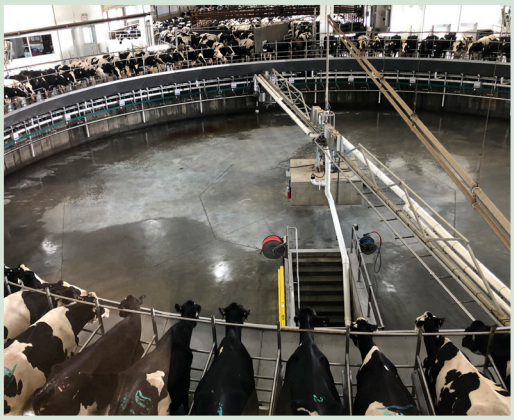
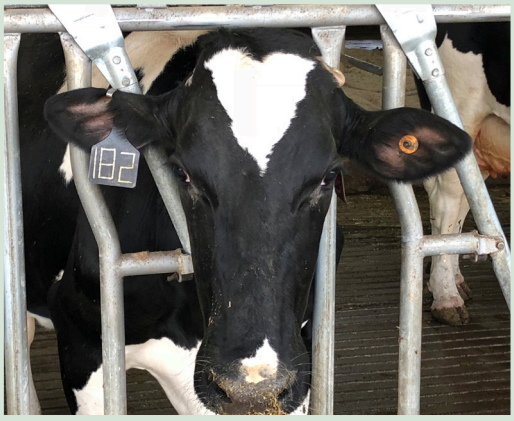




Missouri 3,500-Cow Dairy Business Plan

A financial model of an integrated modern dairy system:

- **Rotary parlor**
- **Sand bedded, tunnel ventilated freestall housing**
- **Passive sand and manure separation**
- **Irrigated forage production**

November 2020

MU Extension
University of Missouri

MASBDA
MISSOURI AGRICULTURAL AND SMALL BUSINESS DEVELOPMENT AUTHORITY

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 – 3,500 Cow Dairy

Contents

Introduction

This dairy farm business plan demonstrates one path forward for the next generation of Missouri's dairy farmers. This path involves producing milk in Missouri with a 3,500-cow single site dairy, a capital and labor efficient scale. This dairy plan gives Missouri dairy producers a vision of a new scale and style of dairying common in growing dairy regions.

This report is designed to guide planning a completely new dairy. The dairy model uses next generation confinement housing solutions: freestalls with sand bedding and tunnel ventilation to improve cow comfort and cooling. A 72-cow rotary parlor is used to milk the herd three times per day. This model serves as a complete business template for starting a new greenfield dairy. Capital investments, operating costs, production plans, rations, forage systems, housing systems and manure systems are designed as integrated systems.

Currently operating dairies seldom start a greenfield dairy by designing a completely new dairy system. However, this strategy can be an option for a group of crop and dairy farmers jointly planning to transition to the next generation of dairying by pooling resources and forming a new entity. This template can also be helpful for existing dairy producers evolving on-site in their current facilities as they examine various technologies for the dairy's expansion path.

This model uses a systems approach to integrate cropland planning, irrigated forage production, specific rations tied to production, comprehensive nutrient management, labor-efficient facilities and modern cow housing solutions. This integrated system reduces obstacles to higher milk production at scale.

These production practices and management techniques, along with the economic analysis, can be applied to other herd sizes. Dairy producers can use these plans to establish production goals and to evaluate how the various performance measures influence their financial statement. Financial statements show how various components of the dairy operation impact the cash flow, the income statement and the five-year budget.

A comparison of key system components and financial indicators for the dairy model can be found in Exhibit A1. This model represents a dairy using 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. 3,500-cow dairy model examination.

Component	3,500-cow model
Milking center	72-cow rotary parlor
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 storage basins and earthen lagoon
Total capital investments	$50,788,606
Total acreage *(includes crops, farmstead and waste acreage)*	4,660
Dairy jobs *(full-time equivalents)*	43.0
Annual net income *(five-year average)*	$2,938,925
Annual net cash flow *(five-year average)*	$4,036,679
Return on assets *(five-year average)*	5.9%

The following key assumptions are included in the model:

- All heifers are raised on-site by the dairy operation.
- All corn silage, alfalfa hay and haylage needs are produced on owned and irrigated land operated by the dairy enterprise; however, planting and harvest functions 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, a mono-slope heifer barn with feed alley that can be scraped, feed rail, and multiple bedded pack pens for precise grouping.
- Manure handling systems include recycled lagoon water towers flushing to a sand separation lane and then to passive manure solids separation basins, where the liquid fraction weeps into an earthen lagoon.

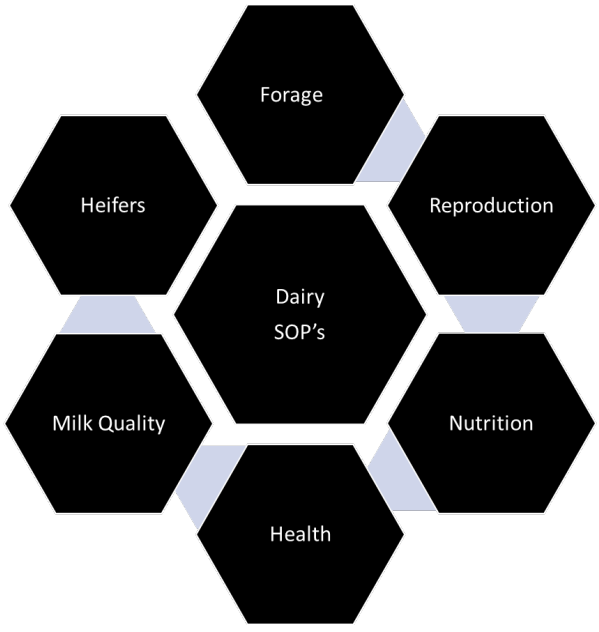
Economies of scale drove the U.S. dairy industry to consolidate toward fewer, larger farms. The midpoint size of U.S. dairies in 1987 was 80 cows, according to USDA. Thirty years later, the midpoint herd size in 2017 was 1,300 cows.

Well-managed larger dairy operations with tight standard operating procedures have a financial advantage over smaller operations. Larger dairies can spread initial investments over more cows, thereby reducing capital investment per cow and fixed costs per hundredweight of milk. Improved operating efficiency and spreading fixed costs over more milk production can ultimately result in significantly lower milk production costs. Larger dairies may also have increased bargaining power with suppliers, which may reduce operating costs per unit purchased.

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 manage scale and use evolving technologies, equipment and management information systems.

