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Profitable Grazing-Based Dairy Systems

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Acknowledgments

Numerous people have provided source information, as well as expert reviews and comments. Their contributions are acknowledged and very much appreciated. This publication is intended to support and encourage the start-up of grazing-based dairy farms across the Nation whether they are organic or “conventional.” With the interest in grazing-based dairies on the rise, this publication is timely. It is a helpful guidepost to those wanting provide their dairy cows fresh pasture for as long as their growing season permits. As an editor recently stated in a grazing magazine, pasturing dairy cows is conventional when we look at the long history of dairy farming here in the United States and the World. It has been a brief moment in history that we have confined dairy cows and hauled everything to them that they eat.

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Introduction

This technical note provides background and general guidance on the concept of grazing-based dairy systems, defined as land management systems that seek to *optimize* dairy production through grazing. As a companion technical note to the Natural Resources Conservation Service sustainable agriculture tech note series, it focuses on associated economic, environmental, and social benefits.

Well-managed grazing-based dairies help protect soil, water, air, plant, and animal resources by maintaining dense vegetative cover on the soil, increasing soil organic matter, improving the distribution of nutrients on fields, and reducing the potential for odors, spills, or runoff from concentrated animal waste storage areas. Compared with traditional confinement dairies, grazing-based dairies harbor more wildlife, more diverse plant communities, and healthier cows with longer productive lives. In addition, grazing-based dairies often boost income by reducing feed, labor, equipment, and fuel costs. Less tractor time frequently increases leisure time or allows for expanded farmer enterprises. Grazing-based dairy systems also provide a lower-cost option to help some small family farms survive without expanding their business, or start dairying with less debt incurred.

This technical note has three parts. Part I defines grazing-based dairies and describes their ecological, social, and economic benefits. It may be of greatest interest to those wanting to know about the advantages and disadvantages of grazing-based dairy systems. Part II describes the considerations involved in developing or making the transition to a grazing-based dairy. It may be of greatest interest to those who have decided on grazing, but want more information on what is involved. Part III is a series of case studies from different parts of the country. Interest in individual case studies may depend on the geographic location of the individual reader.

Part I

Background

While dairy farming is undergoing rapid expansion in arid environments across the country, the overall number of dairies and dairy cows has decreased, but the number of cows per farm has increased. Dairy farm profits are increasingly affected by urban encroachment, rising land costs and taxes, and industry pressure to use the latest milk production technologies. Production per cow and total production have increased more rapidly than demand for milk, keeping pressure on dairy producers either to improve or to get out of the business. Nutrient management regulations to improve water quality are increasing the cost of manure handling. Recently, air quality constituents, such as odors and particulates, associated with confinement and manure storage facilities have come under more scrutiny, as well. Meanwhile, long-term average milk price trends have remained static, whereas short-term milk prices are unpredictable, often falling to unprofitable levels for several months during a production year.

As profitability of dairy farms declined in the 1980s and 1990s, it was common for managers to expand herd size, attempting to maintain or increase net income. As demand for feed and forage increased on a fixed land base, confinement systems seemed to be the appropriate response. However, dairy farmers soon found that large, confined herds required large waste management systems, greater housing investments, and more feed storage and handling equipment. After investments are made, the dairy manager often feels financially “locked in” to a confinement system, and thus, a cycle of ever-increasing herd size to spread fixed costs and increase net income continues.

Grazing-based systems are alternatives to highly capitalized systems of equipment, storage, and housing infrastructure. Grazing systems rely on two primary resources: pasture, the lowest cost source of feed available (Soder and Rotz 2001), and the dairy farmer’s management skills. Because the cow ingests the standing crop, all intermediate steps required to feed the cow are eliminated during the pasture season. Forage reaches the rumen in high quality condition. Less purchased feed and manure handling is required. Fewer acres need to be harvested as stored forage.

Some time is shifted to moving herds and portable fences in rotational pastures. Yet, with well-designed layout of lanes and field divisions, this can be done in minutes rather than hours. Some time must also be devoted to honing skills on feeding supplements to pastured dairy cows, maintaining standing forage quality, and consistently providing enough forage throughout the grazing season.

What is a grazing-based dairy system?

Grazing-based dairy production systems that focus on specific application of grazing principles and practices are a subset of grassland agriculture. Grazing-based dairy production systems are broadly defined as *land use and feed management systems that optimize the intake of forages directly harvested by grazing cows*. This is in sharp contrast to confinement-based dairy systems, which are broadly defined as *land use and feed management systems that optimize milk production with confined cows consuming harvested forages.* Both systems generally use feed supplements to balance the dietary ration.

Grazing-based dairy systems are not "one size fits all." Landowner objectives, soil types, forage species, livestock genetics, land base, and climatic conditions differ from farm to farm. Production methods and management practices vary among farms, within regions and across the continent. Thus, while all grazing-based dairy farms share the common objective of optimizing the intake of forages harvested through grazing, differences in application are often necessary and appropriate.

The characteristics for an efficient, productive grazing-based dairy system are listed below. They focus on practices that optimize livestock performance (whether milk production or live-weight gain), pasture quality and dry matter yield, and the efficiency of forage utilization.

- Lactating animals are pastured using a rotational stocking method where the whole herd grazes a fresh paddock at least every other day and leaves an adequate forage residual (stubble) for optimal forage regrowth. Many graziers provide fresh paddocks after each milking.
- Lactating animals are stocked on pasture at least 75 percent of the grazing season (time of year when adequate grazable dairy forage supply and quality are present). Dry cows and heifers are stocked on pasture at least 90 percent of the grazing season.
- During each grazing season, lactating animals obtain at least 50 percent of their forage intake through grazing. Meanwhile, dry cows and heifers obtain at least 90 percent of their forage intake through grazing.
- Water is provided to the herd in the paddock in which they are grazing or in the laneway near the paddock.
- Paddocks are sized every rotation cycle to provide enough on-offer forage for adequate livestock intake during their time on each paddock while keeping adequate forage residual to maintain stand vigor and desired species composition. A back fence prohibits access to just-grazed paddocks while a front fence limits how much fresh, ungrazed grass is made available to the cows.
- Adequate, stabilized laneways are provided for ease of movement between milk parlor and paddock.
- Fields are sized and laid out so that forage on-offer is sufficient to meet grazing herd demand at all times throughout the grazing season. Fields are also designed for ease of mechanical harvest when needed to remove maturing forage in excess of herd demand during the current rotation cycle.

Pasture and pasture use

Pasture is fundamentally different from other livestock feed crops in three principal ways:

- It must be fenced.
- It is used while actively growing or standing.
- It is harvested by livestock.

Fencing is essential to successful pasture-based livestock feeding. Fences define areas of "feed" so that the dairy manager can ration the amount of forage provided to the livestock. Most systems have permanent perimeter fencing and single-strand, portable interior fences.

Dairy pasture differs from all other feed crops in that it is used while it is alive and actively growing (fig. 1). Consequently, it can change in quantity and quality on a daily basis, losing quality if allowed to get too old before being grazed. Pasture also changes in quality as the growing season progresses. Other feeds are generally harvested and preserved or conserved near or at full maturity and then fed to animals in measured amounts and qualities. Pasture also can be fed in measured amounts by estimating forage dry matter production and sizing a paddock accordingly to feed the herd for the length of the planned stay. However, pasture is generally harvested before maturity, when it is vegetative and very high quality. Pasture has no loss of dry matter by respiration and no shatter, leaf loss, or loss of quality by spoilage or rain damage that generally accompany perishable, stored forage production procedures despite efforts to reduce such losses.

Finally, pasture is harvested by livestock. Animals are the harvesting machines, but unlike mechanical machines they choose what and where they harvest and where they deposit animal wastes. These choices affect forage utilization and manure distribution. Cows shun urine and dung spots and unpalatable plants and plant parts. They often return the nutrients in manure to the pasture in a nonuniform pattern if shade, permanently placed water troughs, mineral feeders, or hay bunks are present that cause them to linger near those areas.

Grazing-based dairy pasture:
A unit of fenced land with productive soil that is managed to provide high quality forage for lactating dairy cows, replacement heifers, or dry cows as a significant portion of their diet throughout the pasture growing season.

Manure distribution in intensive dairy grazing management can vary in warm versus cool weather (White et al. 2001). However, a structured grazing and clipping system can cause animal grazing to mimic closely the uniformity achieved by mechanical harvest and nutrient application. Cows are also extremely efficient harvesters. They leave behind forage that they neither desire nor need. Typically, this includes more mature forage. Grazed forage is usually less mature than mechanically harvested forage. This selectivity cannot be achieved by machines that harvest the good and the bad above the cutter bar.

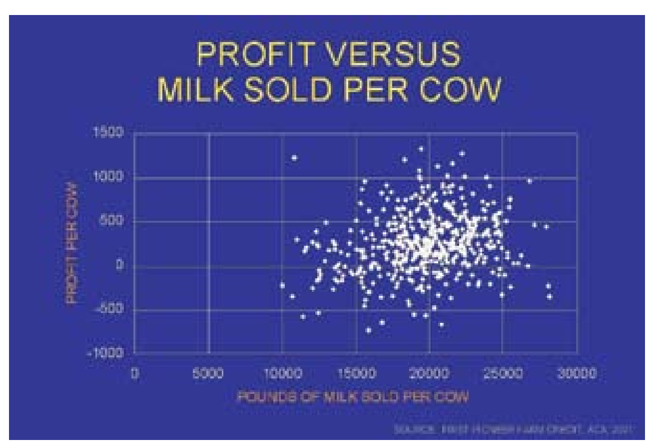
Grazing-based dairy systems require the simultaneous management of a forage production system, a livestock production system, and a forage harvest system. The grazing-based dairy replaces high input costs of a confinement dairy with the managerial skill of the grazier to ration high quality pasture well throughout the grazing season. Understanding forage plant growth patterns and responses to grazing is critical for effective management.

Characteristics of grazing-based dairy system

Dairy producers and supporting businesses and agencies often use milk production (rolling herd average) as the primary indicator to assess the economic success of various practices or systems. Despite the popularity of this indicator, the apparent correlation between milk production and net profit is weak (fig. 2), and its use is often misleading. In fact, it is possible for dairy

Figure 1 A healthy dairy pasture, note legume content

Figure 2 Profit as a function of milk sold per cow



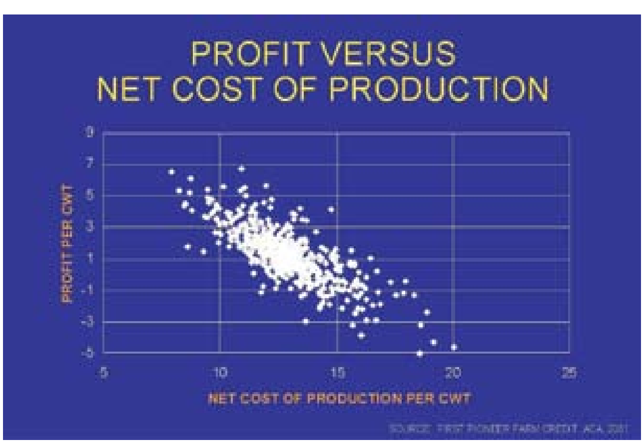
producers with high rolling herd averages to go broke (Smith et al. 2002). A much better indicator is net farm income from operations (NFIFO) per cow or net cost of production per hundred-weight (CWT) of milk produced (fig. 3).

