

Starting a 150-Cow Intensive Rotational Grazing Dairy

This guide examines the financial feasibility of starting a 150-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 120-acre piece of land purchased specifically for developing a grazing dairy. The 120-acre farm is purchased for \$2,000 per acre.

- 111 acres for paddocks (1.35 cows per acre) and 9 acres for farmstead and facilities.
- Permanent lanes, water lines and paddocks are established.
- No irrigation or winter housing is planned.
- A new swing-12 parabolic 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)	150	150	150	150	150
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



Figure 1. 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.

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reproduction, without having to sell all the cull cows for slaughter.

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 \$17.24 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	\$0.08
Gross milk price per cwt	\$17.24

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 husband and wife team will receive a salary of \$40,000, and one part-time employee will be paid hourly at \$12 per hour for 20 hours a week. 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)	5,408	5,408	5,408	5,408	5,408
Full-time equivalents (FTEs) (based on labor hours)	2.6	2.6	2.6	2.6	2.6
Pounds milk per FTE	608,444	698,006	706,703	702,909	702,909
Annual benefits	\$4,015	\$4,115	\$4,218	\$4,323	\$4,431
Total hourly labor	\$12,480	\$12,792	\$13,112	\$13,440	\$13,776
Total salaried labor	\$40,000	\$41,000	\$42,025	\$43,076	\$44,153
Total labor cost	\$56,495	\$57,907	\$59,355	\$60,839	\$62,360

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 \$832,632, or \$5,551 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 150-cow grazing dairy model

Description	Quantity	Cost/Unit	Investment
Land	120 acres	\$2,000	\$240,000
Dairy cows	150 cows	\$1,250	\$187,500
Buildings and farm setup			
Milking parlor, equipment, tank, holding area and office	24 stalls	\$5,600	\$134,400
Manure storage for parlor and holding area		\$40,000	\$40,000
Feed bins (15 tons each)	2 bins	\$6,000	\$12,000
Hay barn and equipment storage	5,000 ft	\$4	\$20,000
Lanes	9,504 ft	\$2.00	\$19,008
Watering system (without well and pump)	9,504 ft	\$1.50	\$14,256
Fencing and paddock setup	34,200 ft	\$0.75	\$25,650
Establishing new forages (fertilizer, seed, tillage)	111 acres	\$138.00	\$15,318
Machinery and equipment			
Tractor	1	\$40,000	\$40,000
Pickup	1	\$25,000	\$25,000
ATV	1	\$4,500	\$4,500
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			\$832,632
Investment per cow			\$5,551

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-12 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 a tractor, pickup, ATV, silage feed wagon and other farm equipment. Other facility investments include equipment storage, hay barn and feed bins.

Financial analysis and statements

The 150-cow model dairy will gross \$328,248 per year in milk and young stock sales. This farm will have a profit of \$47,842 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 \$2,188 per cow and a net operating income of \$319 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 \$82,048 available for principal and interest payments (\$47,842 net income + \$34,206 depreciation = \$82,048). On a per cow basis, this is equivalent to \$547 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 150-cow grazing dairy model

	Year 1	Year 2	Year 3	Year 4	Year 5
Current ratio	1.83	4.67	4.67	4.67	4.67
Return on assets	21%	6.9%	7.4%	7.4%	7.4%
Operating expense ratio	77.6%	69.3%	69.0%	69.7%	70.5%
Depreciation expense ratio	16.6%	14.3%	13.9%	13.7%	13.7%
Net farm income from operations ratio	5.8%	16.4%	17.2%	16.6%	15.8%

Table 9. Dairy enterprise budget for the 150-cow grazing dairy model (5-year average)