While long common in manufacturing industries and other livestock sectors, SOPs on dairy farms were adapted this century by emerging larger dairies. SOPs help management effectively train and monitor labor, develop personnel skills, maintain a healthy and consistent heifer and cow herd, and ensure environmentally compatible manure management systems. Now common across larger dairies, simple but effective dairy farm SOPs can be found from public sources, developed from scratch, or borrowed and customized from another dairy. Dairy consultants or specialized veterinarians can draw on their experiences across farms to continually refine and improve a dairy's SOPs.

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. 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 model. Annual death loss is estimated at 6 percent. Together, these represent a 34.5 percent yearly replacement rate. Other assumptions include a 12.8 month calving interval 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. Exhibit 1.2.1 details investments for the 3,500-cow model. Freestall housing costs are calculated on a per stall basis for 3,150 cows. Barns are assumed to be overstocked by 10 percent to reduce capital costs without impacting cow comfort or bunk space.

Exhibit 1.2.1. Capital investments for the 3,500-cow model.

Item	Units	# of Units	$/Unit	Cost
REAL ESTATE:				
Land	acre	4,660	$3,530	$16,449,011
Freestall (tunnel ventilation, loops with sand)	stall	3,150	$2,555	$8,048,250
Rotary milking parlor	stall	72	$42,000	$3,024,000
Office, milk house, utilities, conference room	square foot	3,600	$50	$180,000
Heifer barn (post-hutch to pre-calving)	head capacity	2,650	$750	$1,987,500
Sand separation apron and pad	cubic yard	1,503	$200	$300,600
Passive manure separation/storage basins	cubic foot	446,450	$2	$892,900
Anaerobic lagoon (365 days of storage)	cubic foot	23,900,749	$0.12	$2,956,611
Calf hutch dry manure & bedding storage	square foot	4,000	$12.00	$48,000
Dry manure/bedding storage (seven days of storage)	square foot	4,000	$12.00	$48,000
Hay and equipment storage	square foot	30,000	$10	$300,000
Silage storage system pile base (eight acres)	cubic foot	348,480	$2	$696,960
Commodity shed	bay	10	$22,000	$220,000
Supplement bins	bin	5	$20,000	$100,000
Truck scale				$75,000
Site preparation				$250,000
All-weather driveway (gravel)				$369,600
Wells and/or water impoundments, lines				$250,000
Electric connection (three-phase power)				$250,000
			SUBTOTAL	**$36,446,432**

Exhibit 1.2.1. Capital investments for the 3,500-cow model (continued).

MACHINERY & EQUIPMENT:				
Skid steer loader	each	2	$35,000	$70,000
Mixer wagon and four automated feed pushers				$560,000
Payloader	each	2	$140,000	$280,000
Tractor, 225 horsepower, new	each	2	$233,637	$467,274
Tractor, 100 horsepower, used	each	4	$50,000	$200,000
Standby generator				$30,000
Flush towers	each	20	$12,000	$240,000
Recycle pump & pipe	each	8	$8,250	$66,000
Liquid manure pump				$35,000
Irrigation (160 acres - machine, generator and pad)	pivot	22	$169,500	$3,729,000
Solid manure spreader truck	each	1	$80,000	$80,000
Livestock chute with scale	each	2	$3,500	$7,000
Calf hutches	each	116	$400	$46,400
Livestock trailer, new	each	1	$25,000	$25,000
Flatbed trailer and miscellaneous rolling stock				$22,500
Pickup truck, used	each	3	$25,000	$75,000
Silage truck	each	1	$75,000	$75,000
Lawn care equipment				$7,500
High-pressure washer	each	3	$500	$1,500
Office equipment				$10,000
Office furniture				$2,000
Silage rake				$15,000
			SUBTOTAL	**$6,044,174**
LIVESTOCK:				
Dairy cows	head	3,500	$1,600	$5,600,000
Heifers	head	2,800	$960	$2,688,000
			SUBTOTAL	**$8,288,000**
TOTAL INVESTMENTS				**$50,778,606**
INVESTMENT PER COW				**$14,508**

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 conservative price level estimate and is based on a Class III milk price of $16.50 and farm-specific basis of $1.75 per cwt, including quality premiums. This long-term basis is what has been seen on other Missouri dairy operations. Additional milk price premiums may be obtained from milk buyers but are not included in this analysis.

Signing a marketing agreement with a financially secure dairy marketing cooperative is critical to long term sustainability and profitability. Opportunities in the future may, or may not, exist to sell milk directly to processors at a higher price in 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, bull calves 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. The 3,500-cow plan was designed for direct loading onto transport trailers to be hauled at a transportation rate at 50 cents per cwt.

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 total mixed ration (TMR) cost of $0.11 per pound of dry matter fed is used in these models. High-yield forage production using center pivot irrigation increases total investment but lowers per unit purchased feed costs compared to lower-yielding forage production.

Controlling feed costs, shrink, and efficiency is the single biggest driver of farm profitability. Rations developed for the dairy model 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.

Ration and cropping plan assumptions are detailed in Exhibits 1.4.1 and 1.4.2.

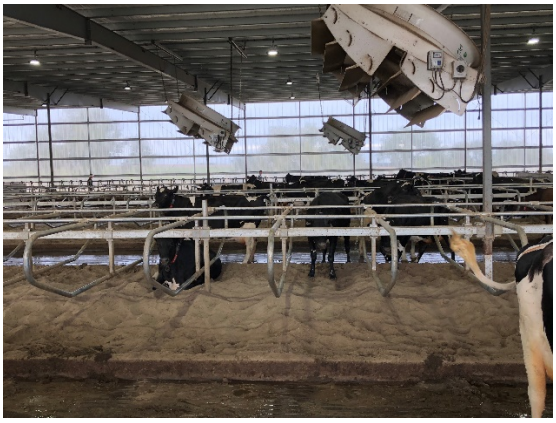


Exhibit 1.4.1. Rations for the 3,500-cow dairy model.