Many grazing-based systems intentionally forgo maximum milk production to meet family and lifestyle goals. Even so, cases exist where grazing-based dairy herds exceed 20,000 pounds of milk per cow per year, and some individual producers routinely report herd averages of 24,000 to 26,000 pounds of milk per cow per year. Some grazing-based dairy herds are still quite profitable producing 15,000 pounds of milk per cow per year or less (Kriegel 2000). As shown in figure 3, dairies with the lowest cost of production generate the highest net profits. Using grazing-based systems can significantly reduce production costs.

Obstacles to grazing-based dairy systems

The greatest obstacle to the adoption and use of grazing as the central part of a production system for dairy cows may be custom and culture. Over the past 40 years, most dairy producers abandoned grazing-based systems for confinement-based systems to maximize milk production. As a result, confinement dairying is the only system many producers know. In spite of high debts and low profit margins resulting from increased mechanization and facilities costs and low milk prices, farmers are reluctant to try a grazing system and learn how to operate it. A mistake farmers sometimes make is to prolong the decision to switch to a grazing-based system until their debt margin is too great to be easily overcome, even with improved profitability.

Figure 3 Profit as a function of net cost of production



Other obstacles, real or imagined, include:

- Physical location of the barn or milking facility in relationship to the cropland that could be used for improved pasture. For example, it is too far for the animals to walk, or there are intervening physical barriers such as roads or watercourses.
- Good management skills are necessary, and new skills are needed. This requires the ability to adapt and the desire to learn.
- The concept of "optimum" milk yield versus "maximum" milk yield can be a tough sell given the dairy industry's tendency to equate high milk yield producers as the most successful dairy managers.
- Former confinement herds placed on pasture must become adapted both genetically and behaviorally to grazing. The genetics takes time.
- The kind of necessary equipment changes, resulting (sometimes) in the misconception that more equipment is needed and older equipment is being underused.
- Balancing rations with grazing selectivity and changing pasture quality throughout the season requires more attention to both the pasture and the animal.
- Herd size is too large for the land base. There is not enough available or potential pastureland to support the herd for the full length of the grazing season.
- Features or characteristics of the climate or land base (rough, broken terrain, wet soils, heat and humidity, periods of drought, or prolonged wet or cold weather) prevent efficient pasturing of dairy cows.
- A misconception persists that pastures are low yielding and, therefore, inferior to row and hay crops as a land use. This often results in managers relegating pastures to marginal lands and not improving them nor managing the grazing of them, thus ensuring poor yields and risking long-term sustainability.
- Forage base is not suitable in the short term to meet the quality or quantity requirements for dairy production. Fields that have been row-cropped or in hay production for many years take time and management to become densely grassed, highly productive pastures.
- Some or all paddocks lack a water supply. Developing a water system requires up-front capital, but some Farm Bill programs may provide cost-share assistance for water development.

- Farmers may also be concerned about the labor needed to move portable troughs, but moving these smaller troughs can be a part of the cattle moving routine.
- Current debt load requires consistent income to service debt. The producer cannot tolerate drops in milk income that might occur by switching to grazing either completely or partially while learning the tricks of the trade.

A good rule of thumb for grazing-based systems is that at least an acre of productive pasture is required for each lactating cow. This ideal acre would be within 1 mile of the milking facility or closer in hot weather. Typically, herd size is only limited by the ability of the soil to yield forage adequate to meet the requirements of the herd. Grazing-based herds of 200 cows or fewer are common, 500 are less common, and 1,000 or more cows are rare. Some producers use portable or low-cost, stationary milking facilities to handle pastures and tracts of land that are more remotely located from the main milking facility.

Lower milk production associated with grazing-based herds is the most frequently cited reason that some dairy producers do not adopt this system. The rationale does not necessarily consider both costs and return, however. Milk production levels at less than maximum can produce greater economic returns if costs are reduced significantly, as has been observed by some dairy graziers and economists. It really is more realistic to consider the optimum milk production level that will return the best economic results over input costs.

What are the benefits of this system?

This system of dairy farming provides more options than confinement dairy systems. Since grazing cows can produce milk at lower cost than confinement systems, grazing-based dairy farmers have a lower cost base, allowing for retention of a higher percentage of gross income in contrast to confinement farms. Producers can also try alternative forage crops to extend their herd's grazing season into fall or winter, or earlier into spring than is typical for their climate. Because less overall labor is required, farmers can spend leisure time off the farm, develop more efficient milking parlors, or pursue other income-providing or value-added enterprises that complement the dairy system.

Perhaps the greatest benefit to well-planned and managed grazing-based dairy systems is that they become more sustainable. This is achieved through a mix of practices that combine social, environmental, and economic advantages. Table 1 summarizes the ecological and social benefits of well-managed, intensive grazing systems. Further discussion of the social, economic, and environmental advantages follow.

Social advantages

Dairy farmers often cite improvements in quality of life as one of the greatest benefits when switching from confinement-based to grazing-based dairying. It still takes time and work to operate a grazing-based dairy, but the kind of work and amount of time changes. Labor involved in growing and harvesting forage and grain crops is reduced or eliminated and is replaced by labor to maintain fences and watering sites and to move cows. In fact, many people report they have more time to spend with family, or doing things other than routine essential confinement-based dairy chores (Ostrum and Jackson-Smith 2000).

Grazing-based systems can help young people become interested in and stay content with the lifestyle of dairy farming by reducing the long hours of hard work common to confinement systems. Start-up costs are also lower for grazing-based systems. This can eliminate a significant problem for young people with little equity to purchase a herd, acquire basic equipment, and rent or buy a farm.

Local communities and rural landscapes also benefit from family-sized grazing-based farms. These farms are more likely to recirculate agriculturally generated dollars locally to support the local community. Large, confinement dairies buy in bulk from the lowest bidder and often use outside businesses for their supplies, bypassing the local economy.

Rural landscapes with cows in pastures tend to be more appealing as tourism grows in importance in various regions of the country such as in the Northeast (fig. 4) and parts of the West. As an example, Whatcom County, a rural county in northwest Washington State, is dominated by small dairies, but ranks fifth in the state for visitor spending. Tourism, according to the Bellingham/Whatcom County Visitor's Bureau, directly creates 6,560 jobs, or 6 percent of the employment in the county in 2006 (Bellingham/Whatcom County 2006).

Economic advantages

Grazing-based dairy systems achieve an economic advantage primarily by using homegrown perennial forage crops. Perennial forage crops are long-lived feed sources whose establishment costs can be spread out over many years. Their yields may be

Table 1 Social and ecological benefits of intensive grazing systems

Feed Source	Poorly managed pasture	Confinement feeding					Well-managed pasture
		Greenchop	Corn silage	Alfalfa hay	Grass hay/haylage	Grass silage	
Ecological/social effects							
Human time	Little time devoted to managing herd	Planting, harvest, storage, and daily feeding required	Planting, harvest, storage, and daily feeding required	Multiple harvest, storage, and daily feeding required	Multiple harvest, storage, and daily feeding required	Multiple harvest, storage, and daily feeding required	Moving and maintaining temporary fences and watering systems and moving cows required
Animal health	Animal stress, soil ingestion, parasite ingestion possible	Confinement: hoof and leg problems, acidosis, udder health, animal stress possible	Confinement: hoof and leg problems, acidosis, udder health, animal stress possible	Confinement: hoof and leg problems, acidosis, udder health, animal stress possible	Confinement: hoof and leg problems, acidosis, udder health, animal stress possible	Confinement: hoof and leg problems, acidosis, udder health, animal stress possible	Improved leg/foot/udder health and less parasite ingestion and climatic stress
Soil quality	Compaction, erosion, reduced OM, reduced permeability likely	Wheel compaction when soils are wet	Reduced OM, erosion, reduced permeability, compaction	Compaction when soils are wet	Compaction when soils are wet	Compaction when soils are wet	Increased OM, compaction minimized, little to no erosion
Nutrient cycling	Nutrient hot spots. Nutrient deficiencies elsewhere. Nutrients may exceed plant needs on long-term overstocked pastures	Close fields tend to receive more nutrients. Higher use of commercial fertilizer due to nitrogen losses in confinement operations and often inefficient collection, storage, and utilization of manures	Nutrient uptake not uniform throughout growing season. Close fields tend to get more nutrients. Higher use of commercial fertilizer due to nitrogen losses in confinement operations and often inefficient collection, storage, and utilization of manures	Close fields tend to get more nutrients. Manure not often applied since it can be harmful to alfalfa stand maintenance. Requires commercial fertilizer applications instead, unless preceding crop receives excess manure	Close fields tend to get more nutrients. Nutrients used throughout the growing season. Higher use of commercial fertilizer due to nitrogen losses in confinement operations and often inefficient collection, storage, and utilization of manures	Close fields tend to get more nutrients. Nutrients used throughout the growing season. Higher use of commercial fertilizer due to nitrogen losses in confinement operations and often inefficient collection, storage, and utilization of manures	Nutrients in balance with plant needs. Nutrients used throughout the growing season. Good nutrient distribution
Perennial characteristics	Most are perennial, but annuals tend to invade. Re-establishment often needed	Frequent reestablishment of some species required	Reseeded annually	Re-established every 3-5 years	Periodic reestablishment of perennials. Annuals reseeded yearly	Perennial, but may be in a crop rotation with corn or other crops	Most are perennial. Occasional, optional reestablishment or overseed necessary
Water quality	Runoff and loss of sediment, nutrients, organics, and pathogens likely	Confinement: Water collection and management, manure storage, manure distribution, and nutrient management required to protect water quality	Confinement: Water collection and management, manure storage, manure distribution, and nutrient management required to protect water quality. Silage leachate potential rapid depletion of dissolved oxygen	Confinement: Water collection and management, manure storage, manure distribution, and nutrient management required to protect water quality	Confinement: Water collection and management, manure storage, manure distribution, and nutrient management required to protect water quality	Confinement: Water collection and management, manure storage, manure distribution, and nutrient management required to protect water quality. Silage leachate potential rapid depletion of dissolved oxygen	Water quality maintained with adequate buffers as needed

