Economics of Minimalist Fescue Belt Pasture-Based Dairies

Joe Horner, Wayne Prewitt, and Ryan Milhollin
University of Missouri Extension
October 2010

Understanding the financial risks and rewards available by pasture-based dairying is important for current and potential dairy farmers. These economic considerations are important for understanding and improving how your operation is financially performing, evaluating expansion options, or starting a new dairy operation. Given the required debt and the necessity of sound production and financial decisions, it is important for dairy farmers to have access to sound decision making tools.

A series of minimalist, start-up pasture-based dairy model farms (75-cow, 150-cow, 300-cow and 600-cow models) were created to help current and potential dairy producers discuss and evaluate the economics of these operations. These models were developed using assumptions, costs and benchmarking information from existing Missouri pasture-based dairies and experts in the dairy industry. While these farms were customized specific to Missouri, they could be adapted regionally in the US.

Farm Location

The model farms assume a carefully selected piece of land that is purchased specifically for developing a minimalist pasture-based dairy. 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 in the model farms is assumed to be made up of 100% purchased crossbred dairy heifers. Because U.S. dairies have only recently started deliberately cross breeding cattle to produce milk under intensive managed rotational grazing systems, a higher cull rate is assumed at startup. 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 are listed in the following table. It is assumed that the average cull rate (voluntary and involuntary) would gradually decline over the first five years of operation. Death loss rate is estimated to remain at four percent in all years. The total herd turnover rate including culls and death loss would begin at 29 percent and then gradually fall until reaching a steady rate of 22 percent by year five.

Table 1. Herd turnover and mortality rates

Description	Year 1	Year 2	Year 3	Year 4	Year 5
Annual cull rate excluding deaths (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 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 can be sold as breeding stock to non-seasonal dairy producers. This allows the dairy to cull as needed for reproduction, without having to sell all of 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 decline 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 grazing dairy systems because of their ability to better utilize pasture, higher reproductively, and overall hybrid vigor.

In the model farms, all calves are assumed to be sold within one week of birth to a contract heifer grower and repurchased back from the contract heifer grower. Heifer raising expenses can have a major impact upon cash flow within the first two years if a dairy farmer has to carry those expenses. In the model farms, all heifer calves will be sold for $250, bull calves for $75 and replacement heifers purchased back for $1,250.

Annual milk production and the rolling herd average were estimated for the model farms. 95% of that volume of milk is assumed to be marketed and 5% from fresh or treated cows being 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 avg.	10,999	12,736	12,894	12,825	12,825

Supplementary feeds were designed to complement the characteristics of the pasture forage at a reasonable cost. Hay and concentrate are purchased in the model farms. Twelve pounds of concentrate costing $200/ton delivered is fed per cow in the parlor for the milking group. An average of five pounds of purchased hay or silage costing $0.08/lb. of dry matter is fed. Parts of the year this may not be needed at all, but in the beginning and ending of the season more will be fed. An average of five pounds is assumed to be fed throughout the year to the milking group. The dry cow group is being fed five lbs of concentrate costing $0.09/lb. and 20 lbs of purchased hay @ $0.045/lb as needed throughout the dry period.

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

Description	Cost/Cow/Day
Purchased concentrates	$1.00
Purchased hay	$0.40
Feed cost/cow/day:	$1.40

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

Description	Cost/Cow/Day
Purchased concentrates	$0.45
Purchased hay	$0.90
Feed cost/cow/day:	$1.35

Milk Marketing

A $17.45 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.

Various factors were considered in developing a projected milk price. Class III price is the most widely used national benchmark price. Class III prices represent the milk used to make cheese, the predominate use of milk in the U.S. Basis (difference between local cash price and futures price) is assumed in the economic models to be $2.66 per cwt in Missouri. Basis can be calculated for your specific operation by getting the difference between your farm pay prices and Class III milk over a historical period. Premiums that would be expected to gain on a pasture-based dairy include a cell count (SCC) and component premiums.

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**

Futures markets exist for Class III milk and are the most liquid of the dairy contracts used for hedging. As the futures basis becomes more predictable, risk management strategies such as forward price contracts and futures/options may be used to lower price volatility. Dairy producers should continually evaluate changing market conditions to seek the most profitable and secure choice for their milk marketing.

