

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. The model dairy described is designed to be a pasture-based dairy to use labor and capital as efficiently as possible. This dairy is designed to be located in an area where winter weather conditions and soil types allow cattle to be housed outside all year.

Farm description

In this model dairy, the farm is a carefully selected 460-acre piece of land purchased specifically for developing a grazing dairy. The 460-acre farm is purchased for \$2,000 per acre.

- 445 acres for paddocks (1.35 cows per acre) and 15 acres for farmstead and facilities.
- Permanent lanes, water lines and paddocks are established.
- A new swing-50 parabone parlor is built near the center of the farm.

Herd management

The beginning herd for this dairy is assumed to include only purchased crossbred dairy heifers. While the heifers will be purchased with an eye to selecting cattle types best suited for grazing, the genetics of the cattle are assumed to be unknown. Because U.S. dairies have only recently started deliberately crossbreeding cattle to produce milk under intensive rotational grazing systems, a higher cull rate is assumed at start-up. By the fifth year of operation, the cull rates are expected to have declined to their expected long-term average.

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, 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 gradually fall to 18 percent in year five. Death loss rate would be 4 percent in all years. The total herd turnover rate would be 29 percent in year one and then gradually fall with lower rates until reaching a steady state of 22 percent by year five.

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	20	18	18
Annual death loss (%)	4	4	4	4	4
Calving interval (months)	14.0	13.5	13.0	12.8	12.8

This entire dairy system is built around a seasonal grass-based dairy concept with a 12-month calving interval. However, when starting a dairy using purchased genetics selected for high production, there will be a few years of transition needed. For the first year of production, many heifers will enter the herd and not rebreed within the window to remain seasonal. They will be rebred eventually but outside the window necessary to calve seasonally. These animals will be sold as breeding stock to nonseasonal dairy producers. This allows the dairy to cull as needed for reproduction, without having to sell all the cull cows for slaughter.



Figure 1. Swing parabone dairy parlors are designed to promote production efficiency by emphasizing cow comfort, cow movement and efficient use of labor.

Written by

Joe L. Horner, Dairy Economist, Commercial Agriculture Program
Ryan Milhollin, Project Manager, Commercial Agriculture Program
Stacey A. Hamilton, State Dairy Specialist
Wayne Prewitt, West Central Region Agriculture Business Specialist
Tony Rickard, Southwest Region Dairy Specialist

The whole herd calving interval will drop as the hard breeders are selected out of the herd. By year four, the calving interval is expected to be 12.8 months. Further improvement can be expected as genetic crosses with higher reproductive performance continually enter the herd.

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 prices than those for Holsteins that are traditionally selected for their high milk production traits. In this model, all calves are to be sold within one week of birth to a contract heifer grower and later to be repurchased from the contract heifer grower. All replacement heifers will be purchased as needed for \$1,250 each. All heifer calves will be sold for \$250, and bull calves for \$75.

Table 2 shows annual milk production estimates and estimated rolling herd average. In the model, 95 percent of the total volume of milk is sold, and 5 percent from fresh or treated cows is discarded or consumed by calves.

Table 2. Daily milk production and rolling herd averages

Description	Year 1	Year 2	Year 3	Year 4	Year 5
Pounds per day	38.0	44.0	45.0	45.0	45.0
365-day rolling herd average	10,999	12,736	12,894	12,825	12,825

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. Ten pounds of concentrate costing \$200/ton delivered is fed to each cow in the parlor for the milking group. Five pounds of purchased hay or silage costing \$0.08/lb of dry matter is fed as needed throughout the year to the milking group. The dry cow group is being fed 5 pounds of concentrate costing \$0.09/lb and 20 pounds of purchased hay at \$0.045/lb as needed throughout the year.

