



# Missouri Robotic Dairy Business Plans

**Financial models of integrated modern dairy systems:**

- 150-, 300- and 600-cow herds
- Robotic milking systems
- Sand bedded, tunnel ventilated freestall housing
- Passive sand and manure separation
- Irrigated forage production

November 2020

The following report was commissioned by the Missouri Dairy Industry Alliance board to prepare producers for the next generation dairy business models in the state. Funding was provided by Missouri Agricultural and Small Business Development Authority through its Missouri Value-Added Grant Program. A special thanks to Steve Bodart with Compeer Financial for his review and feedback to the project team.

Authors of this report:

Joe Horner	State Specialist, Agricultural Business and Policy, MU Extension
Ryan Milhollin	State Specialist, Agricultural Business and Policy, MU Extension
Joseph Zulovich	Assistant Professor, Agricultural Systems Management, MU Extension
Teng Lim	Professor, Agricultural Systems Management, MU Extension

# Missouri Dairy Plan – Robotic Dairies

## Contents

INTRODUCTION .....	1
1. PRODUCTION AND OPERATION PLAN .....	5
1.1 Production assumptions .....	5
1.2 Capital investments .....	6
1.3 Markets and prices.....	11
1.4 Feed cost and management.....	12
1.5 Labor cost and management.....	15
1.6 Other operating costs .....	16
1.7 Land, crops and nutrient management .....	18
1.8 Organizational structure .....	20
2. FINANCIAL STATEMENTS AND ANALYSIS .....	21
2.1 Financial analysis for the 600-cow model.....	22
2.2 Financial analysis for the 300-cow model.....	29
2.3 Financial analysis for the 150-cow model.....	36
2.4 Risk management .....	43
3. IMPLEMENTATION PLAN .....	48
3.1 Timelines.....	48
3.2 Site selection .....	49
3.3 Permits and regulations .....	51
3.4 Consultants .....	51

# Introduction

---

This dairy farm business plan demonstrates one path forward for the next generation of Missouri's dairy farmers. This path involves labor-saving robotic milking systems and next generation confinement housing solutions that improve cow comfort and cooling and remove barriers to higher milk production.

Three model dairy herd sizes (150-, 300- and 600-cow units) are modeled here to fit differences in farm equity levels and available land resources. Each plan uses an integrated systems approach combining capital investments, operating costs, production plans, rations, forage systems, housing systems and manure systems. Each model serves as a complete template for starting a new greenfield dairy.

Currently operating dairies seldom start a greenfield dairy by designing a completely new dairy system. However, this strategy can be an option for dairy farms transitioning to the next generation – especially if milking and housing facilities are functionally obsolete, fully depreciated and poorly located for expansion. This report is designed to guide such farms in planning a completely new dairy. The templates in this report are also helpful for existing dairy producers evolving on-site in their current facilities as they examine possible technologies to use in a dairy's expansion path.

Each economic model evaluates profitability and cash flow potential for each different herd size. This can inform a dairy's production goals and allow producers to evaluate how various investment and performance levels impact financial measures. Financial statements show how various components of the dairy operation impact the operation's cash flow, income statement and the five-year budget. Fitting these financial statements together captures the dairy's business potential.

A comparison of key system components and financial indicators for each model is found in Exhibit A1. Each model assumes the dairy uses 100% equity financing, with no debt. Although unrealistic, this simplifying assumption allows lenders to quickly analyze the free cash flow to determine how much debt the operation could service.



**Exhibit A1. Comparison of alternative Missouri dairy business sizes.**

<b>Component</b>	<b>150-cow model</b>	<b>300-cow model</b>	<b>600-cow model</b>
Milking center	2 robotic milking box systems	4 box robotic milking systems	8 robotic milking box systems
Housing system	Four-row tunnel ventilated freestall housing facility with sand bedding for cows (milking, dry and special needs)		
Manure handling system	Passive manure/sand separation with manure solids storage basins, earthen lagoon tied to center pivot irrigation systems.		
Total capital investments	\$3,173,326	\$5,832,114	\$11,130,621
Total acreage <i>(includes crops, farmstead and waste acreage)</i>	196	393	785
Dairy jobs <i>(full time equivalents)</i>	1.9	3.3	5.8
Net income <i>(five-year average)</i>	(\$41,567)	(\$4,299)	\$153,597
Net cash flow <i>(five-year average)</i>	38,124	167,326	412,634
Return on assets <i>(five-year average)</i>	(1.4%)	(0.1%)	1.4%

The following key assumptions are included in these models:

- All heifers are raised on-site by the dairy operation.
- All corn silage, alfalfa hay and haylage needs are produced on owned land operated by the dairy enterprise; however, planting and harvest are outsourced to custom hire operators.
- Land investments are based on the minimum acreage required to meet forage production needs plus twenty percent more acres to accommodate farmstead, feed storage, roads and unusable land typical to Missouri dairy farms.
- Freestalls with sand bedding in four-row, tunnel-ventilated cow housing barns are used for optimal cow comfort. Adequate bunk space and water troughs are provided. Head catches and manure flush systems are included for labor efficiency.
- Heifer housing includes individual hutches for small calves and a mono-slope heifer barn with a feed alley that can be scraped, a feed rail, and multiple bedded pack pens for precise grouping.
- Manure handling systems include recycled lagoon water towers flushing first to a sand separation lane and then to manure solids separation basins, where the liquid fraction weeps into an earthen lagoon.
- Capital investments are adjusted for each model based on the number of cows.

Well-managed larger dairy operations with tight standard operating procedures typically have a financial advantage over smaller-sized units. Larger dairies can spread initial investments and fixed costs over more cows thereby reducing their capital investment per cow, debt per cow and, ultimately, cost of production.

Well-managed smaller dairy operations succeed financially when family living withdrawals from the business are modest, capital investments are appropriate and debt levels are low. A dairy producer with a strong equity position, tight operating expense control and family labor committed to high production goals helps generate financial sustainability.

The future of the Missouri dairy industry depends on how well producers can use technology to intensify management to handle larger-scale operations; these employ more outside labor and expertise. The next generation of dairy managers must learn to create and manage standard operating procedures (SOPs) to effectively use evolving technologies, equipment, and intensified management systems.

While long common in manufacturing industries and other livestock sectors, SOPs on dairy farms were pioneered in this century by emerging larger scale dairies. Now common on most larger dairies, simple but effective SOPs can be quickly developed and customized for a dairy farm by borrowing other farm SOPs while drawing on expertise from experienced dairy consultants or specialized veterinarians. The SOPs help management hire labor effectively, develop personnel management skills, create and maintain a healthy and consistent cow environment, and ensure environmentally compatible manure management systems.

**Exhibit A2. Dairy standard operating procedures (SOPs).**



# 1. Production and operation plan

---

## 1.1 Production assumptions

### ***Milk production***

Estimated annual milk production and rolling herd averages are shown in Exhibit 1.1.1. Milk production levels are based on a herd of purchased Holstein cattle. Milk production per cow gradually improves as the herd matures and adapts to robotic milking. Only 2.5 percent of total milk production is not sold and is used to feed calves. Dairy producers can increase cash flow and make substantial economic gains by focusing on improving milk production.

**Exhibit 1.1.1. Milk production assumptions.**

	Year 1	Year 2	Year 3	Year 4	Year 5
Daily milk production per cow, pounds	76.0	80.0	81.0	82.0	83.0
Rolling herd average, pounds of milk per 365 days	23,750	25,000	25,313	25,625	25,938

### ***Turnover and reproduction***

Cows will leave the herd based on involuntary factors (death, disease, problem breeders, etc.) and voluntary factors (low milk production). A 28.5 percent annual cull rate is assumed in the robotic dairy models. Annual death loss is estimated at 6 percent. Together, these represent 34.5 percent of yearly herd turnover. Other assumptions include a calving interval of 12.8 months and a 56-day average days dry period for the herd. These calving intervals require tightly managed reproductive protocols and animal health SOPs. Heifers born on the farm would be raised as replacements or sold when heifer numbers exceed the number of replacements needed.

#### **Assumptions**

Cull rate: 28.5 percent  
Death loss: 6 percent  
Calving interval: 12.8 months  
Average days dry: 56 days



## 1.2 Capital investments

Dairy investments are categorized as real estate, machinery and equipment, and livestock. Exhibits 1.2.1, 1.2.2 and 1.2.3 detail investments for the 600-cow, 300-cow and 150-cow models.

### Exhibit 1.2.1. Capital investments for the 600-cow model.

Item	Units	# of units	\$/unit	Cost
<b>REAL ESTATE:</b>				
Land	acre	785	\$3,530	\$2,771,942
Free stall (tunnel ventilation, loops with sand)	stall	600	\$2,500	\$1,500,000
Box robotic milking system and building	box	8	\$205,000	\$1,640,000
Office, milk house, utilities, conf. room	square foot	2,500	\$50	\$125,000
Heifer barn (post-hutch to pre-calving)	head capacity	450	\$750	\$337,500
Sand separation apron and pad	each			\$62,222
Passive manure separation/storage basins	cubic foot	60,820	\$2	\$121,640
Lagoon (365 days of storage)	cubic foot	4,507,128	\$0.123	\$554,377
Calf hutch dry manure and bedding storage (7 days of storage)	square foot	2,400	\$12	\$28,800
Dry manure/bedding storage (7 days of storage)	square foot	2,400	\$12	\$28,800
Hay and equipment storage	square foot	10,000	\$10	\$100,000
Silage storage system pile base	cubic foot	87,120	\$2	\$174,240
Commodity shed	bay	5	\$15,000	\$75,000
Supplement bins	bin	5	\$15,000	\$75,000
Truck scale				\$50,000
Site preparation				\$100,000
All-weather driveway (gravel)				\$50,000
Wells and/or water impoundments, lines				\$100,000
Electric connection (three-phase power)				\$100,000
			<b>SUBTOTAL</b>	<b>\$7,994,521</b>
<b>MACHINERY &amp; EQUIPMENT:</b>				
Bulk tank	gallon	8,000	\$14	\$112,000
Skid steer loader	each	2	\$35,000	\$70,000
Mixer wagon and automatic feed pushers				\$120,000
Payloader	each	1	\$140,000	\$140,000
Tractor 1, 150 horsepower, used	each	1	\$150,000	\$150,000
Tractor 2, 100 horsepower, used	each	1	\$100,000	\$100,000
Tractor 3, 100 horsepower, used	each	1	\$50,000	\$50,000

**Exhibit 1.2.1. Capital investments for the 600-cow model (continued).**

<b>MACHINERY &amp; EQUIPMENT (continued):</b>				
Standby generator	each	1	\$30,000	\$30,000
Flush towers	each	8	\$12,000	\$96,000
Recycle pump & pipe	each	2	\$8,250	\$16,500
Liquid manure pump				\$10,000
Irrigation (160 acre - machine, generator and pad)	pivot	4	\$169,500	\$678,000
Solid manure spreader	each	1	\$45,000	\$45,000
Livestock chute with scale				\$3,500
Calf hutches	each	32	\$400	\$12,800
Livestock trailer, used	each	1	\$17,500	\$17,500
Flatbed trailer and miscellaneous rolling stock				\$22,500
Pickup truck, used	each	1	\$20,000	\$20,000
Silage rake	each	1	\$15,000	\$15,000
Lawn-care equipment				\$2,500
High-pressure washer				\$500
Office equipment				\$1,500
Office furniture				\$2,000
			<b>SUBTOTAL</b>	<b>\$1,715,300</b>
<b>LIVESTOCK:</b>				
Dairy cows	head	600	\$1,600	\$960,000
Heifers	head	480	\$960	\$460,800
			<b>SUBTOTAL</b>	<b>\$1,420,800</b>
<b>TOTAL INVESTMENTS</b>				<b>\$11,130,621</b>
<b>INVESTMENT PER COW</b>				<b>\$18,551</b>

### Exhibit 1.2.2. Capital investments for the 300-cow model.

Item	Units	# of units	\$/unit	Cost
<b>REAL ESTATE:</b>				
Land	acre	393	\$3,530	\$1,386,168
Free stall (tunnel ventilation, loops with sand)	stall	300	\$3,000	\$900,000
Box robotic milking system and building	box	4	\$205,000	\$820,000
Office, milk house, utilities, conference room	square foot	1,600	\$50	\$80,000
Heifer barn (post-hutch to pre-calving)	head capacity	225	\$750	\$168,750
Sand separation apron and pad	cubic yard	204	\$200	\$40,741
Passive manure separation/storage basins	cubic foot	30,410	\$2	\$60,820
Anaerobic lagoon (365 days of storage)	cubic foot	2,276,300	\$0.12	\$279,985
Calf hutch dry manure and bedding storage (7 days of storage)	square foot	2,400	\$12	\$28,800
Dry manure/bedding storage (7 days of storage)	square foot	2,400	\$12	\$28,800
Hay and equipment storage	square foot	10,000	\$10	\$100,000
Silage pad base (asphalt)				\$40,000
Commodity shed	bay	2	\$15,000	\$30,000
Supplement bins	bin	4	\$15,000	\$60,000
Truck scale				\$50,000
Site preparation				\$50,000
All-weather driveway (gravel)				\$25,000
Wells and/or water impoundments, lines				\$50,000
Electric connection (three-phase power)				\$50,000
			<b>SUBTOTAL</b>	<b>\$4,249,064</b>
<b>MACHINERY &amp; EQUIPMENT:</b>				
Bulk tank	gallon	4,000	\$14	\$56,000
Skid steer loader	each	1	\$35,000	\$35,000
Mixer wagon and automatic feed pushers				\$75,000
Tractor 1, 100 horsepower, used	each	1	\$90,000	\$90,000
Tractor 2, 75 horsepower, used	each	1	\$50,000	\$50,000
Tractor 3, 40 horsepower, used	each	1	\$10,000	\$10,000
Standby generator	each	1	\$30,000	\$30,000
Flush towers	each	4	\$12,000	\$48,000
Recycle pump & pipe	each	1	\$8,250	\$8,250
Liquid manure pump				\$10,000
Irrigation (160 acre - machine, generator and pad)	pivot	2	\$169,500	\$339,000
Solid manure spreader	each	1	\$45,000	\$45,000
Livestock chute with scale				\$3,500
Calf hutches	each	16	\$400	\$6,400
Livestock trailer, used	each	1	\$17,500	\$17,500

