

Starting a 600-Cow Intensive Rotational Grazing Dairy

This guide examines the financial feasibility of starting a 600-cow intensive rotational grazing dairy in Missouri. Data presented here reflect costs and conditions as of October 2020. This model was developed using assumptions, costs and benchmarking information from existing Missouri pasture-based dairies and dairy industry experts. While this farm was customized specific to Missouri, it could be adapted to conditions elsewhere.

Farm description

In this model dairy, the farm is a carefully selected 660-acre piece of land purchased specifically for developing a grazing dairy. It is to be located in an area where winter weather conditions and soil types allow cattle to be housed outside all year. The dairy farm is purchased for \$3,500 per acre. An additional 120-acre heifer farm is purchased for \$3,000 per acre.

- 600 acres for paddocks at the grazing dairy
 - 1 cow per acre for 600 cows
- 60 acres for farmstead and facilities
- Permanent lanes, water lines and paddocks are established at each farm
- No irrigation or winter housing is planned
- Both farms are replanted with improved pasture species

Herd management

The beginning herd for this dairy is assumed to include purchased crossbred dairy heifers. The heifers will be purchased with an eye to selecting cattle types best suited for grazing.

Cows are expected to be culled from the herd based on involuntary factors (e.g., death, disease, problem breeders) and voluntary factors (e.g., low milk production, disposition). Projected cow culling rates,

Dairy grazing publication series

This publication is one in a series about operating and managing a pasture-based dairy. Although these publications often refer to conditions in Missouri, many of the principles and concepts described may apply to operations throughout the United States.

death losses and the calving interval for the next five years are listed in Table 1. It is assumed that the average cull rate (excluding deaths) would be 25 percent in the first year and fall to 22 percent in year two. Death loss rate would be 4 percent in all years. The total herd turnover rate would be 29 percent in year one and 26 percent in the remaining years.

Crossbred dairy cows are specified in this grazing dairy system because of their ability to make better use of pasture and their higher reproductivity and overall hybrid vigor. They typically can be purchased for lower



Figure 1. Swing parabone dairy parlors are designed to promote production and capital efficiency by emphasizing rapid cow movement, efficient use of labor and low investment per cow.

Written by

Joe Horner, State Specialist, Agricultural Business and Policy Extension

Ryan Milhollin, State Specialist, Agricultural Business and Policy Extension

Stacey Hamilton, State Dairy Specialist

prices than Holsteins that are traditionally selected for their high milk production traits. In the model, replacement heifers will be raised on-farm. One-third of the heifers and cows will be bred to beef genetics. Beef cross heifers are sold for \$145 each. Bull calves will be sold for an average of \$120 each, reflecting a weighted average value of bull calves from dairy sires and bull calves from crossbreeding to beef sires.

Table 1. Herd turnover and mortality rates.

Description	Year 1	Year 2	Year 3	Year 4	Year 5
Target herd size (head)	600	600	600	600	600
Annual cull rate, excluding deaths (%)	25	22	22	22	22
Annual death loss (%)	4	4	4	4	4
Calving interval (months)	14.0	13.5	12.8	12.5	12.5

Table 2 shows milk production estimates by year. In the model, 97.5 percent of the total volume of milk is sold, and 2.5 percent from fresh or treated cows is discarded or consumed by calves.

Table 2. Milk production.

Description	Year 1	Year 2	Year 3	Year 4	Year 5
Pounds per day	40.0	42.0	45.0	46.0	46.0
365-day rolling herd average	12,289	12,903	13,683	13,920	13,920

Supplementary feeds are designed to complement the characteristics of the pasture forage at a reasonable cost (see Tables 3 and 4). Hay and concentrate are purchased in the dairy model. Eight pounds of concentrate costing \$280/ton delivered is fed to each cow in the parlor for the milking group. Five pounds of purchased hay costing \$0.10/lb is fed as needed throughout the year to the milking group. The dry cow group is being fed 5 pounds of concentrate costing \$280/ton and 20 pounds of purchased hay at \$0.045/lb as needed throughout the year. Heifer feed costs vary by age, see Table 5 for more detail. Milk replacer and calf starter are used in the initial months before receiving other concentrates, pasture and hay after month 2.