Marketing costs that are deducted from the gross milk price in the model farms include CWT assessment ($0.10/cwt.), advertising ($0.15/cwt.), coop fee ($0.10/cwt.) and hauling ($0.80/cwt.) in the models.

Labor Management

A grazing dairy that milks twice 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. Labor efficiency is important on a pasture-based dairy as labor represents one of the top operating costs. Benefits cost for all labor is assumed to include only the employer's share of Social Security and Medicare taxes. Hourly labor was based on a $12.00 per hour rate in year one and manager's salaries were increased incrementally upon herd size due to additional responsibilities. A 2.5% inflation rate is built into all of the labor and operating expenses.

Table 6. Projected labor summary for various dairy herd sizes (5-year Averages)

Description	75-cow Operation	150-cow Operation	300-cow Operation	600-cow Operation
Hired labor (hours)	4,368	5,408	7,280	10,400
# of FTE (based on labor hours)	2.1	2.6	3.5	5.0
Lbs milk per FTE	423,301	683,794	1,015,923	1,422,292
Annual benefits	$2,413	$4,221	$7,634	$10,545
Total hourly labor	$0	$13,120	$52,479	$85,279
Total salaried labor	$31,538	$42,051	$47,307	$52,563
Total labor cost	$33,951	$59,391	$107,420	$148,387

Capital Investments

Capital investments for a pasture-based dairy operation include land, real estate, machinery, equipment and livestock. The character of the investments in the dairy reduces the lender risk because a high percentage of the initial investment being concentrated in appreciating land and reproducing cattle, rather than specialized assets that are harder to liquidate at full value.

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. Stocking rates for the various model farms was assumed at 1.35 cows per acre, and nine to 15 acres (depending on operation size) dedicated to the farmstead/facilities. The following table details the major investment categories necessary to make each size of dairy farm operational.

Table 7. Capital investments for various dairy herd sizes

Description	75-cow Operation	150-cow Operation	300-cow Operation	600-cow Operation
Land ($2,000 per acre)	$130,000	$240,000	$480,000	$920,000
Dairy Cows ($1,250 per cow)	$93,750	$187,500	$375,000	$750,000
Buildings and Farm Setup	$253,582	$280,632	$499,440	$894,278
Machinery and Equipment	$124,500	$124,500	$164,500	$188,200
Total Investment	$601,833	$832,632	$1,518,940	$2,752,478
Investment per Cow	$8,024	$5,550	$5,063	$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. Various size parlors were assumed in the economic models based on herd sizes.

- 75-cow operation – Swing 12 parabone parlor with automatic takeoffs
- 150-cow operation – Swing 12 parabone parlor with automatic takeoffs
- 300-cow operation - Swing 24 parabone parlor with automatic takeoffs
- 600-cow operation - Swing 50 parabone parlor with automatic takeoffs

Most graziers 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 these dairies. 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 was used for perimeter fence and permanent paddock fencing in this dairy system. Water systems in the investments include buried waterlines and permanently installed 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 tractors, pickup, ATVs, silage feeding wagon, and other farm equipment. These investments will vary upon size of the operation. Other facility investments include equipment storage, hay barn and feed bins.

Debt

Debt structure is important to the financial viability of a pasture-based dairy operation. A critical mistake in many operations is to improperly structure their debt, which impacts the ability of the dairy to cash flow during tough financial times. The key is to keep annual per cow principal and interest payments as low as possible. Pasture-based dairies should structure their debt (long term rather than short term) to maximize flexibility in available cash flow and to use prepayments to minimize any interest costs.

Table 8. Impact of debt structure upon principal and interest payments

Debt per Cow		$1,500	$2,000	$2,500	$3,000
% Short Term	% Long Term	Annual Principal and Interest Payment	Annual Principal and Interest Payment	Annual Principal and Interest Payment	Annual Principal and Interest Payment
100	0	$370.75	$494.33	$617.91	$741.49
75	25	$316.25	$421.67	$527.09	$632.51
50	50	$261.76	$349.02	$436.27	$523.53
0	100	$152.78	$203.70	$254.63	$305.56

Assumptions: Short term interest rate of 7.5% and 5-year amortization period
Long term interest rate of 8% and 20-year amortization period

While debt structure is important, the amount of debt that a dairy can support is equally as important. Operations that are too financially leveraged are more susceptible to financial problems due to loan obligations that are too great to support during challenging times. Three good rules of thumbs exist for pasture-based dairy operations related to debt levels.