### Exhibit 1.2.2. Capital investments for the 300-cow model (continued).

<b>MACHINERY &amp; EQUIPMENT (continued):</b>				
Flatbed trailer and miscellaneous rolling stock				\$22,500
Pickup truck, used	each	1	\$20,000	\$20,000
Lawn-care equipment				\$2,500
High-pressure washer				\$500
Office equipment				\$1,500
Office furniture				\$2,000
			<b>SUBTOTAL</b>	<b>\$872,650</b>
<b>LIVESTOCK:</b>				
Dairy cows	head	300	\$1,600	\$480,000
Heifers	head	240	\$960	\$230,400
			<b>SUBTOTAL</b>	<b>\$710,400</b>
<b>TOTAL INVESTMENTS</b>				<b>\$5,832,114</b>
<b>INVESTMENT PER COW</b>				<b>\$19,440</b>

### Exhibit 1.2.3. Capital investments for the 150-cow model.

Item	Units	# of units	\$/unit	Cost
<b>REAL ESTATE:</b>				
Land	acre	196	\$3,530	\$690,259
Free stall (tunnel ventilation, loops with sand)	stall	150	\$3,000	\$450,000
Box robotic milking system and building	box	2	\$205,000	\$410,000
Office, milk house, utilities, conf. room	square foot	900	\$50	\$45,000
Heifer barn (post-hutch to pre-calving)	head capacity	110	\$750	\$82,500
Sand separation apron and pad	cubic yard	136	\$200	\$27,185
Passive manure separation/storage basins	cubic foot	15,220	\$2	\$30,440
Lagoon (365 days of storage)	cubic foot	1,210,500	\$0.12	\$148,892
Calf hutch dry manure and bedding storage (7 days of storage)	square foot	1,600	\$12	\$19,200
Dry manure/bedding storage (7 days of storage)	square foot	1,600	\$12	\$19,200
Hay and equipment storage	square foot	5,000	\$10	\$50,000
Silage bag base (rock)	square foot	5,000	\$3.50	\$17,500
Commodity shed	bay	2	\$15,000	\$30,000
Supplement bins	bin	4	\$15,000	\$60,000
Site preparation				\$25,000
All-weather driveway (gravel)				\$25,000
Wells and/or water impoundments, lines				\$25,000
Electric connection (three-phase power)				\$25,000
			<b>SUBTOTAL</b>	<b>\$1,845,117</b>

**Exhibit 1.2.3. Capital investments for the 150-cow model (continued).**

<b>MACHINERY &amp; EQUIPMENT:</b>				
Bulk tank	gallon	2,000	\$14	\$28,000
Skid steer loader	each	1	\$35,000	\$35,000
Mixer wagon and automatic feed pusher				\$75,000
Tractor 1, 100 horsepower, used	each	1	\$90,000	\$90,000
Tractor 2, 75 horsepower, used	each	1	\$50,000	\$50,000
Standby generator	each	1	\$30,000	\$30,000
Flush towers	each	2	\$12,000	\$24,000
Recycle pump & pipe	each	1	\$8,250	\$8,250
Liquid manure pump				\$10,000
Irrigation (160 acre - machine, generator and pad)	pivot	1	\$169,500	\$169,500
Solid manure spreader	each	1	\$45,000	\$45,000
Livestock chute with scale				\$3,500
Calf hutches	each	8	\$400	\$3,200
Livestock trailer, used	each	1	\$17,500	\$17,500
Flatbed trailer and misc. rolling stock				\$22,500
Pickup truck, used	each	1	\$20,000	\$20,000
Lawn-care equipment				\$2,500
High-pressure washer				\$500
Office equipment				\$1,500
Office furniture				\$2,000
			<b>SUBTOTAL</b>	<b>\$637,950</b>
<b>LIVESTOCK:</b>				
Dairy cows	head	150	\$1,600	\$240,000
Heifers	head	120	\$960	\$115,200
			<b>SUBTOTAL</b>	<b>\$355,200</b>
<b>TOTAL INVESTMENTS</b>				<b>\$3,173,326</b>
<b>INVESTMENT PER COW</b>				<b>\$21,156</b>

## 1.3 Markets and prices

### ***Milk pricing***

A farm level milk price of \$18.25 per hundredweight (cwt) is used across all years in the financial projections. This is considered a realistic price level estimate and is based on a Class III milk price of \$16.50, plus a farm specific basis of \$1.50 per cwt and a \$0.25 per cwt cell count premium. This long-term basis is consistent with what has been seen on other Missouri dairy operations. Additional milk price premiums, although not included in this analysis, may be obtained from milk buyers.

Signing a marketing agreement with a financially secure marketing cooperative is critical to long term sustainability and profitability. Opportunities in the future may, or may not, exist to sell milk at a higher price into Southeast Order plants, Central Order plants, other milk cooperatives or other direct buyers.

### ***Beef pricing***

Dairy herds produce approximately the same quantity of beef as beef herds by selling culls and young stock. Securing higher prices for cull cows, bulls and surplus heifers has become an important driver of dairy farm profitability. This economic model assumes selling three-day to seven-day old bull and heifer calves for an average of \$200 per head. Pricing assumes a percentage of the cows are bred to beef sires (Angus, Limousin, etc.) to improve calf salability. Cull values range from \$225 to \$850 per head, depending on size and age of animal.

#### **Calf and cull value assumptions, by age**

Bull/heifer calves: \$200 per head

2-6 months: \$225 per head

6-12 months: \$485 per head

12-24 months: \$850 per head

Milking/dry cows: \$500 per head

### ***Hauling costs***

Milk hauling costs vary tremendously across Missouri depending on location, distance hauled, volume produced and pickup frequency. An approximate base rate of 75 cents per cwt is assumed in the 150-cow and 300-cow plans. These dairies would likely require transport trailer trucks (48,000- to 50,000-pounds.) picking up milk every other day. The 600-cow plan is designed for daily pickup with a transport trailer truck at a transportation rate of 50 cents per cwt. Hauling sustainability and cost are important considerations when deciding the location and ultimate scale of a dairy. Unless a cluster of dairies is nearby, milk markets and hauling are not assured for dairies unable to fill a milk transport trailer.

## ***Milk assessments or other marketing costs***

Several price deductions for marketing costs affect the net price received by dairy producers. Deductions in this analysis include:

- National milk promotion/checkoff: 15 cents per hundredweight of milk.
- Cooperative capital retain: 20 cents per hundredweight of milk.
- Cooperatives Working Together (CWT) assessment: 4 cents per hundredweight of milk.

## **1.4 Feed cost and management**

Feed is traditionally about 50 percent of milk production costs. A ration cost of \$0.12 per pound of dry matter fed is used in these models, reflecting a slightly higher cost of using pelleted feed in the robotic milker versus total mixed ration (TMR) costs.

Controlling feed costs, shrink, and efficiency is the single biggest driver of farm profitability. Rations developed for the dairy models use homegrown corn silage and alfalfa hay and haylage as the forage base. Additional feedstuffs, such as soybean meal, distillers dried grains, corn gluten feed, and premixes with vitamins, mineral, and energy supplements reflect common feedstuffs readily available to Missouri producers.

Exhibits 1.4.1 through 1.4.4, on the pages following, list the assumptions used for the rations in each robotic dairy model. (Photos: Alfalfa and cow, USDA/ARS; field, Soybean Checkoff)



### Exhibit 1.4.1. Rations for the robotic dairy models.

	Lactating rations					Dry cow rations		Heifer rations	
	Year 1	Year 2	Year 3	Year 4	Average	Dry	Close Up	Growing	Bred
Pounds of milk per day	76	80	81	82					
<b>Feedstuffs</b>	<i>As fed, pounds per head per day</i>								
Corn silage (35% dry matter)	52.0	53.9	53.6	53.9	53.3	20	18	0	15
Alfalfa hay	5.0	5.3	5.3	5.3	5.2	0	0	2.5	0
Alfalfa haylage	24.0	24.9	24.5	25.0	24.6	0	0	0	0
Grass hay						15	9	0	12
Corn grain	5.0	5.0	5.0	5.0	5.0	3	2	5.2	2.8
Soybean meal (47.5% protein)	1.0	1.0	1.2	1.4	1.2	2	2	0.8	1.5
Distillers dried grains	3.0	3.1	2.0	2.0	2.5	0	0	0	1.5
Corn gluten feed (dry)	5.5	4.0	3.0	3.0	3.9	0	0	0	0
Robot pellet and vitamin, mineral and minor ingredients	12.2	14.1	18.5	18.5	15.8	0.33	3.1	1.1	0.3
Total pounds, as fed	107.7	111.2	113.0	114.1	111.5	40.3	34.1	9.5	33.0
<b>Ration profile</b>									
Dry matter intake (pounds per day)	55.0	57.0	57.0	57.4		25.1	20.6	8.5	21.3
Ration dry matter (percent)	51.0	51.0	51.2	50.3		62.3	60.6	89.0	64.5
Metabolizable energy balance (megacalories)	6.1	8.2	7.1	7.7		5.7	0.5		
Crude protein (percent)	17.4	17.3	17.5	17.5		12.1	15.6	16.5	13.1
Neutral Detergent Fiber Digestibility (percent)	31.0	30.6	30.0	30.0		48.7	42.7	18.9	47.4

### Exhibit 1.4.2. 600-cow cropping plan.

Feedstuff	Average tons fed per year	Waste & shrink (percent)	Total tonnage	Tons per acre	Acres needed
Corn silage (35 percent dry matter)	5,877	20.0%	7,053	24.0	294
Alfalfa hay	594	2.0%	606	5.0	121
Alfalfa haylage	2,280	5.0%	2,394	10.0	239
Grass hay	701	2.0%	715	3.0	238*
Corn grain	849	1.0%	858		
Soybean meal (47.5 percent protein)	236	0.5%	238		
Distillers dried grains	295	1.0%	298		
Corn gluten feed (dry)	359	1.0%	363		
Robot pellet and vitamin, mineral and minor ingredients	1,547	1.0%	1,562		
<b>Total</b>	<b>12,739</b>		<b>14,086</b>		<b>893</b>

\*Note: Grass hay may be purchased rather than produced on-farm. Model does not include acreage for grass hay.



### Exhibit 1.4.3. 300-cow cropping plan.

Feedstuff	Average tons fed per year	Waste & shrink (percent)	Total tonnage	Tons per acre	Acres needed
Corn silage (35 percent dry matter)	2,939	20.0%	3,526	24.0	147
Alfalfa hay	297	2.0%	303	5.0	61
Alfalfa haylage	1,140	5.0%	1,197	10.0	120
Grass hay	351	2.0%	358	3.0	119*
Corn grain	425	1.0%	429		
Soybean meal (47.5 percent protein)	118	0.5%	119		
Distillers dried grains	148	1.0%	149		
Corn gluten feed (dry)	180	1.0%	181		
Robot pellet and vitamin, mineral and minor ingredients	773	1.0%	781		
<b>Total</b>	<b>6,370</b>		<b>7,044</b>		<b>446</b>

\*Note: Grass hay may be purchased rather than produced on-farm. Model does not include acreage for grass hay.

### Exhibit 1.4.4. 150-cow cropping plan.

Feedstuff	Average tons fed per year	Waste & shrink (percent)	Total tonnage	Tons per acre	Acres needed
Corn silage (35 percent dry matter)	1,468	20.0%	1,762	24.0	73
Alfalfa hay	146	2.0%	149	5.0	30
Alfalfa haylage	570	5.0%	598	10.0	60
Grass hay	174	2.0%	178	3.0	59*
Corn grain	206	1.0%	208		
Soybean meal (47.5 percent protein)	58	0.5%	58		
Distillers dried grains	74	1.0%	74		
Corn gluten feed (dry)	90	1.0%	91		
Robot pellet and vitamin, mineral and minor ingredients	385	1.0%	389		
<b>Total</b>	<b>3,171</b>		<b>3,508</b>		<b>222</b>

\*Note: Grass hay may be purchased rather than produced on-farm. Model does not include acreage for grass hay.

## 1.5 Labor cost and management

Exhibit 1.5.1 presents a labor and management overview for the robotic dairy models. Each operation is run by a full-time farm manager. The primary farm manager oversees the business operation and makes major management decisions. This person will oversee compliance with the established SOPs and complete all purchasing, contracts, payroll, personnel management and financial analyses. The farm manager salary for the 150-cow and 300-cow models is assumed at \$50,000 annually, split between a husband and wife management team (\$40,000 for the primary manager and \$10,000 for the part-time manager). For the 600-cow model, the single management salary is increased to \$75,000 per year.

Hired labor will complete business functions such as feeding, cattle/heifer/calf care, breeding, calving, equipment maintenance and manure management. Outsourcing of forage crop planting and harvesting is used to keep labor costs low. Total full-time employee equivalents (FTE) vary by operational size, ranging from 1.9 to 5.8 in the models. These workers may be hired or operator family members. Wage rates would begin at \$12.00 per hour for part-time help and \$15.50 per hour for full-time workers. Social Security and Medicare benefits are assumed for all employees. Paid vacation is estimated at 2 percent of total wages. The 600-cow model assumes workers compensation (5 percent of total wages) and unemployment insurance. Exhibits 1.5.2 to 1.5.4 present potential staffing plans and starting wage rates for each robotic dairy model.

### Exhibit 1.5.1. Annual labor overview, robotic dairy models.

	150-cow model	300-cow model	600-cow model
Total labor hours	3,848	6,760	12,064
Total full-time equivalent (FTE)	1.9	3.3	5.8
Pounds of milk per FTE (five-year average)	1,986,233	2,261,250	2,534,159
Total labor cost, including wages and benefits (five-year average)	\$67,032	\$118,544	\$253,104

### Exhibit 1.5.2. Labor schedule and wage rates, 600-cow model.

Employee	Wage rate	Sun	Mon	Tues	Wed	Thu	Fri	Sat	Per week
		Hours							
Position #1	\$15.50/hour	8	8	8	8	8			40
Position #2	\$15.50/hour		8	8	8	8	8		40
Position #3	\$15.50/hour	8			8	8	8	8	40
Position #4	\$12.00/hour	8	8	8	8	8	8	8	56
Manager	\$75,000/year	2	10	10	10	10	10	4	56

### Exhibit 1.5.3. Labor schedule and wage rates, 300-cow model.

Employee	Wage rate	Sun	Mon	Tues	Wed	Thu	Fri	Sat	Per week
		Hours							
Position #1	\$15.50/hour	8	8	8	8	8	8	8	56
Position #2	\$12.00/hour	2	2	2	2	2	2	2	14
Manager #1	\$40,000/year	4	8	8	8	8	8	4	48
Manager #2	\$10,000/year		2	2	2	2	2	2	12

### Exhibit 1.5.4. Labor schedule and wage rates, 150-cow model.

Employee	Wage rate	Sun	Mon	Tues	Wed	Thu	Fri	Sat	Per week
		Hours							
Position #1	\$12.00/hour	2	2	2	2	2	2	2	14
Manager #1	\$40,000/year	4	8	8	8	8	8	4	48
Manager #2	\$10,000/year		2	2	2	2	2	2	12

Hired employees, like other resources, improve farm profitability only if they are essential, qualified and effectively managed. New employees should complement existing personnel rather than duplicate existing strengths. Planning before hiring will help the dairy find employees with skills and personal characteristics best meeting the needs of the business.

