

Missouri 150-Cow Grazing Dairy Model

Financial feasibility of a startup 150-cow intensive rotational grazing dairy



Example of a swing parlor

Authors:

Joe L. Horner, Dairy Economist, Commercial Ag Program, University of Missouri Extension
Ryan Milhollin, Project Manager, Commercial Ag Program, University of Missouri Extension
Stacey A. Hamilton, SW Region Dairy Specialist, University of Missouri Extension
Wayne Prewitt, WC Region Ag Business Specialist, University of Missouri Extension
Tony Rickard, SW Region Dairy Specialist, University of Missouri Extension

September 2007

UNIVERSITY OF MISSOURI
 Extension

This paper examines the financial feasibility of a startup 150-cow intensive rotational grazing dairy in Missouri. The model dairy described is designed from the beginning 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 that is purchased specifically for developing a grazing dairy. A 120-acre farm is purchased for \$2,000/acre.

- 111 acres for paddocks (1.35 cows per acre) and 9 acres for farmstead/facilities.
- Permanent lanes, water lines, and paddocks are established
- No irrigation or winter housing is planned.
- A new swing-12 parabone parlor is built in the farm's center.

Careful farm selection is critical both to the amount of investment needed and to enable future low operating costs. To avoid investments in livestock housing, the farm site must have well drained soils with some timber or brush for cover during the worst winter conditions. To keep feed costs low, the dairy needs mostly open ground with productive soils that can be managed for high producing pastures which can be replanted with annual forage and improved perennial forage varieties.

Herd Management

The beginning herd for this dairy is assumed to be made up of 100% purchased crossbred dairy heifers. While the heifers will be purchased with an eye toward selecting cattle type’s best suited for grazing, the genetics of the cattle are assumed to be unknown. Because U.S. dairies have only recently started deliberately cross breeding cattle to produce milk under intensive rotational grazing systems, a higher cull rate is assumed at startup. By the fifth year of operation, the cull rates are expected to have declined to their expected long term average.

Cows were expected to be culled from the herd based upon involuntary factors (death, disease, problem breeders, etc.) and voluntary factors (low milk production, disposition, etc.). Projected cow culling rates, death losses and the calving interval for the next five years are listed in the following table. It is assumed that the average cull rate (voluntary and involuntary) would be 25 percent in the first year and gradually fall to 18 percent in year 5 as problems. Death loss rate would be 4 percent in all years. The total herd turnover rate would be 29 percent in year 1 and then gradually fall with lower rates until reaching a steady state of 22 percent by year 5.

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 (percent)	25	22	20	18	18
Annual death loss (percent)	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 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 non-seasonal dairymen. This allows the dairy to cull as needed for reproduction, without having to sell all the cull cows for slaughter.

Over time, 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 down to 12.8 months. Further improvement may be expected as genetic crosses with higher reproductive performance continually enter the herd.

Crossbred dairy cows are utilized in this grazing dairy system because of their ability to better utilize pasture, higher reproductivity, and overall hybrid vigor. They typically can be purchased for lower prices than traditional Holsteins that are 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 repurchased back from the contract heifer grower. All replacement heifers will be purchased as needed for \$1,600 each. All heifer calves will be sold for \$300 and bull calves for \$75.

Annual milk production estimates and estimated rolling herd average are depicted in the following table. In the model, 95% of that volume of milk is being sold and 5% from fresh or treated cows being dumped 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	46.0	48.0	49.0
365 day rolling herd avg.	10,999	12,736	13,181	13,680	13,965

Supplementary feeds are designed to complement the characteristics of the pasture forage at a reasonable cost. Hay and concentrate are purchased in the dairy model. Twelve pounds of concentrate costing \$180/ton delivered is fed per cow in the parlor for the milking group. Five pounds of purchased forage dry matter costing \$0.07/lb. of dry matter is fed as needed throughout the year to the milking group. The dry cow group is being fed 5 lbs of concentrate costing \$0.06/lb. and 20 lbs of purchased hay @ \$0.045/lb as needed throughout the year.