- Debt service (principal and interest payments) needs to be less than 15% of gross revenue
- Maximum debt level of $3,000 per cow
- Debt to asset ratio must be no greater than 50%

The financial analysis for the various pasture-based model farms assumes 100% equity financing, with no debt. Although unrealistic, this simplifying assumption allows producers and lenders to quickly analyze the free cash flow to determine how much debt the operation will support.

Financial Analysis of Pasture-Based Dairy Models

Based on the underlying assumptions previously discussed, financial analysis for each Missouri dairy model farm was developed in table nine. It is important to understand that these financial parameters are averaged over five years, which would result in lower financial performance in the first few years and improved performance in years four and five. The larger the operation, the better the economies of scale will be realized on these dairies.

Table 9. Financial analysis for various dairy herd sizes (5-year Average)

Category	75-cow Operation	150-cow Operation	300-cow Operation	600-cow Operation
Total Gross Revenue ($)	$165,991	$331,982	$663,964	$1,327,927
Total Operating Expenses (excluding depreciation) ($)	$127,421	$246,200	$481,038	$895,623
Net Farm Income ($)	$5,154	$51,575	$130,311	$353,413
Net Cash Flow ($)	$37,653	$83,947	$179,256	$424,965
Operating Expense Ratio (%)	73.0%	70.4%	68.7%	63.7%
Return on Assets (%)	1.0%	6.7%	9.1%	13.2%

For further discussion, we will focus on the results of the 150-cow operation model. This model was chosen for discussion because most dairy families can supply the adequate labor. The 150-cow model dairy grosses $331,982 per year in milk and young stock sales. This farm nets $51,575 after all operating costs, labor, and depreciation are deducted. On a per cow basis, this is a gross operating income of $2,213 per cow and a net operating income of $344 per cow, after labor and depreciation are deducted.

Adding net income from operations plus the building and machinery depreciation yields a free cash flow of $85,781 available for principal and interest payments, ($51,575 net income + $34,206 depreciation = $85,781). On a per cow basis, this is equivalent to $572 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.

Complete information about all assumptions and various pasture-based dairy farm models can be downloaded at http://agebb.missouri.edu/dairy/grazing/models/index.htm.

Conversion of an Existing Dairy

Another option for dairy producers to reduce initial capital investments is to purchase a farm with an existing milking facility and modify the farm into a pasture-based dairy. Farm buyers may come across the opportunity to purchase a dairy without paying anything extra for an obsolete milking parlor. Many successful pasture-based dairy producers have renovated an existing parlor with minimal investments. An example renovation would be converting an existing double 4 herringbone parlor to a swing 12 parabone parlor. This is one strategy to overcome the capital threshold that is a barrier for smaller pasture-based dairies.

Economic Data from 12 Pasture-Based Missouri Dairy Farms

To highlight the actual income and expenses of grazing dairies, we have compiled records of 12 pasture-based dairy producers in southwest Missouri. Basic production and financial data were collected from these producers from 2003 to 2007 and reported on a per cow basis.

The operating margin as calculated in these records represents the surplus of income over expenses that the producer has available to pay debts (principal and interest repayments), make capital replacements, cover depreciation and provide for the family. Because these records were taken from actual producers who differ in their debt load, family living expenses and capital purchases, these items were excluded from this analysis.