## 1.6 Other operating costs

Exhibit 1.6.1 details selected operating costs, beyond feed and labor, assumed in each robotic dairy model. These expenses are the same in each model on a per cow basis. A 2 percent annual rate of inflation is assumed for certain operating expenses.

### Exhibit 1.6.1. Selected operating costs for each dairy model, per cow.

Cost category	150-cow model	300-cow model	600-cow model
Artificial insemination	\$55	\$55	\$55
Vet, med and hoof trimming	\$163	\$163	\$163
Farm supplies and bedding	\$108	\$108	\$108
Fuel and oil	\$58	\$58	\$58
Utilities	\$152	\$152	\$152
Farm insurance	\$40	\$40	\$40
Miscellaneous expenses	\$20	\$20	\$20

Other operating costs vary for each dairy model. Each cost, and how it was calculated for each model, is explained below:

- *Repairs – Buildings.* Estimated at 1 percent of initial building capital investment.
- *Repairs – Machinery and equipment.* A \$10,000 service package cost per robot. The cost of other machinery and equipment is assumed at 2.5 percent of initial capital investment.
- *Rent.* For the 150-cow and 300-cow models, rent is assumed for an ag-bag machine to bag corn silage and alfalfa haylage for the dairy operation. Cost is estimated at \$11.65 per foot of bag.
- *Farm taxes.* This includes real estate and personal property taxes. Taxes are estimated at 0.10 percent of total capital investments.
- *Legal and professional fees.* Annual first year estimates for the 150-cow, 300-cow and 600-cow models are \$2,500, \$4,000 and \$5,000, respectively. For accounting and payroll, the dairy is assumed to use a cash basis computerized accounting system with a dairy specific chart of accounts and the ability to make accrual adjustments to produce accrual adjusted income statements. An accounting firm is hired for end of year tax planning and income tax preparation. A lawyer is used for legal discussions and related topics.
- *Custom hire.* Custom hire services are assumed for planting, harvest and forage hauling (corn silage, alfalfa haylage and alfalfa hay). Planting custom rates are assumed at \$17.25 per acre for corn silage (yearly) and \$15.67 for alfalfa (every four years). Chopping and hauling custom rates are assumed at \$9 per wet-basis ton for corn silage and alfalfa haylage. Alfalfa hay is assumed at \$35 per dry ton for cutting, raking and baling.
- *Depreciation.* Straight line depreciation is included for all buildings and equipment investments, with salvage value assumed at \$0. Building investments are depreciated over 15 years; machinery/equipment investments depreciated over 10 years.
- *Non-dairy farm supplies.* Corn silage inoculants, at a cost of \$2.25 per ton, are assumed to be used to enhance crop preservation.

## 1.7 Land, crops and nutrient management

Land required for each dairy operation is based on providing a suitable land base for forage crops, the farmstead and manure application. Exhibit 1.7.1 presents acreage needs for each robotic dairy model. Farmstead and unused land are estimated at 20 percent above the forage crop land base in each model. Unused land includes forests, rivers, streams and similar non-arable land types commonly found on most Missouri farms.

**Exhibit 1.7.1. Land requirements, robotic dairy models.**

Category	150-cow model	300-cow model	600-cow model
Corn silage crop	73	147	294
Alfalfa haylage crop	60	120	239
Alfalfa hay crop	30	61	121
Farmstead or non-usable land	33	65	131
<b>Total acres</b>	<b>196</b>	<b>393</b>	<b>785</b>

Corn and alfalfa will be raised on owned land to guarantee quality, lower feed costs, and ensure nutrient balancing. Forage acreage for each dairy size is represented in exhibit 1.7.1. Exhibit 1.7.2 details yield, market value and shrink assumptions for each crop. Corn silage and some alfalfa are produced under center pivot irrigation to mitigate weather risk and improve yields while decreasing total land investment.

**Exhibit 1.7.2. Forage crop production and price assumptions.**

Category	Unit	Corn silage	Alfalfa haylage	Alfalfa hay
Yield	wet tons per acre	24.0	10	5
Market value in the field	dollars per ton	\$37.50	\$98.00	\$190.50
Shrink added cost in ration	percent	20%	5%	2%

Crop enterprise production costs are estimated in Exhibit 1.7.3. Costs include seed, crop chemicals and fertilizer. Fertilizer expenses have been reduced because of manure applications to forage crop acreage. Seed costs are assumed annually for corn silage and every four years for alfalfa.

**Exhibit 1.7.3. Annual forage crop production costs, per acre.**

<b>Cost category</b>	<b>Corn silage</b>	<b>Alfalfa</b>
Seed	\$84.56	\$11.63
Crop chemicals	\$40.00	\$20.00
Fertilizer and soil amendments	\$150.75	\$115.90
Manure credit - fertilizer value	(\$82.30)	(\$82.30)
<b>Total cost per acre</b>	<b>\$193.01</b>	<b>\$65.23</b>

Note: Alfalfa seed cost assumes planting crop every four years.

The manure handling system for the dairy models is designed to flush parlor wastewater and sand-laden manure to a sand separation concrete apron and collection pad. A passive manure separation storage basin allows gravity and time to settle manure solids out of the solution. The liquid portion of the manure eventually resides in an earthen lagoon impoundment with 365 days of storage available. Irrigation is used under center pivot systems to apply the liquid fraction of manure to crop acreage. The solid fraction of manure is applied to crop acreage with an owned solid manure spreader.

Book values of dairy manure nutrient content were used in these models to estimate manure excretion. Based on the book values and nutrient removal values for corn silage, the model dairy operations will have enough crop acreage to accommodate all manure applications. Farmers are encouraged to use their own manure test results to make more precise estimates.



## 1.8 Organizational structure

Careful thought and consideration should be given to selecting a business entity that best reflects the goals and structure of a dairy. Tax implications, benefits and structure are important considerations. Two of the more common entities used in dairy operations are limited liability companies (LLC) and S corporations. Exhibit 1.8.1 provides an entity comparison chart. Seeking advice from an accountant or tax attorney is recommended to help decide the most suitable entity for a given situation.

**Exhibit 1.8.1. Entity comparison chart.**

	LLC	C Corp	B Corp	S Corp	Cooperative	Non-Profit	Sole Proprietor	General Partnership
Organizing document is required		✓	✓	✓	✓	✓		
Annual meetings are required		✓	✓	✓	✓	✓		
One owner is okay	✓	✓	✓	✓			✓	
Can sell or transfer entity to others	✓	✓	✓	✓	✓			
Personal liability is protected	✓	✓	✓	✓	✓	✓		
Owners can make a profit	✓	✓	✓	✓	✓		✓	✓
Can prioritize a social purpose over making profits	✓		✓	✓	✓	✓	✓	✓
Entity does not have to pay taxes (pass-through)	✓			✓			✓	✓
Potential self-employment tax savings				✓				
Potential to be tax exempt						✓		
Potential for donors to receive a tax deduction						✓		
Potential for favorable tax deductions on business entity's earnings					✓			

Source: Farmers' Guide to Business Structures (<https://farmcommons.org/>)

## 2. Financial statements and analysis

---

The following sections examine the financial feasibility of the 600-cow, 300-cow and 150-cow dairy models. The practical value and use of a detailed production plan can be measured in the ability of the plan to provide positive cash flow and a reasonable rate of return on investment.

Each financial analysis includes an examination of the cash flow, profit/loss, dairy enterprise, balance sheet and financial ratios. A sensitivity analysis is included to show adverse changes to milk price and production. Many dairy producers may not consider such information crucial to the investment decision, judging the investment to be acceptable if the business is projected to sufficiently cash flow and service debt. Additional analysis, however, is needed for two reasons: 1) to analyze the overall financial health of the business and its ability to service financial obligations (debt and expenses); and 2) to determine the financial return on new investments.

These models represent dairies using 100 percent equity financing (no debt). Although unrealistic, this simplifying assumption allows lenders to quickly analyze the operation's free cash flow to determine how much debt the dairy will support.

Various assumptions are made in each analysis. All replacement heifers are developed on-site at the operation. The land base includes enough purchased land for the operation's forage needs. Custom hire operators are used for planting and harvesting of forage crops. Center pivot irrigation systems are implemented for forage crop acreage. Lastly, the land base is sufficient to manage nutrients from all manure applications from the dairy enterprise.

Additional strategies could improve the financial position of each dairy model. Producers could consider outsourcing heifer development to reduce financial costs of raising replacements. Easements or arrangements with neighboring farms could secure land needed for crop acreage or manure application. Capital investment costs could be reduced with due diligence and careful planning and purchasing.



## 2.1 Financial analysis for the 600-cow model

The cash flow statement measures the cash position of the business over a specified period of time. It compares total cash inflow with total cash outflow. The difference is the net cash position of the business at the end of the period. Note that carryover cash from a previous period is not included in the cash flow statement.

**Exhibit 2.1.1. Cash flow statement, 600-cow model.**

	Year 1	Year 2	Year 3	Year 4	Year 5	Five-year average
<b>CASH INFLOWS</b>						
Farm cash receipts						
Milk sales	\$2,535,609	\$2,669,063	\$2,702,426	\$2,735,789	\$2,769,152	\$2,682,408
Livestock sales	\$172,887	\$172,887	\$172,887	\$172,887	\$172,887	\$172,887
Crop sales	\$0	\$0	\$0	\$0	\$0	\$0
Government payments	\$0	\$0	\$0	\$0	\$0	\$0
Other farm income	\$0	\$0	\$0	\$0	\$0	\$0
Patronage dividends	\$0	\$0	\$0	\$0	\$0	\$0
Sale of assets:						
Machinery	\$0	\$0	\$0	\$0	\$0	\$0
Real estate	\$0	\$0	\$0	\$0	\$0	\$0
Other	\$0	\$0	\$0	\$0	\$0	\$0
Money borrowed	\$0	\$0	\$0	\$0	\$0	\$0
Total	\$2,708,496	\$2,841,949	\$2,875,313	\$2,908,676	\$2,942,039	\$2,855,295
<b>CASH OUTFLOWS</b>						
Cash farm expenses						
Seed expenses	\$29,040	\$29,621	\$30,214	\$30,818	\$31,434	\$30,225
Fertilizer & chemicals	\$51,193	\$52,217	\$53,261	\$54,327	\$55,413	\$53,282
Purchased feedstuffs	\$957,393	\$993,153	\$1,002,153	\$1,011,153	\$1,020,154	\$996,801
Labor (includes benefits & Social Security)	\$243,180	\$248,044	\$253,005	\$258,065	\$263,226	\$253,104
Marketing 1/	\$122,265	\$128,700	\$130,309	\$131,918	\$133,526	\$129,344
Artificial insemination	\$33,000	\$33,000	\$33,000	\$33,000	\$33,000	\$33,000
Veterinary, medicine & hoof trimming	\$97,800	\$97,800	\$97,800	\$97,800	\$97,800	\$97,800
Farm supplies & bedding	\$80,669	\$82,282	\$83,928	\$85,606	\$87,318	\$83,961
Fuel & oil	\$34,956	\$34,956	\$34,956	\$34,956	\$34,956	\$34,956
Utilities	\$91,440	\$93,269	\$95,134	\$97,037	\$98,978	\$95,171

**Exhibit 2.1.1. Cash flow statement, 600-cow model (continued).**

	Year 1	Year 2	Year 3	Year 4	Year 5	Five-year average
<b>CASH OUTFLOWS (continued)</b>						
Repairs (buildings)	\$51,476	\$51,476	\$51,476	\$51,476	\$51,476	\$51,476
Repairs (machinery & equipment)	\$122,883	\$122,883	\$122,883	\$122,883	\$122,883	\$122,883
Rent	\$0	\$0	\$0	\$0	\$0	\$0
Farm taxes (real estate & personal property)	\$11,131	\$11,353	\$11,580	\$11,812	\$12,048	\$11,585
Farm insurance	\$24,000	\$24,480	\$24,970	\$25,469	\$25,978	\$24,979
Interest	\$0	\$0	\$0	\$0	\$0	\$0
Legal & professional fees	\$5,000	\$5,100	\$5,202	\$5,306	\$5,412	\$5,204
Custom hire	\$112,699	\$114,953	\$117,253	\$119,598	\$121,990	\$117,299
Car & truck costs	\$0	\$0	\$0	\$0	\$0	\$0
Contract heifer rearing	\$0	\$0	\$0	\$0	\$0	\$0
Other expenses	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000
Miscellaneous	\$31,202	\$32,029	\$32,387	\$32,748	\$33,114	\$32,296
Total cash farm expenses	\$2,111,327	\$2,167,316	\$2,191,509	\$2,215,971	\$2,240,706	\$2,185,366
Capital purchases:						
Breeding livestock	\$0	\$0	\$0	\$0	\$0	\$0
Machinery & equipment	\$257,295	\$257,295	\$257,295	\$257,295	\$257,295	\$257,295
Buildings & land	\$0	\$0	\$0	\$0	\$0	\$0
Principal payments	\$0	\$0	\$0	\$0	\$0	\$0
Family living expenses	\$0	\$0	\$0	\$0	\$0	\$0
Personal draw	\$0	\$0	\$0	\$0	\$0	\$0
State & federal income taxes, self-employment taxes	\$0	\$0	\$0	\$0	\$0	\$0
Other	\$0	\$0	\$0	\$0	\$0	\$0
Total	\$2,368,622	\$2,424,611	\$2,448,804	\$2,473,266	\$2,498,001	\$2,442,661
<b>NET CASH FLOW</b>	<b>\$339,874</b>	<b>\$417,338</b>	<b>\$426,508</b>	<b>\$435,410</b>	<b>\$444,038</b>	<b>\$412,634</b>

1/ Includes milk hauling, state and federal promotion, coop/marketing fees and the cost of marketing beef.

The profit/loss statement provides a business analysis of the farm over a specified period of time. Similar to the cash flow statement, it also includes the value of inventory changes and depreciation charges to the business. Taking into account the value of inventory changes, called income adjustments in this table, attempts to convert the cash measure of income to an accrual-based measure.

