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Starting a 300-Cow Intensive Rotational Grazing Dairy

This guide examines the financial feasibility of starting a 300-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 400-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.

- 360 acres for paddocks
  - 1 cow per acre for 300 cows
  - 60 acres for raising heifers
- 40 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)	300	300	300	300	300
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 general manager will be employed at a salary of $55,000 per year, and two employees working 40 hours per week will be paid $15.50 per hour. 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 (from labor hours)	3.5	3.5	3.5	3.5	3.5
Pounds milk per FTE	1,033,898	1,078,350	1,143,492	1,163,281	1,163,281
Annual benefits	9,140	9,323	9,509	9,700	9,894
Total hourly labor	64,480	65,770	67,085	68,427	69,795
Total salaried labor	55,000	56,100	57,222	58,366	59,534
Total labor cost	128,620	131,193	133,816	136,493	139,223

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 $2,647,160 ($8,824 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	400 acres	3,500	1,400,000
Dairy cows	300 cows	1,100	330,000
Heifers (1 year old)	87 heifers	400	34,800
Buildings and farm setup			
Milking parlor, equipment, tank, holding area and office	48 stalls	7,000	336,000
Manure storage			60,000
Feed bins (15 tons each)	2 bins	7,000	14,000
Hay barn and equipment storage	9,600 ft	10	96,000
Lanes	15,840 ft	2.00	31,680
Watering system (without well and pump)	15,840 ft	2.00	31,680
Water supply well and pump			18,500
Fencing and paddock setup	45,000 ft	0.90	40,500
Establishing new forages (fertilizer, seed, tillage)	360 acres	150.00	54,000
Machinery and equipment			
Tractor (used 130 HP)	1	90,000	90,000
Tractor (used 60-70 HP with loader)	1	25,000	25,000
Pickup truck	1	25,000	25,000
ATV	1	5,000	5,000
Clipper mower	1	15,000	15,000
Silage feeding equipment	1	20,000	20,000
Other farm equipment			20,000
Total investment			**2,647,160**
Investment per cow			**8,824**

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-24 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 tractors, 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 300-cow model dairy will gross $745,490 per year in milk and young stock sales. This farm will have a net income of $74,474 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 $248 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 $142,824 available for principal and interest payments ($74,474 net income + $68,350 depreciation). On a per cow basis, this is equivalent to $476 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	1.0%	2.1%	3.4%	4.0%	4.0%
Operating expense ratio	81.6%	78.9%	75.3%	74.1%	74.6%
Depreciation expense ratio	14.5%	13.6%	12.9%	12.5%	12.5%
Net farm income from operations ratio	3.8%	7.4%	11.8%	13.4%	12.8%

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 300-cow grazing dairy model (5-year average).

	Dollars per herd	Dollars per cow	Dollars per cwt	Percent
INCOME FROM OPERATIONS				
Milk sales	717,373	2,391	18.36	96.2%
Sales of young stock and calves	28,118	94	0.72	3.8%
Total gross receipts	745,490	2,485	19.08	100.0%
OPERATING EXPENSES				
Feed				
Feedstuffs	268,577	895	6.87	40.1%
Less feed for heifers	-65,913	-220	-1.69	-9.8%
Total feed costs	202,664	676	5.19	30.3%
Herd replacement costs				
Depreciation—dairy cows	30,040	100	0.77	4.5%
Loss on sale of cows	15,833	53	0.41	2.4%
Total herd replacement costs	45,874	153	1.17	6.9%
Hired labor (including benefits)	133,869	446	3.43	20.0%
DHIA[1] testing	7,800	26	0.20	1.2%
Semen/breeding	7,500	25	0.19	1.1%
Real estate/personal property taxes	5,939	20	0.15	0.9%
Milk marketing[2]	52,753	176	1.35	7.9%
Repairs	29,400	98	0.75	4.4%
Vet/medicine	19,500	65	0.50	2.9%
Parlor supplies	10,928	36	0.28	1.6%
Utilities	15,612	52	0.40	2.3%
Insurance	12,490	42	0.32	1.9%
Fertilizer	23,184	77	0.59	3.5%
Seed/spray	10,304	34	0.26	1.5%
Custom hire	8,326	28	0.21	1.2%
Truck and fuel	8,000	27	0.20	1.2%
Fence/water	8,000	27	0.20	1.2%
Other expenses	6,000	20	0.15	0.9%
Depreciation	68,350	228	1.75	10.2%
Less other expenses for raising heifers	-5,476	-18	-0.14	-0.82%
Total operating expenses	671,016	2,237	17.17	100.0%
NET INCOME FROM OPERATIONS	**74,474**	**248**	**1.91**	