	Herd	Per cow	Per cwt	Percent
INCOME FROM OPERATIONS				
Milk sales	\$306,504	\$2,043	\$17.24	93.4%
Sales of young stock and calves	\$21,744	\$145	\$1.22	6.6%
Total gross receipts	\$328,248	\$2,188	\$18.46	100.0%
OPERATING EXPENSES				
Feed				
Feedstuffs	\$76,070	\$507	\$4.28	27.1%
Total feed	\$76,070	\$507	\$4.28	27.1%
Herd replacement costs				
Depreciation—dairy cows	\$12,946	\$86	\$0.73	4.6%
Loss on sale of cows	\$8,170	\$54	\$0.46	2.9%
Total herd replacement costs	\$21,116	\$141	\$1.19	7.5%
OTHER OPERATING EXPENSES				
Cow expenses				
Hired labor (including benefits)	\$59,391	\$396	\$3.34	21.2%
DHIA ¹ testing	\$2,400	\$16	\$0.13	0.9%
Semen/breeding	\$4,500	\$30	\$0.25	1.6%
Real estate/personal property taxes	\$788	\$5	\$0.04	0.3%
Milk marketing ²	\$20,445	\$136	\$1.15	7.3%
Repairs/truck/fuel	\$9,000	\$60	\$0.51	3.2%
Vet/medicine	\$7,020	\$47	\$0.39	2.5%
Parlor supplies	\$6,907	\$46	\$0.39	2.5%
Utilities	\$8,484	\$57	\$0.48	3.0%
Insurance	\$1,971	\$13	\$0.11	0.7%
Other expenses	\$5,000	\$33	\$0.28	1.8%
Forage expenses				
Fertilizer	\$9,461	\$63	\$0.53	3.4%
Seed/spray	\$4,205	\$28	\$0.24	1.5%
Custom hire	\$3,154	\$21	\$0.18	1.1%
Fuel	\$2,500	\$17	\$0.14	0.9%
Real estate/ personal property taxes	\$788	\$5	\$0.04	0.3%
Fence/water	\$3,000	\$20	\$0.17	1.1%
Depreciation	\$34,206	\$228	\$1.92	12.2%
Total other operating expenses	\$183,221	\$1,221	\$10.31	65.3%
TOTAL OPERATING EXPENSES	\$280,407	\$1,869	\$15.77	100.0%
NET INCOME FROM OPERATIONS	\$47,842	\$319	\$2.69	

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 150-cow grazing dairy model

	Year 1	Year 2	Year 3	Year 4	Year 5	5-year average
CASH INFLOWS						
Farm cash receipts						
Milk sales	\$272,729	\$312,874	\$316,773	\$315,072	\$315,072	\$306,504
Livestock sales	\$48,600	\$45,984	\$44,550	\$42,732	\$42,732	\$44,920
TOTAL	\$321,329	\$358,858	\$361,322	\$357,804	\$357,804	\$351,423
CASH OUTFLOWS						
Cow expenses						
Purchased concentrates	\$48,739	\$48,517	\$48,277	\$48,150	\$48,150	\$48,367
Purchased hay	\$27,364	\$27,567	\$27,785	\$27,900	\$27,900	\$27,703
Hired labor (including benefits)	\$56,495	\$57,907	\$59,355	\$60,839	\$62,360	\$59,391
DHIA ¹ testing	\$2,400	\$2,400	\$2,400	\$2,400	\$2,400	\$2,400
Semen/breeding	\$4,500	\$4,500	\$4,500	\$4,500	\$4,500	\$4,500
Real estate/ personal property taxes	\$750	\$769	\$788	\$808	\$828	\$788
Milk marketing ²	\$18,192	\$20,870	\$21,130	\$21,017	\$21,017	\$20,445
Repairs/truck/fuel	\$9,000	\$9,000	\$9,000	\$9,000	\$9,000	\$9,000
Vet/medicine	\$7,020	\$7,020	\$7,020	\$7,020	\$7,020	\$7,020
Parlor supplies	\$6,570	\$6,734	\$6,903	\$7,075	\$7,252	\$6,907
Utilities	\$8,070	\$8,272	\$8,479	\$8,691	\$8,908	\$8,484
Insurance	\$1,875	\$1,922	\$1,970	\$2,019	\$2,070	\$1,971
Other expenses	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000
Total cow expenses	\$195,976	\$200,477	\$202,606	\$204,418	\$206,404	\$201,976
Forage expenses						
Fertilizer	\$9,000	\$9,225	\$9,456	\$9,692	\$9,934	\$9,461
Seed/spray	\$4,000	\$4,100	\$4,203	\$4,308	\$4,415	\$4,205
Custom hire	\$3,000	\$3,075	\$3,152	\$3,231	\$3,311	\$3,154
Fuel	\$2,500	\$2,500	\$2,500	\$2,500	\$2,500	\$2,500
Real estate/ personal property taxes	\$750	\$769	\$788	\$808	\$828	\$788
Fence/water	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000
Total forage expenses	\$22,250	\$22,669	\$23,098	\$23,538	\$23,989	\$23,109
Capital purchases						
Breeding livestock	\$54,374	\$48,753	\$45,000	\$41,250	\$41,250	\$46,125
TOTAL	\$272,600	\$271,899	\$270,704	\$269,206	\$271,643	\$271,210
NET CASH FLOW	\$48,729	\$86,960	\$90,619	\$88,598	\$86,161	\$80,213

