p>UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING</p>	<p>DESIGNED BY: <b>JMZ</b></p>	<p>DRAWN BY: <b>JMZ</b></p>	<p>CHECKED BY: <b>JMZ</b></p>
	<p>SHEET 1 OF 6</p>		<p>DATE: 1/96</p>
	<p>SCALE: 1" = 40'</p>		<p>PLAN NO.: <b>HEIFER MANUAL</b></p>

EXAMPLE HUTCH LAYOUT FOR ONE MONTH OF PRODUCTION (38 CALVES).  
ABOUT 1/6 ACRE AREA



NOTES:

1. HUTCH OPENING ORIENTED SOUTH/SOUTHEAST DURING WINTER SEASONS.
2. OUTSIDE AREA ON SOUTH/SOUTHEAST OF HUTCH.
3. HUTCH LOADED UP SLOPE FROM OUTSIDE AREA.
4. HUTCHES SEPARATED BY 4' OR MORE.
5. CALVES EITHER TETHERED OR PENNED.

HUTCH LAYOUT ON ABOUT 1/6 ACRE FOR ONE MONTH OF PRODUCTION

DESIGNED BY:  
JMZ

DRAWN BY:  
JMZ

CHECKED BY:  
JMZ

COOPERATIVE EXTENSION SERVICE  
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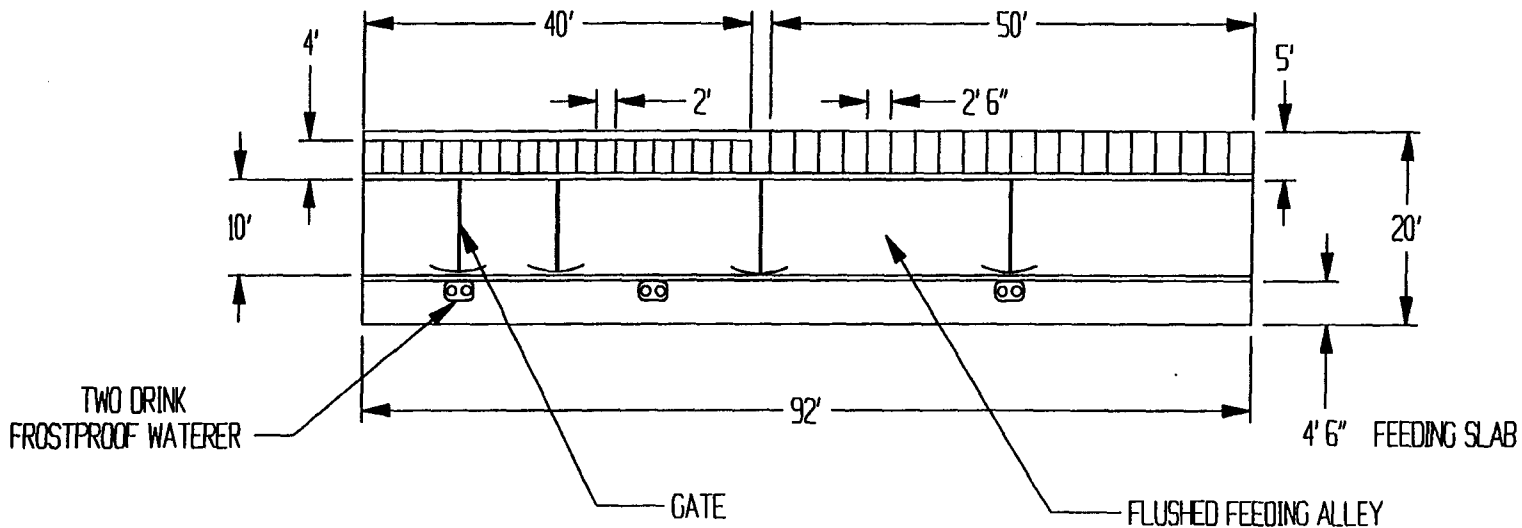
SHEET 2 OF 6

DATE: 1/96

SCALE:  
1" = 20'