Table 1 Social and economic benefits of intensive grazing systems—Continued

Forage production	Less than soil potential; unpalatable or low producing species increase. Quality high on close grazed pastures. Spot grazed or zone grazed pastures have variable quality	High quality but more variable than other harvested forage. Lower production than other harvested forage. Stand loss occurs sooner	Good quantity, quality dependant on harvest and storage conditions	Good quantity, quality dependant on harvest and storage conditions	Good quantity, quality dependant on harvest and storage conditions	Good quantity, quality dependant on harvest and storage conditions	Generally high quality but slightly lower quantity than mechanically harvested forage
Air quality – odor	Fresh manure less offensive than stored manure. Manure build up around haybunks and near shade	Confinement: Concentrated animals and stored manure produce strong odors	Confinement: Concentrated animals, stored manure, and silage effluent produce strong odors	Confinement: Concentrated animals and stored manure produce strong odors	Confinement: Concentrated animals, stored manure, and silage effluent produce strong odors	Confinement: Concentrated animals, stored manure, and excessive silage effluent produce strong odors	Fresh manure less offensive than stored manure. No manure buildup
Energy – fossil fuel	Significant supplemental feeding or return to confinement required. Manure spreading energy costs are low. Futile reseeding efforts take energy	Energy costs associated with tilling, planting, harvesting, fertilization, manure spreading, etc., are higher than for grazing systems	Energy costs associated with tilling, planting, harvesting, fertilization, manure spreading, etc., are higher than for grazing systems	Energy costs associated with tilling, planting, harvesting, fertilization, manure spreading, etc., are higher than for grazing systems	Energy costs associated with tilling, planting, harvesting, fertilization, manure spreading, etc., are higher than for grazing systems	Energy costs associated with tilling, planting, harvesting, fertilization, manure spreading, etc., are higher than for grazing systems	Electric fencing required. ATV often used to move fencing, waterers, and cows. Some energy used to clip, harvest excess forage, and fertilize fields

reduced during years of less than ideal growing conditions, but they generally still provide a product without the annual costs of establishment. Annual crops, on the other hand, must be planted or seeded every year, requiring an annual outlay of cash for fuel, equipment use, labor, pesticides, fertilizer, and seed. These costs generally must be paid back with a single year's production, often a difficult task when the weather refuses to cooperate, sharply reducing yields or crop quality. In other years, insects or disease may reduce the yield or eliminate it. When crop production falls short, feed must be purchased. This dramatically increases the cost of milk production, because money is spent twice, first on a short crop and second on feed purchased to replace the reduced or failed crop. However, annual crops used wisely can complement perennial forage species to improve overall dairy cow performance, or grazing efficiency on some farms, particularly during transitions as perennial pastures are renovated.

Economic studies have demonstrated that well-managed grazing-based dairy systems tend to have higher net incomes per cow than similar sized confinement-based farms (Winsten et al. 1996; Cornell Dairy Farm Business Summary 1996–2000; Kriegel 2000, 2003). These increased economic benefits are primarily related to lower overall production costs, including crop production costs such as the following:

- labor, machinery and fuel to plow, plant, and harvest
- fertilizers, pH remedials, pesticides, and herbicides
- transport and storage costs

Figure 4 Rural landscapes with cows in pastures tend to be more appealing where tourism is important.

On most dairy farms, these crop production inputs account for 25 to 30 percent of the total costs of production (Ford and Hanson 1994; LaDue et al. 2000). Total feed (purchased and homegrown) costs run about 50 percent (Ford and Hanson 1994).

Any significant reduction in input costs will most likely improve net farm income. The amount of forage that has to be mechanically harvested, placed into storage, and then fed back out of storage is reduced by one day for every day that the cows harvest their own feed through grazing. This generally amounts to at least 5 months, depending on growing season length. It can be profitable to extend the grazing season by widening the mix of forage crops by planting cool- and warm-season grasses and forbs that grow or maintain their quality when other forage crops are dormant or low quality.

Grazing-based systems can also lower the costs for animal care and replacement. Cows tend to be healthier and have longer productive lives when they can get fresh air, eat high quality feed, walk more, are less stressed from milk production demands, and get off concrete or "dry" lots. Cows not pushed for maximum milk production tend to breed back more quickly and have fewer reproduction problems. As a result, cull rates and overall veterinary expenses are lower on grazing-based rather than confinement farms (Muller et al. 2002). Grazing-based dairies can also earn additional income by selling higher value springing heifers rather than cull cows, because fewer cows are culled. Alternatively, if they so desire, these dairies can more easily build herd numbers because they have more springing heifers than needed as replacements. However, seasonal calving grazing-based dairies may not enjoy reduced culling rates or fewer reproduction problems. Their cows must all breed back ideally in a narrow 60-day period, so they will calve in the same narrow time frame.

The collective and compounding advantage of reducing all of the production costs is what makes grazing-based dairy production profitable across many geographic areas.

Environmental advantages

Properly managed, intensive grazing systems can benefit soil quality, nutrient cycling, water quality, air quality, energy conservation, and wildlife and animal health (fig. 5).

Soil quality—Indicators of soil quality, including soil erosion, soil compaction, soil tilth, and soil organic matter content, improve when cropland is converted to pasture. The continuous vegetative cover provided by well-managed perennial pasture virtually eliminates soil erosion. This contrasts with erosion on poorly managed pasture that is sometimes only marginally better than cropland. Erosion occurs in abused pastures where plant cover is thin, and along streambanks where livestock have direct access and are not provided with off-stream water or shade.

Well-managed grazing systems can cause dramatic improvements to soil quality from organic matter or soil carbon accumulation. This contrasts with row crops, especially such crops as corn silage that return little in the way of root or aboveground biomass to the soil. In the southeastern United States, converting tilled cropland back to grassland increased soil carbon about 3.5 percent per year for up to 40 years until a higher soil carbon stability level was reached (Conant et al. 2000). Owens and Hothem (2000) found higher levels of soil carbon in pastures than in no-till cropland on the same soil types after 20 years.

Soil tilth is the physical structure of the soil that allows movement of water and air and plant root growth with the least restraint. Tilth is significantly improved with increased soil organic matter and decreased tillage, both direct results of conversion from a row crop based system to a grazing-based dairy system.

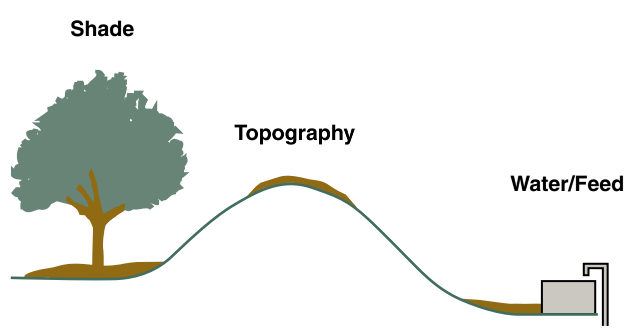
Nutrient cycling—Nutrients are effectively cycled onsite in well-managed grazing systems. Between 75 and 80 percent of the nitrogen consumed by grazing dairy cattle in feeds and forages passes through them and is returned to the pasture (Whitehead 1995). High producing dairy cattle on pasture are typically fed supplemental forages and concentrates to balance their diet. But the nutrients brought into the system tend to match or exceed the nutrients going out through milk production, creating a balanced system and making frequent fertilizer additions unnecessary. This is a clear advantage over hayland or cropland where most nutrients in the harvested crop leave the field and must be replaced with manure or inorganic fertilizer to maintain fertility levels. Between 70 and 90 percent of the phosphorus, potassium, calcium, and magnesium consumed is also excreted back onto the pasture (Mott 1974).

Confinement systems, which do not necessarily balance the number of cows they support with the land base available, are likely to import far more nutrients than the growing crops need, especially if manure is applied in addition to recommended fertilizer applications. This nutrient imbalance can lead to accumulation of phosphorus and potassium in particular. Excess potassium in the soil can lead to problems with plant growth and animal health. Excess phosphorus can lead to water quality problems.

While grazing-based systems are usually superior overall in nutrient cycling, management of the pasture system determines individual success because distribution of nutrients on pastures will be uneven if left unmanaged. In intensive dairy grazing systems, manure deposition is highly correlated with the amount of time spent in various areas (White et al. 2001). In areas where animals congregate, dung and urine spots disproportionately concentrate (fig. 6). In fact, the rates of nitrogen (N) application at urine spots can range from 200 to 900 pounds per acre (Barnes et al. 1995; Whitehead 1995; Stout et al. 1997). Intensive rotationally stocked pastures have a more even distribution of nutrients than continuously stocked pastures (Mott 1974). In either case it is extremely important to space water, feeding areas, salt and mineral boxes, and shade frequently and evenly on a rotational pasture so that animals are not inclined to loiter routinely in small, isolated areas.

Figure 5 Properly managed intensive grazing systems provide many environmental benefits.

Figure 6 Effect of preferential animal movement on manure distribution



Water quality—Erosion is minimal on healthy pastures. In general, sediment transport to water bodies is reduced as permanent pasture replaces tilled cropland. This does not, however, mean that nutrient loading to water bodies is reduced, since surface applied manure and urine nutrients may leave pastures during runoff events in overland flow. Factors that influence whether pastures will reduce nutrient loss to water include:

- stocking density/plant cover
- animal distribution
- rainfall intensity and duration
- water balance
- soil infiltration/percolation characteristics
- amounts and timing of surface applied fertilizer
- proximity to surface water

Pastures typically need fewer chemical applications than do annually tilled row crops. This reduces the potential for chemical pollutants to enter surface or ground water. Grazing-based systems have reduced risk of accidental animal waste spills since there are fewer or smaller manure collection, storage, and disposal facilities. Finally, these systems are not as subject to pollutant loss as are confinement areas and crop fields that receive recent unincorporated, high-rate applications of manure just before transport or runoff events. Where less manure storage is required, better application procedures, including application timing, are possible.

Air quality—Odors associated with fresh manure and silage effluent can be reduced on well-managed pastures as compared with poorly managed pastures or confinement systems. On well-managed pastures, animals tend to herd less, so there is less potential for concentrated manure areas to develop from which strong odors can arise. Manure and undigested feed decompose more rapidly in aerobic conditions found in pastures. In confinement systems, wet, accumulated waste can intensify the odor problem. The co-mingling of urine and dung in confinement systems increases ammonia volatilization. Ammonia combines with other chemicals in the air to form a regulated particulate (Tyrell 2002).