Table 3. Daily purchased feed costs/cow for the milking period

Description	Cost/cow/day
Purchased concentrates	\$1.00
Purchased hay	\$0.40
Total feed cost	\$1.40

Table 4. Daily purchased feed costs/cow for the dry cow period

Description	Cost/cow/day
Purchased concentrates	\$0.45
Purchased hay	\$0.90
Total feed cost	\$1.35

Milk marketing

Financial projections in this model use a farm-level gross milk price of \$17.45 per hundredweight (cwt). This price

level is considered realistic based on long-term historical milk prices and relationships in Missouri (see Table 5). Justification of the price expectation is presented below. Marketing costs that are deducted from the gross milk price in the model include CWT (Cooperatives Working Together) program assessment (\$0.10/cwt), advertising (\$0.15/cwt), co-op fee (\$0.10/cwt) and hauling (\$0.80/cwt).

Table 5. Estimated Missouri milk price

Description	Milk price
Class III average	\$14.50
Long-term basis in Missouri	\$2.66
Hauling premium	\$0.09
Volume premium	\$0.20
Gross milk price per cwt	\$17.45

Labor management

A grazing dairy that milks two times daily will ideally plan to spend no more than 2.5 hours in the parlor per milking. Outsourcing of any necessary forage harvest and heifer development is used to keep labor costs low. A general manager will be employed at a salary of \$50,000 per year, and all other employees will be paid hourly at \$12 per hour. Benefits cost for labor is assumed to include only the employer's share of Social Security and Medicare taxes. A 2.5 percent inflation rate is built into all of the labor and operating expenses (see Table 6).

Table 6. Projected labor summary

Description	Year 1	Year 2	Year 3	Year 4	Year 5
Hired labor (hours)	10,400	10,400	10,400	10,400	10,400
Full-time equivalents (FTEs) (based on labor hours)	5.0	5.0	5.0	5.0	5.0
Pounds milk per FTE	1,265,563	1,451,853	1,469,942	1,462,050	1,462,050
Annual benefits	\$10,031	\$10,281	\$10,538	\$10,802	\$11,072
Total hourly labor	\$81,120	\$83,148	\$85,227	\$87,357	\$89,541
Total salaried labor	\$50,000	\$51,250	\$52,531	\$53,845	\$55,191
Total labor cost	\$141,151	\$144,679	\$148,296	\$152,004	\$155,804

Capital investments

Capital investments for this start-up operation are listed in Table 7. These investments include land, real estate, machinery, equipment and livestock. The total capital invested in the dairy will be \$2,752,478, or \$4,587 per cow. This includes all the minimum components necessary to make the dairy operational.

The financial success of grazing dairies depends upon keeping the capital investment and the operating expenses low. Careful farm selection is critical both to minimize the investment needed and to enabling future low operating costs. To avoid investments in livestock housing, the farm site 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.

Table 7. Capital investments for the 600-cow grazing dairy model

Description	Quantity	Cost/Unit	Investment
Land	460 acres	\$2,000	\$920,000
Dairy cows	600 cows	\$1,250	\$750,000
Buildings and farm setup			
Milking parlor, equipment, tank, holding area and office	100 stalls	\$5,600	\$560,000
Manure storage for parlor and holding area		\$80,000	\$80,000
Feed bins (15 tons each)	3 bins	\$6,000	\$18,000
Hay barn and equipment storage	9,600 ft	\$4	\$38,400
Lanes	26,400 ft	\$2.00	\$52,800
Watering system (without well and pump)	26,400 ft	\$1.50	\$39,600
Fencing and paddock setup	58,757 ft	\$0.75	\$44,068
Establishing new forages (fertilizer, seed, tillage)	445 acres	\$138.00	\$61,410
Machinery and equipment			
Tractor (130 HP MFWD)	1	\$79,200	\$79,200
Used tractor (60–75 HP with loader)	1	\$20,000	\$20,000
Pickup	1	\$25,000	\$25,000
ATV	2	\$4,500	\$9,000
Clipper mower	1	\$15,000	\$15,000
Silage feeding equipment	1	\$20,000	\$20,000
Other farm equipment	1	\$20,000	\$20,000
Total investment			\$2,752,478
Investment per cow			\$4,587

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-50 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. Most producers want a parlor large enough to allow them to complete each milking in 2.5 hours. Parabone swing parlors were used to promote production efficiency by emphasizing cow comfort, cow movement and efficient use of labor.