PLAN NO.:  
HEIFER MANUAL





**CAPACITY SHOWN:**

20 - 2' x 4' FREE STALLS FOR 2 TO 4 MONTH OLD HEIFERS

20 - 2'-6" X 5' FREE STALLS FOR 4 TO 6 MONTH OLD HEIFERS

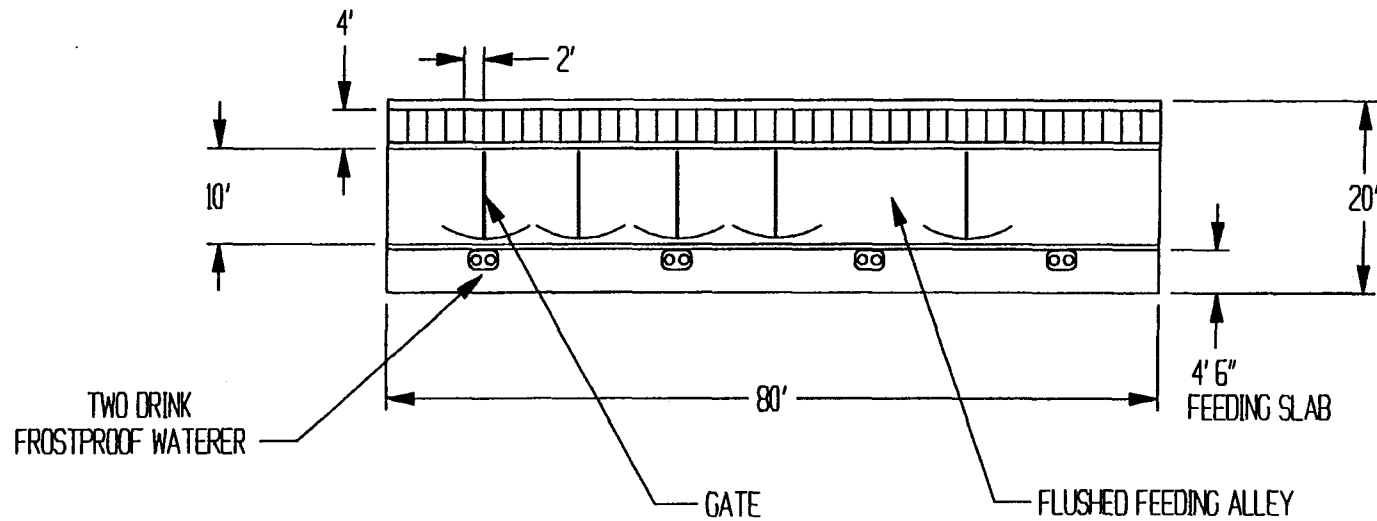
**NOTES:**

1. NUMBER OF FREE STALLS CAN BE ADJUSTED TO MEET NEEDS.
2. BUILDING LENGTH CAN BE ADJUSTED TO MEET NEEDS.
3. NUMBER AND LOCATION OF GATES IS FLEXIBLE TO MEET NEEDS.

BASIC LAYOUT - COURTESY: RON YOUNG, UE REGIONAL DAIRY SPECIALIST

**FLOOR PLAN SHOWING BOTH 24" AND 30" WIDE STALLS**

REPLACEMENT HEIFER FREE STALL BARN PLAN	DESIGNED BY: JMZ	DRAWN BY: JMZ	CHECKED BY: JMZ
COOPERATIVE EXTENSION SERVICE AGRICULTURAL ENGINEERING DEPARTMENT-UNIVERSITY OF MISSOURI-COLUMBIA UNIVERSITY EXTENSION - COMMERCIAL AGRICULTURE PROGRAM UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING	SHEET 3 OF 6		DATE: 1/96
	SCALE: 1" = 20'	PLAN NO.: HEIFER MANUAL	



**CAPACITY SHOWN:**

40 - 2' x 4' FREE STALLS FOR 2 TO 4 MONTH OLD HEIFERS

**NOTES:**

1. NUMBER OF FREE STALLS CAN BE ADJUSTED TO MEET NEEDS.
2. BUILDING LENGTH CAN BE ADJUSTED TO MEET NEEDS.
3. NUMBER AND LOCATION OF GATES IS FLEXIBLE TO MEET NEEDS.