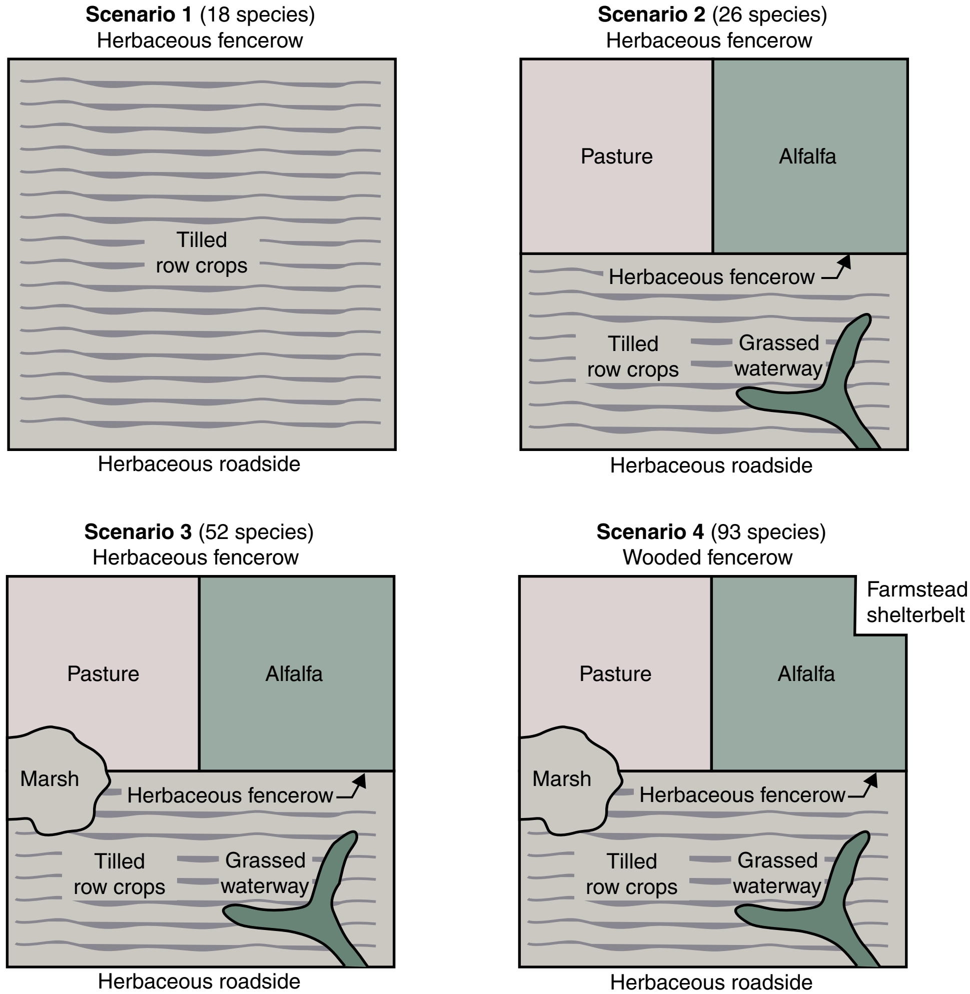
Energy conservation, wildlife and animal health—Under well-managed grazing systems, energy costs associated with tilling, planting, harvesting, fertilization, and manure handling are dramatically reduced. The handling of manure may be reduced from daily collection and spreading to once a week or less during the grazing season.

Pastures along with woody perennials can add an element of landscape diversity to row-cropped land. Wildlife that use grassland habitat or edges between land cover types are favored. Figure 7 shows how songbird numbers increase as pastureland and other perennial habitats are restored on a quarter section of farmland (Best et al. 1995). The perennial nature of most well-managed pastures reduces the need for soil disturbance and external chemical inputs. The diversity of soil flora and fauna also increases because of increased organic matter and decreased soil disturbance and farm chemical inputs.

Finally, a grazing-based system has marked advantages for animal health when compared with confinement. Dry cows get more exercise, which can facilitate calving ease and easier transition to lactation (fewer metabolic health issues). Hoof and leg problems, acidosis, udder sores, mastitis, and general animal stress associated with confinement are largely alleviated under pasture, although some animal health issues remain and new ones emerge. For example, under pasture, the potential increases for animals to ingest parasites. Also, if shelter is not provided, excessive heat or cold may cause stress. On the other hand, pastured cows exercise while they eat and walk to and from the milking parlor, allowing them to maintain better overall physical condition than cows in confinement. As a result, grazing-based animals remain productive over more lactations compared with cows kept in confinement systems.

Landscape-scale impacts—Grazing-based dairies are valued for their appearance in the landscape and often enhance regional tourism economies. The aesthetically pleasing and nostalgic characteristics of traditional barns, silos, open pasture, and tidy farmsteads attract visitors to a dairy area. These landscapes become even more valuable as larger, industrial appearing confinement dairies replace smaller dairies.

Figure 7 Effect of agricultural landscapes on nesting bird species (modified from Best et al. 1995)



These four agricultural landscapes (scenarios) represent a range from an intensive row-crop monoculture to a diverse mixture of crop and noncrop habitats. Each illustration is intended to represent a quarter section (160 acres) of land. The maximum number of nesting bird species is given in parentheses.

Who should implement a grazing-based dairy system?

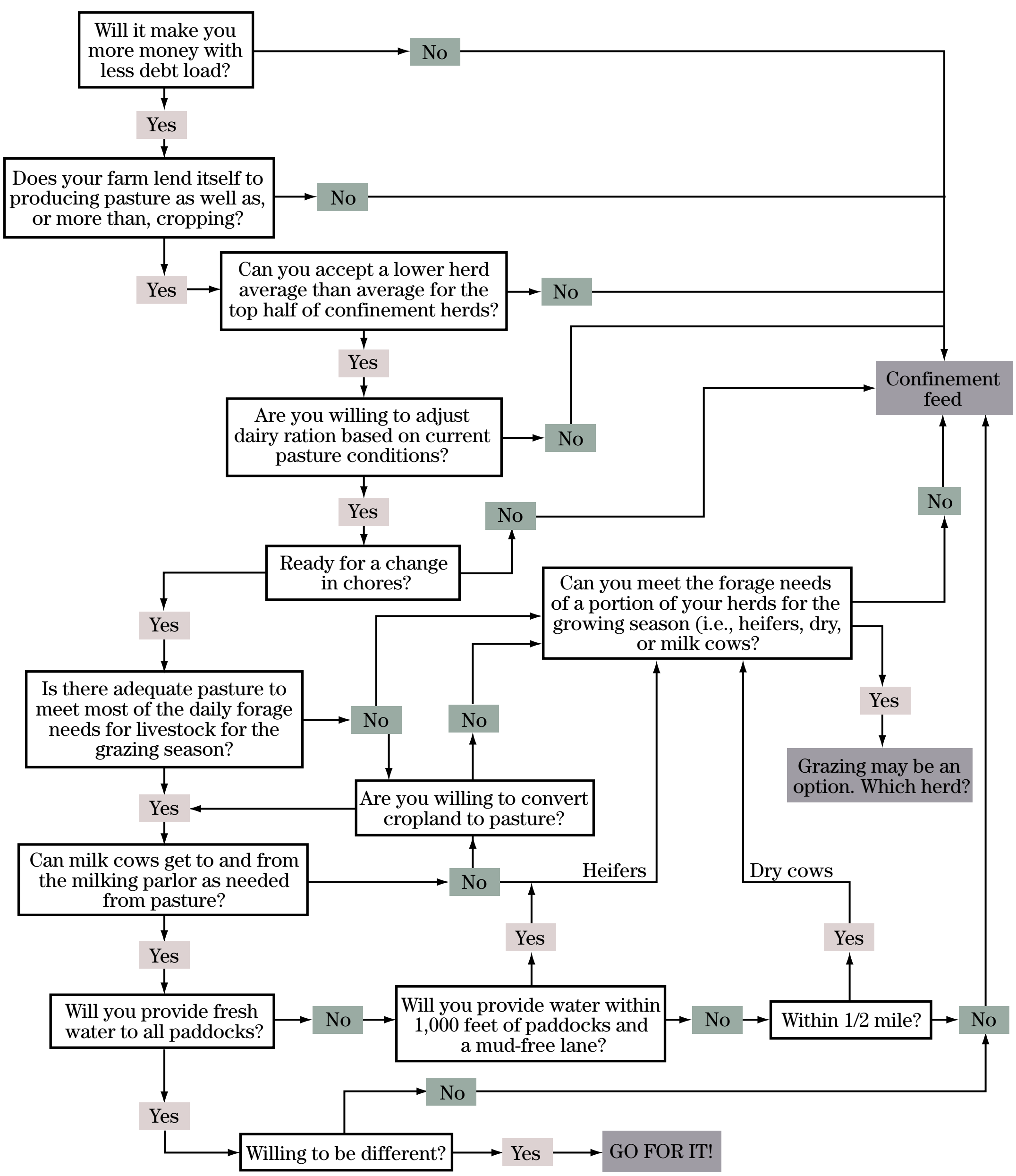
Despite many advantages, a grazing-based system is not for all dairy farmers. Figure 8, based on a list of questions developed by the Cooperative Extension Service in New York, Iowa, and Wisconsin, provides a schematic of a thought process for determining when intensive grazing is an appropriate system for a given dairy. If the answers lead to consideration of a grazing-based dairy system, the farmer should contact the local USDA, NRCS, Conservation District, Cooperative Extension office, or a private consultant to explore available options or alternatives for solving resource problems and increasing profitability.

Question: Is it really hard mentally to go from confinement production to the grazing level?

Answer: No. If you have the mental capability to excel or fail with one system, you can do it with another, as well.

Lance Johnson, **Hesperia, MI**

Figure 8 Is intensive grazing for you?



Part II

Considerations for implementing a grazing-based dairy system

Economic considerations

Farmers need to clearly understand their economic goals, whether they propose to start up a dairy or remain in the dairy business. How many hundredweight of milk are needed to produce the desired net return to meet principal and interest payments and other costs of running the farm? For the start-up grazing farm, this analysis may be simple because investment can be limited at the outset to purchase only the absolute essentials in equipment, cows, and land to get started. It may mean renting for a while to keep capital costs down. Existing confinement dairy farms that carry holdover debt from machinery and facilities, may find transitioning to grazing more difficult. However, selling unneeded machinery, equipment, and other items can help lower debt principal, making payback easier.

Another economic consideration will be the transition from cropland to pasture. This transition requires substantial time and reinvestment in fences, forage seed, lanes, and watering facilities. Whatever the case, planning for the possibility of low milk prices that would make it difficult to meet all cash flow needs is imperative. Then, determine what other outside income sources are available to meet this low milk price contingency. Farm expenses must be satisfied before discretionary family living expenses. A planning horizon of at least 3 years is needed to project income, expenses, and cash flow if major changes are to be implemented.

Marketing—A marketing strategy is essential for economic success when starting or changing to a grazing-based dairy business. Some fundamental questions to consider are:

- What kind of milk market is already in the area?
- Can you sell to either the fluid milk market or a processing milk market?
- How many processors within hauling distance are willing to buy and pick up your milk?
- On what basis is the milk priced (butterfat, solids, protein, and volume)?
- Are specialized milk market opportunities available for milk produced in a pasture-based system?

Direct marketing may be an option for some. It may use much of the extra time gained by going to a grass-based system. A “people-focus” is required to win over a customer base and keep them happy and returning. Another skill set, licenses and permits, and additional equipment must be acquired to process the milk into the product to be sold. Direct marketing also requires taking some level of risk as it goes against the established, consolidated milk industry that is specialized in function. A misstep in direct marketing can be costly.

Sustainable Agriculture Technical Note 2, Marketing Tips for Sustainable Agriculture, provides a variety of references that may help you develop a marketing strategy for your dairy. It can be found electronically at *http://policy.nrcs.usda.gov/media/pdf/TN_SA_2_a.pdf*.

Transition period—All economic aspects of a changeover must be considered when attempting major shifts in production and operations. Once the decision to change has been made, a set of transition actions and considerations should be prepared. Needed actions include:

- Improving the milking facilities so that more cows can be milked in a shorter time.
- Improving pasture fertilization by soil testing and following recommended fertilizer rates.
- Keeping fixed costs low—avoiding the purchase of expensive farm machinery without careful analysis.
- Rationing pasture forage based on estimated herd dry matter intake for the grazing period used, quantity of standing forage presented to the herd within the paddock, and a nutritional analysis of forage samples collected from pastures throughout the season.