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

Description	Cost/Cow/Day
Purchased concentrates	\$1.08
Purchased hay	\$0.35
Feed cost/cow/day:	\$1.43

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

Description	Cost/Cow/Day
Purchased concentrates	\$0.30
Purchased hay	\$0.90
Feed cost/cow/day:	\$1.20

Milk Marketing

A \$14.70 farm level gross milk price was used in the financial projections. This price level is considered realistic, neither optimistic nor pessimistic based upon long term historical milk prices and relationships in Missouri. Justification of the price expectation is presented below. Marketing costs that are deducted from the gross milk price in the model include advertising (\$0.15/cwt), coop fee (\$0.10/cwt.) and hauling (\$0.65/cwt.).

Table 5. Estimated Missouri milk price

Description	Milk Price
Class III average	\$12.45
Long term basis in Missouri	\$1.50
Cell count premium	\$0.25
Component premium	\$0.50
Gross milk price per cwt.	\$14.70

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 family draw salary of \$40,000 and one part-time employee will be paid hourly at \$12.00 per hour for 20 hours/week. Benefits cost for all labor is assumed to include only the employer's share of Social Security and Medicare taxes. A 2.5% inflation rate is built into all of the labor and operating expenses.

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
# of FTE (based on labor hours)	2.6	2.6	2.6	2.6	2.6
Lbs milk per FTE	608,444	698,006	722,408	749,769	765,389
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 the following table. These investments include land, real estate, machinery, equipment and livestock. The total capital invested in the dairy will be \$876,582 or \$5,844 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 the amount of 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 which 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	\$1,600	\$240,000
<u>Buildings and Farm Setup</u>			
Milking parlor, equipment, tank, holding area and office	24 stalls	\$5,600	\$134,400
Manure storage structure for parlor and holding area		\$40,000	\$40,000
Feed bins (15 ton)	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.	\$0.50	\$17,100
Establishing new forages (fert, seed, tillage)	111 acres	\$138.00	\$15,318
<u>Machinery and Equipment</u>			
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			\$876,582
Investment per cow			\$5,844

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 takeoffs. The basic philosophy of most graziers carries over to the milking parlor. They want a facility that is inexpensive, very efficient and can be updated or improved as cash flow permits. Bottom line, most producers want a parlor large enough to allow them to complete each milking in 2.5 hours. Parabone swing parlors were used in order to promote production efficiency by emphasizing cow comfort, cow movement and efficient labor usage.

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 waterlines and permanently installed stock tanks.

Initial expenses of forage establishment are also factored 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 feeding 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 \$295,994 per year in milk and young stock sales. This farm nets \$12,580 after all operating costs, labor, and depreciation are deducted. On a per cow basis, this is a gross operating income of \$1,973 per cow and a net operating income of \$84 per cow, after labor and depreciation are deducted.

The 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 will support. Adding net income from operations plus the building and machinery depreciation yields a free cash flow of \$46,216 available for principal and interest payments, (\$12,580 net income + \$33,636 depreciation = \$46,216). On a per cow basis this is equivalent to \$308 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 the lenders 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	2.15	4.67	4.67	4.67	4.67
Return on assets	-2.9%	1.1%	2.3%	3.6%	4.1%
Operating expense ratio	87.5%	78.0%	76.0%	74.0%	73.5%
Depreciation expense ratio	21.9%	18.7%	17.7%	16.7%	16.4%
Net farm income from operations ratio	-9.6%	3.1%	6.1%	9.1%	9.9%