Table 3. Daily milking period feed costs (Cost/cow/day).

Description	Cost/cow/day
Purchased concentrates	\$1.12
Purchased hay	\$0.50
Total feed cost	\$1.62

Table 4. Daily dry cow period feed costs (Cost/cow/day).

Description	Cost/cow/day
Purchased concentrates	0.70
Purchased hay	0.90
Total feed cost	1.60

Table 5. Daily youngstock feed costs (Cost/animal/day).

Description	0-2 mos.	2-6 mos.	6-12 mos.	12-24 mos.
Purchased concentrates	1.70	0.48	0.60	0.72
Purchased hay	0.00	0.06	0.35	0.49
Total feed cost	1.70	0.54	0.95	1.21

Note: mos. = months

Milk marketing

Financial projections use a farm-level gross milk price of \$18.30 per hundredweight (cwt) in the first two years and \$18.44 per cwt in the remaining years, including Dairy Margin Coverage payments during low price months. These price levels are considered realistic based on long-term historical milk prices, component levels and expected premiums in Missouri. Marketing costs deducted from the gross milk price in the model include DMC insurance (\$0.15/cwt), dairy checkoff (\$0.15/cwt), co-op fee (\$0.20/cwt) and hauling (\$0.75/cwt).

Labor management

A grazing dairy that milks two times daily will ideally spend no more than 2.5 hours in the parlor per milking. Outsourcing of forage harvest is used to keep labor cost low. A general manager is employed at \$75,000 per year. Three employees are hired at \$15.50, \$16.50 and \$17.50 per hour, respectively. Benefit costs include employer's share of Social Security and Medicare taxes, workers compensation insurance and paid vacation. Table 6 presents a labor summary. A 2 percent inflation rate is built into labor and select operating expenses.

Table 6. Labor summary.

Description	Year 1	Year 2	Year 3	Year 4	Year 5
Full-time equivalents (from labor hours)	5.0	5.0	5.0	5.0	5.0
Pounds milk per FTE	1,447,457	1,509,690	1,600,889	1,628,593	1,628,593
Annual benefits	27,343	27,890	28,448	29,017	29,597
Total hourly labor	111,644	113,877	116,154	118,478	120,847
Total salaried labor	75,000	76,500	78,030	79,591	81,182
Total labor cost	213,987	218,267	222,632	227,085	231,627

Capital investments

Capital investments for this start-up operation are listed in Table 7. These investments include land, buildings, machinery, equipment and livestock. The total capital invested in the dairy will be \$4,670,081 (\$7,783 per cow). This includes all the minimum components necessary to make the dairy operational.

Table 7. Capital investments.

Description	Quantity	Cost/ Unit	Total (dollars)
Land for dairy farm	660 acres	3,500	2,310,000
Land for heifer farm	120 acres	3,000	360,000
Dairy cows	600 cows	1,100	660,000
Heifers (1 year old)	174 heifers	400	69,600
Buildings and farm setup			
Milking parlor, equipment, tank, holding area and office	80 stalls	7,000	560,000
Manure storage			80,000
Feed bins (15 tons each)	4 bins	7,000	28,000
Hay barn and equipment storage	9,600 ft	10	96,000
Lanes	26,400 ft	2.00	52,800
Watering system (without well and pump)	26,400 ft	2.00	52,800
Water supply well and pump			20,000
Fencing and paddock setup	58,757 ft	0.90	52,881
Establishing new forages (fertilizer, seed, tillage)	720 acres	150.00	108,000
Machinery and equipment			
Tractor (used 130 HP with loader)	1	100,000	100,000
Tractor (used 60-70 HP with loader)	1	25,000	25,000
Pickup truck, used	1	25,000	25,000
ATV	3	5,000	15,000
Clipper mower	1	15,000	15,000
Silage feeding equipment	1	20,000	20,000
Other farm equipment			20,000
Total investment			4,670,081
Investment per cow			7,783