**FLOOR PLAN SHOWING ONLY 24" WIDE FREE STALLS**

REPLACEMENT HEIFER FREE STALL BARN PLAN

DESIGNED BY:  
JMZ

DRAWN BY:  
JMZ

CHECKED BY:  
JMZ

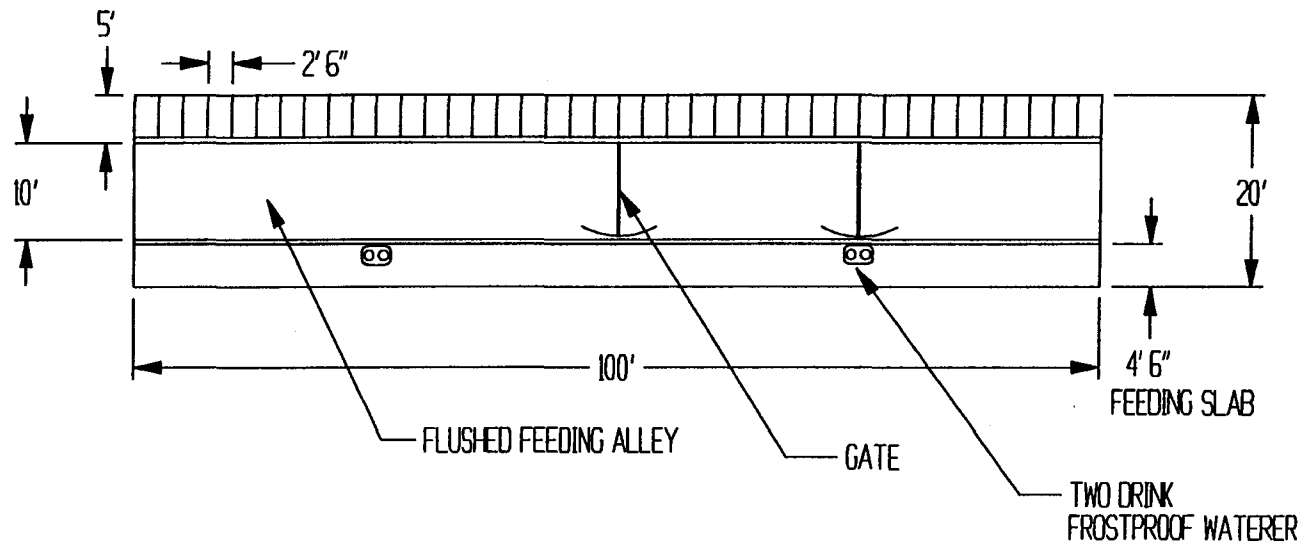
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 UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING

SHEET 4 OF 6

DATE: 1/96

SCALE:  
1" = 20'

PLAN NO.:  
HEIFER MANUAL



**CAPACITY SHOWN:**

40 - 2'-6" x 5' FREE STALLS FOR 4 TO 6 MONTH OLD HEIFERS.

**NOTES:**

1. NUMBER OF FREE STALLS CAN BE ADJUSTED TO MEET NEEDS.
2. BUILDING LENGTH CAN BE ADJUSTED TO MEET NEEDS.
3. NUMBER AND LOCATION OF GATES IS FLEXIBLE TO MEET NEEDS.