Table 10. Average income and expenditures for 12 Missouri pasture-based dairies

Expressed as Per Cow	2003	2004	2005	2006	2007	5-year Avg.
Milk Price	$13.77	$16.89	$15.71	$13.68	$20.59	$16.13
Production	12,671	12,510	13,380	12,178	11,668	12,481
Income						
Milk Sales	$1,745	$2,113	$2,102	$1,666	$2,402	$2,006
Cattle Sales	$120	$187	$182	$268	$227	$197
Misc./Dividends	$162	$45	$26	$126	$41	$80
Total Income	$2,027	$2,345	$2,310	$2,060	$2,670	$2,282
Expenditures						
Concentrates	$502	$484	$522	$505	$594	$521
Harvested Forages	$212	$207	$235	$207	$229	$218
Hired Labor	$92	$109	$195	$194	$309	$180
DHIA	$4	$6	$9	$12	$10	$8
Semen/Breeding	$9	$13	$17	$23	$15	$15
R.E./P.P. Taxes	$6	$6	$6	$6	$5	$6
Milk Marketing	$84	$85	$91	$133	$118	$102
Repairs/Truck/Fuel	$56	$69	$75	$104	$103	$81
Vet/Med	$58	$54	$50	$47	$57	$53
Parlor Supplies	$40	$46	$47	$42	$44	$44
Utilities	$49	$48	$48	$62	$47	$51
Insurance	$20	$21	$20	$26	$18	$21
Misc.	$32	$41	$53	$16	$44	$37
Rent	$10	$10	$12	$12	$15	$12
Fertilizer	$55	$54	$60	$72	$100	$68
Seed/Spray	$22	$23	$28	$41	$39	$31
Custom Hire	$11	$59	$66	$72	$85	$59
Fuel	$9	$10	$29	$17	$20	$17
R.E./P.P.	$4	$4	$6	$6	$5	$5
Fence/Water	$28	$18	$13.00	$7.00	$20.00	$17.20
Total Operating Expenditures (w/o interest)	$1,303	$1,367	$1,587	$1,605	$1,877	$1,548
Operating Margin before interest	$724	$978	$723	$455	$793	$735

Note: Dry cow and heifer expenses are included

When looking at this table, a couple key observations must be explained. First and foremost, profit is driven by two things, cost of feed and price of milk. Given that a dairy farmer has very little impact on the price of milk (however we would encourage producers to take advantage of milk price protection services available), we need to focus on understanding cost control in grazing dairies.

Feed costs represent approximately 50% of the total cost of production on a pasture-based dairy. Understanding the importance of high quality forage as a feed source can be quickly explained. High quality pasture costs between two and four cents per pound of dry matter. Pasture is the least costly feed source available on the farm. Farms that enjoy the least cost of production have a high utilization rate of fresh, high quality standing forage. The cows and paddocks are managed to ensure quality forage is available to the cows as many days as possible during the milking season. Excess forage is usually baled into baleage and can be utilized during the winter or during periods of drought when high quality forage may not be available. Some producers prefer corn silage as a feed source during these times. As a general rule, silage typically costs six to eight cents per pound of dry matter and good alfalfa hay costs between eight to ten cents per pound of dry matter. The most expensive feed source is concentrate feed delivered to the bulk bin, which usually costs nine cents and above per pound of dry matter.

Looking at the preceding data supplied by participating pasture-based dairy producers, labor contributes about 13% to the overall cost of production. Labor would include both full and part-time employees such as relief milkers. Unproductive or underproductive labor can become a cash drain for the farm instead of positive cash producer for the farm. The farmer needs to evaluate the number of full time equivalents (FTE) required for the farm to be productive as well as ensuring the labor available on the farm is efficient.

Understanding the contribution to the overall profitability of each major and minor cost input is very important if the farm is to be profitable. Developing the appropriate record systems to track the financial and physical aspects of the farm is important for successful farms. The proper systems provide the farmer with the appropriate information to make sound decisions thus adding to the success of the farming operation.

Dairy Report Card

As farms increase in size and scope, farmers are faced with making decisions that have large impacts upon their farm business and the future of their family and other investors. Pasture-based dairy farmers need to develop a set of indicators that can be used to monitor their operation. The farmer needs to understand the impact these indicators have upon the business. Evaluation indicators can allow the farmer to quickly identify potential issues and make adjustments either on the production or business level. Once the indicators are identified, it is important to develop appropriate benchmarks and monitor the indicators.

Benchmarking allows the farmer to quickly evaluate the situation and make necessary adjustments. Benchmarking has two important components – the first is to compare the farm performance over time in relation to the set targets. The second component is to compare key performance indicators (KPIs) with others in the same field to determine if improvements are being made at the same rate by others.