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 also included in the capital investments. These expenses include fertilizer, seed and tillage. Pastures can be seeded either on a prepared seedbed or by no-till drilling, depending on site conditions and crop requirements. Machinery investments include two tractors, pickup, ATVs, 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 \$1,327,927 per year in milk and young stock sales. This farm will have a profit of \$353,413 after all operating costs, labor and depreciation are deducted (see Tables 8–11). On a per cow basis, this is a gross operating income of \$2,213 per cow and a net operating income of \$589 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 \$432,304 available for principal and interest payments (\$353,413 net income + \$78,890 depreciation = \$432,304). On a per cow basis, this is equivalent to \$721 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.

Table 8. Financial measurements of the 600-cow grazing dairy model

	Year 1	Year 2	Year 3	Year 4	Year 5
Current ratio	1.81	4.67	4.67	4.67	4.67
Return on assets	8.3%	14.0%	14.5%	14.6%	14.7%
Operating expense ratio	69.6%	62.1%	61.7%	62.3%	62.8%
Depreciation expense ratio	11.5%	9.8%	9.5%	9.3%	9.3%
Net farm income from operations ratio	18.9%	28.1%	28.8%	28.4%	27.9%

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

	Herd	Per cow	Per cwt	Percent
INCOME FROM OPERATIONS				
Milk sales	\$1,240,950	\$2,068	\$17.45	93.5%
Sales of young stock and calves	\$86,978	\$145	\$1.22	6.5%
Total gross receipts	\$1,327,927	\$2,213	\$18.67	100.0%
OPERATING EXPENSES				
Feed				
Feedstuffs	\$304,279	\$507	\$4.28	28.5%
Total feed	\$304,279	\$507	\$4.28	28.5%
Herd replacement costs				
Depreciation—dairy cows	\$51,782	\$86	\$0.73	4.9%
Loss on sale of cows	\$32,679	\$54	\$0.46	3.1%
Total herd replacement costs	\$84,461	\$141	\$1.19	7.9%
OTHER OPERATING EXPENSES				
Cow expenses				
Hired labor (including benefits)	\$148,387	\$247	\$2.09	15.2%
DHIA ¹ testing	\$9,600	\$16	\$0.13	1.0%
Semen/breeding	\$18,000	\$30	\$0.25	1.8%
Real estate/personal property taxes	\$3,154	\$5	\$0.04	0.3%
Milk marketing ²	\$81,782	\$136	\$1.15	8.4%
Repairs/truck/fuel	\$36,000	\$60	\$0.51	3.7%
Vet/medicine	\$28,080	\$47	\$0.39	2.9%
Parlor supplies	\$27,627	\$46	\$0.39	2.8%
Utilities	\$33,935	\$57	\$0.48	3.5%
Insurance	\$7,884	\$13	\$0.11	0.8%
Other expenses	\$20,000	\$33	\$0.28	2.1%
Forage expenses				
Fertilizer	\$37,846	\$63	\$0.53	3.9%
Seed/spray	\$16,820	\$28	\$0.24	1.7%
Custom hire	\$12,615	\$21	\$0.18	1.3%
Fuel	\$10,000	\$17	\$0.14	1.0%
Real estate/ personal property taxes	\$3,154	\$5	\$0.04	0.3%
Fence/water	\$12,000	\$20	\$0.17	1.2%
Other expenses	\$0	\$0	\$0.00	0.0%
Depreciation	\$78,890	\$131	\$1.11	8.1%
Less other expenses for raising heifers	\$0	\$0	\$0.00	0.00%
Total other operating expenses	\$585,774	\$976	\$8.24	60.1%
TOTAL OPERATING EXPENSES	\$974,514	\$1,624	\$13.70	100.0%
NET INCOME FROM OPERATIONS	\$353,413	\$589	\$4.97	