**FLOOR PLAN SHOWING ONLY 30" WIDE FREE STALLS**

**REPLACEMENT HEIFER FREE STALL BARN PLAN**

DESIGNED BY:  
JMZ

DRAWN BY:  
JMZ

CHECKED BY:  
JMZ

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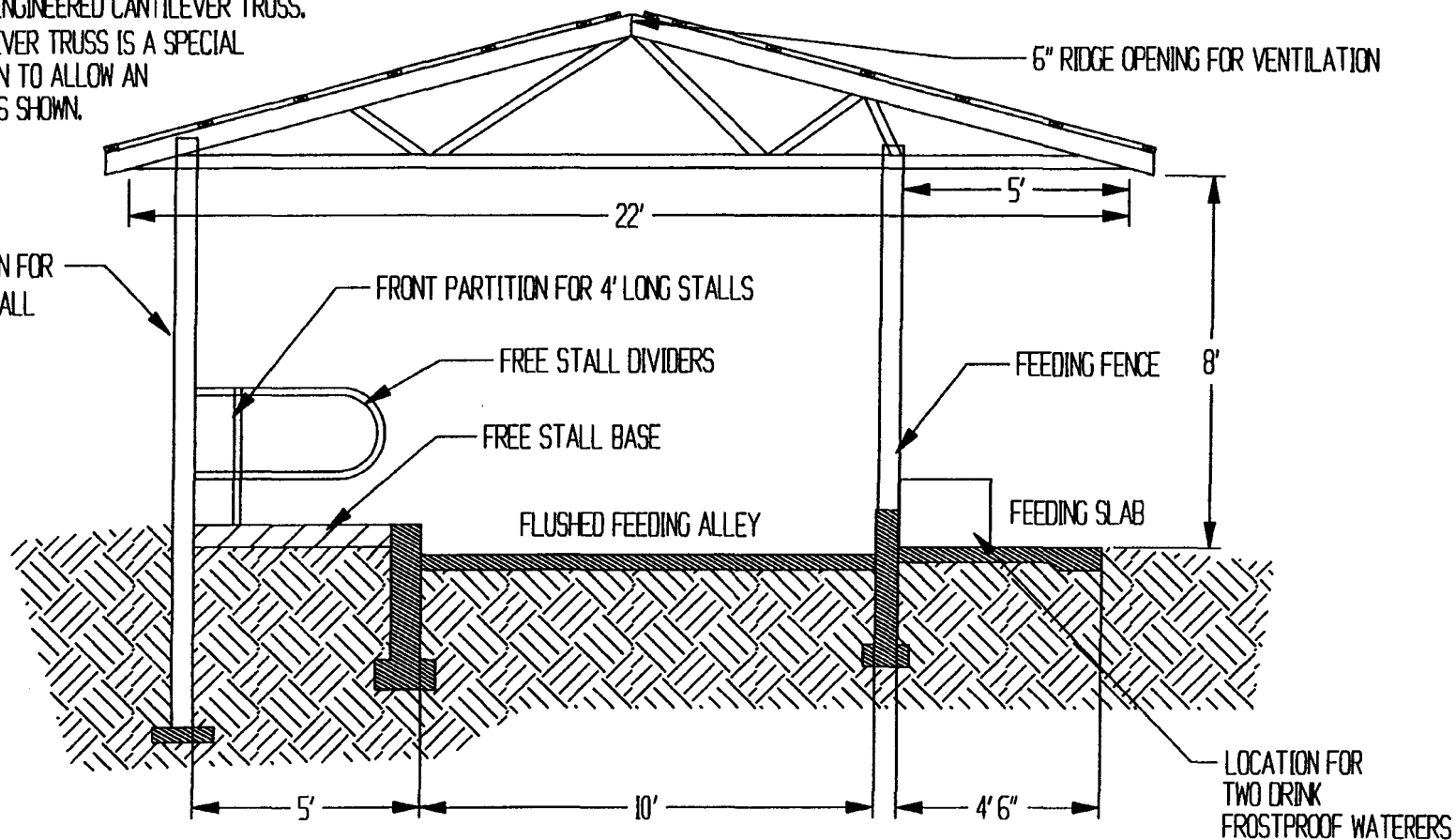
SHEET 5 OF 6

DATE: 1/96

SCALE:  
1" = 20'

PLAN NO.:  
HEIFER MANUAL

NOTE: USE A PRE-ENGINEERED CANTILEVER TRUSS.  
 THE CANTILEVER TRUSS IS A SPECIAL  
 TRUSS DESIGN TO ALLOW AN  
 OVERHANG AS SHOWN.



### GENERAL BUILDING CROSS SECTION

REPLACEMENT HEIFER FREE STALL BARN PLAN

DESIGNED BY: JMZ	DRAWN BY: JMZ	CHECKED BY: JMZ
---------------------	------------------	--------------------

COOPERATIVE EXTENSION SERVICE  
 AGRICULTURAL ENGINEERING DEPARTMENT—UNIVERSITY OF MISSOURI—COLUMBIA  
 UNIVERSITY EXTENSION — COMMERCIAL AGRICULTURE PROGRAM  
 UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING

SHEET 6 OF 6	DATE: 1/96
SCALE: 1/4" = 1'-0"	PLAN NO.: HEIFER MANUAL

## Appendix B

### Synchronization Programs

There are two pharmacological compounds approved for use to synchronize estrus in dairy heifers. These compounds are prostaglandins and a combination of norgestomet and estradiol. To be successful, a high percentage of the heifers must be cycling prior to the onset of synchronization. Cyclicity is determined by observing heifers for signs of estrus. Approximately 5% of a heifer group should exhibit signs of estrus each day. It is generally recommended that the group be observed for five consecutive days. Ovarian activity can also be determined by performing a rectal exam.

Prostaglandin F<sub>2</sub> $\alpha$  is generally accepted as the luteolytic agent that ends the life span of the bovine corpus luteum. At the end of the normal bovine estrous cycle the corpus luteum regresses resulting in a drop in progesterone. Dropping progesterone levels allows the release of gonadotropin from the anterior pituitary gland which triggers estrus. Prostaglandins require the presence of a functional corpus luteum (day 5 - 17 of the estrous cycle) to be effective.

Four methods are used to synchronize estrus with prostaglandins. The first method is the "double injection" method. In this method two injections are given eleven days apart. Those heifers that respond to the injection of prostaglandin exhibit estrus 2 - 5 days later. Approximately 35% of the heifers will be at the wrong stage of the estrous cycle and will not respond to an injection of prostaglandin. Therefore, the second injection given 11 days later is required to achieve synchronization.

The second method is a single injection of prostaglandin followed by heat detection and AI or natural service. The heifers that are not observed in estrus following the initial injection are observed for heat and bred or turned with a bull.