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 150-cow grazing dairy model

	Year 1	Year 2	Year 3	Year 4	Year 5	5-year average
GROSS REVENUE						
Milk sales	\$272,729	\$312,874	\$316,773	\$315,072	\$315,072	\$306,504
Calves and heifers sold	\$20,475	\$21,233	\$22,050	\$22,482	\$22,482	\$21,744
Total gross revenue	\$293,204	\$334,108	\$338,822	\$337,554	\$337,554	\$328,248
OPERATING EXPENSES						
Purchased concentrates	48,739	48,517	48,277	48,150	48,150	\$48,367
Purchased hay	27,364	27,567	27,785	27,900	27,900	\$27,703
Total operating expenses	\$76,104	\$76,083	\$76,062	\$76,050	\$76,050	\$76,070
HERD REPLACEMENT COSTS						
Depreciation—dairy cows	\$14,416	\$13,465	\$12,774	\$12,037	\$12,037	\$12,946
Loss on sale of cows	\$9,390	\$8,525	\$7,984	\$7,475	\$7,475	\$8,170
Total herd replacement costs	\$23,805	\$21,990	\$20,758	\$19,512	\$19,512	\$21,116
OTHER OPERATING EXPENSES						
Cow expenses						
Hired labor (includes benefits)	\$56,495	\$57,907	\$59,355	\$60,839	\$62,360	\$59,391
DHIA ¹ testing	\$2,400	\$2,400	\$2,400	\$2,400	\$2,400	\$2,400
Semen/breeding	\$4,500	\$4,500	\$4,500	\$4,500	\$4,500	\$4,500
Real estate/personal property taxes	\$750	\$769	\$788	\$808	\$828	\$788
Milk marketing ²	\$18,192	\$20,870	\$21,130	\$21,017	\$21,017	\$20,445
Repairs/truck/fuel	\$9,000	\$9,000	\$9,000	\$9,000	\$9,000	\$9,000
Vet/medicine	\$7,020	\$7,020	\$7,020	\$7,020	\$7,020	\$7,020
Parlor supplies	\$6,570	\$6,734	\$6,903	\$7,075	\$7,252	\$6,907
Utilities	\$8,070	\$8,272	\$8,479	\$8,691	\$8,908	\$8,484
Insurance	\$1,875	\$1,922	\$1,970	\$2,019	\$2,070	\$1,971
Other expenses	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000
Total cow expenses	\$119,872	\$124,394	\$126,544	\$128,368	\$130,354	\$125,907
Forage expenses						
Fertilizer	\$9,000	\$9,225	\$9,456	\$9,692	\$9,934	\$9,461
Seed/spray	\$4,000	\$4,100	\$4,203	\$4,308	\$4,415	\$4,205
Custom hire	\$3,000	\$3,075	\$3,152	\$3,231	\$3,311	\$3,154
Fuel	\$2,500	\$2,500	\$2,500	\$2,500	\$2,500	\$2,500
Real estate/personal property taxes	\$750	\$769	\$788	\$808	\$828	\$788
Fence/water	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000
Total forage expenses	\$22,250	\$22,669	\$23,098	\$23,538	\$23,989	\$23,109
Depreciation (buildings and equipment)	\$34,206	\$34,206	\$34,206	\$34,206	\$34,206	\$34,206
Total other operating expenses	\$176,328	\$181,269	\$183,848	\$186,112	\$188,549	\$183,221
TOTAL OPERATING EXPENSES	\$276,237	\$279,342	\$280,668	\$281,674	\$284,111	\$280,407
INCOME BEFORE FINANCING COSTS	\$16,967	\$54,766	\$58,155	\$55,880	\$53,443	\$47,842
NET INCOME (LOSS)	\$16,967	\$54,766	\$58,155	\$55,880	\$53,443	\$47,842

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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