Notes**1 Dairy Herd Improvement Association****2 Includes milk hauling, state and federal promotion, co-op or marketing fees and the cost of marketing beef.**

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

	Year 1	Year 2	Year 3	Year 4	Year 5	5-year average
CASH INFLOWS						
Farm cash receipts						
Milk sales	\$1,104,204	\$1,266,742	\$1,282,525	\$1,275,639	\$1,275,639	\$1,240,950
Livestock sales	\$194,400	\$183,934	\$178,200	\$170,929	\$170,929	\$179,678
TOTAL	\$1,298,603	\$1,450,676	\$1,460,724	\$1,446,568	\$1,446,568	\$1,420,628
CASH OUTFLOWS						
Cow expenses						
Purchased concentrates	\$194,957	\$194,067	\$193,108	\$192,600	\$192,600	\$193,466
Purchased hay	\$109,457	\$110,267	\$111,138	\$111,600	\$111,600	\$110,812
Hired labor (including benefits)	\$141,151	\$144,679	\$148,296	\$152,004	\$155,804	\$148,387
DHIA ¹ testing	\$9,600	\$9,600	\$9,600	\$9,600	\$9,600	\$9,600
Semen/breeding	\$18,000	\$18,000	\$18,000	\$18,000	\$18,000	\$18,000
Real estate/ personal property taxes	\$3,000	\$3,075	\$3,152	\$3,231	\$3,311	\$3,154
Milk marketing ²	\$72,770	\$83,482	\$84,522	\$84,068	\$84,068	\$81,782
Repairs/truck/fuel	\$36,000	\$36,000	\$36,000	\$36,000	\$36,000	\$36,000
Vet/medicine	\$28,080	\$28,080	\$28,080	\$28,080	\$28,080	\$28,080
Parlor supplies	\$26,280	\$26,937	\$27,610	\$28,301	\$29,008	\$27,627
Utilities	\$32,280	\$33,087	\$33,914	\$34,762	\$35,631	\$33,935
Insurance	\$7,500	\$7,688	\$7,880	\$8,077	\$8,279	\$7,884
Other expenses	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000
Total cow expenses	\$699,075	\$714,961	\$721,300	\$726,322	\$731,981	\$718,728
Forage expenses						
Fertilizer	\$36,000	\$36,900	\$37,823	\$38,768	\$39,737	\$37,846
Seed/spray	\$16,000	\$16,400	\$16,810	\$17,230	\$17,661	\$16,820
Custom hire	\$12,000	\$12,300	\$12,608	\$12,923	\$13,246	\$12,615
Fuel	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Real estate/ personal property taxes	\$3,000	\$3,075	\$3,152	\$3,231	\$3,311	\$3,154
Fence/water	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000
Total forage expenses	\$89,000	\$90,675	\$92,392	\$94,152	\$95,955	\$92,435
Capital purchases						
Breeding livestock	\$217,499	\$195,003	\$180,000	\$165,000	\$165,000	\$184,500
TOTAL	\$1,005,574	\$1,000,638	\$993,692	\$985,473	\$992,937	\$995,663
NET CASH FLOW	\$293,030	\$450,037	\$467,032	\$461,094	\$453,631	\$424,965