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	\$270,905	\$1,806	\$14.70	91.5%
Sales of youngstock & calves	\$25,090	\$167	\$1.36	8.5%
Total Gross Receipts	\$295,994	\$1,973	\$16.06	100.0%
OPERATING EXPENSES:				
Feed:				
Feedstuffs	\$75,623	\$504	\$4.10	26.7%
Less feed for heifers	\$0	\$0	\$0.00	0.0%
Total feed	\$75,623	\$504	\$4.10	26.7%
Herd replacement costs:				
Depreciation--dairy cows	\$20,066	\$134	\$1.09	7.1%
Loss on sale of cows	\$10,638	\$71	\$0.58	3.8%
Total herd replacement costs	\$30,704	\$205	\$1.67	10.8%
Other operating expenses:				
Cow expenses				
Hired labor (including benefits)	\$59,391	\$396	\$3.22	21.0%
Rent	\$540	\$4	\$0.03	0.2%
DHIA testing	\$1,500	\$10	\$0.04	0.5%
Semen/breeding	\$1,980	\$13	\$0.11	0.7%
Real estate/P.P. taxes	\$1,041	\$7	\$0.06	0.4%
Milk marketing 1/	\$16,586	\$111	\$0.90	5.9%
Repairs/truck/fuel	\$9,000	\$60	\$0.49	3.2%
Vet/medicine	\$7,020	\$47	\$0.38	2.5%
Parlor supplies	\$7,065	\$47	\$0.38	2.5%
Utilities	\$8,137	\$54	\$0.44	2.9%
Insurance	\$3,343	\$22	\$0.18	1.2%
Other expenses	\$5,070	\$34	\$0.28	1.8%
Forage Expenses				
Rent	\$0	\$0	\$0.00	0.0%
Fertilizer	\$9,051	\$60	\$0.49	3.2%
Seed/spray	\$4,289	\$29	\$0.23	1.5%
Custom hire	\$3,154	\$21	\$0.17	1.1%
Fuel	\$2,430	\$16	\$0.13	0.9%
Real estate/P.P. taxes	\$915	\$6	\$0.05	0.3%
Fence/water	\$2,940	\$20	\$0.16	1.0%
Other expenses	\$0	\$0	\$0.00	0.0%
Depreciation	\$33,636	\$224	\$1.83	11.9%
Less other expenses for raising heifers	\$0	\$0	\$0.00	0.00%
Total other operating expenses	\$177,087	\$1,181	\$9.61	62.5%
TOTAL OPERATING EXPENSES	\$283,414	\$1,889	\$15.38	100.0%
NET INCOME FROM OPERATIONS	\$12,580	\$84	\$0.68	
1/ Includes milk hauling, state and federal promotion, coop/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	\$232,547	\$266,778	\$276,104	\$286,562	\$292,532	\$270,905
Livestock sales	\$54,562	\$51,726	\$50,192	\$48,216	\$48,216	\$50,582
TOTAL	\$287,110	\$318,504	\$326,296	\$334,778	\$340,748	\$321,487
CASH OUTFLOWS						
Cow Expenses						
Purchased concentrates	\$50,606	\$50,290	\$49,950	\$49,770	\$49,770	\$50,077
Purchased hay	\$25,173	\$25,396	\$25,636	\$25,763	\$25,763	\$25,546
Hired labor (including benefits)	\$56,495	\$57,907	\$59,355	\$60,839	\$62,360	\$59,391
Rent	\$540	\$540	\$540	\$540	\$540	\$540
DHIA testing	\$1,500	\$1,500	\$1,500	\$1,500	\$1,500	\$1,500
Semen/breeding	\$1,980	\$1,980	\$1,980	\$1,980	\$1,980	\$1,980
Real estate/P.P. taxes	\$990	\$1,015	\$1,040	\$1,066	\$1,093	\$1,041
Milk marketing 1/	\$14,238	\$16,333	\$16,904	\$17,545	\$17,910	\$16,586
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	\$6,720	\$6,888	\$7,060	\$7,237	\$7,418	\$7,065
Utilities	\$7,740	\$7,934	\$8,132	\$8,335	\$8,544	\$8,137
Insurance	\$3,180	\$3,260	\$3,341	\$3,425	\$3,510	\$3,343
Other expenses	\$5,070	\$5,070	\$5,070	\$5,070	\$5,070	\$5,070
Total cow expenses	\$190,251	\$194,132	\$196,528	\$199,088	\$201,476	\$196,295
Forage Expenses						
Rent	\$0	\$0	\$0	\$0	\$0	\$0
Fertilizer	\$8,610	\$8,825	\$9,046	\$9,272	\$9,504	\$9,051
Seed/spray	\$4,080	\$4,182	\$4,287	\$4,394	\$4,504	\$4,289
Custom hire	\$3,000	\$3,075	\$3,152	\$3,231	\$3,311	\$3,154
Fuel	\$2,430	\$2,430	\$2,430	\$2,430	\$2,430	\$2,430
Real estate/P.P. taxes	\$870	\$892	\$914	\$937	\$960	\$915