The third method requires for each heifer to be palpated for the presence of a corpus luteum. Heifers diagnosed with a corpus luteum are given an injection of prostaglandin, observed for signs of estrus, and bred.

The fourth method requires heifers to be observed for signs of estrus for five days. Heifers observed in heat are bred. Those heifers not observed in heat are given a single injection of prostaglandin.

Each method is effective if the heifers are cycling prior to the start of synchronization. All methods have advantages and disadvantages depending on the particular situation. Your veterinarian can assist in determining the best breeding method for your farm.

The Synchronate B<sup>®</sup> (SMB) treatment consists of an ear implant that contains 6 mg of norgestomet and an intramuscular injection of 5 mg estradiol valerate and 3 mg norgestomet mixed together in a single 2 ml dose. Norgestomet acts as an "artificial corpus luteum" and therefore prevents ovulation and the formation of a corpus luteum. The estradiol valerate acts to prevent the formation of the corpus luteum. The implant is placed in the ear and then removed nine days later. Heifers generally exhibit signs of estrus in 24 to 36 hours. This treatment generally achieves a high degree of synchrony. SMB is highly successful for fixed-time insemination 48 to 54 hours after implant removal.

A combination of Synchronate B<sup>®</sup> and Prostaglandin F<sub>2</sub> $\alpha$  is also used to synchronize heifers. Heifers are implanted with the norgestomet. The implant is removed after nine days and the heifers are injected with 25 mg of prostaglandin. Norgestomet act as an "artificial corpus luteum" preventing ovulation and the prostaglandin regresses any luteal tissue that might be present on the ovary. Heifers generally exhibit estrus in 2 to 3 days.

## Appendix C

### Contract Options

#### Advantages to Owner

1. Decrease labor requirements - Reported estimates of the total labor requirement to raise a replacement from birth to 24 months is 24 hours. Management of replacements is often a low priority and can result in undesirable heifers entering the lactation herd, inefficient use of labor and equipment, and inefficient breeding practices.
2. Increase management time for milking herd - Concentrating management time to fine-tuning rations and records on the lactating herd should result in more milk, greater efficiency of labor, and increased profits.
3. Increase herd size without capital investment - Herds can sometimes use heifer facilities as a temporary arrangement for additional dry or lactating cows during an expansion.
4. Increase feed inventory for milking herd and dry cows - Replacements typically consume approximately one-third of the annual forage intake of the dairy herd.
5. Potential for better quality replacements - Heifer growers should focus on producing larger and more uniformly developed heifers.
6. Potential to lower costs of raising replacements - Grower should develop heifers to calve at 24 months of age or less, and weigh 1,350 pounds or more precalving. Effectively grouping heifers to optimize growth and improve breeding efficiencies will lower the cost of raising replacements. DHI herds in Missouri average first calving at 27 months of age.

### Disadvantages to Owner

1. Lose management control - Performance standards must be clearly identified in the contract. Standards should include rate of growth, body condition, and breeding goals. Contract should include a penalty in case standards are not met.
2. Lose market for lower quality forages/feeds - Forages that do not meet quality standards for the lactating herd are often fed to the replacement herd.
3. Owner/grower conflicts - Disagreements are minimized with a clearly written, complete contract.
4. Unused facilities - Fixed costs (depreciation, repairs, taxes, and opportunity costs) continue in unused facilities.
5. Possible increased costs of replacements - Contract growing can be more costly than raising if the heifers do not meet expectations, the market changes, or the contractual agreement fails. Added costs are justified, however, if the heifer is larger and more productive at a younger age.
6. Potential exposure to diseases - Moving animals from one location/source to another results in greater risk of spreading diseases. A well designed health program is a must!

### Advantages to Grower

1. Business opportunity - Contract raising offers a viable business opportunity to those with the management ability to raise healthy heifers.
2. Use of existing facilities - Many farms have facilities that can be used or modified for raising replacements.
3. Flexible working hours - Time required for raising replacements can follow a flexible schedule. However, for best results, heifers should be fed and managed on a routine schedule.
4. Market for existing pasture, forage, and grain crops - Contract raising of replacement heifers offers an opportunity to market production and an alternative to beef production.
5. Market security - Contracts better assure the grower of final sale dates, terms, and price. Contracts reduce the effect of market trends and prices.