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 300-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	662,212	690,683	732,407	750,781	750,781	717,373
Calves and heifers sold	26,176	27,146	28,630	29,898	30,188	28,408
Total gross revenue	688,388	717,829	761,037	780,679	780,969	745,780
OPERATING EXPENSES						
Feed						
Purchased concentrates	186,625	183,827	185,149	186,540	187,057	185,840
Purchased hay	82,868	81,166	82,374	83,463	83,815	82,737
Less feed for heifers	-66,457	-62,143	-64,958	-67,570	-68,438	-65,913
Total feed costs	203,036	202,850	202,566	202,434	202,434	202,664
Herd replacement costs						
Depreciation—dairy cows	31,715	29,622	29,621	29,621	29,621	30,040
Loss on sale of cows	17,357	15,453	15,452	15,452	15,452	15,833
Total herd replacement costs	49,072	45,075	45,074	45,074	45,074	45,874
Hired labor (includes benefits)	128,620	131,193	133,816	136,493	139,223	133,869
DHIA[1] testing	7,800	7,800	7,800	7,800	7,800	7,800
Semen/breeding	7,500	7,500	7,500	7,500	7,500	7,500
Real estate/personal property taxes	5,706	5,820	5,936	6,055	6,176	5,939
Milk marketing[2]	48,852	50,952	54,030	54,965	54,965	52,753
Repairs	29,400	29,400	29,400	29,400	29,400	29,400
Vet/medicine	19,500	19,500	19,500	19,500	19,500	19,500
Parlor supplies	10,500	10,710	10,924	11,143	11,366	10,928
Utilities	15,000	15,300	15,606	15,918	16,236	15,612
Insurance	12,000	12,240	12,485	12,734	12,989	12,490
Fertilizer	22,275	22,721	23,175	23,638	24,111	23,184
Seed/spray	9,900	10,098	10,300	10,506	10,716	10,304
Custom hire	8,000	8,160	8,323	8,490	8,659	8,326
Truck and fuel	8,000	8,000	8,000	8,000	8,000	8,000
Fence/water	8,000	8,000	8,000	8,000	8,000	8,000
Other expenses	6,000	6,000	6,000	6,000	6,000	6,000
Depreciation (buildings and equipment)	68,350	68,350	68,350	68,350	68,350	68,350
Less other expenses for raising heifers	-5,473	-5,177	-5,418	-5,625	-5,689	-5,476
Total operating expenses	662,037	664,491	671,368	676,375	680,811	671,016
NET INCOME (LOSS)	**26,351**	**53,338**	**89,669**	**104,304**	**100,158**	**74,764**

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 300-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	662,212	690,683	732,407	750,781	750,781	717,373
Livestock sales	67,426	63,446	64,930	66,198	66,488	65,698
Total cash inflows	729,638	754,130	797,337	816,979	817,269	783,071
CASH OUTFLOWS						
Purchased concentrates	186,625	183,827	185,149	186,540	187,057	185,840
Purchased hay	82,868	81,166	82,374	83,463	83,815	82,737
Hired labor (including benefits)	128,620	131,193	133,816	136,493	139,223	133,869
DHIA[1] testing	7,800	7,800	7,800	7,800	7,800	7,800
Semen/breeding	7,500	7,500	7,500	7,500	7,500	7,500
Real estate/ personal property taxes	5,706	5,820	5,936	6,055	6,176	5,939
Milk marketing[2]	48,852	50,952	54,030	54,965	54,965	52,753
Repairs	29,400	29,400	29,400	29,400	29,400	29,400
Vet/medicine	19,500	19,500	19,500	19,500	19,500	19,500
Parlor supplies	10,500	10,710	10,924	11,143	11,366	10,928
Utilities	15,000	15,300	15,606	15,918	16,236	15,612
Insurance	12,000	12,240	12,485	12,734	12,989	12,490
Fertilizer	22,275	22,721	23,175	23,638	24,111	23,184
Seed/spray	9,900	10,098	10,300	10,506	10,716	10,304
Custom hire	8,000	8,160	8,323	8,490	8,659	8,326
Truck and fuel	8,000	8,000	8,000	8,000	8,000	8,000
Fence/water	8,000	8,000	8,000	8,000	8,000	8,000
Other expenses	6,000	6,000	6,000	6,000	6,000	6,000
Total cash outflows	616,546	618,389	628,320	636,146	641,514	628,183
NET CASH FLOW	**113,092**	**135,741**	**169,017**	**180,833**	**175,756**	**154,888**

Notes

[1] Dairy Herd Improvement Association

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

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