	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					
Feedstuffs	*As fed, pounds per head per day*								
Corn silage (35 percent dry matter)	52.0	53.9	55.0	55.0	54.0	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	26.0	27.0	25.5	0	0	0	0
Grass hay						15	9	0	12
Corn grain	10.5	10.3	12.5	12.5	11.5	3	2	5.2	2.8
Soybean meal (47.5 percent)	2.0	2.0	1.8	1.8	1.9	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)	7.5	8.0	5.0	5.0	6.4	0	0	0	0
Vitamin, mineral & minor ingredients	3.7	3.8	5.5	5.5	4.6	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
Ration profile									
Dry matter intake (pounds per day)	55.0	56.6	57.0	57.4		25.1	20.6	8.5	21.3
Ration dry matter (percent)	51.0	50.9	50.4	50.3		62.3	60.6	89.0	64.5
Metabolizable energy balance (megacalories)	6.4	7.5	7.4	7.7		5.7	0.5		
Crude protein (percent)	17.3	17.5	17.5	17.5		12.1	15.6	16.5	13.1
Neutral Detergent Fiber Digestibility (percent)	30.6	30.9	29.9	30.0		48.7	42.7	18.9	47.4

Exhibit 1.4.2. 3,500-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)	34,603	20.0%	41,523	24.0	1,730
Alfalfa hay	3,466	2.0%	3,535	5.0	707
Alfalfa haylage	13,772	5.0%	14,460	10.0	1,446
Grass hay	4,075	2.0%	4,156	3.0	1,385*
Corn grain	8,443	1.0%	8,528	4.5	1,895*
Soybean meal (47.5 percent protein)	1,764	0.5%	1,773		
Distillers dried grains	1,720	1.0%	1,737		
Corn gluten feed (dry)	3,447	1.0%	3,482		
Vitamin, mineral & minor ingredients	2,985	1.0%	3,015		
Total	**74,274**		**82,209**		**7,163**

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

1.5 Labor cost and management

This model operation is run by a full-time farm manager who sees that the business operates smoothly and makes major management decisions. This person completes all purchasing, contracts, payroll, personnel management and financial analysis. The starting salary for this position is assumed at $150,000 annually.

Other management positions include an assistant manager and a dairy herd manager. The assistant manager performs decisions in absence of the general manager and focuses on milking management, feed selection/rations, feed quality, calf treatment, herd recordkeeping and manure management. The dairy herd manager focuses on breeding/sire selection, cull cow selection, replacement heifers and other animal health-related activities. These positions have starting salaries of $110,000 and $70,000, respectively. Exhibit 1.5.1 presents a labor overview for the 3,500-cow dairy model.

Exhibit 1.5.1. Annual labor summary by year.

	Year 1	Year 2	Year 3	Year 4	Year 5
Total labor hours	89,440	89,440	89,440	89,440	89,440
Total full-time equivalents	43.0	43.0	43.0	43.0	43.0
Pounds of milk per full-time equivalents	1,884,811	1,984,012	2,008,812	2,033,612	2,058,412
Total benefits	$246,916	$251,854	$256,891	$262,029	$267,269
Total hourly labor cost	$1,268,384	$1,293,752	$1,319,627	$1,346,019	$1,372,940
Total salaried labor cost	$330,000	$336,600	$343,332	$350,199	$357,203
Total labor cost	$1,845,300	$1,882,206	$1,919,850	$1,958,247	$1,997,412

Hired labor completes business functions such as milking, feeding, cattle/heifer/calf care, breeding, calving, equipment maintenance, office support and manure management. Outsourcing of forage crop planting and harvesting is used to keep labor costs low.

Exhibit 1.5.2 presents a potential staffing plan and wage rates for each position. Starting wage rates for most full-time and part-time employees would begin at $15.50 per hour. Higher pay levels would be provided to higher-skilled jobs like mechanics, feeding and young stock care. Paid vacation is factored in by hiring two to three floaters that fill in so that each employee gets two weeks of paid vacation per year. Social Security and Medicare benefits are assumed for all employees. Paid vacation is estimated at 2 percent of total wages. Workers compensation is estimated at 5 percent of total wages. Unemployment insurance costs are also included.

Exhibit 1.5.2 – Hourly labor positions and wage rates – 3,500-cow model.

Type of position	Number of employees	Starting wage rate	Hours per week
First shift	6 to 8	$15.50/hour	336
Second shift	6 to 8	$15.50/ hour	336
Third shift	5 to 7	$15.50/ hour	280
Feeding	2	$20.00/ hour	70
Young-stock	5 to 7	$16.00/ hour	280
Office support	1	$15.50/ hour	40
Mechanic	1	$25.00/ hour	56
Floater/vacation	2 to 3	$15.50/ hour	112

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 business needs.

1.6 Other operating costs

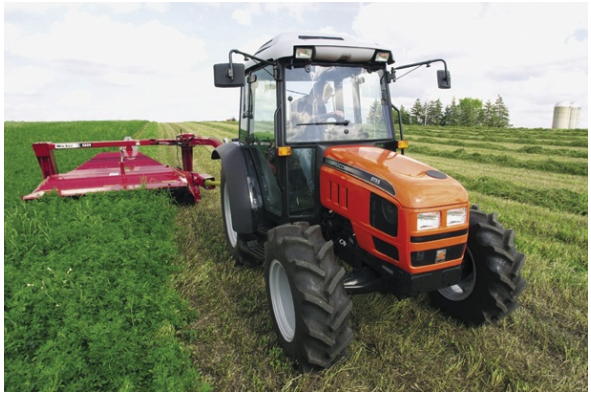
Exhibit 1.6.1 details selected operating costs beyond feed and labor. These expenses are on a per cow basis. A 2 percent annual rate of inflation is projected for most operating expenses.

Exhibit 1.6.1. Selected operating costs, per cow.

Cost category	Per cow
Artificial insemination	$55
Veterinarian, medicine and hoof trimming	$163
Farm supplies and bedding	$128
Fuel and oil	$58
Utilities	$100
Farm insurance	$20
Miscellaneous expenses	$20

The dairy model includes other operating costs. Each cost, and how it was calculated for the model, is explained below.

- *Repairs – Buildings.* Estimated at 1 percent of initial building capital investment.
- *Repairs – Machinery and equipment.* Machinery and equipment repairs are assumed at 2.5 percent of initial capital investment.
- *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.* An accounting firm is hired to prepare GAAP accounting statements quarterly, end of year tax planning and income tax preparation. A lawyer is used to develop contracts, provide legal opinions and advise on related topics. Other consultants, like nutritionists or engineers, are hired as needed. Estimated costs for these services is $58,275 in year one.
- *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 hay/haylage (one-fourth of acreage each year). Chopping and hauling custom rates are assumed at $9 per wet-basis ton for corn silage and alfalfa haylage. Alfalfa hay custom charges are $35.00 per dry ton for cutting, raking and baling.
- *Depreciation.* Straight line depreciation is included for all buildings and equipment investments; salvage value is assumed at $0. Building investments are depreciated over 15 years; machinery/equipment investments are depreciated over 10 years.
- *Non-dairy farm supplies.* Corn silage inoculants are used to enhance crop preservation. Inoculants are assumed to cost $2.25 per ton.