**Disadvantages to Grower**

1. **Commitment to labor and management - Contract raising of heifers requires commitment to implement best management practices that results in a large healthy heifer that meets the owner's expectations. Heifers must be fed and checked each day.**
2. **Facility and repair maintenance - Facilities must be repaired and maintained to efficiently provide animal health and comfort.**
3. **Owner/grower conflicts - Concise contracts minimize potential disagreements.**

**Expense of raising heifers follows feed cost in most dairy farm budgets. A heifer grower must produce a well developed, healthy, productive heifer at a cost competitive with the owner's cost of producing the same heifer.**

## Selecting a Grower

A professional heifer grower must be committed to producing well developed healthy heifers that meet owner's expectations. Heifer growers must maintain competitive production costs and implement management techniques that encourage repeat business. Owner satisfaction is required from all phases of the heifer production enterprise.

Owner/grower arrangements must be mutually beneficial. Select a grower whose views on performance expectations, responsibilities, and terms agree with those of the owner.

**Expectations** - A specified system of monitoring and reporting performance expectations must be clearly specified in a written contract. Weight, height, and body condition scores are the primary performance measures that should be evaluated. Penalties for not meeting these expectations should be identified. Owners must realize that normal variations in growth exist, and provide some flexibility in the performance measures.

**Record keeping/Monitoring** - Record keeping, heifer monitoring, and performance reports should be mutually agreed upon. An accurate record system and permanent identification are absolutely necessary. A method and time of measuring height, weight, and body condition should be established. Caution should be given to over-conditioning heifers. Over-conditioning during the prepubertal period will affect future milk production because fat may replace milk secretory cells. Over-conditioning heifers can also cause calving difficulties.

Heifer performance can be adequately monitored by taking measurements and reporting the performance data to the owner every three to four months. The reporting system should also include vaccinations, treatments, breedings, and any significant observations on individual animals. Growers should be encouraged to keep the owners informed of any sickness, lameness, losses, or unthriftiness of heifers as observed.

**Responsibilities** - The following checklist, developed by dairy scientists at the University of Minnesota, identifies areas of responsibility between a heifer grower and owner. The contract should specify inputs and responsibilities of each party.

**Checklist for establishing responsibilities in custom heifer growing agreement.**

		Grower	Owner	Other
<b>BREEDING</b>				
	Breeding Service			
	Semen, Supplies & Cost			
	Sire Selection			
	Heat Detection Aids			
	Pregnancy Checking			
	Heat Detection			
<b>FEED</b>				
	Ration Balancing			
	Forage Testing			
	Forage Supply/Selection			
	Grain			
	Protein supplement			
	Mineral			
	Salt			
	Feed additives			
<b>VETERINARY</b>				
	Autopsy			
	Routine health care			
	Emergency health care			
	Medications			
	Vaccinations			
	Deworming			
	Dehorning			
	Hoof trimming			
	Fly & parasite control			
	Death losses			
<b>GENERAL</b>				
	Identification			
	Record keeping			
	Growth monitoring			
	Labor			
	Insurance			
	Bedding			
	Manure hauling			
	Trucking			
	Electric & water			
	Repairs & maintenance			

Example of a custom rearing contract. (For Educational Purposes Only)

### HEIFER CONTRACT

This contract is made between \_\_\_\_\_ (custom grower) of \_\_\_\_\_ (address/phone) and \_\_\_\_\_ (owner), \_\_\_\_\_ (address and phone) on \_\_\_\_\_ (date) and is for the purpose of custom housing, feeding and managing dairy replacement heifers.

\_\_\_\_ (Owner) will be responsible for veterinary costs (vaccinations, worming, pregnancy checks), insurance, semen, proper ear tagging for identification purposes, and trucking to and from heifer growing facility.

\_\_\_\_ (Custom grower) will provide the feed (mineral, salt, grain mix, dry hay, pasture), heat detection, breeding, bedding, dehorning, foot trimming, housing, labor, and daily observation.

NOTE: This contract includes healthy animals only. \_\_\_\_\_ Custom grower assumes no responsibility for animals with any illnesses or contagious diseases upon arrival.

Responsibility for death losses will be as follows:

- 0% - 2%    Owner
- 3% - 5%    50/50 split - market value (owner/custom grower - 50/50 split @ market value)
- over 5%    Custom grower - market value

The owner will deliver heifers in good health at 8 to 10 months of age, weighing 450 to 700 lbs, to the feeder. The custom feeder will return pregnant animals to the owner approximately 45 days prior to freshening, weighing 1200 to 1400 lbs. and measuring approximately 52 to 58 inches at the hip. All non-breeding animals shall become the responsibility of the owner. Animals will be bred to calve at 23 to 26 months of age.

In case of mortality, an autopsy will be performed by \_\_\_\_\_ (veterinarian) at the expense of \_\_\_\_\_ (custom grower).

The owner will be alerted by the custom grower of any health problems in the cattle.