KPIs for a pasture-based dairy farm are quantifiable measurements that reflect the critical success factors. KPIs are calculated for an individual farm and are valuable in tracking performance over time. They reveal a high-level snapshot of the farm. Before any KPIs are selected, it is vital to identify the farm's goals, which are dependent upon its mission and stakeholders (including owners, employees, lenders and others). KPIs must be critical to the success of the farm and a solid indicator of progress. They are expressed by saying what is to be measured and how it is to be measured. Traditionally, KPIs have dealt with production issues faced on a confinement farm, but a combination of both financial and production measures better determine what is occurring on a pasture-based dairy farm.

KPIs are most successful when used to evaluate the success of a department or system. For an example, "percent calved within the window" might be useful to measure the efficiency of the breeding program. "Percent calved within the window" might be a great way to evaluate the breeding program, but does it reflect the "percentage of cows bred"? To better understand the entire breeding program, "percent calved" might be a better measure. There are several standard measures used to evaluate success but in the end, the decisions on which KPIs to use ultimately are determined by the owners and the management team.

Successful use of KPIs to improve pasture-based dairy business management begins with a three step process.

1) Determine what areas of the business will be evaluated
2) Select KPIs to measure and establish goals for each indicator
3) Develop a simple reporting and monitoring system for each indicator

It is important to develop a simple process because if data cannot be collected easily and computed accurately, it is of no practical use. Reports must show results compared with the goals established for each indicator in each department. When all indicators have been calculated, a "dairy report card" should be developed and reported to dairy operators and owners who can immediately prioritize their activities to focus on tasks for farm improvement.

There are several KPIs available for pasture-based dairy farmers to use on their operations. The following sections discuss some examples of various indicators that can be used on a pasture-based dairy operation.

Physical KPIs

Physical KPIs relate directly to the production systems on the farm itself. When looking at the performance of a grazing dairy farm, these KPIs can be used to evaluate the performance of the grass and the management of the forage resources. Physical indicators provide the farmer an indication of his/her cost of production. Below are some select KPIs that can be used to evaluate these production aspects.

Grazing Wedge

Managing for the highest quality and quantity of forage available is critical to the overall success for the farm. By taking weekly forage measurements, a farmer understands how the grass is growing and available forage. It is important measurements are taken regularly and used to create a grazing wedge (visual picture of dry matter available in each paddock). A grazing wedge represents the quality and quantity of forage dry matter available both now and during the next round of grazing. A good resource was developed by the University of Missouri that allows farms to develop their grazing wedges (http://plantsci.missouri.edu/grazingwedge/). This information allows the farmer to understand the forage conditions on the farm, including the quantity available today and in the future. It also assists the farmer in determining what paddocks to graze, fertilize or mechanically harvest.

Stocking Rate

Stocking Rate is simply the number of cows divided by the effective acres on the milking platform (total acres used to directly support dairy cows). Stocking rate is one measure of grass productivity as well as grass utilization. Depending on the management ability of the farmer and the forage system, stocking rates should range from one to 1.5 cows per acre on most pasture-based dairy farms. The ultimate challenge is replacing as much concentrates as you can with cow harvested forage, while maintaining grass quality.

Milk per Acre/Cow

Since the stocking rate can vary greatly from one farm to the next, an alternative measure might be to calculate the milk production (lbs.) per acre. This can lead to the determination of income and ultimately net profit per acre. The calculation would simply be the total milk production divided by the milking platform. This allows the farmer to evaluate overall farm productivity.

Milk production per cow is determined by the total pounds of milk produced by the peak number of cows milked. This measure indicates the cow productivity given the grazing and feeding program on the farm. Milk production on most pasture-based dairy operations in Missouri tends to range from 10,000 to 14,000 pounds per cow, which will vary depending on the herd and quantity of concentrates in the total ration.

Tons of Dry Matter Utilized per Acre
It is less costly to utilize the forage produced either as standing forage, harvested baleage or hay than purchasing feed from off-farm. This measure shows farm productivity, over-all pasture forage management and cow management. Even baleage is usually less costly than concentrates so there is every incentive to utilize as much forage from the farm as possible.

