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Dairy Grazing

Economics of Pasture-Based Dairies

Understanding the financial risks and rewards of pasture-based dairying is important for dairy farmers. The development of a new dairy or expansion of an existing one must be carefully considered to determine if it will create the economic returns needed to sustain any debt, family living and profits to owners. Most decisions on a dairy will have financial implications and need to be based on sound production and financial information. Maintaining records and monitoring appropriate benchmarks can help a farmer understand the state of the dairy and improve its financial performance.

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 may apply to operations throughout the United States.

Operating costs

The most important observation that can be made from financial summaries is that the two primary drivers of profit are the cost of feed and the price of milk. Given that dairy farmers have very little impact on the price of milk (although we encourage producers to take advantage of milk price protection services), they need to focus on controlling costs in grazing dairies.

Feed costs represent about half of the total operating cost of production on a pasture-based dairy. Figure 1 shows typical feeds on a pasture-based dairy. Grass production, management and utilization drive feed costs. High-quality pasture is an important substitute feed source. Pasture is the least costly feed source available on a farm. High-quality pasture costs from 2 to 5 cents per pound of dry matter. Farms with the lowest production costs typically use fresh, high-quality pasture at a high rate. 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. This baleage can be used during the winter or periods of drought when high-quality forage may not be available. Some producers, however, prefer corn silage as a feed source during these times. Silage typically costs 6 to 8 cents per pound of dry matter and good alfalfa hay 8 to 10 cents per pound of dry matter. The most expensive feed source is concentrate feed delivered to the bulk bin, which usually costs 12 cents or more per pound of dry matter. The combination of feed cost control and optimal milk production is a major driver in the profitability of a pasture-based dairy.

Figure 1. Understand the cost implications of each feed source.

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Labor is typically the second largest cost on a pasture-based dairy. Labor comprises full-time employees and part-time employees, such as relief milkers. Unproductive or underproductive labor can become a cash drain instead of a cash producer for the farm, so the number of full-time equivalent (FTE) employees required for the farm to be productive and efficient needs to be evaluated.

In addition to feed and labor costs, other costs can affect overall profitability of a pasture-based dairy farm. A dairy manager must identify and understand the dairy's key operating costs. Key operating costs are critical to the farm's success. They are the costs that a manager can influence the most and that have the greatest impact on profitability.

Dairy report card

For a dairy farm to be profitable, the farmer needs to understand the contribution of each major and minor cost input to overall profitability and to develop appropriate record systems to track the financial and physical aspects of the operation. Proper record systems provide the farmer with the appropriate information to make sound decisions, thus adding to the success of the farming operation.

As a farm increases in size and scope, the farmer must make decisions that have large impacts on the farm business and the future of his or her family and other investors. To ensure the farm's continued success, the farmer needs to be able to quickly identify potential issues. To be able to do this, the farmer must develop a set of evaluation indicators, set benchmarks for them and regularly monitor them. The farmer needs to understand the impact these indicators have on the business so that issues can be readily identified and the proper adjustments made on either the production or business level.

Benchmarking allows a farmer to quickly evaluate a situation and make necessary adjustments. Benchmarking has two important components:

- Comparing the farm performance over time in relation to the set targets.
- Comparing key performance indicators (KPIs) with others in the same field to determine if others are making improvements at the same rate.

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 the farm's performance. They reveal a high-level overview of the farm. The farm's goals, which are dependent upon its mission and stakeholders (owners, employees, lenders and others), must be identified before any KPIs are selected. To be a KPI, an indicator must be critical to the success of the farm and a solid indicator of progress. KPIs are expressed by defining what is to be measured and describing how it is to be measured. Traditionally, KPIs have dealt with production issues faced on a confinement farm, but a combination of financial and production measures better determines 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 example, in evaluating the breeding program, "percent calved within the window" might be useful to measure the efficiency of the breeding program, but it does not reflect the "percentage of cows bred." To better understand the entire breeding program, "percent calved" might be a better measure. Several standard measures are used to evaluate success, but in the end, the owners and the management team ultimately determine which KPIs to use.

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.

Developing a simple process is important 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. When all indicators have been calculated, a "dairy report card" should be developed and provided to dairy operators and owners who can immediately prioritize their activities to focus on tasks for farm improvement.

Table 1 presents an example of KPIs for a pasture-based dairy farm. Several physical and financial KPIs exist for pasture-based dairy farmers to use on their operations. The following sections discuss some of those indicators.

Physical KPIs

Physical KPIs relate directly to the production systems on the farm itself. These KPIs can be used to evaluate grass performance and management of the forage system. Physical indicators give the farmer an indication of the farm's cost of production.

Grazing wedge

Managing for the highest quality and quantity of forage available is critical to the overall success of a farm. A grazing wedge is a visual representation of the dry matter available in each paddock. It depicts the quality and quantity of forage dry matter available both now

Table 1. Example of a pasture-based dairy farm's key performance indicators.

	When to measure					
	Daily	Weekly	Quarterly	Annually	How to measure	Benchmarks for comparison
Physical KPIs						
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 KPIs						
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

and during the next round of grazing. It also helps the farmer determine what paddocks to graze, fertilize or mechanically harvest.