The financial success of grazing dairies depends upon keeping the capital investment and the operating expenses low. Careful farm selection is critical to

minimize the investment needed and to enable low operating costs. To avoid investments in livestock housing, the farm sites must have well-drained soils. To keep feed costs low, the dairy needs mostly open ground with productive soils that can be managed for high-producing pastures that can be planted with annual forage and improved perennial forage varieties.

Investments in the milking center include a milking parlor, milking equipment, holding area, utility room, milk room, rest rooms and tanks. Milking equipment includes parabone stalls designed for rapid cow flow, a flush system for the parlor, automatic take-offs, plate cooler with chilled water and a heater. The parlor is assumed to be a swing-40 parabone parlor with automatic take-offs. The basic philosophy of most graziers carries over to the milking parlor. They want a facility that is both inexpensive and efficient and can be updated or improved as cash flow permits. Parabone swing parlors were used to promote production efficiency by emphasizing cow comfort, cow movement and efficient use of labor. This does not suggest other parlors will not work, but cost and efficiency must always be considered.

Permanent lanes, water lines and paddocks are established in this dairy. Lanes are essential in a pasture-based dairy to move cows easily from pasture to parlor, whether the grazing cell design is fixed or flexible. Constructing raised lanes with adequate drainage capacity and using crushed rock, lime screenings or other stabilizing material reduces annual maintenance needs and keeps cows cleaner and healthier. Electrified 12.5-gauge high-tensile wire is used for perimeter fence and permanent paddock fencing in this dairy system. Water systems include buried water lines and permanently installed stock tanks.

Initial expenses of forage establishment are included in the capital investments. These expenses include fertilizer, seed and tillage. Pastures can be seeded either on a prepared seedbed or no-till drilling, depending on site conditions and crop requirements. Machinery investments include tractors, pickup, ATVs, clipper/rotary mower, silage feed wagon and other farm equipment. Other facility investments include equipment storage, hay barn and feed bins.

Financial analysis and statements

The 600-cow model dairy will gross \$1,490,981 per year in milk and young stock sales. This farm will have a net income of \$328,371 after all operating costs, labor and depreciation are deducted (see Tables 8–11 for financial measurements and statements). On a per cow basis, this is a gross operating income of \$2,485 per cow

and a net operating income of \$547 per cow after labor and depreciation are deducted.

The model represents a dairy using 100 percent equity financing with no debt. Although unrealistic, this simplifying assumption helps lenders analyze the free cash flow to determine how much debt the operation will support. Adding net income from operations plus the building and machinery depreciation yields a free cash flow of \$419,112 available for principal and interest payments (\$328,371 net income + \$90,741 depreciation). On a per cow basis, this is equivalent to \$678 of cash available for principal and interest payments. This free cash flow estimate assumes no additional cash will be used for family living expenses other than what is already used to pay labor in the dairy.

The character of the investments in the dairy reduces a lender’s risk because a high percentage of the initial investment is concentrated in appreciating land and reproducing cattle rather than specialized assets that are harder to liquidate at full value.

Original authors: Joe Horner, Ryan Milhollin, Stacey Hamilton, Wayne Prewitt and Tony Rickard, University of Missouri.

Table 8. Financial measurements.

	Year 1	Year 2	Year 3	Year 4	Year 5
Current ratio	1.51	4.67	4.67	4.67	4.67
Return on assets	5.1%	6.2%	7.5%	8.3%	8.2%
Operating expense ratio	72.1%	69.7%	66.6%	65.5%	66.0%
Depreciation expense ratio	11.2%	10.4%	9.9%	9.6%	9.6%
Net farm income from operations ratio	16.7%	19.9%	23.6%	24.9%	24.4%

Table 9. Dairy enterprise budget for the 600-cow grazing dairy model (5-year average).