**Exhibit 2.1.2. Profit and loss statement, 600-cow model.**

	Year 1	Year 2	Year 3	Year 4	Year 5	Five-year average
<b>GROSS REVENUE</b>						
Milk sales	\$2,535,609	\$2,669,063	\$2,702,426	\$2,735,789	\$2,769,152	\$2,682,408
Calves & heifers sold	\$87,387	\$87,387	\$87,387	\$87,387	\$87,387	\$87,387
Other farm income 2/	\$0	\$0	\$0	\$0	\$0	\$0
Total revenue	\$2,622,996	\$2,756,449	\$2,789,813	\$2,823,176	\$2,856,539	\$2,769,795
<b>OPERATING EXPENSES:</b>						
<b>PURCHASED FEED</b>						
Feedstuffs	\$957,393	\$993,153	\$1,002,153	\$1,011,153	\$1,020,154	\$996,801
Less feed for heifers	(\$270,791)	(\$270,550)	(\$270,549)	(\$270,549)	(\$270,549)	(\$270,598)
Total feed	\$686,602	\$722,603	\$731,604	\$740,604	\$749,605	\$726,204
<b>HERD REPLACEMENT COSTS</b>						
Depreciation (dairy cows)	\$127,355	\$127,355	\$127,355	\$127,355	\$127,355	\$127,355
Loss on sale of cows	\$71,097	\$71,097	\$71,097	\$71,097	\$71,097	\$71,097
<b>OTHER OPERATING EXPENSES</b>						
Seed expenses	\$29,040	\$29,621	\$30,214	\$30,818	\$31,434	\$30,225
Fertilizer & chemicals	\$51,193	\$52,217	\$53,261	\$54,327	\$55,413	\$53,282
Hired labor (includes benefits, Social Security)	\$243,180	\$248,044	\$253,005	\$258,065	\$263,226	\$253,104
Marketing 1/	\$122,265	\$128,700	\$130,309	\$131,918	\$133,526	\$129,344
Artificial insemination	\$33,000	\$33,000	\$33,000	\$33,000	\$33,000	\$33,000
Veterinary, medicine, hoof trimming	\$97,800	\$97,800	\$97,800	\$97,800	\$97,800	\$97,800
Supplies & bedding	\$80,669	\$82,282	\$83,928	\$85,606	\$87,318	\$83,961
Fuel & oil	\$34,956	\$34,956	\$34,956	\$34,956	\$34,956	\$34,956
Utilities	\$91,440	\$93,269	\$95,134	\$97,037	\$98,978	\$95,171
Repairs (buildings)	\$51,476	\$51,476	\$51,476	\$51,476	\$51,476	\$51,476
Repairs (machinery & equipment)	\$122,883	\$122,883	\$122,883	\$122,883	\$122,883	\$122,883
Farm taxes (real estate & personal property)	\$11,131	\$11,353	\$11,580	\$11,812	\$12,048	\$11,585
Farm insurance	\$24,000	\$24,480	\$24,970	\$25,469	\$25,978	\$24,979
Legal & professional fees	\$5,000	\$5,100	\$5,202	\$5,306	\$5,412	\$5,204
Custom hire	\$112,699	\$114,953	\$117,253	\$119,598	\$121,990	\$117,299
Car & truck costs	\$0	\$0	\$0	\$0	\$0	\$0
Other expenses	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000
Miscellaneous	\$31,202	\$32,029	\$32,387	\$32,748	\$33,114	\$32,296
Depreciation (buildings, robots & equipment)	\$522,202	\$522,202	\$522,202	\$522,202	\$522,202	\$522,202
Less other expenses for raising heifers	(\$19,237)	(\$19,221)	(\$19,221)	(\$19,221)	(\$19,221)	(\$19,225)
Total other operating expenses	\$1,656,899	\$1,677,144	\$1,692,337	\$1,707,798	\$1,723,533	\$1,691,542
<b>TOTAL OPERATING EXPENSES</b>	\$2,541,952	\$2,598,199	\$2,622,392	\$2,646,854	\$2,671,589	\$2,616,197
<b>INCOME BEFORE FINANCING COSTS</b>	\$81,044	\$158,250	\$167,421	\$176,322	\$184,950	\$153,597
Interest and rent expense	\$0	\$0	\$0	\$0	\$0	\$0
<b>NET INCOME (LOSS)</b>	<b>\$81,044</b>	<b>\$158,250</b>	<b>\$167,421</b>	<b>\$176,322</b>	<b>\$184,950</b>	<b>\$153,597</b>

1/ Includes milk hauling, state and federal promotion, coop/marketing fees and the cost of marketing beef.

2/ Other farm income is assumed at zero here but could include crop sales, government payments, patronage, dividends, etc.

### Exhibit 2.1.3. Dairy enterprise, 600-cow model.

	Herd	Per cow	Per hundred pounds of milk produced	Percent
<b>INCOME FROM OPERATIONS:</b>				
Milk sales	\$2,682,408	\$4,471	\$18.25	97.1%
Sales of young stock & calves	\$79,587	\$133	\$0.54	2.9%
Other farm income	\$0	\$0	\$0.00	0.0%
Patronage dividend	\$0	\$0	\$0.00	0.0%
Total gross receipts	\$2,761,995	\$4,603	\$18.79	100.0%
<b>OPERATING EXPENSES:</b>				
Feed:				
Feedstuffs	\$1,611,250	\$2,685	\$10.96	56.4%
Less feed for heifers	(\$270,598)	(\$451)	(\$1.84)	(9.5%)
Total feed	\$1,340,653	\$2,234	\$9.12	46.9%
Herd replacement costs:				
Depreciation (dairy cows)	\$127,355	\$212	\$0.87	4.5%
Loss on sale of cows	\$71,097	\$118	\$0.48	2.5%
Total herd replacement costs	\$198,452	\$331	\$1.35	6.9%
Other operating expenses:				
Labor (includes benefits & Social Security)	\$222,732	\$371	\$1.52	7.8%
Marketing 1/	\$129,344	\$216	\$0.88	4.5%
Artificial insemination	\$33,000	\$55	\$0.22	1.2%
Veterinary, medicine & hoof trimming	\$97,800	\$163	\$0.67	3.4%
Supplies & bedding	\$67,444	\$112	\$0.46	2.4%
Fuel & oil	\$34,956	\$58	\$0.24	1.2%
Utilities	\$95,171	\$159	\$0.65	3.3%
Repairs (buildings)	\$51,476	\$86	\$0.35	1.8%
Repairs (machinery & equipment)	\$116,738	\$195	\$0.79	4.1%
Rent	\$0	\$0	\$0.00	0.0%
Farm taxes (real estate & personal property)	\$7,646	\$13	\$0.05	0.3%
Farm insurance	\$22,481	\$37	\$0.15	0.8%
Legal & professional fees	\$4,684	\$8	\$0.03	0.2%
Custom hire	\$0	\$0	\$0.00	0.0%
Car & truck costs	\$0	\$0	\$0.00	0.0%
Other	\$11,400	\$19	\$0.08	0.4%
Interest	\$0	\$0	\$0.00	0.0%
Depreciation	\$443,872	\$740	\$3.02	15.5%
Less other expenses for raising heifers	(\$19,225)	(\$32)	(\$0.13)	(0.7%)
Total other operating expenses	\$1,319,519	\$2,199	\$8.98	46.2%
<b>TOTAL OPERATING EXPENSES</b>	\$2,858,623	\$4,764	\$19.45	100.0%
<b>NET INCOME FROM OPERATIONS</b>	<b>(\$96,629)</b>	<b>(\$161)</b>	<b>(\$0.66)</b>	

1/ Includes milk hauling, state and federal promotion, coop/marketing fees and the cost of marketing beef.

The balance sheet provides a picture of the business at a particular point in time. It compares assets with liabilities in order to determine equity in the business. Market value basis is used in this analysis since it provides a more realistic view of returns on investment and more closely resembles the approach an investor would use.

**Exhibit 2.1.4. Balance sheet, 600-cow model.**

	Beginning Year 1	Ending Year 1	Ending Year 2	Ending Year 3	Ending Year 4	Ending Year 5
<b>ASSETS</b>						
Current assets:						
Cash	\$10,000	\$10,000	\$53,381	\$54,049	\$54,716	\$55,383
Other current assets	\$115,143	\$212,400	\$507,122	\$513,461	\$519,800	\$526,139
Total current assets	\$125,143	\$222,400	\$560,503	\$567,509	\$574,516	\$581,522
Non-current assets:						
Dairy herd	\$900,000	\$900,000	\$1,382,317	\$1,382,316	\$1,382,316	\$1,382,316
Farm & equipment						
Land	\$2,771,942	\$2,771,942	\$2,771,942	\$2,771,942	\$2,771,942	\$2,771,942
Nonfarm real estate	\$0	\$0	\$0	\$0	\$0	\$0
Buildings	\$5,147,579	\$4,804,407	\$4,461,235	\$4,118,063	\$3,774,891	\$3,431,719
Equipment, autos & trucks	\$1,790,300	\$1,868,565	\$1,946,830	\$2,025,095	\$2,103,360	\$2,181,625
Total	\$9,709,821	\$9,444,914	\$9,180,007	\$8,915,100	\$8,650,193	\$8,385,286
Other assets:						
Investment in co-ops	\$0	\$18,764	\$38,515	\$58,513	\$78,757	\$99,249
Other (notes receivable, etc.)	\$0	\$0	\$0	\$0	\$0	\$0
Total other assets	\$0	\$18,764	\$38,515	\$58,513	\$78,757	\$99,249
Total non-current assets	\$10,609,821	\$10,363,677	\$10,600,838	\$10,355,929	\$10,111,267	\$9,866,851
Total assets	\$10,734,964	\$10,586,077	\$11,161,341	\$10,923,438	\$10,685,782	\$10,448,373
<b>LIABILITIES</b>						
Current liabilities:	\$0	\$114,102	\$120,108	\$121,609	\$123,111	\$124,612
Long-term liabilities:	\$0	\$0	\$0	\$0	\$0	\$0
Total liabilities	\$0	\$114,102	\$120,108	\$121,609	\$123,111	\$124,612
<b>EQUITY</b>						
Owners equity:						
Capital contributions		\$0	\$0	\$0	\$0	\$0
Owner withdrawals		\$0	\$0	\$0	\$0	\$0
Total owner equity		\$0	\$0	\$0	\$0	\$0
Retained earnings		\$10,390,931	\$10,882,983	\$10,634,408	\$10,386,350	\$10,138,811
Net income		\$81,044	\$158,250	\$167,421	\$176,322	\$184,950
Total equity		\$10,471,975	\$11,041,234	\$10,801,829	\$10,562,672	\$10,323,762
Total liabilities and equity		\$10,586,077	\$11,161,341	\$10,923,438	\$10,685,782	\$10,448,373

**Exhibit 2.1.5. Financial ratios, 600-cow model.**

	Year 1	Year 2	Year 3	Year 4	Year 5
<b>Liquidity</b>					
1. Current ratio	1.95	4.67	4.67	4.67	4.67
2. Working capital	\$108,297	\$440,395	\$445,900	\$451,405	\$456,910
<b>Solvency</b>					
3. Debt/asset ratio	1.1%	1.1%	1.1%	1.2%	1.2%
4. Equity/asset ratio	98.9%	98.9%	98.9%	98.8%	98.8%
5. Debt/equity ratio	1.09%	1.09%	1.13%	1.17%	1.21%
<b>Profitability</b>					
6. Rate of return on assets	0.8%	1.5%	1.5%	1.6%	1.8%
7. Rate of return on equity	0.8%	1.4%	1.5%	1.7%	1.8%
8. Operating profit margin ratio	3.1%	5.7%	6.0%	6.2%	6.5%
<b>Financial Efficiency</b>					
9. Asset turnover ratio	24.6%	25.3%	25.3%	26.1%	27.0%
<b>10. Operational ratios</b>					
a. Operating expense ratio	72.1%	70.7%	70.7%	70.7%	70.8%
b. Depreciation expense ratio	24.8%	23.6%	23.3%	23.0%	22.7%
c. Interest expense ratio	0.0%	0.0%	0.0%	0.0%	0.0%
d. Net farm income from operations	3.1%	5.7%	6.0%	6.2%	6.5%
<b>DuPont Identities</b>					
11. Profit margin	3.1%	5.7%	6.0%	6.2%	6.5%
12. Asset turnover	0.2	0.3	0.3	0.3	0.3
13. Financial leverage	1.0	1.0	1.0	1.0	1.0
14. Return on equity	0.8%	1.4%	1.5%	1.7%	1.8%
<b>Dairy Profitability Ratios</b>					
15. Total assets per cow	\$17,768	\$18,123	\$18,404	\$18,008	\$17,612
16. Total debt per cow	\$190	\$200	\$203	\$205	\$208
17. Assets per hundredweight of milk	\$76	\$76	\$74	\$71	\$69
18. Gross milk margin	48.7%	49.9%	50.2%	50.5%	50.7%
19. Net milk margin 1/	(6.9%)	(3.5%)	(3.0%)	(2.4%)	(1.9%)
20. Feed cost 1/	49.7%	48.6%	48.4%	48.1%	47.9%
21. Hired labor 1/	8.2%	7.9%	8.0%	8.1%	8.1%
22. Milk marketing costs 1/	4.7%	4.7%	4.7%	4.7%	4.7%
23. Herd replacement costs 1/	7.6%	7.2%	7.1%	7.0%	7.0%

1/ From the dairy enterprise as a percent of sales.

A sensitivity analysis measures how changing market and financial conditions may impact the financial feasibility of a business plan. The dairy must be able to financially survive short-term changes in milk and feed prices, milk production levels and other financial variables. Additionally, changing the level of initial capital invested may also impact the financial picture. The following results show these changes in market conditions and capital efficiency.