Financial terms of this contract are \$\_\_\_\_\_ per head per day, payable on the 25th day of each month. Contract to be renewed on an annual basis on \_\_\_\_\_ (date) of each year.

A 5-day notice is to be given for the purpose of taking cattle out on the part of the owner.

A 30-day notice is to be given for the purpose of taking cattle out on the part of the custom grower, except in cases of health related problems in the cattle.

\_\_\_\_\_  
Owner

\_\_\_\_\_  
Custom Grower

## Appendix D

### Diets

#### Preweaning Ration Birth to two months, 90 to 180 pounds

Feed Item	lbs/d	lbs/stage	\$/lb	\$/stage
Milk Replacer	1	42	\$0.65	\$27.30
Calf Starter (18%)	1	60	\$0.13	\$7.80
Alfalfa Hay	0.9	40	\$0.05	\$2.00
<b>Total</b>				<b>\$37.10</b>
<b>Cost/Hd/Day</b>				<b>\$0.61</b>

#### Transition Ration Two to three months, 180 to 235 pounds

Feed Item	lbs/d	lbs/stage	\$/lb	\$/stage
Calf Starter (18%)	2	60	\$0.13	\$7.80
Alfalfa Hay	3	90	\$0.05	\$4.50
<b>Total</b>	<b>7</b>	<b>150</b>		<b>\$12.30</b>
<b>Cost/Hd/Day</b>				<b>\$0.41</b>

#### Early Growing Ration Three to six months, 235 to 400 pounds

Feed Item	lbs/d	lbs/stage	\$/lb	\$/stage
Calf Grower (16%)	3.5	315	\$0.10	\$31.50
Alfalfa/Grass Hay	4.5	405	\$0.04	\$16.20
<b>Total</b>	<b>8</b>	<b>720</b>		<b>\$47.70</b>
<b>Cost/Hd/Day</b>				<b>\$0.53</b>

**Growing Ration #1 - Winter Feeding**  
**Six to twelve months, 400 to 725 pounds (5 months)**

<b>Feed Item</b>	<b>lbs/d</b>	<b>lbs/stage</b>	<b>\$/lb</b>	<b>\$/stage</b>
Corn Gluten Feed	3.50	525.00	0.0475	24.94
Cracked Corn	1.50	225.00	0.0475	10.69
Soybean Hulls	1.75	262.50	0.0400	10.50
Mineral w/lasalocid	0.20	30.00	0.2800	8.40
Orchard Grass Hay	9.00	1350.00	0.0300	40.50
<b>Total</b>	<b>15.95</b>	<b>2392.50</b>		<b>\$95.03</b>
<b>Cost/Hd/Day</b>				<b>\$0.63</b>

**Growing Ration #2 - Spring & Fall**  
**Six to twelve months, 400 to 725 pounds (lush forage-4 months)**

<b>Feed Item</b>	<b>lbs/d</b>	<b>lbs/stage</b>	<b>\$/lb</b>	<b>\$/stage</b>
Soybean Hulls	3.00	360.00	0.0400	14.40
Cracked Corn	1.00	120.00	0.0475	5.70
Mineral w/lasalocid	0.20	24.00	0.2800	6.72
<b>Total</b>	<b>4.20</b>	<b>504.00</b>		<b>\$26.82</b>
<b>Cost/Hd/Day</b>				<b>\$0.22</b>

**Growing Ration #3 - Mid-summer**  
**Six to twelve months, 400 to 725 pounds (average forage-3 months)**

<b>Feed Item</b>	<b>lbs/d</b>	<b>lbs/stage</b>	<b>\$/lb</b>	<b>\$/stage</b>
Corn Gluten Feed	2.75	247.50	0.0475	11.76
Soybean Hulls	2.50	225.00	0.0400	9.00
Cracked Corn	1.00	90.00	0.0475	4.28
Mineral w/lasalocid	0.20	18.00	0.2800	5.04
<b>Total</b>	<b>6.45</b>	<b>580.50</b>		<b>\$30.07</b>
<b>Cost/Hd/Day</b>				<b>\$0.33</b>

**Growing Ration #4 - Winter Feeding**  
**Twelve to twenty-four months, 725 to 1380 pounds (5 months)**

<b>Item</b>	<b>lbs/d</b>	<b>lbs/stage</b>	<b>\$/lb</b>	<b>\$/stage</b>
Corn Gluten Feed	5.50	825.00	0.0475	39.19
Cracked Corn	3.50	525.00	0.0475	24.94
Mineral w/ lasalocid	0.20	30.00	0.2800	8.40
Orchard Grass Hay	15.00	2250.00	0.0300	67.50
<b>Total</b>	<b>24.20</b>	<b>3630.00</b>		<b>\$140.03</b>
<b>Cost/Hd/Day</b>				<b>\$0.93</b>