Weekly forage measurements are needed to create a grazing wedge. (The University of Missouri has developed an online grazing wedge calculator for farmers at ***https://grazingwedge.missouri.edu***.)

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 and grass use. Depending on the farmer's management ability and the forage system, stocking rates should range from 1 to 1.5 cows per acre on most pasture-based dairy farms. The ultimate challenge is to replace as much concentrate as possible with cow-harvested forage, while maintaining grass quality.

Milk per acre and per cow

Because the stocking rate can vary greatly between farms, an alternative measure is to calculate the milk production (pounds) per acre by dividing the total milk production by the milking platform. This measure can lead to the determination of income and, ultimately, net profit per acre. It allows the farmer to evaluate overall farm productivity.

Milk production per cow is determined by dividing 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 16,000 pounds per cow, which varies depending on herd genetics, quantity of high-quality forage available, quantity of concentrates in the total ration and whether the dairy is seasonal.

Tons of dry matter used per acre

Using the forage produced on the farm as either standing forage, harvested baleage or hay is less costly than purchasing off-farm feed. The measure of tons of dry matter used per acre shows farm productivity over all pasture forage management and cow management. Baleage is usually less costly than concentrates, providing yet another incentive to use as much forage from the farm as possible.

Pre- and post-grazing measurements

Tracking how much forage is being grazed in a paddock is as easy as calculating 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 per day

The cost of concentrates is 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 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)

Pounds of milk per FTE is a measure of labor efficiency. This measure is scale dependent and thus will increase with larger operation size. Greater labor efficiency will ultimately lower the cost of production on a pasture-based dairy.

Calving window

The calving window indicator represents the percentage of calves born in the window, or 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 use farm-produced grass to produce as much milk as profitable. A goal for Missouri producers is 80 percent calved in an 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 to survive. Financial KPIs measure profitability or cost goals. Unpaid operator or family labor should be factored into these calculations. The key to calculating these indicators is to keep detailed farm financial records and to complete a yearly income statement and balance sheet.

Net farm income from operations (NFIFO)

NFIFO is a measure of the net income generated from the ordinary production and marketing activities of the farm. It is calculated by subtracting 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)

ROA is an indication of profitability per dollar of asset. This measure is a good indicator of how well the farm investment is doing compared with other investment opportunities. It is calculated by taking NFIFO, adding interest paid, subtracting the value of 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 8 to 15 percent ROA, but a minimum return goal should at least be greater than the interest rate paid on the debt.

Cost to produce cwt of milk

Dairy farmers need to understand the cost of producing 100 pounds of milk. The annual cost of production allows a farmer to understand the efficiency and competitive position of the operation. Monthly cost of production estimates take more work but can allow seasonal dairy producers to quickly estimate the financial impacts of different calving seasons and winter milking.

Operating expense ratio

The operating expense ratio provides an understanding of a dairy farm's cost control. To calculate the operating expense ratio, divide total operating expenses (minus depreciation and interest) by gross revenue.

Interest expense ratio

The interest expense ratio reveals the proportion of interest expenses that are consumed out of total farm revenue. To calculate the interest expense ratio, divide the total farm interest expense by gross revenue.

Term debt coverage ratio

Term debt coverage ratio represents the net income available from the business annually for every dollar of principal and interest payments on term debt. It is used to understand the farm's ability to repay term debt on time. Figure 2 shows how to calculate the term debt coverage ratio. A ratio of 1.5 or greater is generally accepted as a strong liquidity position.

Capital investments

Capital investments for a pasture-based dairy operation include land, real estate, machinery, equipment and livestock. The character of the investments in a pasture-based dairy reduces the lender 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. The financial success of a grazing

$$\frac{\text{Net farm income + Nonfarm income + Depreciation + Term and lease interest – Family living expenses – Income taxes}}{\text{Scheduled principal and interest payments on term loans and leases}}$$

Figure 2. Calculating term debt coverage ratio.

dairy depends on keeping the capital investment and the operating expenses low.

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 and a heater.

Most graziers want an inexpensive, efficient facility that can be updated or improved as cash flow permits. Ultimately, they want a parlor large enough to allow them to complete each milking in 2.5 hours. Parabone swing parlors have been used to promote production efficiency by emphasizing cow comfort, cow movement and efficient labor usage. Examples of parlors by herd size would be as follows.

- 75-cow operation — Swing 12 parabone parlor
- 150-cow operation — Swing 12 parabone parlor
- 300-cow operation — Swing 24 parabone parlor
- 600-cow operation — Swing 50 parabone parlor

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 made of 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 has been used for perimeter fence and permanent paddock fencing in this dairy system. Water system investments tend to include buried waterlines and permanently installed tanks.

Initial expenses of forage establishment for a new dairy development should 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 tend to include tractors, pickup, ATVs, silage feeding wagon and other farm equipment. Other facility investments include equipment storage, hay barn and feed bins. Such investments will vary by operation size.

Farm location

Careful farm selection is critical 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 that can be replanted with annual forage and improved perennial forage varieties.

Conversion of an existing dairy

Another option for dairy producers wanting to reduce initial capital investments is to buy a farm with an existing milking facility and modify the farm into a pasture-based dairy. Farm buyers may come across an opportunity to buy a dairy without paying 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 option is one strategy for overcoming the capital threshold that can be a barrier for smaller pasture-based dairies.

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