Seasonal calving, a potential modification to a grazing-based dairy, can be a successful venture, but there are many aspects to consider before making such a move. Transition from confinement to grazing is a major step, and switching to seasonal calving at the same time would not be advisable. Consider the following when embarking on a seasonal calving operation:

- Plan to transition the lactating herd into a seasonal calving herd so that it can provide cash flow to meet debt payments. For example, it may mean prolonging the lactation period of some cows and delaying their being bred back to get all the cows on the same breeding schedule. Also, some breeds and individual cows within breeds may be difficult to maintain in a seasonal system because of lower estrus detection and fertility (Washburn et al. 2002)

- Milk production will be much lower during the transition.
- Will the processor accept milk when the amount of milk supplied daily is more variable?
- Facilities and labor must be available to feed and care for all of the newborn calves simultaneously. Additional laborers may be needed to handle all the cows calving at once.

Ongoing evaluation—Another factor in achieving desired economic goals is ongoing evaluation of changes and analysis of how these changes affect performance outcomes. Some of the more important evaluation tasks include:

- keeping good production records and using a reliable accounting system to track farm performance, preferably on an enterprise-by-enterprise basis
- monitoring quality and quantity of milk produced by its measurable constituents
- monitoring forage quality regularly and adjusting rations accordingly
- monitoring animal health
- monitoring pasture growth at least weekly in all paddocks
- establishing a good advisory team (e.g., veterinarian, nutritionist, economic consultant)

Animal-plant interactions

Grazing animals and pasture plants have co-evolved over time. This plant-animal co-evolution occurred in an uncontrolled setting, however. Once grazing animals are enclosed in a pasture, it is essential to plan stocking densities so that the animals do not undergraze or overgraze the plants. If too densely stocked, desirable grasses are overused and can weaken and die out. Chronic overgrazing leads to a dominance of unpalatable and/or low-yielding species. If under stocked, little-grazed or ungrazed areas may appear as random patches or in less accessible places or more distant places from water. These areas become less productive and even less desirable over time because of invasion by taller plant species and the presence of standing dead residue that shade and slow new shoot growth, causing further livestock avoidance. Good pasture management ensures that both the animals and the grass prosper.

Animal nutritional requirements—Under United States economic conditions, dairy cows are usually supplemented with concentrates for optimal milk production (fig. 9), whether they graze standing forage or eat stored forages (Peyraud et al. 1999). Most United States herds will not reach their genetic potential to produce milk on a grazed grass-only diet (Mayne 1998) without supplemental rations to account for nutritional deficiencies and changes in the quantity or chemical constituents of the grass being grazed. Optimal amounts of supplements for grazing dairy cows may vary by farm and across seasons within a farm. Methods to gauge the quality of the ration balance include the following:

- Testing the forage frequently to monitor changes in quality across seasons, weather conditions, and forage species and maturity. Send forage samples to a nearby certified forage-testing laboratory. Check this Web site: *http://www.foragetesting.org/.*

Figure 9 Under United States economic conditions, dairy cows are usually supplemented with concentrates in a mixed ration for optimal milk production.

- Monitoring milk production and constituents to see how cows are responding to changes in diet quality and climatic conditions. For instance, monitoring milk fat production to ensure the herd is ingesting enough effective fiber for cud chewing.

Applying proper supplementation strategies requires experience. New producers and those thinking about substantial grazing-based dietary changes should work with an animal nutritionist familiar with pasture ration building to ensure the optimal ration balance for the dairy herd at all times.

Forage species selection—Proper selection of forage species is needed to ensure that forage is high quality and highly digestible. Guidelines for selecting forage species follow:

- Use a mix of disease-resistant varieties of forage species (4–5, includes legumes) adapted to local soils and climate that will produce adequate forage on-offer during each grazing period throughout the grazing season.
- When different desired forage species do not grow well together because of competition or maturity differences, grow them in separate pastures.
- Use seasonal pastures if forage species can be chosen that grow best at different times of the year and the number of grazing days can be extended by doing so.
- Use species with the best regrowth potential during the grazing season. Offer the cows 80 to 100 pounds of forage dry matter per cow per day in the paddock at turn-in (Muller et al. 2002).

Animal selection—Dairy graziers need to select the best artificial insemination (AI) bulls. Bull genetics can be evaluated using the following Animal Improvement Programs Laboratory (AIPL) Web site: *http://www.aipl.arsusda.gov/*, and then clicking on **Active AI Lists** or **Top Bull Lists**. A bull's predicted transmitting ability (PTA) values are useful for predicting daughter performance on pasture (McAllister 2002). The only exception for this is the PTA for milk fat. Grazing herds can have significantly lower average milk fat percent and milk fat production than confined herds. PTA fat is, therefore, a poor predictor of a sire's daughter fat production in grazing herds (Weigel and Pohlman 1998). Another Web site for selecting AI sires is *http://www.dairybulls.com/*. This Web site identifies bulls by specific trait, background, and location.

Reproductive traits are important for seasonal calving (Washburn et al. 2002). Cows must conceive as a group (within 60 days) so that a 12-month calving interval is maintained and all cows can be dried off at the same time. Seasonal graziers may benefit from using the USDA productive life (PL) and daughter pregnancy rate (DPR) trait information at the AIPL Web site, by either clicking on **Active AI Lists** or **Top Bull Lists** and going to the **PL** and **DPR** columns for each bull of interest. Another good indicator is estimated relative conception rates (ERCR) now at the AIPL Web page: *http://www.aipl.arsusda.gov/eval/summary/ercr.cfm*.

Generally, dairy graziers, seasonal or not, need to select animal traits that allow for high dry matter intake, ease of gain, survivability, and the relationship these factors have on timely breed-back. However, before deciding on the crossbreeding option, read the McAllister paper in its entirety and gather more facts. Crossbreeding needs to be done with care. Cows with a high genetic trait to produce over 66 pounds of milk daily during early lactation (Sayers 2001) often fail to breed back easily on pasture. If not supplemented well, their feed intake becomes too low to maintain weight, thus they lose too much body condition to conceive at first or second service. Success with a sire is measured by having daughters with good milk yield that have been successfully rebred on grazing-based dairies (Mayne 1998). This technique requires patience because it will be 3 years before the outcome is known with a first calf milk-producing heifer.

Paddock layout and design

For lactating dairy cow herds, paddock systems should be set up to efficiently strip graze fields. Strip grazing involves using movable front and back fences so that new forage is offered to the herd after each milking. The pasture itself works best as a rectangle about a quarter mile wide with a lane lengthwise through the middle (fig. 10). With this configuration, the paddocks on either side do not extend beyond 660 feet from the lane to the perimeter fence. This ideal set-up keeps the distance to water in each paddock relatively short. However, other configurations can work where terrain and farm boundaries do not allow for the most efficient setup. The animals are watered from a portable trough moved with each move to fresh grass. The water is furnished to the trough through convenient coupling attachments from a pipeline traveling along the lane.

Another advantage of this layout is its suitability for cutting and harvesting excess forage. With only two permanently fenced subdivisions and a laneway, forage too mature for grazing can be easily cut and harvested for later use with a minimum of turns. The pasture field(s) should be allocated to ensure that just enough vegetation is cut so cows will not be grazing overmature forage at times or regrazing paddocks where forage is too immature and short at other times.

The following design considerations are effective in installing long-lasting serviceable laneways:

- Construct laneways with a relatively flat grade, but allow some elevation change for drainage along the length. Side-to-side drainage can be achieved by crowning the lane or using graded deflectors to collect water and redirect it into a stable grassed area (fig. 11).
- Harden steep or heavily used laneways. A layered, compacted composite of filter fabric cloth (bottom layer), coarse stone or gravel, and fine granular material (top layer) are typical components (fig. 12).
- Maintain laneways regularly to avoid trail ruts that can deliver sediment, nutrients, and bacteria to nearby waterbodies.
- Make sure the topcoat material of laneways is foot-friendly and does not bruise or injure feet.

Water distribution

A single, fixed watering site should be avoided when distance to water is greater than 800 feet. Multiple, dispersed water sites ensure that lactating dairy cows do not spend too much time in laneways. Excessive travel time:

- degrades laneways and gate openings
- increases the potential to move nutrients and other pollutants offsite
- increases the potential for nutrient transfer to those areas not needing additional nutrients
- reduces milk production by depressing water and forage intake (cows at a watering facility are unlikely to return to the paddock if far away or during hot weather)
- increases the amount of energy used by the animal for nonproductive activity (walking to/from water), energy otherwise devoted to foraging or lactation

The equipment necessary to hook up a portable water trough is readily available and inexpensive. A pressurized delivery system is best for portable troughs. Troughs should be kept full at all times to keep cows well watered and prevent them from overturning them. Install a pipeline to serve all paddocks. Pipelines can be laid on the soil surface at the lane fence if polyethylene water tubing is used. Burying in a trench is preferred to deliver cooler water and reduce maintenance. However, burying involves a long-term commitment to the layout as it is now. Do not restrict flow by using a narrow diameter pipe. Winterize as needed.

Figure 10 Hypothetical paddock layout design

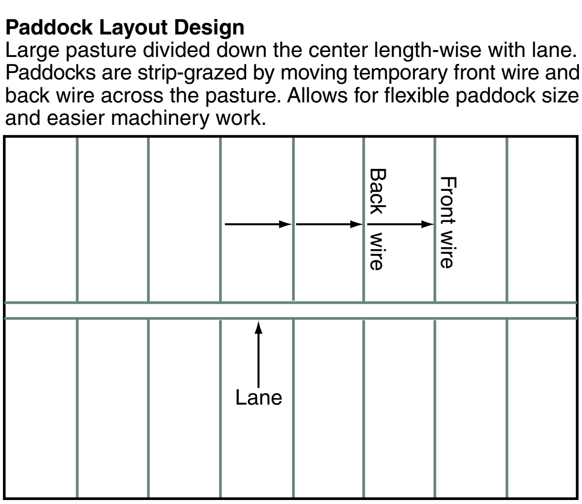


Figure 11 Water bar design

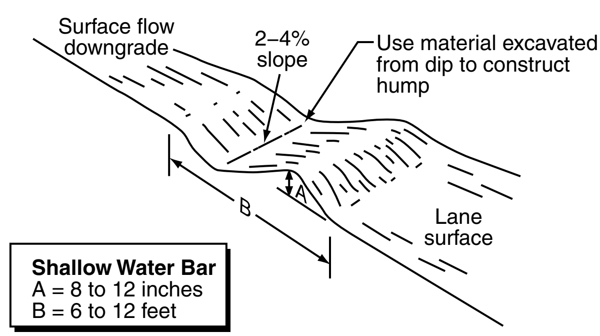
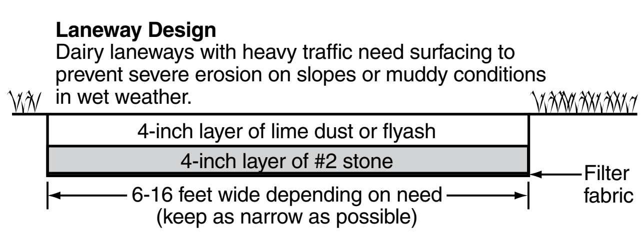


Figure 12 Laneway design



Pastures with live streams in them should have an alternative livestock watering facility to decrease livestock visitation to the streambed and banks. Ideally, these pastures should also be isolated as a separate treatment unit and grazed less intensely, and only under firm soil conditions. This sharply reduces problems associated with water contamination from bed and bank erosion, as well as from manure and urine. Water in ponds and streams can be of questionable quality. An improved stream crossing may be necessary when cows must cross the creek in a streamside pasture or gain access to a set of pastures flanking either side of a stream. Livestock ponds should be fenced and an appropriate grassy buffer established between the fence and pond's edge. If pond water must be used to water livestock, use a siphon hose or gravity flow pipe to convey water to a trough outside the pond fence. These actions improve water quality for receiving bodies and often improve herd health by reducing the transmission of water-borne diseases and parasites through direct udder contact or ingestion. This can contribute to the production of higher quality milk and a healthier herd.