	Dollars per herd	Dollars per cow	Dollars per cwt	Percent
INCOME FROM OPERATIONS				
Milk sales	1,434,746	2,391	18.36	96.2%
Sales of young stock and calves	56,235	94	0.72	3.8%
Total gross receipts	1,490,981	2,485	19.08	100.0%
OPERATING EXPENSES				
Feed				
Feedstuffs	485,888	810	6.22	41.8%
Less feed for heifers	-131,826	-220	-1.69	-11.3%
Total feed costs	354,062	590	4.53	30.5%
Herd replacement costs				
Depreciation—dairy cows	60,080	100	0.77	5.2%
Loss on sale of cows	31,667	53	0.41	2.7%
Total herd replacement costs	91,747	153	1.17	7.9%
Hired labor (including benefits)	222,720	371	2.85	19.2%
DHIA ¹ testing	7,200	12	0.09	0.6%
Semen/breeding	10,200	17	0.13	0.9%
Real estate/personal property taxes	12,152	20	0.16	1.0%
Milk marketing ²	97,690	163	1.25	8.4%
Repairs	58,800	98	0.75	5.1%
Vet/medicine	36,000	60	0.46	3.1%
Parlor supplies	21,857	36	0.28	1.9%
Utilities	28,102	47	0.36	2.4%
Insurance	24,979	42	0.32	2.1%
Fertilizer	46,368	77	0.59	4.0%
Seed/spray	20,608	34	0.26	1.8%
Custom hire	16,653	28	0.21	1.4%
Truck and fuel	10,000	17	0.13	0.9%
Fence/water	10,000	17	0.13	0.9%
Other expenses	12,000	20	0.15	1.0%
Depreciation	90,741	151	1.16	7.8%
Less other expenses for raising heifers	-9,268	-15	-0.12	-0.80%
Total operating expenses	1,162,610	1,938	14.88	100.0%
NET INCOME FROM OPERATIONS	328,371	547	4.20	

Notes

¹ Dairy Herd Improvement Association² Includes milk hauling, Dairy Margin Coverage (DMC) insurance, federal promotion and cooperative fees.

Table 10. Pro forma income statement for the 600-cow grazing dairy model.

	Year 1 (dollars)	Year 2 (dollars)	Year 3 (dollars)	Year 4 (dollars)	Year 5 (dollars)	5-year average (dollars)
GROSS REVENUE						
Milk sales	1,324,423	1,381,366	1,464,813	1,501,563	1,501,563	1,434,746
Calves and heifers sold	52,353	54,292	57,261	59,795	60,375	56,815
Total gross revenue	1,376,776	1,435,658	1,522,074	1,561,358	1,561,938	1,491,561
OPERATING EXPENSES						
Feed						
Purchased concentrates	321,289	316,041	319,216	322,243	323,276	320,413
Purchased hay	165,737	162,332	164,749	166,927	167,630	165,475
Less feed for heifers	-132,914	-124,287	-129,916	-135,139	-136,875	-131,826
Total feed costs	354,111	354,087	354,049	354,031	354,031	354,062
Herd replacement costs						
Depreciation—dairy cows	63,429	59,243	59,243	59,243	59,243	60,080
Loss on sale of cows	34,714	30,906	30,905	30,905	30,905	31,667
Total herd replacement costs	98,143	90,149	90,148	90,148	90,148	91,747
Hired labor (includes benefits)	213,987	218,267	222,632	227,085	231,627	222,720
DHIA ¹ testing	7,200	7,200	7,200	7,200	7,200	7,200
Semen/breeding	10,200	10,200	10,200	10,200	10,200	10,200
Real estate/personal property taxes	11,675	11,909	12,147	12,390	12,638	12,152
Milk marketing ²	90,466	94,356	100,056	101,787	101,787	97,690
Repairs	58,800	58,800	58,800	58,800	58,800	58,800
Vet/medicine	36,000	36,000	36,000	36,000	36,000	36,000
Parlor supplies	21,000	21,420	21,848	22,285	22,731	21,857
Utilities	27,000	27,540	28,091	28,653	29,226	28,102
Insurance	24,000	24,480	24,970	25,469	25,978	24,979
Fertilizer	44,550	45,441	46,350	47,277	48,222	46,368
Seed/spray	19,800	20,196	20,600	21,012	21,432	20,608
Custom hire	16,000	16,320	16,646	16,979	17,319	16,653
Truck and fuel	10,000	10,000	10,000	10,000	10,000	10,000
Fence/water	10,000	10,000	10,000	10,000	10,000	10,000
Other expenses	12,000	12,000	12,000	12,000	12,000	12,000
Depreciation (buildings and equipment)	90,741	90,741	90,741	90,741	90,741	90,741
Less other expenses for raising heifers	-9,262	-8,762	-9,168	-9,519	-9,627	-9,268
Total operating expenses	1,146,411	1,150,343	1,163,309	1,172,537	1,180,452	1,162,610
NET INCOME (LOSS)	230,365	285,315	358,766	388,821	381,486	328,951