Fence/water	\$2,940	\$2,940	\$2,940	\$2,940	\$2,940	\$2,940
Other expenses	\$0	\$0	\$0	\$0	\$0	\$0
Total forage expenses	\$21,930	\$22,344	\$22,768	\$23,203	\$23,649	\$22,779
Capital purchases:						
Breeding livestock	\$69,598	\$62,403	\$57,600	\$52,800	\$52,800	\$59,040
TOTAL	\$281,780	\$278,879	\$276,896	\$275,092	\$277,925	\$278,114
NET CASH FLOW	\$5,330	\$39,625	\$49,400	\$59,686	\$62,822	\$43,373
1/ Includes milk hauling, state and federal promotion, coop/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	\$232,547	\$266,778	\$276,104	\$286,562	\$292,532	\$270,905
Crops sold	\$0	\$0	\$0	\$0	\$0	\$0
Calves & heifers sold	\$23,625	\$24,500	\$25,442	\$25,941	\$25,941	\$25,090
Total gross revenue	\$256,172	\$291,278	\$301,546	\$312,503	\$318,473	\$295,994
OPERATING EXPENSES:						
Purchased concentrates	50,606	50,290	49,950	49,770	49,770	\$50,077
Purchased hay	25,173	25,396	25,636	25,763	25,763	\$25,546
Less feed for heifers	\$0	\$0	\$0	\$0	\$0	\$0
Total operating expenses	\$75,779	\$75,686	\$75,586	\$75,533	\$75,533	\$75,623
HERD REPLACEMENT COSTS						
Depreciation--dairy cows	\$22,344	\$20,870	\$19,800	\$18,657	\$18,657	\$20,066
Loss on sale of cows	\$12,529	\$11,188	\$10,350	\$9,562	\$9,562	\$10,638
Total herd replacement costs	\$34,873	\$32,059	\$30,150	\$28,219	\$28,219	\$30,704
OTHER OPERATING EXPENSES						
Cow expenses						
Hired labor (includes benefits)	\$56,495	\$57,907	\$59,355	\$60,839	\$62,360	\$59,391
DHIA testing	\$1,500	\$1,500	\$1,500	\$1,500	\$1,500	\$1,500
Semen/breeding	\$1,980	\$1,980	\$1,980	\$1,980	\$1,980	\$1,980
Real estate/P.P. taxes	\$990	\$1,015	\$1,040	\$1,066	\$1,093	\$1,041
Milk marketing 1/	\$14,238	\$16,333	\$16,904	\$17,545	\$17,910	\$16,586
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	\$6,720	\$6,888	\$7,060	\$7,237	\$7,418	\$7,065
Utilities	\$7,740	\$7,934	\$8,132	\$8,335	\$8,544	\$8,137
Insurance	\$3,180	\$3,260	\$3,341	\$3,425	\$3,510	\$3,343
Other expenses	\$5,070	\$5,070	\$5,070	\$5,070	\$5,070	\$5,070
Total cow expenses	\$113,932	\$117,906	\$120,402	\$123,016	\$125,404	\$120,132
Forage Expenses						
Fertilizer	\$8,610	\$8,825	\$9,046	\$9,272	\$9,504	\$9,051
Seed/spray	\$4,080	\$4,182	\$4,287	\$4,394	\$4,504	\$4,289
Custom hire	\$3,000	\$3,075	\$3,152	\$3,231	\$3,311	\$3,154
Fuel	\$2,430	\$2,430	\$2,430	\$2,430	\$2,430	\$2,430
Real estate/P.P. taxes	\$870	\$892	\$914	\$937	\$960	\$915
Fence/water	\$2,940	\$2,940	\$2,940	\$2,940	\$2,940	\$2,940
Other expenses	\$0	\$0	\$0	\$0	\$0	\$0
Total forage expenses	\$21,930	\$22,344	\$22,768	\$23,203	\$23,649	\$22,779
Depreciation (buildings & equipment)	\$33,636	\$33,636	\$33,636	\$33,636	\$33,636	\$33,636
Less other expenses for raising heifers	\$0	\$0	\$0	\$0	\$0	\$0
Total other operating expenses	\$169,498	\$173,886	\$176,807	\$179,855	\$182,689	\$176,547
TOTAL OPERATING EXPENSES	\$280,151	\$281,631	\$282,542	\$283,607	\$286,441	\$282,874
INCOME BEFORE FINANCING COSTS	(\$23,979)	\$9,647	\$19,004	\$28,896	\$32,032	\$13,120
Interest and rent expense	\$540	\$540	\$540	\$540	\$540	\$540
NET INCOME (LOSS)	(\$24,519)	\$9,107	\$18,464	\$28,356	\$31,492	\$12,580
1/ Includes milk hauling, state and federal promotion, coop/marketing fees, and the cost of marketing beef.						