**Exhibit 2.1.6. Milk production sensitivity, 600-cow model, five-year averages.**

	Pounds (lbs) of milk per cow per day						
	Decrease 6.0 lbs	Decrease 4.0 lbs	Decrease 2.0 lbs	80 lbs per day (five-year average)	Increase 2.0 lbs	Increase 4.0 lbs	Increase 6.0 lbs
Net cash flow	\$222,251	\$285,712	\$349,173	\$412,634	\$476,095	\$539,555	\$603,016
Net income	(\$36,785)	\$26,676	\$90,137	\$153,597	\$217,058	\$280,519	\$343,980
Rate of return on assets	(0.3%)	0.2%	0.8%	1.4%	2.0%	2.6%	3.2%
Operating expenses per hundredweight of milk (excluding depreciation)	\$17.68	\$17.24	\$16.83	\$16.43	\$16.05	\$15.69	\$15.35

**Exhibit 2.1.7. Milk price sensitivity, 600-cow model, five-year averages.**

	Milk prices						
	Decrease \$3	Decrease \$2	Decrease \$1	Base price \$18.25	Increase \$1	Increase \$2	Increase \$3
Net cash flow	(\$28,310)	\$118,671	\$265,652	\$412,634	\$559,615	\$706,596	\$853,577
Net income	(\$287,346)	(\$140,365)	\$6,616	\$153,597	\$300,579	\$447,560	\$594,541
Rate of return on assets	(2.7%)	(1.3%)	0.1%	1.4%	2.8%	4.1%	5.5%

**Exhibit 2.1.8. Capital efficiency sensitivity, 600-cow model, five-year averages.**

	Initial capital invested per cow				
	Decrease \$5,000	Decrease \$2,500	Base investment	Increase \$2,500	Increase \$5,000
Total assets per cow	\$13,399	\$15,691	\$17,983	\$20,274	\$22,566
Total assets per hundredweight of milk	\$55	\$64	\$73	\$82	\$92
Asset turnover ratio	0.34	0.29	0.26	0.23	0.20
Rate of return on assets	3.4%	2.3%	1.4%	0.8%	0.3%

## 2.2 Financial analysis for the 300-cow model

The cash flow statement measures the cash position of the business over a specified period of time. It compares total cash inflow with total cash outflow. The difference is the net cash position of the business at the end of the period. Note that carryover cash from a previous period is not included in the cash flow statement.

**Exhibit 2.2.1. Cash flow statement, 300-cow model.**

	Year 1	Year 2	Year 3	Year 4	Year 5	Five-year average
<b>CASH INFLOWS</b>						
Farm cash receipts						
Milk sales	\$1,267,805	\$1,334,531	\$1,351,213	\$1,367,895	\$1,384,576	\$1,341,204
Livestock sales	\$86,443	\$86,443	\$86,443	\$86,443	\$86,443	\$86,443
Crop sales	\$0	\$0	\$0	\$0	\$0	\$0
Government payments	\$0	\$0	\$0	\$0	\$0	\$0
Other farm income	\$0	\$0	\$0	\$0	\$0	\$0
Patronage dividends	\$0	\$0	\$0	\$0	\$0	\$0
Sale of assets:						
Machinery	\$0	\$0	\$0	\$0	\$0	\$0
Real estate	\$0	\$0	\$0	\$0	\$0	\$0
Other	\$0	\$0	\$0	\$0	\$0	\$0
Money borrowed	\$0	\$0	\$0	\$0	\$0	\$0
Total	\$1,354,248	\$1,420,975	\$1,437,656	\$1,454,338	\$1,471,020	\$1,427,647
<b>CASH OUTFLOWS</b>						
Cash farm expenses						
Seed expenses	\$14,521	\$14,811	\$15,107	\$15,409	\$15,718	\$15,113
Fertilizer & chemicals	\$25,599	\$26,111	\$26,633	\$27,166	\$27,709	\$26,644
Purchased feedstuffs	\$478,652	\$496,532	\$501,032	\$505,532	\$510,033	\$498,356
Labor (includes benefits & Social Security)	\$113,896	\$116,174	\$118,497	\$120,867	\$123,284	\$118,544
Marketing 1/	\$78,500	\$82,631	\$83,664	\$84,697	\$85,730	\$83,044
Artificial insemination	\$16,500	\$16,500	\$16,500	\$16,500	\$16,500	\$16,500
Veterinary, medicine & hoof trimming	\$48,900	\$48,900	\$48,900	\$48,900	\$48,900	\$48,900
Farm supplies & bedding	\$40,334	\$41,141	\$41,964	\$42,803	\$43,659	\$41,980
Fuel & oil	\$17,478	\$17,478	\$17,478	\$17,478	\$17,478	\$17,478
Utilities	\$45,720	\$46,634	\$47,567	\$48,518	\$49,489	\$47,586



**Exhibit 2.2.1. Cash flow statement, 300-cow model (continued).**

	Year 1	Year 2	Year 3	Year 4	Year 5	Five-year average
<b>CASH OUTFLOWS (continued)</b>						
Repairs (buildings)	\$20,429	\$20,429	\$20,429	\$20,429	\$20,429	\$20,429
Repairs (machinery & equipment)	\$61,816	\$61,816	\$61,816	\$61,816	\$61,816	\$61,816
Rent	\$28,961	\$28,961	\$28,961	\$28,961	\$28,961	\$28,961
Farm taxes (real estate & personal property)	\$5,832	\$5,949	\$6,068	\$6,189	\$6,313	\$6,070
Farm insurance	\$12,000	\$12,240	\$12,485	\$12,734	\$12,989	\$12,490
Interest	\$0	\$0	\$0	\$0	\$0	\$0
Legal & professional fees	\$4,000	\$4,080	\$4,162	\$4,245	\$4,330	\$4,163
Custom hire	\$56,358	\$57,485	\$58,635	\$59,808	\$61,004	\$58,658
Car & truck costs	\$0	\$0	\$0	\$0	\$0	\$0
Contract heifer rearing	\$0	\$0	\$0	\$0	\$0	\$0
Other expenses	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000
Miscellaneous	\$16,132	\$16,558	\$16,738	\$16,921	\$17,105	\$16,691
Total cash farm expenses	\$1,091,629	\$1,120,431	\$1,132,637	\$1,144,975	\$1,157,447	\$1,129,424
Capital purchases:						
Breeding livestock	\$0	\$0	\$0	\$0	\$0	\$0
Machinery & equipment	\$130,898	\$130,898	\$130,898	\$130,898	\$130,898	\$130,898
Buildings & land	\$0	\$0	\$0	\$0	\$0	\$0
Principal payments	\$0	\$0	\$0	\$0	\$0	\$0
Family living expenses	\$0	\$0	\$0	\$0	\$0	\$0
Personal draw	\$0	\$0	\$0	\$0	\$0	\$0
State & federal income taxes, self-employment taxes	\$0	\$0	\$0	\$0	\$0	\$0
Other	\$0	\$0	\$0	\$0	\$0	\$0
Total	\$1,222,526	\$1,251,329	\$1,263,534	\$1,275,872	\$1,288,344	\$1,260,321
<b>NET CASH FLOW</b>	<b>\$131,722</b>	<b>\$169,646</b>	<b>\$174,122</b>	<b>\$178,466</b>	<b>\$182,675</b>	<b>\$167,326</b>

1/ Includes milk hauling, state and federal promotion, coop/marketing fees and the cost of marketing beef.

The profit/loss statement provides a business analysis of the farm over a specified period of time. Similar to the cash flow statement, it also includes the value of inventory changes and depreciation charges to the business. Taking into account the value of inventory changes, called income adjustments in this table, attempts to convert the cash measure of income to an accrual-based measure.

**Exhibit 2.2.2. Profit/loss statement, 300-cow model.**

	Year 1	Year 2	Year 3	Year 4	Year 5	Five-year average
<b>GROSS REVENUE</b>						
Milk sales	\$1,267,805	\$1,334,531	\$1,351,213	\$1,367,895	\$1,384,576	\$1,341,204
Calves & heifers sold	\$43,693	\$43,693	\$43,693	\$43,693	\$43,693	\$43,693
Other farm income 2/	\$0	\$0	\$0	\$0	\$0	\$0
Total revenue	\$1,311,498	\$1,378,225	\$1,394,906	\$1,411,588	\$1,428,270	\$1,384,897
<b>OPERATING EXPENSES:</b>						
<b>PURCHASED FEED</b>						
Feedstuffs	\$478,652	\$496,532	\$501,032	\$505,532	\$510,033	\$498,356
Less feed for heifers	(\$135,396)	(\$135,275)	(\$135,275)	(\$135,275)	(\$135,275)	(\$135,299)
Total feed	\$343,257	\$361,257	\$365,758	\$370,258	\$374,758	\$363,057
<b>HERD REPLACEMENT COSTS</b>						
Depreciation (dairy cows)	\$63,678	\$63,678	\$63,678	\$63,678	\$63,678	\$63,678
Loss on sale of cows	\$35,548	\$35,548	\$35,548	\$35,548	\$35,548	\$35,548
<b>OTHER OPERATING EXPENSES</b>						
Seed expenses	\$14,521	\$14,811	\$15,107	\$15,409	\$15,718	\$15,113
Fertilizer & chemicals	\$25,599	\$26,111	\$26,633	\$27,166	\$27,709	\$26,644
Hired labor (includes benefits, Social Security)	\$113,896	\$116,174	\$118,497	\$120,867	\$123,284	\$118,544
Marketing 1/	\$78,500	\$82,631	\$83,664	\$84,697	\$85,730	\$83,044
Artificial insemination	\$16,500	\$16,500	\$16,500	\$16,500	\$16,500	\$16,500
Veterinary, medicine & hoof trimming	\$48,900	\$48,900	\$48,900	\$48,900	\$48,900	\$48,900
Supplies & bedding	\$40,334	\$41,141	\$41,964	\$42,803	\$43,659	\$41,980
Fuel & oil	\$17,478	\$17,478	\$17,478	\$17,478	\$17,478	\$17,478
Utilities	\$45,720	\$46,634	\$47,567	\$48,518	\$49,489	\$47,586
Repairs (buildings)	\$20,429	\$20,429	\$20,429	\$20,429	\$20,429	\$20,429
Repairs (machinery & equipment)	\$61,816	\$61,816	\$61,816	\$61,816	\$61,816	\$61,816
Farm taxes (real estate. & personal property)	\$5,832	\$5,949	\$6,068	\$6,189	\$6,313	\$6,070
Farm insurance	\$12,000	\$12,240	\$12,485	\$12,734	\$12,989	\$12,490
Legal & professional fees	\$4,000	\$4,080	\$4,162	\$4,245	\$4,330	\$4,163
Custom hire	\$56,358	\$57,485	\$58,635	\$59,808	\$61,004	\$58,658
Car & truck costs	\$0	\$0	\$0	\$0	\$0	\$0
Other expenses	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000
Miscellaneous	\$16,132	\$16,558	\$16,738	\$16,921	\$17,105	\$16,691
Depreciation (buildings, robots & equipment)	\$305,458	\$305,458	\$305,458	\$305,458	\$305,458	\$305,458
Less other expenses for raising heifers	(\$9,619)	(\$9,611)	(\$9,611)	(\$9,611)	(\$9,611)	(\$9,612)
Total other operating expenses	\$879,855	\$890,785	\$898,491	\$906,328	\$914,300	\$897,952
<b>TOTAL OPERATING EXPENSES</b>	\$1,322,337	\$1,351,268	\$1,363,474	\$1,375,812	\$1,388,284	\$1,360,235
<b>INCOME BEFORE FINANCING COSTS</b>	(\$10,839)	\$26,956	\$31,432	\$35,776	\$39,985	\$24,662
Interest and rent expense	\$28,961	\$28,961	\$28,961	\$28,961	\$28,961	\$28,961
<b>NET INCOME (LOSS)</b>	<b>(\$39,800)</b>	<b>(\$2,005)</b>	<b>\$2,471</b>	<b>\$6,815</b>	<b>\$11,024</b>	<b>(\$4,299)</b>

1/ Includes milk hauling, state and federal promotion, coop/marketing fees and the cost of marketing beef.

2/ Other farm income is assumed at zero here but could include crop sales, government payments, patronage, dividends, etc.

**Exhibit 2.2.3. Dairy enterprise, 300-cow model.**

	<b>Herd</b>	<b>Per cow</b>	<b>Per 100 pounds of milk produced</b>	<b>Percent</b>
<b>INCOME FROM OPERATIONS:</b>				
Milk sales	\$1,341,204	\$4,471	\$18.25	97.1%
Sales of young stock & calves	\$39,793	\$133	\$0.54	2.9%
Other farm income	\$0	\$0	\$0.00	0.0%
Patronage dividend	\$0	\$0	\$0.00	0.0%
Total gross receipts	\$1,380,997	\$4,603	\$18.79	100.0%
<b>OPERATING EXPENSES:</b>				
Feed:				
Feedstuffs	\$805,625	\$2,685	\$10.96	54.6%
Less feed for heifers	(\$135,299)	(\$451)	(\$1.84)	(9.2%)
Total feed	\$670,326	\$2,234	\$9.12	45.4%
Herd replacement costs:				
Depreciation--dairy cows	\$63,678	\$212	\$0.87	4.3%
Loss on sale of cows	\$35,548	\$118	\$0.48	2.4%
Total herd replacement costs	\$99,226	\$331	\$1.35	6.7%
Other operating expenses:				
Labor (includes benefits & Social Security)	\$104,318	\$348	\$1.42	7.1%
Marketing 1/	\$83,044	\$277	\$1.13	5.6%
Artificial insemination	\$16,500	\$55	\$0.22	1.1%
Veterinary, medicine & hoof trimming	\$48,900	\$163	\$0.67	3.3%
Supplies & bedding	\$33,722	\$112	\$0.46	2.3%
Fuel & oil	\$17,478	\$58	\$0.24	1.2%
Utilities	\$47,586	\$159	\$0.65	3.2%
Repairs (buildings)	\$20,429	\$68	\$0.28	1.4%
Repairs (machinery & equipment)	\$58,725	\$196	\$0.80	4.0%
Rent	\$0	\$0	\$0.00	0.0%
Farm taxes (real estate & personal property)	\$4,006	\$13	\$0.05	0.3%
Farm insurance	\$11,241	\$37	\$0.15	0.8%
Legal & professional fees	\$3,747	\$12	\$0.05	0.3%
Custom hire	\$0	\$0	\$0.00	0.0%
Car & truck costs	\$0	\$0	\$0.00	0.0%
Other	\$5,700	\$19	\$0.08	0.4%
Interest	\$0	\$0	\$0.00	0.0%
Depreciation	\$259,639	\$865	\$3.53	17.6%
Less other expenses for raising heifers	(\$9,612)	(\$32)	(\$0.13)	(0.7%)
Total other operating expenses	\$705,424	\$2,351	\$9.60	47.8%
<b>TOTAL OPERATING EXPENSES</b>	\$1,474,976	\$4,917	\$20.07	100.0%
<b>NET INCOME FROM OPERATIONS</b>	<b>(\$93,979)</b>	<b>(\$313)</b>	<b>(\$1.28)</b>	

1/ Includes milk hauling, state and federal promotion, coop/marketing fees and the cost of marketing beef.