Notes

¹ Dairy Herd Improvement Association² Includes milk hauling, Dairy Margin Coverage (DMC) insurance, federal promotion and cooperative fees.

Table 11. Pro forma cash flow statement for the 600-cow grazing dairy model.

	Year 1 (dollars)	Year 2 (dollars)	Year 3 (dollars)	Year 4 (dollars)	Year 5 (dollars)	5-year average (dollars)
CASH INFLOWS						
Milk sales	1,324,423	1,381,366	1,464,813	1,501,563	1,501,563	1,434,746
Livestock sales	134,853	126,892	129,861	132,395	132,975	131,395
Total cash inflows	1,459,276	1,508,259	1,594,674	1,633,958	1,634,538	1,566,141
CASH OUTFLOWS						
Purchased concentrates	321,289	316,041	319,216	322,243	323,276	320,413
Purchased hay	165,737	162,332	164,749	166,927	167,630	165,475
Hired labor (including benefits)	213,987	218,267	222,632	227,085	231,627	222,720
DHIA ¹ testing	7,200	7,200	7,200	7,200	7,200	7,200
Semen/breeding	10,200	10,200	10,200	10,200	10,200	10,200
Real estate/ personal property taxes	11,675	11,909	12,147	12,390	12,638	12,152
Milk marketing ²	90,466	94,356	100,056	101,787	101,787	97,690
Repairs	58,800	58,800	58,800	58,800	58,800	58,800
Vet/medicine	36,000	36,000	36,000	36,000	36,000	36,000
Parlor supplies	21,000	21,420	21,848	22,285	22,731	21,857
Utilities	27,000	27,540	28,091	28,653	29,226	28,102
Insurance	24,000	24,480	24,970	25,469	25,978	24,979
Fertilizer	44,550	45,441	46,350	47,277	48,222	46,368
Seed/spray	19,800	20,196	20,600	21,012	21,432	20,608
Custom hire	16,000	16,320	16,646	16,979	17,319	16,653
Truck and fuel	10,000	10,000	10,000	10,000	10,000	10,000
Fence/water	10,000	10,000	10,000	10,000	10,000	10,000
Other expenses	12,000	12,000	12,000	12,000	12,000	12,000
Total cash outflows	1,099,705	1,102,504	1,121,505	1,136,307	1,146,067	1,121,217
NET CASH FLOW	359,572	405,755	473,170	497,651	488,472	444,924

Notes

¹ Dairy Herd Improvement Association

² Includes milk hauling, Dairy Margin Coverage (DMC) insurance, federal promotion and cooperative fees.