1.7 Land, crops and nutrient management

The dairy operation's land needs are based on providing a suitable land base for forage crops, manure application and the farmstead. Exhibit 1.7.1 presents acreage needs for the 3,500-cow model. Farmstead and unusable land are estimated at 20 percent above the total area used for forage production. Unusable land includes areas such as forests, rivers, streams and other similar non-arable land types that are commonly found on most Missouri farms.

Exhibit 1.7.1. Land requirements – 3,500-cow model.

Category	Total
Corn silage crop	1,730
Alfalfa haylage crop	1,446
Alfalfa hay crop	707
Farmstead or unusable land	777
Total acres	**4,660**

Forage crops such as corn silage, alfalfa hay and alfalfa haylage are raised on owned land to guarantee quality, lower feed costs, and ensure nutrient balancing. Exhibit 1.7.2 details yield, market value and shrink assumptions in each cropping enterprise. 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%

Production costs for each crop enterprise are estimated in Exhibit 1.7.3. Costs include seed, crop chemicals and fertilizer. Fertilizer expenses have been reduced because of manure applied to the 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.

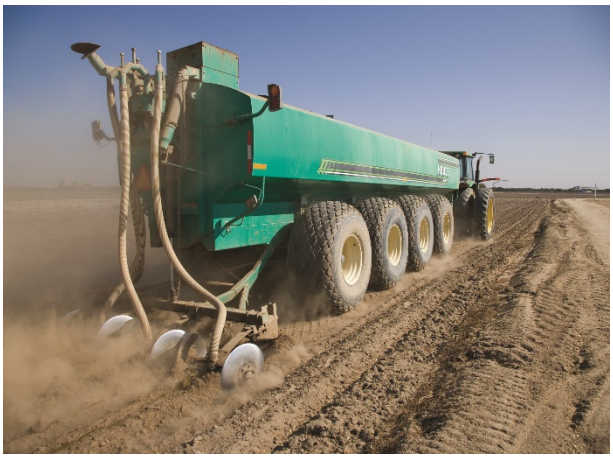
Cost category	Corn silage	Alfalfa
Seed	$84.56	$11.63
Crop chemicals	$40.00	$20.00
Fertilizer and soil amendments	$150.75	$115.90
Manure credit - fertilizer value	($82.30)	($82.30)
Total cost per acre	**$193.01**	**$65.23**

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

The manure handling system for the dairy is designed to flush parlor waste water 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 available storage. Center pivot irrigation is used to apply the agitated liquid fraction of manure from the lagoon to crop acreage. The solid fraction of manure that settles in the manure separation storage basin is applied to crop acreage with an owned solid manure spreader.

Passive separation systems have lower operating costs than mechanical systems such as screen separation or screw press systems. Producers elect to use mechanical systems such as screen separation or screw press systems when site selection, previous building arrangements or a need to reuse manure solids for bedding is an overriding factor.

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



(Photo: USDA/ARS)

1.8 Organizational structure

Careful thought and consideration should be given to selecting the business entity best reflecting the goals and structure of the dairy. 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 3,500-cow dairy model. 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 to provide a reasonable rate of return on investment.

The financial analysis includes an examination of the cash flow, profit/loss, dairy enterprise, balance sheet and financial ratios. Many dairy producers do not consider financial ratios crucial to the investment decision. Investment may be judged acceptable if the business is projected to cash flow sufficiently and service debt. Additional information provided in the financial ratios, 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.

A sensitivity analysis is also included to show how changes to milk price, milk production per day and initial capital investment impact the financial performance of the dairy. Dairying is not a static business. Fluctuations in milk prices and weather can impact the viability of the business. Dairy owners can examine the sensitivity analyses to quantify opportunities to improve profitability. Owners can also use a sensitivity analysis to identify risks in the dairy's risk management plan that must be mitigated to survive perilous periods.

This model represents dairies using 100% equity financing (no debt). Although unrealistic, this simplifying assumption allows lenders to quickly analyze free cash flow to determine how much debt the operation will support.

Various assumptions are made in the analysis. All replacement heifers are developed by the dairy, either on-site or at a nearby but non-contiguous owned heifer farm; this depends on how the dairy decides to maintain total animal unit numbers within the Class 1B CAFO size limit. 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 used to water forage crop acreage and distribute liquid lagoon water. Lastly, the land base is sufficient to manage nutrients from all manure applications from the dairy enterprise.

Additional strategies could improve the financial performance of the dairy model. Producers could consider outsourcing heifer development to a professional heifer development ranch to reduce financial

investment and managerial commitment involved in raising replacements. Manure easements or lease arrangements with nearby farms could secure land needs for crop acreage or manure application. Capital investment costs could be reduced with due diligence and careful planning of construction projects and other capital purchases.

2.1 Cash flow statement

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, 3,500-cow model.

	Year 1	Year 2	Year 3	Year 4	Year 5	Five-year average
CASH INFLOWS						
Farm cash receipts						
Milk sales	$14,791,055	$15,569,531	$15,764,150	$15,958,770	$16,153,389	$15,647,379
Livestock sales	$1,008,106	$1,008,086	$1,008,106	$1,008,106	$1,008,106	$1,008,102
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	$15,799,161	$16,577,618	$16,772,256	$16,966,875	$17,161,495	$16,655,481

Exhibit 2.1.1 Cash flow statement, 3,500-cow model (continued).

	Year 1	Year 2	Year 3	Year 4	Year 5	Five-year average
CASH OUTFLOWS						
Cash farm expenses						
Seed expenses	$171,329	$174,755	$178,250	$181,815	$185,452	$178,320
Fertilizer and chemicals	$303,034	$309,095	$315,277	$321,582	$328,014	$315,401
Purchased feedstuffs	$4,918,183	$5,110,422	$5,158,545	$5,206,668	$5,254,792	$5,129,722
Labor (includes benefits & Social Security)	$1,845,300	$1,882,206	$1,919,850	$1,958,247	$1,997,412	$1,920,603
Marketing 1/	$713,213	$750,750	$760,134	$769,519	$778,903	$754,504
Artificial insemination	$192,500	$192,500	$192,500	$192,500	$192,500	$192,500
Veterinary, medicine & hoof trimming	$570,500	$570,500	$570,500	$570,500	$570,500	$570,500
Farm supplies and bedding	$541,427	$552,256	$563,301	$574,567	$586,058	$563,522
Fuel & oil	$203,910	$203,910	$203,910	$203,910	$203,910	$203,910
Utilities	$350,000	$357,000	$364,140	$371,423	$378,851	$364,283
Repairs (buildings)	$169,734	$169,734	$169,734	$169,734	$169,734	$169,734
Repairs (machinery & equipment)	$226,704	$226,704	$226,704	$226,704	$226,704	$226,704
Rent	$0	$0	$0	$0	$0	$0
Farm taxes (real estate, personal property)	$50,779	$51,794	$52,830	$53,887	$54,964	$52,851
Farm insurance	$70,000	$71,400	$72,828	$74,285	$75,770	$72,857
Interest	$0	$0	$0	$0	$0	$0
Legal & professional fees	$58,275	$59,441	$60,629	$61,842	$63,079	$60,653
Custom hire	$665,854	$679,171	$692,755	$706,610	$720,742	$693,026
Car & truck costs	$0	$0	$0	$0	$0	$0
Contract heifer rearing	$0	$0	$0	$0	$0	$0
Other expenses	$70,000	$70,000	$70,000	$70,000	$70,000	$70,000
Miscellaneous	$166,811	$171,475	$173,578	$175,707	$177,861	$173,086
Total cash farm expenses	$11,287,553	$11,603,113	$11,745,466	$11,889,499	$12,035,246	$11,712,175
Capital purchases:						
Breeding livestock	$0	$0	$0	$0	$0	$0
Machinery & equipment	$906,626	$906,626	$906,626	$906,626	$906,626	$906,626
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	$12,194,179	$12,509,739	$12,652,092	$12,796,125	$12,941,872	$12,618,802
NET CASH FLOW	**$3,604,981**	**$4,067,879**	**$4,120,164**	**$4,170,750**	**$4,219,622**	**$4,036,679**