Notes

1 Dairy Herd Improvement Association

2 Includes milk hauling, state and federal promotion, co-op or marketing fees and the cost of marketing beef.

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

	Year 1	Year 2	Year 3	Year 4	Year 5	5-year average
GROSS REVENUE						
Milk sales	\$1,104,204	\$1,266,742	\$1,282,525	\$1,275,639	\$1,275,639	\$1,240,950
Calves and heifers sold	\$81,900	\$84,933	\$88,200	\$89,929	\$89,929	\$86,978
Total gross revenue	\$1,186,103	\$1,351,675	\$1,370,724	\$1,365,568	\$1,365,568	\$1,327,927
OPERATING EXPENSES						
Purchased concentrates	\$194,957	\$194,067	\$193,108	\$192,600	\$192,600	\$193,466
Purchased hay	\$109,457	\$110,267	\$111,138	\$111,600	\$111,600	\$110,812
Total operating expenses	\$304,414	\$304,333	\$304,246	\$304,200	\$304,200	\$304,279
HERD REPLACEMENT COSTS						
Depreciation—dairy cows	\$57,663	\$53,858	\$51,097	\$48,148	\$48,148	\$51,782
Loss on sale of cows	\$37,558	\$34,096	\$31,935	\$29,902	\$29,902	\$32,679
Total herd replacement costs	\$95,221	\$87,954	\$83,032	\$78,049	\$78,049	\$84,461
OTHER OPERATING EXPENSES						
Cow expenses						
Hired labor (includes benefits)	\$141,151	\$144,679	\$148,296	\$152,004	\$155,804	\$148,387
DHIA ¹ testing	\$9,600	\$9,600	\$9,600	\$9,600	\$9,600	\$9,600
Semen/breeding	\$18,000	\$18,000	\$18,000	\$18,000	\$18,000	\$18,000
Real estate/personal property taxes	\$3,000	\$3,075	\$3,152	\$3,231	\$3,311	\$3,154
Milk marketing ²	\$72,770	\$83,482	\$84,522	\$84,068	\$84,068	\$81,782
Repairs/truck/fuel	\$36,000	\$36,000	\$36,000	\$36,000	\$36,000	\$36,000
Vet/medicine	\$28,080	\$28,080	\$28,080	\$28,080	\$28,080	\$28,080
Parlor supplies	\$26,280	\$26,937	\$27,610	\$28,301	\$29,008	\$27,627
Utilities	\$32,280	\$33,087	\$33,914	\$34,762	\$35,631	\$33,935
Insurance	\$7,500	\$7,688	\$7,880	\$8,077	\$8,279	\$7,884
Other expenses	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000
Total cow expenses	\$394,661	\$410,628	\$417,054	\$422,122	\$427,781	\$414,449
Forage expenses						
Fertilizer	\$36,000	\$36,900	\$37,823	\$38,768	\$39,737	\$37,846
Seed/spray	\$16,000	\$16,400	\$16,810	\$17,230	\$17,661	\$16,820
Custom hire	\$12,000	\$12,300	\$12,608	\$12,923	\$13,246	\$12,615
Fuel	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Real estate/personal property taxes	\$3,000	\$3,075	\$3,152	\$3,231	\$3,311	\$3,154
Fence/water	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000
Total forage expenses	\$89,000	\$90,675	\$92,392	\$94,152	\$95,955	\$92,435
Depreciation (buildings and equipment)	\$78,890	\$78,890	\$78,890	\$78,890	\$78,890	\$78,890
Less other expenses for raising heifers	\$0	\$0	\$0	\$0	\$0	\$0
Total other operating expenses	\$562,551	\$580,193	\$588,336	\$595,164	\$602,627	\$585,774
TOTAL OPERATING EXPENSES	\$962,186	\$972,480	\$975,615	\$977,413	\$984,876	\$974,514
INCOME BEFORE FINANCING COSTS	\$223,917	\$379,195	\$395,109	\$388,155	\$380,692	\$353,413
NET INCOME (LOSS)	\$223,917	\$379,195	\$395,109	\$388,155	\$380,692	\$353,413

Notes**1 Dairy Herd Improvement Association****2 Includes milk hauling, state and federal promotion, co-op or marketing fees and the cost of marketing beef.**

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