Avoiding environmental problems

Soil compaction is perhaps the most serious resource concern that can occur because of livestock on poorly managed pasture. Compaction can occur wherever cattle tread on moist soils. It increases runoff, reducing plant-available moisture, (Dickerson and Rogers 1941), and reduces soil pore space, making root penetration and nutrient uptake more difficult (Hodgson 1990; Gradwell 1965; Tanner and Marmaril 1959; Kok et al. 1996). However, rotationally grazed pastures are less likely to be compacted by cattle traffic than continuously grazed pastures in that they limit access of dairy cattle to a small area at any one time and are vacated between rotations and during the dormant season (fig. 5). Cropland soil compaction often occurs from wheel traffic on moist soils. This compaction can penetrate deep into the soil and be difficult and expensive to correct. Soil compaction by livestock traffic is most severe at the surface, but can extend 1 foot into tilled soil of annual forage crops (Krenzer et al. 1989).

Streambank and shoreline erosion accelerated by livestock can be prevented or remedied by

- providing alternative watering sites
- controlling the grazing duration and leaving a higher stubble
- providing abundant forage outside the immediate banks
- providing shade away from the stream
- providing cattle watering ramps to water's edge
- improving stream fording areas
- fencing off sensitive (or easily disturbed) areas to control or prohibit access

Managing overall plant growth

All effective grazing systems require a grazing plan. Knowing when to start grazing a paddock based on estimating dry matter production and monitoring grass growth helps the farmer determine when the paddock will be ready to be grazed again. There must be enough paddocks to complete the rotation cycle so that the first-grazed paddocks are ready for regrazing.

When forage plants are experiencing high growth rates, excess pasture can be machine harvested and stored. This extra output is crucial during periods of low forage production, such as mid-summer for cool-season species pastures or where freezing weather or drought causes forage production to cease. During periods of slow growth, additional paddocks are required so that a rotational cycle can be lengthened to a maximum of 40 to 42 days to ensure sufficient regrowth while maintaining forage quality. If the current and projected weather might prevent sufficient regrowth, then stored forage can be fed along with pasture to maintain intake.

Monitoring forages

Grass growth should be monitored and recorded in a log at least once every 2 weeks. For the greatest accuracy, forage should be measured in the paddock just vacated and the paddock to be occupied. Take several measurements on each paddock using a ruler, pasture stick, or rising plate meter (fig. 13). These measuring devices must be calibrated to convert height into forage dry weight. Experienced graziers can often

Figure 13 Monitoring forage regularly is important for determining the number and size of paddocks needed and proper feed ration for the herd.

estimate forage production by eye, but it is useful to calibrate the eye with field measurements from time to time. Forage from several random small areas of known size may be clipped, dried, and weighed for accurate yield determination. Visual checks may be inadequate for changes generated by climate or soil conditions because grass stands change in composition and thickness over a grazing season.

Complete records should be kept by individual paddock even when strip grazing. This information can be used to predict in advance how many paddocks are needed and how big they should be.

Monitoring forage quality through regular testing (at least every 2 weeks or when forage species or quality is noticeably different) aids in formulating a proper feed ration. Proper ration balancing is needed to keep milk flow and constituents at their best for the season and lactation cycle of the herd.

Monitoring animals

To keep grazing cows at the body condition score (BCS) appropriate for the portion of the lactation cycle they are in, their BCS must be monitored throughout the cycle. Body condition is extremely important at breeding to keep the cow on a 12-month calving cycle. Using the dairy cow BCS scale of 1 to 5, they should freshen (calve) with a BCS of 3+ to 4– (Wildman et al. 1982). Pastured cows tend to be trimmer and will score lower than this at 3 or slightly less (Washburn et al. 2002). They should lose no more than 1 BCS during early lactation to avoid ketosis and rebreeding difficulties (Mahanna 1998). The following Web sites may provide additional information on BCS:
http://cahpwww.vet.upenn.edu/dairy/bcs.html
http://www.dasc.vt.edu/extension/nutritioncc/ELANCO.html

Monitor dry matter intake—Cows generally reach maximum daily intake 10 weeks after freshening (calving). At this point, they should be eating 4 percent of their body weight. For every 2 pounds of expected milk production, the cows should eat 1 pound of dry matter. Otherwise, they lose too much body condition and become prone to metabolic disorders. Forage consumption should be at least 2 percent of body weight to assure proper rumen function. Hot weather depresses intake. Temperatures above 75 degrees Fahrenheit cause a 3.3 percent drop in dry matter intake for each 2.2 degrees Fahrenheit increase. Heat stress occurs when temperatures exceed 80 degrees Fahrenheit, relative humidity exceeds 80 percent, or the two combined exceed 140 (Mahanna 1998).

In warmer regions, mid-day shade is needed to maintain intake (West 1995). Either provide portable shade in pastures or keep the milking herd off pasture and furnish stored feed under cover during the heat of the day. Pasture the herd at night when air temperatures are cooler. If possible, paddocks with natural shade areas should be rotated to avoid excessive nutrient accumulation in any one area when heat and/or humidity are extreme.

Monitor milk production—Ideally, milk production should be monitored for individual cows. If this is impossible, then farmers should monitor the bulk tank at end of each milking. Chart milk production and compare it with a normal chart for your region, dairy breed, and rolling herd average. Instructions on how to chart milk and use milk charts is in Dairy Production and Management Benchmarks, University of Georgia College of Agriculture and Environmental Sciences Extension Publication B1193 (Smith et al. 2002).

Monitor milk quality—Milk protein-to-fat ratios should be near 0.9 for Brown Swiss and Milking Shorthorns, 0.85 to 0.88 for Holsteins and Ayrshires, and near 0.8 for Guernseys and Jerseys. Higher values may indicate a fat test problem. Lower values may mean protein test problems from too much fat, or too little total or undegraded protein in the feed ration. Make sure the ration has enough effective fiber to produce a desirable fat test (Mahanna 1998). Lush cool-season grasses often do not have enough effective fiber if they test lower than 35 percent neutral detergent fiber (NDF). Fresh grass fiber is readily fermented in the rumen so only 40 to 50 percent may be effective (Kolver 2001).

Summary

A grazing-based dairy system can be a profitable alternative to a confinement dairy system (Jackson-Smith et al. 1996; Kriegel 2000; White et al. 2002). It requires a different skill set for the manager that involves managing and feeding a live, standing crop of forage rather than a forage crop that is cut, cured or fermented, and stored before feeding. Transitioning to a grazing-based system takes time, knowledge, patience, and experience. Find an experienced grazier or pasture group that can give advice or examples to follow at the outset. Attend grazing conferences where dairy grazing is a part of the program. Focus on accepted and tested practices that optimize livestock performance while sustaining the quality of the natural resources of the farm, watershed, and airshed.

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Part III

Case studies

Six case studies of farmers who have successfully implemented grazing-based dairies begin on the next page. These dairy farms span the Nation showing that any dairy farm situation can make grazing work. A commitment is required to make pasture the primary feed source and land use near the milking facilities. Pasture should be treated as a crop and as a feeding and housing facility. This means:

- keeping tabs on its soil fertility needs
- meeting soil test recommendations
- removing excess water
- providing irrigation water in more arid parts of the Nation
- scheduling harvests with at least as much care as if it were an alfalfa field
- creating an infrastructure in the pasture (fences, gates, water troughs, laneways, and perhaps shade structures) as is done with confinement operations at the farmstead to feed, water, and house livestock

Each of the six different farms takes a different approach to grazing-based dairying. This is because of the uniqueness of the individual or partners operating each farm and the uniqueness of the soil, water, and climatic resources each farm is faced with. All of them find it a rewarding experience.

Figure 14 Dairy cows returning to a fresh grass paddock along a laneway on this Pennsylvania farm. Heifer pasture is the back pasture just in front of the mountain range.

Owned by:
Dr. Edward and Peg Clarke

Operated by:
Peg Clarke

Location:
Lowman, Chemung County, New York

Local contact:
USDA NRCS
Waverly Service Center
109A Chemung St.
Waverly, NY 14892–1306
(607) 565–2106

No. acres:
600

No. pasture acres:
200

Breed(s) of cows:
Registered Jersey

No. lactating cows:
140

Average milk yield:
13,000 lb/cow/yr

Number of years grazing:
18

Grazing-based dairy issues:
Grazing system
Pasture management
Feed and water management
Challenges

Upon completion of her education in dairy production at Pennsylvania State University, Peg Clarke knew that she wanted to have her own dairy farm. However, it was not until she and her husband, Edward, visited New Zealand that she envisioned it as a grass-based system.

Peggy began dairy farming in 1984 with 30 cows and 40 acres of pasture divided into twenty-six 1.5-acre paddocks. In 1991, the Clarke's purchased an adjoining farm and expanded their enterprise to nearly 90 cows and 140 acres of pasture. Currently, they milk 140 cows, maintain 45 to 50 dry cows and bred heifers, and own or lease nearly 600 acres. To accommodate the larger herd size and make milking the herd easier and faster, a new barn with a double four-side opening milking parlor was built in 1995.

Milking is on a twice a day schedule year-round with peak cow numbers coming late in summer or early in fall. During the grazing season, only about 110 cows are in the milking herd at any one time.

Grazing system

Peggy grazes her herd of Jerseys using a rotational stocking method with the cows moved to a fresh paddock every day. Grazing generally begins in April and continues through October, with 180 days an average length of grazing season. Winter is the primary limit to the grazing season, followed by wet saturated spring soils. The farm receives about 33 inches of precipitation a year, and while drought can be a hindrance, it is a rare occurrence.

Pasture management

The pastures consist of mixed forage stands of orchardgrass, bluegrass, reed canarygrass, and red and white clover. They are fenced with two strands of high-tensile smooth wire and are subdivided into paddocks with polywire. Nearly 150 acres of the 200 acres in the system are harvested mechanically each year before being grazed. In some cases, this land is mechanically harvested twice before becoming part of the grazing system. As a rule, Peggy plans to harvest all of the land that is not too steep to harvest mechanically at least once every 3 years.