The balance sheet provides a picture of the business at a particular point in time. It compares assets with liabilities in order to determine equity in the business. Market value basis is used in this analysis since it provides a more realistic view of returns on investment and more closely resembles the approach an investor would use.

**Exhibit 2.2.4. Balance sheet, 300-cow model.**

	<b>Beginning Year 1</b>	<b>Ending Year 1</b>	<b>Ending Year 2</b>	<b>Ending Year 3</b>	<b>Ending Year 4</b>	<b>Ending Year 5</b>
<b>ASSETS</b>						
Current assets:						
Cash	\$10,000	\$10,000	\$26,691	\$27,024	\$27,358	\$27,692
Other current assets	\$57,572	\$106,200	\$253,561	\$256,730	\$259,900	\$263,069
Total current assets	\$67,572	\$116,200	\$280,252	\$283,755	\$287,258	\$290,761
Non-current assets:						
Dairy herd	\$450,000	\$450,000	\$691,159	\$691,158	\$691,158	\$691,158
Farm & equipment						
Land	\$1,386,168	\$1,386,168	\$1,386,168	\$1,386,168	\$1,386,168	\$1,386,168
Nonfarm real estate	\$0	\$0	\$0	\$0	\$0	\$0
Buildings	\$2,042,896	\$1,906,703	\$1,770,510	\$1,634,317	\$1,498,123	\$1,361,930
Equipment, autos & trucks	\$1,692,650	\$1,654,283	\$1,615,915	\$1,577,548	\$1,539,180	\$1,500,813
Total	\$5,121,714	\$4,947,153	\$4,772,593	\$4,598,032	\$4,423,472	\$4,248,911
Other assets						
Investment in co-ops	\$0	\$9,382	\$19,257	\$29,256	\$39,379	\$49,625
Other (notes receivable, etc.)	\$0	\$0	\$0	\$0	\$0	\$0
Total other assets	\$0	\$9,382	\$19,257	\$29,256	\$39,379	\$49,625
Total non-current assets	\$5,571,714	\$5,406,535	\$5,483,008	\$5,318,446	\$5,154,008	\$4,989,694
Total assets	\$5,639,285	\$5,522,735	\$5,763,260	\$5,602,201	\$5,441,266	\$5,280,455
<b>LIABILITIES</b>						
Current liabilities:	\$0	\$57,051	\$60,054	\$60,805	\$61,555	\$62,306
Long-term liabilities:	\$0	\$0	\$0	\$0	\$0	\$0
Total liabilities	\$0	\$57,051	\$60,054	\$60,805	\$61,555	\$62,306
<b>EQUITY</b>						
Owners equity:						
Capital contributions		\$0	\$0	\$0	\$0	\$0
Owner withdrawals		\$0	\$0	\$0	\$0	\$0
Total owner equity		\$0	\$0	\$0	\$0	\$0
Retained earnings		\$5,505,484	\$5,705,211	\$5,538,926	\$5,372,896	\$5,207,124
Net income		(\$39,800)	(\$2,005)	\$2,471	\$6,815	\$11,024
Total equity		\$5,465,683	\$5,703,206	\$5,541,397	\$5,379,711	\$5,218,149
Total liabilities and equity		\$5,522,735	\$5,763,260	\$5,602,201	\$5,441,266	\$5,280,455

**Exhibit 2.2.5. Financial ratios, 300-cow model.**

	Year 1	Year 2	Year 3	Year 4	Year 5
<b>Liquidity</b>					
1. Current ratio	2.04	4.67	4.67	4.67	4.67
2. Working capital	\$59,149	\$220,198	\$222,950	\$225,703	\$228,455
<b>Solvency</b>					
3. Debt/asset ratio	1.0%	1.0%	1.1%	1.1%	1.2%
4. Equity/asset ratio	99.0%	99.0%	98.9%	98.9%	98.8%
5. Debt/equity ratio	1.04%	1.05%	1.10%	1.14%	1.19%
<b>Profitability</b>					
6. Rate of return on assets	(0.7%)	0.0%	0.0%	0.1%	0.2%
7. Rate of return on equity	(0.7%)	0.0%	0.0%	0.1%	0.2%
8. Operating profit margin ratio	(3.0%)	(0.1%)	0.2%	0.5%	0.8%
<b>Financial Efficiency</b>					
9. Asset turnover ratio	23.5%	24.4%	24.5%	25.6%	26.6%
<b>10. Operational ratios</b>					
a. Operating expense ratio	72.7%	71.3%	71.3%	71.3%	71.4%
b. Depreciation expense ratio	28.1%	26.8%	26.5%	26.2%	25.8%
c. Interest expense ratio	0.0%	0.0%	0.0%	0.0%	0.0%
d. Net farm income from operations ratio	(3.0%)	(0.1%)	0.2%	0.5%	0.8%
<b>DuPont Identities</b>					
11. Profit margin	(3.0%)	(0.1%)	0.2%	0.5%	0.8%
12. Asset turnover	0.2	0.2	0.2	0.3	0.3
13. Financial leverage	1.0	1.0	1.0	1.0	1.0
14. Return on equity	(0.7%)	0.0%	0.0%	0.1%	0.2%
<b>Dairy Profitability Ratios</b>					
15. Total assets per cow	\$18,603	\$18,810	\$18,942	\$18,406	\$17,870
16. Total debt per cow	\$190	\$200	\$203	\$205	\$208
17. Assets per hundredweight of milk	\$79	\$79	\$76	\$73	\$70
18. Gross milk margin	48.7%	49.9%	50.2%	50.5%	50.7%
19. Net milk margin 1/	(10.3%)	(6.9%)	(6.3%)	(5.7%)	(5.1%)
20. Feed cost 1/	49.7%	48.6%	48.4%	48.1%	47.9%
21. Hired labor 1/	7.7%	7.4%	7.5%	7.6%	7.6%
22. Milk marketing costs 1/	6.0%	6.0%	6.0%	6.0%	6.0%
23. Herd replacement costs 1/	7.6%	7.2%	7.1%	7.0%	7.0%

1/ From the dairy enterprise as a percent of sales.

A sensitivity analysis measures how changing market and financial conditions may impact the financial feasibility of a business plan. The dairy must be able to financially survive short-term changes in milk and feed prices, milk production levels and other financial variables. Additionally, changing the level of initial capital invested may also impact the financial picture. The following results show these changes in market conditions and capital efficiency.

**Exhibit 2.2.6. Milk production sensitivity, 300-cow model, five-year averages.**

	Pounds (lbs) of milk produced per cow per day						
	Decrease 6.0 lbs	Decrease 4.0 lbs	Decrease 2.0 lbs	80 lbs per day (five-year average)	Increase 2.0 lbs	Increase 4.0 lbs	Increase 6.0 lbs
Net cash flow	\$73,527	\$104,793	\$136,060	\$167,326	\$198,593	\$229,859	\$261,126
Net income	(\$98,099)	(\$66,832)	(\$35,566)	(\$4,299)	\$26,968	\$58,234	\$89,501
Rate of return on assets	(1.8%)	(1.2%)	(0.6%)	(0.1%)	0.5%	1.0%	1.6%
Operating expenses per hundredweight of milk (excluding depreciation)	\$17.78	\$17.34	\$16.93	\$16.54	\$16.16	\$15.81	\$15.47

**Exhibit 2.2.7. Milk price sensitivity, 300-cow model, five-year averages.**

	Milk prices						
	Decrease \$3	Decrease \$2	Decrease \$1	Base price \$18.25	Increase \$1	Increase \$2	Increase \$3
Net cash flow	(\$53,146)	\$20,345	\$93,836	\$167,326	\$240,817	\$314,307	\$387,798
Net income	(\$224,771)	(\$151,280)	(\$77,790)	(\$4,299)	\$69,192	\$142,682	\$216,173
Rate of return on assets	(4.1%)	(2.7%)	(1.4%)	(0.1%)	1.2%	2.6%	3.9%

**Exhibit 2.2.8. Capital efficiency sensitivity, 300-cow model, five-year averages.**

	Initial capital invested per cow				
	Decrease \$5,000	Decrease \$2,500	Base investment	Increase \$2,500	Increase \$5,000
Total assets per cow	\$13,943	\$16,235	\$18,526	\$20,818	\$23,110
Total assets per hundredweight of milk	\$57	\$66	\$75	\$84	\$94
Asset turnover ratio	0.33	0.28	0.25	0.22	0.20
Rate of return on assets	1.3%	0.5%	(0.1%)	(0.5%)	(0.9%)

## 2.3 Financial analysis for the 150-cow model

The cash flow statement measures the cash position of the business over a specified period of time. It compares total cash inflow with total cash outflow. The difference is the net cash position of the business at the end of the period. Note that carryover cash from a previous period is not included in the cash flow statement.

**Exhibit 2.3.1. Cash flow statement, 150-cow model.**

	Year 1	Year 2	Year 3	Year 4	Year 5	Five-year average
<b>CASH INFLOWS</b>						
Farm cash receipts						
Milk sales	\$633,902	\$667,266	\$675,606	\$683,947	\$692,288	\$670,602
Livestock sales	\$43,072	\$43,072	\$43,072	\$43,072	\$43,072	\$43,072
Crop sales	\$0	\$0	\$0	\$0	\$0	\$0
Government payments	\$0	\$0	\$0	\$0	\$0	\$0
Other farm income	\$0	\$0	\$0	\$0	\$0	\$0
Patronage dividends	\$0	\$0	\$0	\$0	\$0	\$0
Sale of assets:						
Machinery	\$0	\$0	\$0	\$0	\$0	\$0
Real estate	\$0	\$0	\$0	\$0	\$0	\$0
Other	\$0	\$0	\$0	\$0	\$0	\$0
Money borrowed	\$0	\$0	\$0	\$0	\$0	\$0
Total	\$676,974	\$710,337	\$718,678	\$727,019	\$735,360	\$713,674
<b>CASH OUTFLOWS</b>						
Cash farm expenses						
Seed expenses	\$7,248	\$7,393	\$7,541	\$7,692	\$7,846	\$7,544
Fertilizer & chemicals	\$12,760	\$13,016	\$13,276	\$13,541	\$13,812	\$13,281
Purchased feedstuffs	\$239,669	\$248,898	\$251,148	\$253,398	\$255,648	\$249,752
Labor (includes benefits & Social Security)	\$64,404	\$65,692	\$67,006	\$68,346	\$69,713	\$67,032
Marketing 1/	\$39,597	\$41,681	\$42,202	\$42,723	\$43,244	\$41,890
Artificial insemination	\$8,250	\$8,250	\$8,250	\$8,250	\$8,250	\$8,250
Veterinary, medicine & hoof trimming	\$24,450	\$24,450	\$24,450	\$24,450	\$24,450	\$24,450
Farm supplies & bedding	\$20,164	\$20,567	\$20,978	\$21,398	\$21,826	\$20,987
Fuel & oil	\$8,739	\$8,739	\$8,739	\$8,739	\$8,739	\$8,739
Utilities	\$22,860	\$23,317	\$23,784	\$24,259	\$24,744	\$23,793

**Exhibit 2.3.1. Cash flow statement, 150-cow model (continued).**

	Year 1	Year 2	Year 3	Year 4	Year 5	Five-year average
<b>CASH OUTFLOWS (continued)</b>						
Repairs (buildings)	\$10,799	\$10,799	\$10,799	\$10,799	\$10,799	\$10,799
Repairs (machinery & equipment)	\$35,949	\$35,949	\$35,949	\$35,949	\$35,949	\$35,949
Rent	\$14,471	\$14,471	\$14,471	\$14,471	\$14,471	\$14,471
Farm taxes (real estate & personal property)	\$3,173	\$3,237	\$3,302	\$3,368	\$3,435	\$3,303
Farm insurance	\$6,000	\$6,120	\$6,242	\$6,367	\$6,495	\$6,245
Interest	\$0	\$0	\$0	\$0	\$0	\$0
Legal & professional fees	\$2,500	\$2,550	\$2,601	\$2,653	\$2,706	\$2,602
Custom hire	\$28,056	\$28,617	\$29,190	\$29,774	\$30,369	\$29,201
Car & truck costs	\$0	\$0	\$0	\$0	\$0	\$0
Contract heifer rearing	\$0	\$0	\$0	\$0	\$0	\$0
Other expenses	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000
Miscellaneous	\$8,281	\$8,501	\$8,594	\$8,688	\$8,782	\$8,569
Total cash farm expenses	\$560,372	\$575,248	\$581,522	\$587,865	\$594,279	\$579,857
Capital purchases:						
Breeding livestock	\$0	\$0	\$0	\$0	\$0	\$0
Machinery & equipment	\$95,693	\$95,693	\$95,693	\$95,693	\$95,693	\$95,693
Buildings & land	\$0	\$0	\$0	\$0	\$0	\$0
Principal payments	\$0	\$0	\$0	\$0	\$0	\$0
Family living expenses	\$0	\$0	\$0	\$0	\$0	\$0
Personal draw	\$0	\$0	\$0	\$0	\$0	\$0
State & federal income & SE taxes	\$0	\$0	\$0	\$0	\$0	\$0
Other	\$0	\$0	\$0	\$0	\$0	\$0
Total	\$656,064	\$670,941	\$677,215	\$683,558	\$689,972	\$675,550
<b>NET CASH FLOW</b>	<b>\$20,910</b>	<b>\$39,396</b>	<b>\$41,464</b>	<b>\$43,461</b>	<b>\$45,388</b>	<b>\$38,124</b>

1/ Includes milk hauling, state and federal promotion, coop/marketing fees and the cost of marketing beef.

The profit/loss statement provides a business analysis of the farm over a specified period of time. Similar to the cash flow statement, it also includes the value of inventory changes and depreciation charges to the business. Taking into account the value of inventory changes, called income adjustments in this table, attempts to convert the cash measure of income to an accrual-based measure.