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

2.2 Profit/loss statement

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. By taking into account the value of inventory changes, called income adjustments in this table, the profit/loss statement converts the cash measure of income to a more accurate accrual-based measure that is necessary for analyzing a business.

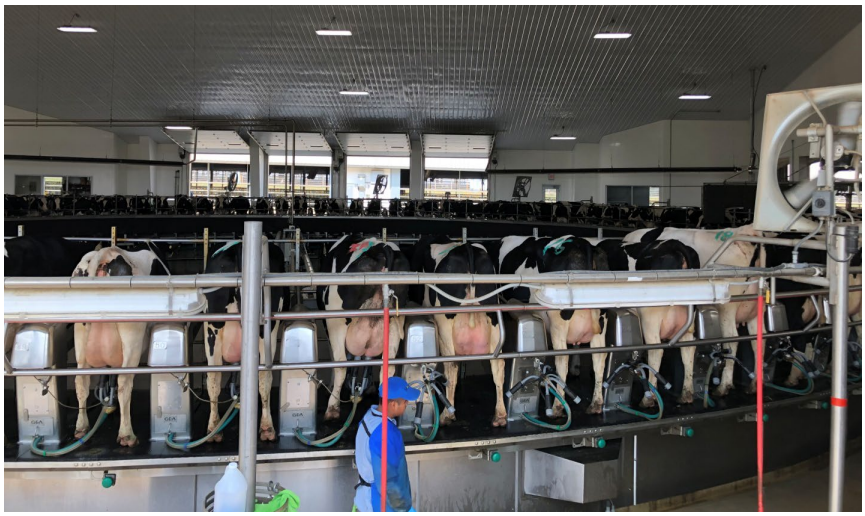
Exhibit 2.2.1. Profit/loss statement – 3,500-cow model.

	Year 1	Year 2	Year 3	Year 4	Year 5	Five-year average
GROSS REVENUE						
Milk sales	$14,791,055	$15,569,531	$15,764,150	$15,958,77	$16,153,38	$15,647,379
Calves and heifers sold	$509,356	$509,336	$509,356	$509,356	$509,356	$509,352
Other farm income 2/	$0	$0	$0	$0	$0	$0
Total revenue	$15,300,411	$16,078,867	$16,273,506	$16,468,12	$16,662,74	$16,156,731
OPERATING EXPENSES:						
PURCHASED FEED						
Feedstuffs	$1,006,831	$1,041,110	$1,049,735	$1,058,360	$1,066,985	$1,044,604
Less feed for heifers	($288,753)	($288,532)	($288,531)	($288,531)	($288,531)	($288,576)
Total feed	$718,079	$752,579	$761,204	$769,829	$778,454	$756,029
HERD REPLACEMENT COSTS						
Depreciation (dairy cows)	$742,904	$742,905	$742,904	$742,904	$742,904	$742,904
Loss on sale of cows	$414,730	$414,732	$414,730	$414,730	$414,730	$414,731
OTHER OPERATING EXPENSES						
Seed expenses	$171,329	$174,755	$178,250	$181,815	$185,452	$178,320
Fertilizer and chemicals	$303,034	$309,095	$315,277	$321,582	$328,014	$315,401
Hired labor (includes benefits, Social Security)	$1,845,300	$1,882,206	$1,919,850	$1,958,247	$1,997,412	$1,920,603
Marketing 1/	$713,213	$750,750	$760,134	$769,519	$778,903	$754,504
Artificial insemination	$192,500	$192,500	$192,500	$192,500	$192,500	$192,500
Veterinary, medicine, hoof trimming	$570,500	$570,500	$570,500	$570,500	$570,500	$570,500
Supplies and bedding	$541,427	$552,256	$563,301	$574,567	$586,058	$563,522
Fuel & oil	$203,910	$203,910	$203,910	$203,910	$203,910	$203,910
Utilities	$350,000	$357,000	$364,140	$371,423	$378,851	$364,283
Repairs--buildings	$169,734	$169,734	$169,734	$169,734	$169,734	$169,734
Repairs--machinery & equipment	$226,704	$226,704	$226,704	$226,704	$226,704	$226,704
Farm taxes (real estate, personal property)	$50,779	$51,794	$52,830	$53,887	$54,964	$52,851
Farm insurance	$70,000	$71,400	$72,828	$74,285	$75,770	$72,857
Legal & professional fees	$58,275	$59,441	$60,629	$61,842	$63,079	$60,653
Custom hire	$665,854	$679,171	$692,755	$706,610	$720,742	$693,026
Car and truck costs	$0	$0	$0	$0	$0	$0

Exhibit 2.2.1 Profit/loss statement – 3,500-cow model (continued).

	Year 1	Year 2	Year 3	Year 4	Year 5	Five-year average
Other expenses	$70,000	$70,000	$70,000	$70,000	$70,000	$70,000
Miscellaneous	$166,811	$171,475	$173,578	$175,707	$177,861	$173,086
Depreciation (buildings, equipment)	$2,038,379	$2,038,379	$2,038,379	$2,038,379	$2,038,379	$2,038,379
Less other expenses for raising	($112,141)	($112,125)	($112,125)	($112,125)	($112,125)	($112,128)
Total other operating expenses	$8,295,607	$8,418,944	$8,513,175	$8,609,085	$8,706,708	$8,508,704
TOTAL OPERATING EXPENSES	$12,792,967	$13,108,799	$13,251,151	$13,395,184	$13,540,930	$13,217,806
INCOME BEFORE FINANCING	$2,507,443	$2,970,068	$3,022,356	$3,072,941	$3,121,814	$2,938,925
Interest and rent expense	$0	$0	$0	$0	$0	$0
NET INCOME (LOSS)	**$2,507,443**	**$2,970,068**	**$3,022,356**	**$3,072,941**	**$3,121,814**	**$2,938,925**

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.