The soils are described as typical hill soils for the region, with moderate water holding capacity and good drainage. Soil fertility is maintained in the medium to high range, and pH is maintained in the low to mid 6s. The pastures receive 100 pounds of nitrogen per acre per year, as well as "brown water" from the manure storage lagoon. The barn is cleaned with a flush system, and after the solids are separated, the water is used to irrigate the pastures. The solids are spread as a dry material on the cropland.

Feed and water management

In addition to pasture, the herd also receives a total mixed ration consisting of corn silage, high moisture shell corn, cottonseed, and a mineral mix. On average, Peggy plans on the cows obtaining approximately 60 percent of their diet from pasture.

Water is pumped from the barn to troughs in each paddock. The cows are generally moved to a fresh paddock every day. The furthest paddock from the barn is nearly two-thirds of a mile distant, or about a 20-minute walk by the cows. There are no hoof or leg problems associated with this walk, and Peggy suggests that the fact that she has some 8- to 10-year-old cows in her herd, pasturing promotes healthy cows.

Challenges

Grazing is often described as a less labor-intensive method of dairy production compared with confinement dairying. While Peggy finds the work involved with grass-based dairying both enjoyable and satisfying, she is also quick to point out there are still plenty of things that need to be done and problems that need to be addressed. For example, with increased herd size, the layout and design of fencing systems takes more time and thought. The same can be said for getting water to the paddocks. Controlling flies is a little more problematic, and certainly the year-to-year differences in weather, and thus plant growth, make every year a unique challenge.

Despite these observations, Peggy has always grazed her dairy cows, and she is in no hurry to change. Future plans may include another herd expansion and a second barn. Grazing will be very much a part of the process as well as the possibility of manure composting.

All in all, Peggy is very satisfied with operating her farm as a grass-based dairy. In her view, grazing is an alternative production practice that, while not for everyone, is a method that works on her farm and others might consider trying.

Case Study 2—Sullivan Family Dairy

Owned by:
Kevin and Amy Sullivan

Operated by:
Kevin, Amy, and their children, Sara and Brian

Location:
Carthage, Northern Lewis County, New York

Point of contact:
USDA–NRCS
Lowville Service Center
P.O. Box 9
Lowville, NY 13367
(315) 376–7021

No. acres:
210 Total

No. pasture acres:
100–120

Breed(s) of cows:
Holstein, Jersey-Holstein cross

No. Lactating Cows:
65

No. of heifers and calves:
40

Average milk yield:
17,000 lb/cow/yr

Number years grazing:
15

Grazing-based dairy issues:
Pasture management
Grazing system
Challenges and advantages

The Sullivan family dairy farm is a seasonal grass-based dairy system located in a part of northern New York known for its long, cold winters and where snowfalls are often measured in feet. Despite the length and harshness of winter in this area, the moderate summer temperatures and generally adequate rainfall make the Tug Hill region nearly ideal for the production and utilization of perennial grasses.

The Sullivans began dairy farming with a conventional tie stall barn where the cows were fed in confinement the year round. However, because of the high production costs and labor associated with this type of feeding program, they soon began to look for a more cost-effective and less labor-intensive means to produce milk. In 1987, they turned their herd out to graze.

The Sullivans currently graze their 65 Holstein and Jersey-Holstein cross cows using a seasonal approach to milk production. The herd is spring freshened so that peak milk production coincides with the availability of the greatest amount of high-quality spring pasture. During the grazing season, milking is done twice a day in a homemade six-unit, step-up milking parlor. The entire herd is dried off during February and March.

This approach allows the Sullivans to produce the greatest amount of milk for the lowest cost during the summer months and reduce their winter feed costs by feeding only a low-cost maintenance ration to their herd during the drying-off period. It also allows them to take the 2 months off from milking.

Pasture management

The Sullivan's pastures consist mostly of orchardgrass-clover or orchardgrass-alfalfa mixtures with a small amount of perennial ryegrass. They are frost seeded with clover almost every spring. The primary hay fields are reseeded about every 6 years. Fertility is maintained using liquid manure from storage. All pastures are mowed at least once per season to control weeds and to eliminate vegetation that has become overmature. Little commercial fertilizer is used.

Grazing system

In a normal year, Kevin and Amy find they can graze their herd for nearly 6 months. The grazing season begins late in April or early in May and winds down by the end of October. The grazing system is constructed using a combination of electrified, high-tensile strength, smooth wire to form perimeters and polywire to create individual paddocks. The cows are generally moved to fresh grass three times a day. In addition to the pasture, each cow receives about

12 pounds a day of a supplemental total mixed ration (TMR) consisting primarily of high-moisture shell corn and rolled oats. If drought limits pasture growth, chopped balage is fed along fencelines. Spring and fall transitions are accomplished by slowly decreasing or increasing the amount of TMR fed corresponding with pasture growth and forage availability. Some balage is also fed during the fall as pasture growth begins to slow.

The furthest paddock from the barn is a 20-minute walk for the herd or between a half and two-thirds of a mile distant. To keep the herd grazing once they get to a pasture, water is pumped from the barn through either 3/4- or 1-inch plastic pipes to portable tanks in each paddock. Kevin notes that while he occasionally sees a cow with a sore foot, herd health is generally excellent. As evidence of this, Kevin points out he has some 8-year old cows in his herd. This means that instead of culling cows because of problems, he has the opportunity to sell cows and heifers at a profit. Veterinary costs, including vaccinations and dry cow treatments, average $16 to $18 per cow per year.

Challenges and advantages

Kevin is quick to point out that "grazing is not easy and is not a magic bullet. It works for people who are willing to take the time to make it work. However, it takes thinking and dedication to stick with it until you learn and understand the process. It takes more management than conventional dairying." He cites his biggest problem is keeping track of his feed supply. "Guessing what the weather is going to do to forage yield and quality is not easy. However, you get back what you put into it."

Kevin suggests that grazing has allowed them to handle 65 cows with about the same amount of time and effort that it took them to handle 40 when they were a conventional dairy. Furthermore, Kevin concludes, "they can make a good living without pushing the cows' production." This in turn allows the cows to last longer and breed back sooner. Being seasonal means that April, May, and June are extremely busy on the Sullivan farm. However, the winter months are so enjoyable for the Sullivans, especially February and March, that Kevin states, "they would never go back to milking cows the year round."

In addition to improving the quality of their lives and the lives of their cows, Kevin also points out both the environmental, as well as economic benefits. "Being sod-based, soil erosion is little to nothing. As well, we use very little chemicals, either in herbicides or in fertilizers. We have lower inputs for fuel, electricity, feed supplements, fertilizers, and repair bills, which simply adds to our bottom line."

While seasonal grass-based dairying is not suitable for every dairy farm or dairy producer, for the Sullivans it is the perfect blend of lifestyle and standard of living. Also, milk processing plants in their area are less concerned about fluctuations in milk production at the farm caused by all the cows in a seasonal calving herd being nearly in the same number of days in lactation.

> *"It is not easy, it is not just a job,*
> *it is a way of life."*
>
> *Kevin Sullivan*

Case Study 3—Mallonee Dairy

Owned and operated by;
Maynard and Kim Mallonee, parents John and Mary, and son Jack

Location:
Lewis County, Washington

Local contact:
USDA–NRCS
Chehalis Service Center
1554 Bishop Rd.
Chehalis, WA 98532–8710
(360) 748–0083

No. acres:
215

No. pasture acres:
90

Breed(s) of cows
Holsteins

No. cows:
65

No. heifers:
60

Average milk yield:
65 lb per day

Grazing-based dairy issues:
Overview
Grazing system layout
Pasture management
Additional farm activities

Mallonee Dairy is owned and operated by Maynard and Kim Mallonee along with their parents, John and Mary, and son, Jack. The Mallonee Dairy is a transitional-organic grazing dairy located in Lewis County in western Washington. The dairy is home to approximately 65 Holstein cows and 60 heifers. Of the 215 acres on the farm, 90 acres are pasture for grazing dairy cows.

Grazing has been a tradition on the Mallonee Dairy for several generations, and they plan to continue grazing in the future. According to Maynard, maintaining a high level of milk production has been one of the greatest advantages of grazing. In addition, the Mallonees feel that grazing has played an important role in preventing cow health problems and increasing cow longevity.

The Mallonee Dairy is an organic dairy. The land has been certified organic for several years. Organic dairying assures the Mallonees that they are decreasing health concerns for their animals as well promoting a safe product for consumers. Although the Mallonee Dairy was always close to being organic, economic considerations led them to seek certification to sell their product as organic.

To diversify farm income, Mallonee Dairy also supports a small organic beef cattle enterprise. The beef enterprise combines easily with the grazing system already present for the dairy cattle and is an additional enterprise for the farm. It includes breeding stock and organically raised, grass-fed steers.

In addition to the usual daily activities on the dairy, the Mallonee family is also making an effort to advance nutrient management knowledge by volunteering an area of their pasture for university research studies. A research study was started in January 2002 to determine the effects of manure application during winter months.

The wet conditions of western Washington are among the greatest challenges for the Mallonee Dairy. Average rainfall in this part of Washington is 60 inches. About 80 percent of the rainfall occurs from September through April. The saturated field conditions during winter limit the grazing season and require feeding of stored forages for about 6 months.

Cows are milked twice a day in a double two-side release parlor. The cows average around four lactations, with several cows reaching 6 or more.

Overall, few health problems are seen on this dairy. The health problems of greatest concern are milk fever occurrences in early spring when cows are moved to pasture and an occasional case of foot rot if conditions become wet and muddy.

Grazing system layout

The grazing season lasts from around May 1 to November 1. The lactating cows are on a management intensive grazing program and are moved to a new strip of pasture at least once a day. In spring when grass growth is lush, cows are moved to a new strip of pasture on a daily basis. As the grass growth slows in summer and fall, cows are moved twice a day to provide adequate amounts of grass. Each pasture is grazed four to five times per year. The grazing season is limited by soil saturation resulting from the high rainfall during the winter. In contrast to the lactating cows, heifers are on a rotational grazing system and are moved once every 3 or 4 weeks throughout the summer months.

The pastures are located less than a quarter mile from the milking parlor and have a terrain that is fairly flat. Moving the cows from pasture to the milking parlor takes about 15 minutes. Once in the milking parlor, cows receive a grain supplement while they are milked. During the grazing season, lactating cows are given 25 pounds of grain per day. Besides the grain, cows are supplemented with a mixture of salt and trace minerals, which they have access to while they are grazing. Water is made available through a hose and trough system that is moved with the cows from pasture to pasture. Water accessibility is one of the main factors that prevent the grazing pastures from extending further from the milking facility.

Forage supplementation begins in October to help transition cows into a winter-feeding system that includes preserved forages. During the winter months, cows are housed in a freestall barn where they are fed a combination of forage harvested from pastures and purchased hay.