**Exhibit 2.3.2. Profit/loss statement, 150-cow model.**

	Year 1	Year 2	Year 3	Year 4	Year 5	Five-year average
<b>GROSS REVENUE</b>						
Milk sales	\$633,902	\$667,266	\$675,606	\$683,947	\$692,288	\$670,602
Calves & heifers sold	\$21,697	\$21,697	\$21,697	\$21,697	\$21,697	\$21,697
Other farm income 2/	\$0	\$0	\$0	\$0	\$0	\$0
Total revenue	\$655,599	\$688,962	\$697,303	\$705,644	\$713,985	\$692,299
<b>OPERATING EXPENSES</b>						
<b>PURCHASED FEED</b>						
Feedstuffs	\$239,669	\$248,898	\$251,148	\$253,398	\$255,648	\$249,752
Less feed for heifers	(\$67,408)	(\$67,638)	(\$67,637)	(\$67,637)	(\$67,637)	(\$67,592)
Total feed	\$172,260	\$181,261	\$183,511	\$185,761	\$188,011	\$182,161
<b>HERD REPLACEMENT COSTS</b>						
Depreciation (dairy cows)	\$31,839	\$31,839	\$31,839	\$31,839	\$31,839	\$31,839
Loss on sale of cows	\$17,774	\$17,774	\$17,774	\$17,774	\$17,774	\$17,774
<b>OTHER OPERATING EXPENSES</b>						
Seed expenses	\$7,248	\$7,393	\$7,541	\$7,692	\$7,846	\$7,544
Fertilizer and chemicals	\$12,760	\$13,016	\$13,276	\$13,541	\$13,812	\$13,281
Hired labor (includes benefits & Social Security)	\$64,404	\$65,692	\$67,006	\$68,346	\$69,713	\$67,032
Marketing 1/	\$39,597	\$41,681	\$42,202	\$42,723	\$43,244	\$41,890
Artificial insemination	\$8,250	\$8,250	\$8,250	\$8,250	\$8,250	\$8,250
Veterinary, medicine & hoof trimming	\$24,450	\$24,450	\$24,450	\$24,450	\$24,450	\$24,450
Supplies & bedding	\$20,164	\$20,567	\$20,978	\$21,398	\$21,826	\$20,987
Fuel & oil	\$8,739	\$8,739	\$8,739	\$8,739	\$8,739	\$8,739
Utilities	\$22,860	\$23,317	\$23,784	\$24,259	\$24,744	\$23,793
Repairs (buildings)	\$10,799	\$10,799	\$10,799	\$10,799	\$10,799	\$10,799
Repairs (machinery & equipment)	\$35,949	\$35,949	\$35,949	\$35,949	\$35,949	\$35,949
Farm taxes (real estate & personal property)	\$3,173	\$3,237	\$3,302	\$3,368	\$3,435	\$3,303
Farm insurance	\$6,000	\$6,120	\$6,242	\$6,367	\$6,495	\$6,245
Legal & professional fees	\$2,500	\$2,550	\$2,601	\$2,653	\$2,706	\$2,602
Custom hire	\$28,056	\$28,617	\$29,190	\$29,774	\$30,369	\$29,201
Car & truck costs	\$0	\$0	\$0	\$0	\$0	\$0
Other expenses	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000
Miscellaneous	\$8,281	\$8,501	\$8,594	\$8,688	\$8,782	\$8,569
Depreciation (buildings, robots & equipment)	\$176,789	\$176,789	\$176,789	\$176,789	\$176,789	\$176,789
Less other expenses for raising heifers	(\$4,791)	(\$4,805)	(\$4,805)	(\$4,805)	(\$4,805)	(\$4,802)
Total other operating expenses	\$478,230	\$483,863	\$487,887	\$491,980	\$496,144	\$487,621
<b>TOTAL OPERATING EXPENSES</b>	\$700,104	\$714,736	\$721,010	\$727,354	\$733,767	\$719,394
<b>INCOME BEFORE FINANCING COSTS</b>	(\$44,505)	(\$25,774)	(\$23,707)	(\$21,710)	(\$19,783)	(\$27,096)
Interest and rent expense	\$14,471	\$14,471	\$14,471	\$14,471	\$14,471	\$14,471
<b>NET INCOME (LOSS)</b>	<b>(\$58,976)</b>	<b>(\$40,245)</b>	<b>(\$38,179)</b>	<b>(\$36,181)</b>	<b>(\$34,254)</b>	<b>(\$41,567)</b>

1/ Includes milk hauling, state and federal promotion, coop/marketing fees and the cost of marketing beef.

2/ Other farm income is assumed at zero here but could include crop sales, government payments, patronage, dividends, etc.

### Exhibit 2.3.3. Dairy enterprise, 150-cow model.

	Herd	Per cow	Per 100 pounds of milk produced	Percent
<b>INCOME FROM OPERATIONS:</b>				
Milk sales	\$670,602	\$4,471	\$18.25	97.1%
Sales of young stock & calves	\$19,897	\$133	\$0.54	2.9%
Other farm income	\$0	\$0	\$0.00	0.0%
Patronage dividend	\$0	\$0	\$0.00	0.0%
Total gross receipts	\$690,499	\$4,603	\$18.79	100.0%
<b>OPERATING EXPENSES:</b>				
Feed:				
Feedstuffs	\$402,755	\$2,685	\$10.96	52.2%
Less feed for heifers	(\$67,592)	(\$451)	(\$1.84)	(8.8%)
Total feed	\$335,163	\$2,234	\$9.12	43.5%
Herd replacement costs:				
Depreciation (dairy cows)	\$31,839	\$212	\$0.87	4.1%
Loss on sale of cows	\$17,774	\$118	\$0.48	2.3%
Total herd replacement costs	\$49,613	\$331	\$1.35	6.4%
Other operating expenses:				
Labor (includes benefits & Social Security)	\$58,988	\$393	\$1.61	7.6%
Marketing 1/	\$41,890	\$279	\$1.14	5.4%
Artificial insemination	\$8,250	\$55	\$0.22	1.1%
Veterinary, medicine & hoof trimming	\$24,450	\$163	\$0.67	3.2%
Supplies & bedding	\$16,861	\$112	\$0.46	2.2%
Fuel & oil	\$8,739	\$58	\$0.24	1.1%
Utilities	\$23,793	\$159	\$0.65	3.1%
Repairs (buildings)	\$10,799	\$72	\$0.29	1.4%
Repairs (machinery & equipment)	\$34,151	\$228	\$0.93	4.4%
Rent	\$0	\$0	\$0.00	0.0%
Farm taxes (real estate & personal property)	\$2,180	\$15	\$0.06	0.3%
Farm insurance	\$5,620	\$37	\$0.15	0.7%
Legal & professional fees	\$2,342	\$16	\$0.06	0.3%
Custom hire	\$0	\$0	\$0.00	0.0%
Car & truck costs	\$0	\$0	\$0.00	0.0%
Other	\$2,850	\$19	\$0.08	0.4%
Interest	\$0	\$0	\$0.00	0.0%
Depreciation	\$150,271	\$1,002	\$4.09	19.5%
Less other expenses for raising heifers	(\$4,802)	(\$32)	(\$0.13)	(0.6%)
Total other operating expenses	\$386,382	\$2,576	\$10.52	50.1%
<b>TOTAL OPERATING EXPENSES</b>	\$771,158	\$5,141	\$20.99	100.0%
<b>NET INCOME FROM OPERATIONS</b>	<b>(\$80,660)</b>	<b>(\$538)</b>	<b>(\$2.20)</b>	

1/ Includes milk hauling, state and federal promotion, coop/marketing fees and the cost of marketing beef.

The balance sheet provides a picture of the business at a particular point in time. It compares assets with liabilities in order to determine equity in the business. Market value basis is used in this analysis since it provides a more realistic view of returns on investment and more closely resembles the approach an investor would use.

**Exhibit 2.3.4. Balance sheet, 150-cow model.**

	<b>Beginning Year 1</b>	<b>Ending Year 1</b>	<b>Ending Year 2</b>	<b>Ending Year 3</b>	<b>Ending Year 4</b>	<b>Ending Year 5</b>
<b>ASSETS</b>						
Current assets:						
Cash	\$10,000	\$10,000	\$13,345	\$13,512	\$13,679	\$13,846
Other current assets	\$28,786	\$53,100	\$126,780	\$128,365	\$129,950	\$131,535
Total current assets	\$38,786	\$63,100	\$140,126	\$141,877	\$143,629	\$145,380
Non-current assets:						
Dairy herd	\$225,000	\$225,000	\$345,580	\$345,579	\$345,579	\$345,579
Farm & equipment						
Land	\$690,259	\$690,259	\$690,259	\$690,259	\$690,259	\$690,259
Nonfarm real estate	\$0	\$0	\$0	\$0	\$0	\$0
Buildings	\$1,079,917	\$1,007,922	\$935,928	\$863,933	\$791,939	\$719,944
Equipment, autos & trucks	\$1,047,950	\$1,038,848	\$1,029,745	\$1,020,643	\$1,011,540	\$1,002,438
Total	\$2,818,126	\$2,737,029	\$2,655,932	\$2,574,835	\$2,493,738	\$2,412,641
Other assets:						
Investment in coops	\$0	\$4,691	\$9,629	\$14,628	\$19,689	\$24,812
Other (notes receivable, etc.)	\$0	\$0	\$0	\$0	\$0	\$0
Total other assets	\$0	\$4,691	\$9,629	\$14,628	\$19,689	\$24,812
Total non-current assets	\$3,043,126	\$2,966,720	\$3,011,140	\$2,935,042	\$2,859,006	\$2,783,032
Total assets	\$3,081,911	\$3,029,819	\$3,151,266	\$3,076,920	\$3,002,635	\$2,928,413
<b>LIABILITIES</b>						
Current liabilities	\$0	\$28,526	\$30,027	\$30,402	\$30,778	\$31,153
Long-term liabilities	\$0	\$0	\$0	\$0	\$0	\$0
Total liabilities	\$0	\$28,526	\$30,027	\$30,402	\$30,778	\$31,153
<b>EQUITY</b>						
Owners equity:						
Capital contributions		\$0	\$0	\$0	\$0	\$0
Owner withdrawals		\$0	\$0	\$0	\$0	\$0
Total owner equity		\$0	\$0	\$0	\$0	\$0
Retained earnings		\$3,060,270	\$3,161,484	\$3,084,696	\$3,008,039	\$2,931,514
Net income		(\$58,976)	(\$40,245)	(\$38,179)	(\$36,181)	(\$34,254)
Total equity		\$3,001,294	\$3,121,239	\$3,046,517	\$2,971,858	\$2,897,260
Total liabilities and equity		\$3,029,819	\$3,151,266	\$3,076,920	\$3,002,635	\$2,928,413

**Exhibit 2.3.5. Financial ratios, 150-cow model.**

	Year 1	Year 2	Year 3	Year 4	Year 5
<b>Liquidity</b>					
1. Current ratio	2.21	4.67	4.67	4.67	4.67
2. Working capital	\$34,574	\$110,099	\$111,475	\$112,851	\$114,228
<b>Solvency</b>					
3. Debt/asset ratio	0.9%	1.0%	1.0%	1.0%	1.1%
4. Equity/asset ratio	99.1%	99.0%	99.0%	99.0%	98.9%
5. Debt/equity ratio	0.95%	0.96%	1.00%	1.04%	1.08%
<b>Profitability</b>					
6. Rate of return on assets	(1.9%)	(1.3%)	(1.2%)	(1.2%)	(1.2%)
7. Rate of return on equity	(2.0%)	(1.3%)	(1.3%)	(1.2%)	(1.2%)
8. Operating profit margin ratio	(9.0%)	(5.8%)	(5.5%)	(5.1%)	(4.8%)
<b>Financial Efficiency</b>					
9. Asset turnover ratio	21.5%	22.3%	22.4%	23.2%	24.1%
<b>10. Operational ratios</b>					
a. Operating expense ratio	75.0%	73.5%	73.5%	73.5%	73.6%
b. Depreciation expense ratio	31.8%	30.3%	29.9%	29.6%	29.2%
c. Interest expense ratio	0.0%	0.0%	0.0%	0.0%	0.0%
d. Net farm income from operations ratio	(9.0%)	(5.8%)	(5.5%)	(5.1%)	(4.8%)
<b>DuPont Identities</b>					
11. Profit margin	(9.0%)	(5.8%)	(5.5%)	(5.1%)	(4.8%)
12. Asset turnover	0.2	0.2	0.2	0.2	0.2
13. Financial leverage	1.0	1.0	1.0	1.0	1.0
14. Return on equity	(2.0%)	(1.3%)	(1.3%)	(1.2%)	(1.2%)
<b>Dairy Profitability Ratios</b>					
15. Total assets per cow	\$20,372	\$20,604	\$20,761	\$20,265	\$19,770
16. Total debt per cow	\$190	\$200	\$203	\$205	\$208
17. Assets per hundredweight of milk produced	\$87	\$86	\$83	\$80	\$77
18. Gross milk margin	48.7%	49.9%	50.2%	50.5%	50.7%
19. Net milk margin 1/	(15.4%)	(11.7%)	(11.1%)	(10.5%)	(9.9%)
20. Feed cost 1/	49.7%	48.6%	48.4%	48.1%	47.9%
21. Hired labor 1/	8.7%	8.4%	8.5%	8.5%	8.6%
22. Milk marketing costs 1/	6.1%	6.1%	6.1%	6.1%	6.1%
23. Herd replacement costs 1/	7.6%	7.2%	7.1%	7.0%	7.0%

1/ From the dairy enterprise as a percent of sales.

A sensitivity analysis measures how changing market and financial conditions may impact the financial feasibility of a business plan. The dairy must be able to financially survive short-term changes in milk and feed prices, milk production levels and other financial variables. Additionally, changing the level of initial capital invested may also impact the financial picture. The following results show these changes in market conditions and capital efficiency.

**Exhibit 2.3.6. Milk production sensitivity, 150-cow model, five-year averages.**

	Pounds (lbs) of milk per cow per day						
	Decrease 6.0 lbs	Decrease 4.0 lbs	Decrease 2.0 lbs	80 lbs per day (five-year average)	Increase 2.0 lbs	Increase 4.0 lbs	Increase 6.0 lbs
Net cash flow	(\$8,748)	\$6,876	\$22,500	\$38,124	\$53,748	\$69,372	\$84,996
Net income	(\$88,439)	(\$72,815)	(\$57,191)	(\$41,567)	(\$25,943)	(\$10,319)	\$5,305
Rate of return on assets	(2.9%)	(2.4%)	(1.9%)	(1.4%)	(0.8%)	(0.3%)	0.2%
Operating expenses per hundredweight of milk (excluding depreciation)	\$18.17	\$17.72	\$17.30	\$16.90	\$16.51	\$16.15	\$15.80

**Exhibit 2.3.7. Milk price sensitivity, 150-cow model, five-year averages.**

	Milk prices						
	Decrease \$3	Decrease \$2	Decrease \$1	Base price \$18.25	Increase \$1	Increase \$2	Increase \$3
Net cash flow	(\$72,112)	(\$35,367)	\$1,378	\$38,124	\$74,869	\$111,614	\$148,360
Net income	(\$151,803)	(\$115,058)	(\$78,312)	(\$41,567)	(\$4,822)	\$31,924	\$68,669
Rate of return on assets	(5.0%)	(3.8%)	(2.6%)	(1.4%)	(0.2%)	1.0%	2.2%

**Exhibit 2.3.8. Capital efficiency sensitivity, 150-cow model, five-year averages.**

	Initial capital invested per cow				
	Decrease \$5,000	Decrease \$2,500	Base investment	Increase \$2,500	Increase \$5,000
Total assets per cow	\$16,382	\$18,368	\$20,354	\$22,341	\$24,327
Total assets per hundredweight of milk produced	\$67	\$75	\$83	\$91	\$99
Asset turnover ratio	0.28	0.25	0.23	0.21	0.19
Rate of return on assets	(0.6%)	(1.0%)	(1.4%)	(1.6%)	(1.8%)

## 2.4 Risk management

Farmers face many risks that generally fit into one or more of these categories: production, marketing/price, financial and legal/institutional. Risk management is an important aspect of the dairy farming business. The uncertainties of weather, yields, prices, government policies, global markets, and other factors can cause wide swings in farm income. Risk management involves choosing among alternatives that reduce the financial effects of such uncertainties. The following sections explain key risks and management strategies that farmers should consider when making decisions for their dairy.

