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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. Data presented here reflect costs and conditions as of June 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.

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 apply to operations throughout the United States.

Farm description

In this model dairy, the farm is a carefully selected 200-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 farm is purchased for $3,500 per acre.

- 180 acres for paddocks
  - 1 cow per acre for 150 cows
  - 30 acres for raising heifers
- 20 acres for farmstead and facilities
- Permanent lanes, water lines and paddocks are established
- No irrigation or winter housing is planned
- The farm is 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, 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. 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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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. All bull calves will be sold for $120 each, reflecting a price of mixed crossbred bull calves from dairy and beef sires.

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	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 annual milk production estimates and estimated rolling herd average. 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. Ten pounds of concentrate costing $280/ton delivered is fed to each cow in the parlor for the milking group. Five pounds of purchased hay or silage costing $0.10/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 $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	1.40
Purchased hay	0.50
Total feed cost	1.90

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 ($0.85/cwt).

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 is used to keep labor costs low. A husband and wife team will be employed at a salary of $42,000 per year, and one part-time employee will be paid $15.50 per hour for 28 hours per week. Benefits cost for labor include only the employer's share of Social Security and Medicare taxes. 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 (FTEs) (from labor hours)	2.8	2.8	2.8	2.8	2.8
Pounds milk per FTE	646,186	673,969	714,683	727,051	727,051
Annual benefits	4,939	5,038	5,139	5,242	5,347
Total hourly labor	22,568	23,019	23,480	23,949	24,428
Total salaried labor	42,000	42,840	43,697	44,571	45,462
Total labor cost	69,507	70,898	72,316	73,762	75,237

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 $1,327,996 ($8,853 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	200 acres	3,500	700,000
Dairy cows	150 cows	1,100	165,000
Heifers (1 year old)	43 heifers	400	17,200
Buildings and farm setup			
Milking parlor, equipment, tank, holding area and office	24 stalls	7,000	168,000
Manure storage			40,000
Feed bins (15 tons each)	2 bins	7,000	14,000
Hay barn and equipment storage	5,000 ft	10	50,000
Lanes	9,504 ft	2.00	19,008
Watering system (without well and pump)	9,504 ft	2.00	19,008
Fencing and paddock setup	34,200 ft	0.90	30,780
Establishing new forages (fertilizer, seed, tillage)	180 acres	150.00	27,000
Machinery and equipment			
Tractor (100 HP with loader)	1	28,500	28,500
Pickup truck	1	15,000	15,000
ATV	1	5,000	5,000
Clipper mower	1	5,000	5,000
Silage feeding equipment	1	12,000	12,000
Other farm equipment			12,500
Total investment			**1,327,996**
Investment per cow			**8,853**

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 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.

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. 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 always 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 a tractor, pickup, ATV, 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 150-cow model dairy will gross $372,745 per year in milk and young stock sales. This farm will have a net income of $32,921 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 $219 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 $64,886 available for principal and interest payments ($32,291 net income + $32,595 depreciation). On a per cow basis, this is equivalent to $436 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.

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	0.7%	1.7%	3.0%	3.7%	3.6%
Operating expense ratio	83.3%	80.5%	76.9%	75.6%	76.2%
Depreciation expense ratio	14.1%	13.2%	12.5%	12.1%	12.1%
Net farm income from operations ratio	2.6%	6.3%	10.6%	12.2%	11.7%

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.

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

	Dollars per herd	Dollars per cow	Dollars per cwt	Percent
INCOME FROM OPERATIONS				
Milk sales	358,686	2,391	18.36	96.2%
Sales of young stock and calves	14,059	94	0.72	3.8%
Total gross receipts	372,745	2,485	19.08	100.0%
OPERATING EXPENSES				
Feed				
Feedstuffs	134,289	895	6.87	39.5%
Less feed for heifers	-32,957	-220	-1.69	-9.7%
Total feed costs	101,332	676	5.19	29.8%
Herd replacement costs				
Depreciation—dairy cows	15,020	100	0.77	4.4%
Loss on sale of cows	7,917	53	0.41	2.3%
Total herd replacement costs	22,937	153	1.17	6.7%
Hired labor (including benefits)	72,344	482	3.70	21.3%
DHIA[1] testing	3,900	26	0.20	1.1%
Semen/breeding	3,750	25	0.19	1.1%
Real estate/personal property taxes	3,455	23	0.18	1.0%
Milk marketing[2]	26,376	176	1.35	7.8%
Repairs	14,700	98	0.75	4.3%
Vet/medicine	9,750	65	0.50	2.9%
Parlor supplies	5,464	36	0.28	1.6%
Utilities	7,806	52	0.40	2.3%
Insurance	6,245	42	0.32	1.8%
Fertilizer	11,592	77	0.59	3.4%
Seed/spray	5,152	34	0.26	1.5%
Custom hire	4,163	28	0.21	1.2%
Truck and fuel	4,000	27	0.20	1.2%
Fence/water	4,000	27	0.20	1.2%
Other expenses	3,000	20	0.15	0.9%
Depreciation	32,595	217	1.67	9.6%
Less other expenses for raising heifers	-2,738	-18	-0.14	-0.81%
Total operating expenses	339,824	2,265	17.39	100.0%
NET INCOME FROM OPERATIONS	**32,921**	**219**	**1.68**	