Pre and Post Grazing Measurements
This is an indicator of how much forage is being consumed/grazed in a paddock. It is calculated from the difference between the pre-grazing measurement and the post-grazing measurement. Knowing how much the cows are consuming allows the farm manager to better understand the cows' intakes and balance the total ration. The pre-grazing measurement is also an indication of the quality of forage being grazed.

Pounds of Feed per Cow/Day
Concentrates cost three to four times the cost of high quality pasture. The daily cost of feed being delivered to the bunk is an indicator of how well the grass is being managed and is an indicator of total cost of production. Concentrate feeding levels will vary depending on the availability of quality forage throughout the grass season.

Pounds of Milk per Full Time Equivalent (FTE)
This is a measure of labor efficiency on a pasture-based dairy. This measure is very scale dependent, and will increase with larger operation size. Greater labor efficiency will ultimately lower the cost of production on a pasture-based dairy.

Calving Window
This indicator represents the percentage of calves born in the window (time period). In Missouri, some of the most profitable grazing dairies are seasonal producers. These operations intend to calve in the spring and are able to utilize farm produced grass to produce as much milk as profitable. A goal for Missouri producers is to have 80% calved in the eight week window beginning the middle of February and the remaining calves born within a 12 week window.

Financial KPIs
A business must be profitable in order to survive over time. Financial KPIs measure profitability or cost goals. Within these calculations, any unpaid operator or family labor should be factored in. The key to calculating these indicators is to keep detailed farm financial records and complete a yearly income statement and balance sheet.

Net Farm Income from Operations (NFIFO)
This is a measure of the net income generated from the ordinary production and marketing activities of the farm. It is calculated by subtracting the gross farm expenses from gross farm revenue. NFIFO is the easiest way to see if the farm is covering the cash cost of production.

Return on Assets (ROA)
This measure is an indication of profitability per dollar of asset. ROA is a good indicator of how well the farm investment is doing compared against other investment opportunities. It is calculated by taking NFIFO, adding interest paid, subtracting a value for any unpaid family labor, and then dividing this total by the value of farm assets calculated at the beginning of the financial year. Many pasture-based dairy farms have routinely maintained a range of eight to 15% ROA, but a minimum return goal should at least be greater than the interest rate paid on the debt.

Operating Expenses and Profit per Acre
Operating expenses per acre allows the farmer to quickly see the profit margin on a per acre basis. Simply take the total operating expenses and divide by the milking platform (effective acres). Calculating operating expenses per acre allows the farmer to review overall performance of cost containment.

Operating profit per acre is a very important KPI because it is an indicator of overall performance. It allows the farmer to quickly determine profits and evaluate purchased property as well as rented property. The difference between the income and expenses indicates the operating margin. Operating margin would then be divided by number of effective acres to calculate operating profit per acre.

Farm Income per Acre
Farm income per acre indicates the farm's ability to generate cash flow. Income per acre is calculated by dividing the income generated by milk and livestock sales divided by the acres in the milking platform (effective acres). Income is driven on price and production of milk and animals sold. This stresses the importance of making sure the maximum amount of milk is sold given the quantity of feed, but also the importance of getting the cows back in calf as quickly as possible to continue generating milk sales.

Table 11. Example of a pasture-based dairy farm's key performance indicators

	When				How to Measure	Benchmarks for Comparison
	Day	Week	Quarter	Annual		
Physical KPI's						
Average cover		X			Grazing wedge calculations	Seasonal plan
Pre-grazing cover	X				Plate meter next paddock to graze	Management goal
Post-grazing cover	X				Plate meter last paddock grazed	Management goal
Milk per acre			X	X	Add milk shipments and divide by useable acres	Historical and peer group
Milk per cow	X	X	X	X	Add milk shipments and divide by milking cows	Historical and peer group
Tons dry matter per acre		X		X	Grazing wedge summaries	Historical and peer group
Financial KPI's						
Cost to produce cwt milk			X	X	Financial record analysis	Peer groups or published benchmarks
Operating expense ratio				X	Financial record analysis	Peer groups or farm financial standards council
Interest expense ratio				X	Financial record analysis	Peer groups or farm financial standards council
Term debt coverage ratio				X	Financial record analysis	Peer groups or farm financial standards council