2.3 Dairy enterprise summary

The dairy enterprise summary shows a five-year average projection of income and expenses for the dairy enterprise, excluding the crop enterprises. This enterprise summary, presented in Exhibit 2.3.1 in a format comparable to financial cost studies published by specialized dairy accounting firms, enables management and potential lenders to quickly benchmark this dairy plan against existing large dairies.

Exhibit 2.3.1. Dairy enterprise – 3,500-cow model.

	Herd	Per cow	Per hundred pounds of milk produced	Percent
INCOME FROM OPERATIONS:				
Milk sales	$15,647,379	$4,471	$18.25	97.1%
Sales of young stock & calves	$464,256	$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	$16,111,635	$4,603	$18.79	100.0%
OPERATING EXPENSES:				
Feed:				
Feedstuffs	$8,777,353	$2,508	$10.24	59.2%
Less feed for heifers	($1,578,255)	($451)	($1.84)	(10.6%)
Total feed	$7,199,098	$2,057	$8.40	48.6%
Herd replacement costs:				
Depreciation--dairy cows	$742,904	$212	$0.87	5.0%
Loss on sale of cows	$414,731	$118	$0.48	2.8%
Total herd replacement costs	$1,157,635	$331	$1.35	7.8%
Other operating expenses:				
Labor (includes benefits & SS)	$1,690,130	$483	$1.97	11.4%
Marketing 1/	$754,504	$216	$0.88	5.1%
Artificial insemination	$192,500	$55	$0.22	1.3%
Veterinary, medicine & hoof trimming	$570,500	$163	$0.67	3.8%
Supplies and bedding	$466,282	$133	$0.54	3.1%
Fuel & oil	$203,910	$58	$0.24	1.4%
Utilities	$364,283	$104	$0.42	2.5%
Repairs (buildings)	$169,734	$48	$0.20	1.1%
Repairs (machinery & equipment)	$215,369	$62	$0.25	1.5%
Rent	$0	$0	$0.00	0.0%
Farm taxes (real estate & personal property)	$34,882	$10	$0.04	0.2%
Farm insurance	$65,571	$19	$0.08	0.4%
Legal & professional fees	$54,588	$16	$0.06	0.4%
Custom hire	$0	$0	$0.00	0.0%
Car and truck costs	$0	$0	$0.00	0.0%
Other	$66,500	$19	$0.08	0.4%
Interest	$0	$0	$0.00	0.0%
Depreciation	$1,732,622	$495	$2.02	11.7%
Less other expenses for raising heifers	($112,128)	($32)	($0.13)	(0.8%)
Total other operating expenses	$6,469,246	$1,848	$7.55	43.6%
TOTAL OPERATING EXPENSES	$14,825,980	$4,236	$17.29	100.0%
NET INCOME FROM OPERATIONS	**$1,285,655**	**$367**	**$1.50**	

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

2.4 Balance sheet

A balance sheet provides a picture of the business at a particular point in time. It reports assets and liabilities to determine the amount of owner equity in the business. The balance sheet for this dairy is presented in Exhibit 2.4.1.

Assets are listed at market value in this balance sheet, compatible with the Farm Financial Standards Council (FFSC) recommendations familiar to farmers and agricultural lenders. Accountants preparing balance sheets for a dairy with more than $10 million in sales, such as this dairy, would likely also be required to develop financial statements prepared according to Generally Accepted Accounting Principles (GAAP). GAAP accounting differs from FFSC in the way heifer development costs are amortized and in the valuation method used for breeding livestock and machinery.

Exhibit 2.4.1. Balance sheet – 3,500-cow model.

	Beginning Year 1	Ending Year 1	Ending Year 2	Ending Year 3	Ending Year 4	Ending Year 5
ASSETS						
Current assets:						
Cash	$20,000	$20,000	$311,391	$315,283	$319,175	$323,068
Other current assets	$627,399	$627,399	$2,958,211	$2,995,189	$3,032,166	$3,069,144
Total current assets	$647,399	$647,399	$3,269,602	$3,310,472	$3,351,342	$3,392,212
Non-current assets:						
Dairy herd	$5,250,000	$5,250,000	$8,063,512	$8,063,511	$8,063,511	$8,063,511
Farm and equipment						
Land	$16,449,011	$16,449,011	$16,449,011	$16,449,011	$16,449,011	$16,449,011
Nonfarm real estate	$0	$0	$0	$0	$0	$0
Buildings	$16,973,421	$15,841,860	$14,710,298	$13,578,737	$12,447,176	$11,315,614
Equipment, autos & trucks	$9,068,174	$9,067,983	$9,067,791	$9,067,600	$9,067,409	$9,067,218
Total	$42,490,606	$41,358,853	$40,227,101	$39,095,348	$37,963,595	$36,831,842
Other assets:						
Investment in co-ops	$0	$109,454	$224,668	$341,323	$459,418	$578,953
Other (notes receivable, etc.)	$0	$0	$0	$0	$0	$0
Total other assets	$0	$109,454	$224,668	$341,323	$459,418	$578,953
Total non-current assets	$47,740,606	$46,718,307	$48,515,280	$47,500,182	$46,486,524	$45,474,306
Total assets	$48,388,005	$47,365,706	$51,784,882	$50,810,654	$49,837,866	$48,866,518
LIABILITIES						
Current liabilities:	$0	$665,597	$700,629	$709,387	$718,145	$726,902
Long-term liabilities:	$0	$0	$0	$0	$0	$0
Total liabilities	$0	$665,597	$700,629	$709,387	$718,145	$726,902
EQUITY						
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		$44,192,665	$48,114,185	$47,078,911	$46,046,780	$45,017,802
Net income		$2,507,443	$2,970,068	$3,022,356	$3,072,941	$3,121,814
Total equity		$46,700,108	$51,084,253	$50,101,267	$49,119,721	$48,139,616
Total liabilities and equity		$47,365,706	$51,784,882	$50,810,654	$49,837,866	$48,866,518

2.5 Financial ratios

Exhibit 2.5.1. Financial ratios – 3,500-cow model.