**Growing Ration #5 - Spring & Fall**  
**Twelve to twenty-four months, 725 to 1380 pounds (lush forage-4 months)**

<b>Feed Item</b>	<b>lbs/d</b>	<b>lbs/stage</b>	<b>\$/lb</b>	<b>\$/stage</b>
Soybean Hulls	3.00	360.00	0.0400	14.40
Cracked Corn	1.00	120.00	0.0475	5.70
Mineral w/lasalocid	0.20	24.00	0.2800	6.72
<b>Total</b>	<b>4.20</b>	<b>504.00</b>		<b>\$26.82</b>
<b>Cost/Hd/Day</b>				<b>\$0.22</b>

**Growing Ration #6 - Mid-summer**  
**Twelve to twenty-four months, 725 to 1380 pounds (average forage-3 months)**

<b>Feed Item</b>	<b>lbs/d</b>	<b>lbs/stage</b>	<b>\$/lb</b>	<b>\$/stage</b>
Corn Gluten Feed	4.75	427.50	0.0475	20.31
Cracked Corn	1.50	135.00	0.0475	6.41
Soybean Hulls	2.50	225.00	0.0400	9.00
Mineral w/lasalocid	0.20	18.00	0.2800	5.04
<b>Total</b>	<b>8.95</b>	<b>805.50</b>		<b>\$40.76</b>
<b>Cost/Hd/Day</b>				<b>\$0.45</b>

### Recommended Nutrient Content of Milk Replacers<sup>1</sup>

Nutrient	Amount
Metabolizable energy, Mcal/lb	1.71
Crude protein, %	22
Ether extract (min)	10 <sup>2</sup>
Ca, %	0.70
P, %	0.60
Mg, %	0.07
K, %	0.65
Na, %	0.10
Cl, %	0.20
S, %	0.29
Fe, ppm	100
Co, ppm	0.10
Cu, ppm	10
Mn, ppm	40
Zn, ppm	40
I, ppm	0.25
Se, ppm	0.30
Vitamin A, IU/lb	1700
Vitamin D, IU/lb	270
Vitamin E, IU/lb	18 <sup>3</sup>

<sup>1</sup>National Research Council. 1989.

<sup>2</sup>In warm weather, should be at least 15%; in cold weather, 20%.

<sup>3</sup>Based on recent research, should be 90IU/lb for increased function of immune system.



**Recommended Nutrient Content of Calf Starters<sup>1</sup>**

Nutrient	Amount
NEM, Mcal/lb	0.86
NEG, Mcal/lb	0.54
ME, Mcal/lb	1.41
DE, Mcal/lb	1.60
TDN, % of DM	80
Crude protein %	18
Ether extract (minimum), %	3
Major minerals (%):	
	Ca 0.60
	P 0.40
	Mg 0.10
	K 0.65
	Na 0.10
	Cl 0.20
	S 0.20
Trace minerals (ppm):	
	Fe 50
	Co 0.10
	Cu 10
	Mn 40
	Zn 40
	I 0.25
	Se 0.30
Vitamins (IU/lb):	
	A 1000
	D 140
	E 30 <sup>2</sup>

<sup>1</sup> From National Research Council (1989)

<sup>2</sup> Research by Reddy et al. (1987) suggests that the NRC recommendation for vitamin E is low; therefore, 30 IU per lb is recommended.

**Effect of temperature on  $NE_m$  requirements of dairy replacement heifers.<sup>1</sup>**

Temp, F	Heifer Weight (lbs)			
	300	600	900	1200
	----- $NE_m$ Mcal-----			
86	3.1	5.3	7.2	8.9
77	3.3	5.5	7.5	9.3
68	3.4	5.8	7.8	9.7
59	3.6	6.0	8.1	10.1
50	3.7	6.2	8.4	10.5
41	3.8	6.5	8.8	10.9
32	4.0	6.7	9.1	11.3
23	4.1	6.9	9.4	11.7
14	4.3	7.2	9.7	12.1
5	4.4	7.4	10.0	12.5
-4	4.5	7.6	10.4	12.8
-13	4.7	7.9	10.7	13.2
-22	4.8	8.1	11.0	13.6

<sup>1</sup> Adapted from Hoffman, P.M., 1994.

Environmental temperature will influence the energy requirements of the growing calf. As the environmental temperature decreases, energy requirements increase. Additional grain should be fed during periods of inclement weather with help maintain proper growth and development.