### ***Milk production risk***

Monitoring the quantity of milk shipped on a daily basis and tracking it over time can provide quick insight into whether the “milk production system” is producing within the target range and if any upward or downward trend is occurring. If a lot of scatter (lots of highs and lows) is occurring in daily milk production, evaluating the daily activities can determine whether activities are not occurring properly on some days and need to be adjusted. Cows will produce at a higher level if they experience less change in their daily routine. Significant daily scatter over time will most likely result in lower average production levels that may adversely affect the operation’s financial position.

Average days in milk should remain constant for a continuous freshening herd. A slow upward trend in the average number of days in milk may be an indication of a reproduction problem that may not exhibit itself until a number of months after the problem started.

Freestall conditions will be inspected on a weekly basis to evaluate whether daily maintenance is adequate. A number of production problems can result from poor stall maintenance occurring over an extended period of time. Taking a few pictures of typical stall conditions and comparing the pictures to the stall condition the next week may be needed to detect small, unwanted



changes in stall conditions over time. Individual stall conditions need to be looked at as well as variation in stall conditions throughout available housing.

The monthly cow inventory should be monitored. Knowing the actual number of cows milked can provide insight into whether an adequate number of replacement cows are entering the herd and/or if the cull rate is greater than anticipated. For a large herd, a few pounds of milk per cow per day can mask a slow upward or downward trend in cow numbers. The inventory of cows milked needs to be compared with projected inventories to ensure cow numbers remain adequate to implement production plan.

### ***Milk pricing risk***

Milk prices are more volatile than almost any other agricultural commodity produced in the U.S. Although milk price swings have become somewhat predictable, dairies continually evaluate changing market conditions to manage price risks. Managing milk price risk begins with a marketing plan, which is driven by the goals and objectives of the business. The suite of tools now available to be used in dairy marketing plans includes: Dairy Margin Coverage, Dairy Revenue Protection, and Dairy Gross Margin Insurance.

The futures market is also used, in addition to the packaged milk price risk protection tools listed above, to reduce the risk of price change and increase the level of price certainty. One can use futures and options to price milk up to two years in advance through a specialized dairy commodity broker. Contracts are available on the Chicago Mercantile Exchange for Class III and IV Milk; each contract size is 200,000 pounds.

In the futures market, hedging can be used to mitigate price risk. Hedging is simultaneous but opposite transactions on the cash and futures markets. The theory behind hedging is:

**cash market losses (gains) = futures markets gains (losses).**

Options are a hedging tool that can establish a floor price for milk to protect against any downward movement.

When using the futures market, it is important to understand the concept of basis:

**basis = cash price minus futures price.**

The less a producer knows about the farm's basis history, the greater the farm's basis risk and the less effective dairy futures and options will be as price risk management tools. Knowing the basis is essential



for a dairy producer to translate a dairy futures price into an expected cash milk price to be paid in the future.

Some cooperatives pass through cash-forward contracting opportunities to producers. This is a cash market transaction in which a seller agrees to deliver at least a portion of their milk to a buyer at some point in the future for a set price.

Brokers or cooperatives with risk management services are used by producers to make transactions on the futures market. Producers should take “baby steps” to get comfortable with using futures marketing tools. Those new to futures contracting, or those with low debt levels, might consider using futures to contract less than 50 percent of monthly production. Setting a minimum and maximum volume of milk to contract each month guards a producer from “locking it all in” on the futures market.

### ***Feed risk***

Corn silage and alfalfa haylage are planned to be a significant portion of the diets fed throughout the year. Soon after harvest, both the quantity and quality of the forages should be evaluated. This will determine if there is an adequate silage supply for the coming year and will determine any ration modifications needed to best use the forage supply. It is relatively easy to minimize feed cost and production



problems by making small ration adjustments early in a “supply year,” rather than waiting until later in the year when the corn silage or alfalfa haylage supply is either of insufficient quantity or quality. An estimate of the quantity of forage harvested should be made at harvest to get an indication of available quantity. Finally, the amount of spoiled silage or haylage removed from storage needs to be monitored to determine if excessive waste may be reducing forage quality or quantity.

Monitoring the price, quantity and quality of purchased feedstuffs ensures that an adequate amount of feedstuffs are contracted or sourced for the dairy’s feed needs. Protecting price, quality and quantity helps control input costs and ensures feedstuff quality and quantity are available for the planned rations.



### ***Herd health risk***

Assembling a large herd requires commingling replacement animals from various sources with often unknown health histories. To minimize disease introduction, the dairy will follow vaccination and cow cleanliness protocols. Replacement heifer care is a critical risk area. If heifer calves are not kept alive and raised appropriately to calve in at the targeted 24 months of age, additional cash flow will be needed to purchase replacements.

### ***Weather risk***

Heat stress causes more milk loss and cow mortality in Missouri than any other weather condition. Frostbite-caused mastitis is a risk for unprotected cows during winter extremes. Wind damage from tornados is always a possibility in Missouri; property insurance can manage tornado damage risk to farm infrastructure. Drought can lower forage yields and raise purchased hay and feed prices. Drought-distressed corn intended for grain harvest often becomes available for purchase as silage.

### ***Human resources risk***

Good communication between management and all employees is essential. Assembling an employment manual creates the official source for operational policies, practices, standards and other details about the business. A process should be established for timely communication and decision-making. Regularly scheduled meetings will help improve decision making assure employees are held accountability for their role in meeting farm goals. Regular employee training helps assure job satisfaction, performance and worker safety.

## ***Financial risk***

Financial risk has three basic components: 1) the cost and availability of debt capital; 2) the ability to meet cash flow needs in a timely manner; and 3) the ability to maintain and grow equity. Borrowing is necessary for most farm businesses. Although interest rate risk is mostly beyond the farm's control, appropriately structuring debt and using fixed rates can mitigate risk. Cash flows are especially important because of the variety of ongoing farm obligations like cash input costs, cash lease payments, tax payments, debt repayment and family living expenses.

Financial risk should be managed through sound planning and financial control that conserves cash and liquidity for the operation. A set of well-maintained financial records is absolutely necessary to maintain financial control of a farm or ranch. The dairy should avoid making any uncritical capital purchases. Understanding the dairy's competitive position and planning for the future is also important. If the equity position of the operation is not maintained or improved over time, then the operator's time and investments would be better suited doing something else. (Photo: USDA/ARS)

## ***Legal risk***

Site-specific environmental risks can be minimized by careful examination before construction. The dairy operator should conduct a critical overview of the farm's overall site management, cattle housing and feeding systems, manure management, nutrient management and livestock mortality management; a non-regulatory assessment of the production site should also be conducted. A good resource for exploring publicly available environmental information is the AgSite Assessment Tool ([agsite.missouri.edu/](http://agsite.missouri.edu/)). Further information about site selection can be found in Section 3.2.



A plan should be developed for manure application including protocols for accidental spills, agency contact and neighbor communication. The dairy operation should follow a comprehensive nutrient management plan and apply all manure in accordance with state and federal laws.

## 3. Implementation plan

### 3.1 Timelines

The dairy's startup phase has important long-term effects on the financial performance of the overall plan. Detailed planning (see Exhibit 3.1.1) is strongly recommended given the size of the investments required and the degree of risk. Planning includes selecting and testing a site and completing all plans and drawings necessary for the dairy operation. Budgeting, permitting, financing and contractual obligations would be met during months #4 to #6. It is assumed that construction of the new facilities would take about five months before cows could be milked. Replacement heifers would also be purchased and added to maintain the herd size.

**Exhibit 3.1.1. Project timeline by month.**

#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15	#16
A. Site selection	B. Test borings		D. Budget												
	C. Plans and drawing		E. Permits												
			F. Financing												
			G. Contracts signed												
						H. Delivery of materials									
						I. Site prep/roads									
								K. Electrical utilities							
								L. Water and wells							
										M. Purchase cows/heifers					
													N. Startup/Begin Milking		
													O. Grade/landscape		

## 3.2 Site selection

Potential dairy production facility sites must be thoroughly and accurately evaluated to ensure that:

1. Adequate land area is available to store and spread animal manure in an environmentally acceptable manner.
2. A water supply of sufficient quantity and quality is available to serve the production needs of the facility.

Lack of land area for waste spreading or an inadequate water supply renders a site unsuitable for confined livestock production units.

### ***Manure handling systems***

Lagoons and liquid manure storage tanks are the two basic manure handling systems presently utilized to store animal manure. Planning waste handling systems for a specific site depends on the results of a geologic investigation. Earthen manure storage structures cannot be used in areas where a geologic rating of "severe" is determined for the "collapse potential" classification.

A soils investigation of the site is also necessary to determine the availability of suitable clay material to seal an earthen manure storage basin. This investigation will also reveal if soil amendments will be required to adequately seal the earthen basin. Other options such as concrete or high-density polyethylene (HDPE) lined storage facilities can also be considered when needed.

Soil properties must also be evaluated for how well effluent will infiltrate the soil-plant filter and be used by growing plants. Plant use of nutrients contained in the effluent requires certain moisture storing capabilities and an adequate residual time in the soil profile. A soil permeability range of 0.2 - 2.0 inches per hour is suitable for irrigation.

A separate waste management system is required to treat sanitary wastes from restrooms at the production unit and any residences located on the site. These on-site treatment systems are also site-specific and need to be planned and designed to complement the other facilities in the operation.

### ***Water supply***

Each specific site has requirements for the availability of an adequate water supply. A successful livestock production unit requires a large quantity of water with sufficient quality to maintain production.

Intermediate water storage, with a minimum volume of one day's usage, is necessary to provide production protection should the main water system become inoperable.

### ***Accessibility***

The site for a large dairy operation must have highway access for large trucks during construction as well as an adequate, all-weather route for milk trucks to market. Electrical service and other necessary utilities must also be available to the site.

### ***Isolation***

The site needs to be reasonably isolated so that prevailing winds and air drainage patterns do not create nuisances for neighbors or local public use areas. Each potential dairy production site should be thoroughly evaluated in order to minimize the chance of future nuisance complaints.

### ***Topography***

The topography at the building site needs to be level to gently sloping so that buildings can be properly located and constructed to the desired slopes without excessive cuts and fills. Space is also needed for the manure management and storage facilities, feed storage and other required facilities. Planned traffic lanes for efficient movement of wheel traffic, animals, and workers must be incorporated into the overall facility layout.

### ***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 and tools). The major disease risks are associated with animal contact or the contamination of drinking water. A location which prevents fence line contact or the possibility of intermingling of neighboring livestock is highly desirable. A proper way of managing the routine operational mortality should also be planned to minimize the risk of animal and human health/safety and regulatory risks, and protect environmental resources. Mortality composting is becoming more popular compared to other disposal practices because of biosecurity reasons, reduced environmental risks and the generation of a useful end-product.

Water supplies should be from deep wells or fenced reservoirs which limit access of wildlife. Buildings should be constructed in a manner that discourages bird nesting and roosting sites. Feed bunks and areas where waste feeds accumulate need to be routinely cleaned. Stringent rodent control must be routinely practiced.

### **3.3 Permits and regulations**

#### ***Missouri State Milk Board***

Operation of a dairy in the state of Missouri requires a health permit from the Missouri State Milk Board ([agriculture.mo.gov/animals/milk/](http://agriculture.mo.gov/animals/milk/)). The board administers the state's Grade A and manufacturing grade milk sanitation programs. The board administers inspections relating to Grade A milk and milk supplies to assure uniformity of procedures and interpretation of milk inspection regulations. Milk procurers, manufacturing plants, field superintendents, testers, grades, samplers, bulk milk truck operators and market testing laboratories are licensed by the State Milk Board.

#### ***Missouri Department of Natural Resources***

As of August 2020, the operation sizes (150-cow, 300-cow and 600-cow) discussed in this business plan would not need construction and operating permits from the Missouri Department of Natural Resources (DNR). The DNR concentrated animal feeding operations (CAFO) regulations typically only pertain to operations maintaining an inventory of 700 dairy cows or more in confinement. This does not include animals kept on pasture. Contact information for DNR's Water Protection Program is (573) 751-1300 by phone or the web address ([dnr.mo.gov/env/wpp/cafo/](http://dnr.mo.gov/env/wpp/cafo/)).

### **3.4 Consultants**

Successful dairy producers effectively utilize the technical expertise of professional consultants.

Consultants could be used as sources of information on existing and emerging technologies and how new technologies might be applied to an operation. Areas of the dairy operation benefiting from professional consultants are environment, nutrition, structures, herd health and finances.

Consulting engineers can provide the professional expertise to plan, construct and operate efficient dairy facilities. Site planning, facility layout, building design, construction, and management that are all integrated with efficient manure and nutrient management facilities can help the operation optimize cow production potentials and more fully utilize labor.

Nutritionists can evaluate the herd's nutritional needs, balance rations and offer advice on feed bunk management. In addition, nutritionists can offer technical advice on the use of alternative feedstuffs.

Alternative feedstuffs offer the potential of increasing milk production while lowering feed costs per hundredweight (cwt) of milk produced.

The veterinarian, along with the manager and other farm personnel, should establish and monitor a complete preventive health care program for the herd. The veterinarian can provide technical information gained from examinations, observations, laboratory analysis and treatment response. This information is extremely valuable in making adjustments to the preventive health care program.

Financial advisors, bankers or accountants can provide financial evaluation and planning, tax advice and estate planning.