	Year 1	Year 2	Year 3	Year 4	Year 5
Liquidity					
1. Current ratio	0.97	4.67	4.67	4.67	4.67
2. Working capital	($18,199)	$2,568,973	$2,601,085	$2,633,197	$2,665,309
Solvency					
3. Debt/asset ratio	1.4%	1.4%	1.4%	1.4%	1.5%
4. Equity/asset ratio	98.6%	98.6%	98.6%	98.6%	98.5%
5. Debt/equity ratio	1.43%	1.37%	1.42%	1.46%	1.51%
Profitability					
6. Rate of return on assets	5.2%	6.0%	5.9%	6.1%	6.3%
7. Rate of return on equity	5.4%	5.8%	6.0%	6.3%	6.5%
8. Operating profit margin ratio	16.4%	18.5%	18.6%	18.7%	18.7%
Financial Efficiency					
9. Asset turnover ratio	32.0%	32.4%	31.7%	32.7%	33.8%
10. Operational ratios					
a. Operating expense ratio	65.4%	64.2%	64.3%	64.5%	64.6%
b. Depreciation expense ratio	18.2%	17.3%	17.1%	16.9%	16.7%
c. Interest expense ratio	0.0%	0.0%	0.0%	0.0%	0.0%
d. Net farm income from operations ratio	16.4%	18.5%	18.6%	18.7%	18.7%
DuPont Identities					
11. Profit margin	16.4%	18.5%	18.6%	18.7%	18.7%
12. Asset turnover	0.3	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	5.4%	5.8%	6.0%	6.3%	6.5%
Dairy Profitability Ratios					
15. Total assets per cow	$13,679	$14,164	$14,657	$14,378	$14,101
16. Total debt per cow	$190	$200	$203	$205	$208
17. Assets per cwt	$58	$61	$59	$57	$55
18. Gross milk margin	52.8%	53.9%	54.1%	54.4%	54.7%
19. Net milk margin 1/	5.2%	8.0%	8.4%	8.8%	9.2%
20. Feed cost 1/	45.8%	44.8%	44.5%	44.3%	44.1%
21. Hired labor 1/	10.6%	10.3%	10.4%	10.5%	10.6%
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.

2.6 Sensitivity analysis

A sensitivity analysis can show business vulnerability to changes in critical prices, production and investment decisions. This measures how well the business would respond to changing conditions in milk production. The following exhibits show these changes in production, milk prices and investment capital efficiency. The business must be capable of financially surviving short-term changes in milk and feed prices, milk production levels and other unfavorable financial situations. Additionally, understanding the impact of initial capital invested (Exhibit 2.6.3) is important to evaluating the financial picture.

Exhibit 2.6.1. Milk production sensitivity, 3,500-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 pounds per day (five-year average)	Increase 2.0 lbs	Increase 4.0 lbs	Increase 6.0 lbs
Net cash flow	$2,926,115	$3,296,303	$3,666,491	$4,036,679	$4,406,867	$4,777,055	$5,147,243
Net income	$1,828,361	$2,198,549	$2,568,737	$2,938,925	$3,309,113	$3,679,301	$4,049,489
Rate of return on assets	3.7%	4.4%	5.2%	5.9%	6.6%	7.4%	8.1%
Operating expenses per hundredweight of milk (excluding depreciation)	$16.43	$16.02	$15.64	$15.27	$14.92	$14.59	$14.27

Exhibit 2.6.2. Milk price sensitivity, 3,500-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	$1,464,507	$2,321,898	$3,179,289	$4,036,679	$4,894,070	$5,751,461	$6,608,851
Net income	$366,753	$1,224,143	$2,081,534	$2,938,925	$3,796,315	$4,653,706	$5,511,096
Rate of return on assets	0.7%	2.5%	4.2%	5.9%	7.6%	9.3%	11.0%

Exhibit 2.6.3. Capital efficiency sensitivity, 3,500-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	$9,612	$11,904	$14,196	$16,487	$18,779
Total assets per cwt.	$40	$49	$58	$67	$76
Asset turnover ratio	48.1%	38.8%	32.5%	28.0%	24.6%
Rate of return on assets	10.8%	7.9%	5.9%	4.5%	3.4%

2.7 Risk management

Risk management is an important aspect of the dairy farming business. Farmers face many risks that generally fit into one or more of these categories: production, marketing/price, financial and legal/institutional. Creating simple standard operating procedures (SOPs) and continually auditing the farm for compliance with those SOPs is critical for managing risks.

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 can reduce the financial effects of such uncertainties. The following sections explain key risks and risk management strategies that farmers should consider when making decisions for their dairy.

Milk production risk

Monitoring the daily quantity of milk shipped 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 the daily milk production, evaluating the daily activities can determine what 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.

The 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 should be inspected on a weekly basis to evaluate whether daily stall 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 those to stall conditions the next week can help detect small unwanted changes in stall conditions over time. Individual stall condition needs to be looked at as well as variations in stall condition throughout the available housing. Barns are assumed to be overstocked by 10 percent, as is typical in large dairies to reduce capital costs. Overstocking by 10 percent without impacting cow comfort requires management to assure all stalls are useable and feed is distributed along the entire bunk.

The monthly cow inventory should be monitored closely. 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. Comparing the inventory of cows milked with projected inventories can ensure cow numbers remain adequate for the production plan.

Milk pricing risk

Milk prices are more volatile than almost any other agricultural commodity produced in the U.S. Dairies continually monitor changing market conditions to manage price risk. Managing milk price risk begins with a marketing plan. The business plan, leverage and overall risk sensitivity of the dairy should drive the marketing plan. The suite of margin management tools available to dairy producers now includes: Dairy Margin Coverage from USDA; Dairy Revenue Protection available from crop insurance agents; and Dairy Gross Margin Insurance available from crop insurance agents. In addition, some dairy cooperatives offer members an in-house risk management service that can, for a cost, customize insurance products to lock in floor prices or collars around expected milk prices.

Most milk price risk hedging is ultimately placed in the CME dairy futures market. Futures contracts for 200,000 pounds of Class III and IV milk are available monthly for up to two years into the future.

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. Specialized dairy commodity brokers can help producers design hedges.

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 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.

Feed risk

This model 3,500-cow dairy uses irrigation wells and 22 center pivots, tied to the dairy lagoon and designed to water 160-acre blocks, to reduce drought risk to forage quality and quantity. Dairies of this size are easier to establish in the western U.S. where larger blocks of land are more readily available and arid conditions make heat stress easier to mitigate. One principal motivation to locate this dairy in select areas of Missouri is the long-term availability of fast recharging irrigation water that improves sustainability and reduces long-term business risk.