Notes

[1] Dairy Herd Improvement Association

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

Table 10. Pro forma income statement for the 150-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	331,106	345,342	366,203	375,391	375,391	358,686
Calves and heifers sold	13,088	13,573	14,315	14,949	15,094	14,204
Total gross revenue	344,194	358,915	380,519	390,340	390,485	372,890
OPERATING EXPENSES						
Feed						
Purchased concentrates	93,312	91,914	92,575	93,270	93,528	92,920
Purchased hay	41,434	40,583	41,187	41,732	41,908	41,369
Less feed for heifers	-33,229	-31,072	-32,479	-33,785	-34,219	-32,957
Total feed costs	101,518	101,425	101,283	101,217	101,217	101,332
Herd replacement costs						
Depreciation—dairy cows	15,857	14,811	14,811	14,811	14,811	15,020
Loss on sale of cows	8,678	7,727	7,726	7,726	7,726	7,917
Total herd replacement costs	24,536	22,538	22,537	22,537	22,537	22,937
Hired labor (includes benefits)	69,507	70,898	72,316	73,762	75,237	72,344
DHIA[1] testing	3,900	3,900	3,900	3,900	3,900	3,900
Semen/breeding	3,750	3,750	3,750	3,750	3,750	3,750
Real estate/personal property taxes	3,320	3,386	3,454	3,523	3,594	3,455
Milk marketing[2]	24,426	25,476	27,015	27,483	27,483	26,376
Repairs	14,700	14,700	14,700	14,700	14,700	14,700
Vet/medicine	9,750	9,750	9,750	9,750	9,750	9,750
Parlor supplies	5,250	5,355	5,462	5,571	5,683	5,464
Utilities	7,500	7,650	7,803	7,959	8,118	7,806
Insurance	6,000	6,120	6,242	6,367	6,495	6,245
Fertilizer	11,138	11,360	11,587	11,819	12,056	11,592
Seed/spray	4,950	5,049	5,150	5,253	5,358	5,152
Custom hire	4,000	4,080	4,162	4,245	4,330	4,163
Truck and fuel	4,000	4,000	4,000	4,000	4,000	4,000
Fence/water	4,000	4,000	4,000	4,000	4,000	4,000
Other expenses	3,000	3,000	3,000	3,000	3,000	3,000
Depreciation (buildings and equipment)	32,595	32,595	32,595	32,595	32,595	32,595
Less other expenses for raising heifers	-2,737	-2,589	-2,709	-2,813	-2,844	-2,738
Total operating expenses	335,103	336,444	339,998	342,619	344,957	339,824
NET INCOME (LOSS)	**9,091**	**22,470**	**40,521**	**47,721**	**45,527**	**33,066**

Notes

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

Table 11. Pro forma cash flow statement for the 150-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	331,106	345,342	366,203	375,391	375,391	358,686
Livestock sales	33,713	31,723	32,465	33,099	33,244	32,849
Total cash inflows	364,819	377,065	398,669	408,490	408,635	391,535
CASH OUTFLOWS						
Purchased concentrates	93,312	91,914	92,575	93,270	93,528	92,920
Purchased hay	41,434	40,583	41,187	41,732	41,908	41,369
Hired labor (including benefits)	69,507	70,898	72,316	73,762	75,237	72,344
DHIA[1] testing	3,900	3,900	3,900	3,900	3,900	3,900
Semen/breeding	3,750	3,750	3,750	3,750	3,750	3,750
Real estate/ personal property taxes	3,320	3,386	3,454	3,523	3,594	3,455
Milk marketing[2]	24,426	25,476	27,015	27,483	27,483	26,376
Repairs	14,700	14,700	14,700	14,700	14,700	14,700
Vet/medicine	9,750	9,750	9,750	9,750	9,750	9,750
Parlor supplies	5,250	5,355	5,462	5,571	5,683	5,464
Utilities	7,500	7,650	7,803	7,959	8,118	7,806
Insurance	6,000	6,120	6,242	6,367	6,495	6,245
Fertilizer	11,138	11,360	11,587	11,819	12,056	11,592
Seed/spray	4,950	5,049	5,150	5,253	5,358	5,152
Custom hire	4,000	4,080	4,162	4,245	4,330	4,163
Truck and fuel	4,000	4,000	4,000	4,000	4,000	4,000
Fence/water	4,000	4,000	4,000	4,000	4,000	4,000
Other expenses	3,000	3,000	3,000	3,000	3,000	3,000
Total cash outflows	313,937	314,971	320,053	324,084	326,888	319,987
NET CASH FLOW	**50,882**	**62,094**	**78,616**	**84,406**	**81,746**	**71,549**

Notes

[1] Dairy Herd Improvement Association

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

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