This dairy uses truck scales to track weights of all trucks entering and leaving the dairy as an SOP to monitor quantities of feed grown, purchased and fed at the dairy. Feed shrink is a hidden cost to the dairy. Management tracking of quantities mitigates risk of lost feed.

Corn silage and alfalfa haylage are a significant portion of the diets fed throughout the year. Both the quantity and quality of forages should be evaluated soon after harvest. This will determine if the available silage supply is adequate 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.

Monitoring the price, quantity and quality of purchased feedstuffs ensures adequate volumes are forward contracted or sourced for the dairy's needs. Establishing quality control SOPs for delivered ration ingredients and for TMR delivered to the feed bunk enables safe and consistent feed to the cows. Mycotoxins are a major feed risk best controlled by quality control SOPs implemented at the delivery and storage point on the dairy. Protecting price, quality and quantity helps control costs and assures feedstuff quality and quantity availability for the planned rations.

Herd health risk

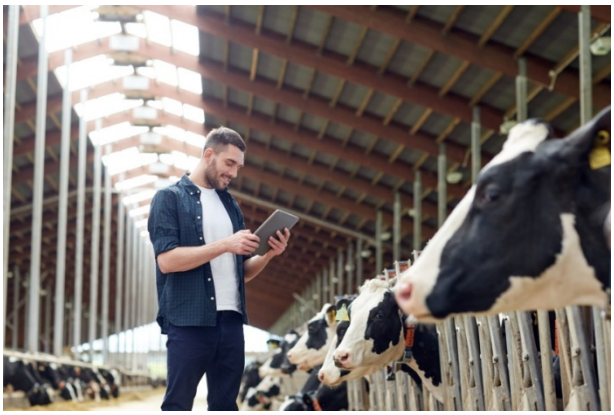
Assembling a large herd requires commingling replacement animals with often unknown health histories from various sources. The dairy will follow vaccination and cow cleanliness protocols to minimize disease introduction. Replacement heifer care is a critical risk area. If heifer calves are not kept alive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

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. Housing infrastructure investments operated with extreme weather SOPs mitigates these risks. Wind and ice damage to buildings and crops is always a possibility in Missouri. Property insurance, if the appropriate riders are purchased, can manage wind and ice risk to farm infrastructure. Drought that lowers crop yields can raise purchased hay and feed prices. Hedging feed costs or income over feed cost margins can mitigate this drought risk.

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. Regular employee SOP training helps assure performance and worker safety. Regularly scheduled meetings will help improve decision making and assure employees are held accountable for implementing the SOPs for their roles. (Photo: Shutterstock).



Financial risk

Financial risk has three basic components: 1) the cost and availability of debt; 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 growth. Although interest rate risk is mostly beyond the farm's control, appropriately structuring debt 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 labor expenses.

Financial risk should be managed through sound planning and financial controls that conserve 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 important. If the equity position of the operation is not maintained or improved over time, then the owner's capital would be better invested elsewhere.

Legal risks

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, livestock mortality management; a non-regulatory assessment of the livestock production site should also be conducted. A good resource for exploring publicly available environmental and geological information is the AgSite Assessment Tool (agsite.missouri.edu/). Further information about site selection can be found in Section 3.2.

Standard operating procedures should be developed for manure application; these include protocols for accidental spills, agency contact and neighbor communication. The dairy operation should follow its site specific comprehensive nutrient management plan (CNMP), and all manure application should be conducted 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 dairy's financial performance. Detailed planning (see Exhibit 3.1.1) is strongly recommended given the size of the required investments and the degree of risk. This 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. Construction of the new facilities would take about five months before cows could be milked. Replacement heifers would 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 sites must be thoroughly and accurately evaluated to ensure that:

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

Either 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 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 restroom facilities 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. Three phase electrical service, phone, and internet service must also be available to the site.

Isolation

The site needs to be 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 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. Proper management for 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/). 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

Missouri regulations require a Class I concentrated animal feeding operation (CAFO) to obtain coverage under a National Pollutant Discharge Elimination System (NPDES) or a state no-discharge operating permit. These regulations typically pertain to operations maintaining an inventory of 700 dairy cows or greater in confinement (1,000 animal units or greater). Class IB CAFOs pertain to dairies with 2,100 to 4,899 mature dairy cows (0.7 animal unit per head) and also factor dairy heifer inventories (1.0 animal unit per head) if raised onsite. All replacement heifers in this model are assumed to be developed by the dairy at a nearby, but non-contiguous, owned heifer farm.

A NPDES operating permits allows for a discharge from an uncovered liquid storage structure due to a catastrophic storm or chronic weather event. A state no-discharge operating permit does not allow a discharge for any reason. Operating permits are valid for a five-year period and require inspection, recordkeeping and reporting.

Other permits may be needed. Additionally, a construction permit is needed for the construction or modification of an earthen manure storage structure. A land disturbance/stormwater permit is required if one acre or more land is disturbed during the construction process. A Clean Water Act permit must be obtained from the U.S. Army Corps of Engineers if any disturbance occurs into waters of the United States, including wetlands.

Expected permits and costs necessary for a 3,500-cow dairy operation are shown in Exhibit 3.3.1.

Exhibit 3.3.1. Likely permits and fees for 3,500-cow dairy operation.

Type of Permit	Fee
Construction permit (< 500,000 gallons per day design flow)	$1,000
Stormwater/land disturbance permit (25 to 100 acres)	$1,500
Class IB CAFO NPDES permit annual fee	$450

CAFO regulatory requirements also include buffer distances, neighbor notice/comment periods, nutrient management plans and production area setbacks. Buffer distances for a Class IB CAFO operation are 2,000 feet from the operation to an existing public building or occupied residences not owned by the CAFO. Neighbor notification is required prior to submitting an operating permit. All adjoining property owners within 6,000 feet of the property, the county governing body and Missouri Department of Naturals Resources must be notified by letter with information about the proposed project. Written comments will be accepted for a 30-day period after an operating permit is received. Nutrient management plans must be developed for the operation. Minimum setback distances are required for confinement buildings, manure storage structure and composting. These include property lines (50 feet), public roads (50 feet), lakes (300 feet), perennial/intermittent streams (100 feet) and sinkholes (300 feet).

It is advisable to start early when developing the required documents and submitting applications. Applications for operating and construction permits should be submitted together. Permits can take up to 180 days for approval after an application is received.

Further information about Missouri's permits and regulations can be found through the Missouri Department of Natural Resources at dnr.mo.gov/pubs/pub2351.htm.

3.4 Consultants

Successful dairy producers effectively use 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 benefitting from professional consultants are environment, nutrition, structures, herd health and finances.

Consulting engineers can provide the professional expertise needed 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 have the potential of increasing milk production while lowering feed costs per 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