Pasture management

Pastures are maintained in native (i.e., commonly occurring, but mostly introduced species that have naturalized) forage species and are not replanted on a regular basis. Tall fescue is the main grass species though a variety of other grass species occur, and several pastures are approximately 25 percent clover. In the spring, grass species overtake the clover, thus the best clover growth occurs after the first cutting of grass has been removed from the pasture. Pastures with sandy loam soil are the first pastures grazed each spring because they dry faster than those with more clay in the soil. The Mallonee Dairy has not had any particular problems with weed species. Grazing and clipping the pastures appears adequate to control weeds.

In addition to grazing, pastures are mechanically harvested at least once a year and may be harvested a second or third time if weather conditions allow. Harvested forage is stored as dry hay or wrapped silage bales and used as a feed source during the winter.

During the summer months, pastures are irrigated after cows finish grazing and are moved to another pasture. The irrigation system is a hand-line sprinkler system that is manually moved from pasture to pasture. Besides the normal summer irrigation, pastures are also irrigated after they are fertilized to encourage fertilizer incorporation. Pastures are fertilized with manure once per year using broadcast application.

Additional farm activities

Besides the ongoing winter application study, the Mallonee Dairy plans to continue assisting with research projects and was part of a research study that began in November 2003. The second research trial monitored fecal bacteria in runoff from fields receiving applications of dairy manure slurry. This research trial was an important component to determine the risks of winter manure application. The research results formed the basis for writing Agronomy Technical Note 14, *Winter Period Application of Manure in Washington State* by the Washington State NRCS office. Risk of transport of dairy slurry nutrients nitrogen, phosphorus, and potassium were also studied.

Another research trial conducted at the farm measured nitrogen uptake of forage crops where manure slurry was applied at two different rates. Reports of all these findings have been produced by Washington State University Extension at Puyallup.

Owned and/or operated by:
Wangsgard family

Location:
Cache County, Utah

Local contact:
USDA–NRCS
North Logan Service Center
1860 North 100 East
North Logan, UT 84341-1784
(435) 753-5616

No. acres:
290 (two farms)

No. pasture acres:
80 (+ 20) + 150 on home farm

Breed(s) of cows:
Holstein

No. cows:
150

No. heifers:
250–300

Average milk yield:
15,000 lb/cow/yr

Grazing-based dairy issues:
Objectives
Pasture Grasses
Grazing System Layout
Irrigation, Fertilization and Manure
Pests
Economics

Mike Wangsgard, his wife Beth, and his father Ross manage a 150-cow dairy herd with approximately 250 to 300 heifers in Cache County, Utah. Their farm business is split between two farms of approximately 150 acres each, Young Ward Farm and Cornish Farm. Grazing currently takes place on about 150 acres on Young Ward Farm. Cornish Farm and the remainder of Young Ward produce primarily alfalfa for winter feeding. Cornish Farm has 80 acres in pasture with 20 more planted in 2002.

Mike and his family run a semi-seasonal pasture dairy. The cows are turned out on pasture around May 1. The Wangsgards begin supplemental feeding around October 1, but the animals are outside for most of the year, remaining in the barn only when it becomes too muddy in the spring. Breeding is timed so the cows are dry during the winter so supplemental feeding is cheapest.

Objectives

Mike's main objective is to maintain a profitable dairy over the long term. The family has been milking for two generations, and Mike would like his children to have the opportunity to continue if they so choose. To this end, the Wangsgards are contemplating converting one of their two farms to an organic dairy, using the other to manage any cows that might become sick and need to be isolated or receive antibiotic treatments.

Pasture grasses

Each pasture at Young Ward Farm has one grass species mixed with one or more legumes. The grass species include a mixture of different fescues, orchardgrass, bromegrass, perennial ryegrass, and native (naturalized, not intentionally planted) quackgrass. Each grass species has its own growth rate, nutritional value, palatability, and maturity. The Wangsgards keep the grass species separate so they can be more effectively managed.

The fescue on the farm forms a dense sod and starts growing early in the spring. Cows are turned onto fescue pasture first. They graze it lightly, but frequently, as it is less palatable than many of the other grasses, especially when it is allowed to mature. Perennial ryegrass is a highly palatable species, so it is allowed to grow taller and be grazed lower and rested longer than the fescues. Orchardgrass is the highest yielding forage species on the farm. It must often be mechanically harvested to prevent it from growing too rank before it can be grazed. Some grasses and some fields are easier to mechanically harvest than others are. They are often saved for mechanical harvesting. Mike advises farmers contemplating a grazing-based system to get to know their grasses and learn to manage what they have. “Native (naturalized) grasses are there for a reason—because they work best,” he says.

Grazing system layout

Young Ward Farm is a quarter-mile wide and three-quarters-mile long, with an alley down the center. Gates and water troughs are located about every 300 feet along the alley. Portable fences that allow access to one or two water troughs are moved every 12 hours so that the cows receive new pasture after every milking. A grain supplement and minerals are fed in the barn as the cows are being milked. These are supplied by the local grain elevator.

Irrigation, fertilization, and manure

A quarter of the farm is flood irrigated every week so at least half of the fields are accessible to grazing at any one time (allows the irrigated ground to dry for 1–2 weeks). Grazing is timed to avoid conflict with the irrigation schedule.

Soil tests have shown phosphorus and potassium to be adequate, but not excessive in the pastures. Fields are generally fertilized with nitrogen once in early spring and again during the summer. What little manure is produced in the barn during the summer is stockpiled and applied to the fields in the fall. Manure collected over the winter is applied in the spring before grazing begins and usually before green-up. Manure contamination of feed has not been a major issue when manure is applied in this fashion.

Pests

The biggest pest problems the Wangsgards have encountered have been biting flies, mosquitoes, and weeds. The flies and mosquitoes result (they expect) from the farm’s location in bottomlands where they thrive. Grazing probably does not exacerbate the problem. Weed pressures are most severe in new pastures, so weed control is critical during establishment. In mature pastures, barley headed foxtail and thistles are the worst weeds. Spot spraying is used to control thistles. Irrigation ditches that harbor barley headed foxtail are sprayed before the grass heads out and when ditch is empty of water.

Economics

The advantages of this system over confinement dairies include cheap feed, healthier cows, and reduced labor. As the farm is largely a family run business, labor savings are important. Cost savings are also important. Mike points out that, “Whatever you put into a cow produces a return in milk, but the return diminishes depending on the input.” Water is the most cost-effective input you can supply. Next is alfalfa grass, and finally grain. In this part of Utah, adequate water and forage produce approximately 45 pounds of milk per animal day. Grain produces another 5 pounds per day. Whether a major grain supplement is justified depends on the price of milk and the price of grain.

Owned and operated by:
Buck and Dorothy Shand

Location:
Dallas County, Alabama

Local contact:
USDA–NRCS
105 Moseley Dr., Suite A
Selma, AL 36701
(334) 872–2611 ext. 3

No. acres:
1,650 total

No. pasture acres:
1,450 (200 dairy; 1,250 beef)

Breed(s) of cows:
Holstein-Jersey Cross

No. cows:
100

No. heifers:
30–35

Average milk yield:
14,000–15,000 lb/cow/yr

Variable cost/100 wt. milk:
$5.04–$8.52, $6.52 average
(2003 data)

Grazing-based dairy issues:
Grazing system
Animals
Future plans

Buck Shand and his wife Dorothy have a 1,650-acre farm in Dallas County in central Alabama. Two hundred acres of the farm is devoted to dairying. Buck has been around the dairy business his entire life. He began the transition from confinement to a grazing-based system in the mid 1990s when it became apparent that the price of milk was not keeping up with inflation and quality labor was becoming difficult to find. Based on fairly detailed recordkeeping, he realized he needed to cut costs to stay in business. Dallas County is in the black belt of Alabama where the dominant soils are heavy black clays and rainfall is usually plentiful. This is ideal grass-growing country—perfect for grazing. Buck looked backward to the time when most farmers were grazing their dairy cows and forward to a grazing system developed in New Zealand, and decided to convert to a grazing-based dairy system.

To get started, pastures had to be developed and fencing, laneways, and watering facilities were needed, but a lot of equipment could be retired. One step in the transition was to start breeding the Holstein herd with Jersey bulls. Jerseys are a smaller breed than Holstein. On grass the two breeds produce about the same amount of milk. Breeding smaller animals that consume less feed seemed a logical step.

Grazing system

The dairy has four pastures that are subdivided by permanent and portable electric fencing. Water is provided for each pasture. Laneways have drainage tile to keep them from becoming muddy. Pastures are rotated daily. Each pasture is rested for 30 to 45 days after being grazed. In the spring when grazing cannot keep up with the lush growth, pastures are mechanically harvested and saved for use later when dry matter is low.

The primary forage crops on the dairy are dallisgrass, white clover, Persian clover, and several hardy fescue varieties with beneficial endophytes. The clovers and dallisgrass grow naturally on the farm, but Buck is planting the fescue over time and eventually hopes to have 200 to 300 acres of fescue pasture (some of which may be used by the beef cattle). The forage species are seasonal. White clover is a winter perennial that is grazed early and sets seed by mid June. Persian clover is an early annual that grows during most winter months. The fescues are cool-season grasses that do best early in spring and late in fall. Dallisgrass is most active in the summer months. This variety of forage crops permits grazing 10 months of the year.

Pastures are fertilized strictly according to soil test recommendations and rarely need any additions except phosphorus. During drought, feed is supplemented with cottonseed to prevent overgrazing. In the barn, cows are also fed soy hull pellets.

One of Buck's challenges is weeds in the pastures. Buttercup in the spring and camphorweed, ironweed, and cocklebur in the summer are some of the main problems. These generally can be controlled with 2,4–D when necessary. Wild onion in winter pastures can affect milk flavor. To avoid this problem, cows are taken off winter pasture 2 hours before milking.

Animals

The cows on Buck Shand's dairy farm are generally very healthy. As long as the cows are kept out of the mud, mastitis and other health problems have been minimal. The pastures are rotated daily using electric fencing to keep the cows out of the mud. Drainage tile has also been placed under areas that tend to pond water.

Cows are milked twice a day in a double-4, straight-through milking parlor. "It's old, but effective," says Buck. With this system 8 cows can be milked every 10 minutes. Travel time from the pastures to the barn is about 15 to 20 minutes. Cows tend to remain productive for 5 lactations. The average number of lactations per cow in this part of Alabama, according to a University report, is 1.5.

Manure management

Animal waste management has become relatively simple since the transition to grazing. Most of the waste is spread on the pasture by the cows themselves. Waste that is produced in the barn is pushed into a dry stack where solids and liquids are separated. Liquids flow to a treatment pond, and solids are periodically spread on the pastures.

Future plans

Buck plans to develop a calf feeding operation on the farm once the pastures have been renovated. He thinks this will be a profitable new enterprise. He also plans to do a better job of managing farm records to increase the profitability of the dairy. Overall he is happy with his move to grazing. "It's an enjoyable enterprise, and it's reasonably profitable," he says. "We think this part of the country could stand some more dairy operations. If they're sustainable and grass-based, they could be profitable. Our heavy clay soil is well adapted for growing grass."

Case Study 6—Tom Trantham*

Owned and operated by:
Tom Trantham

Location:
Pelzer, South Carolina

Local contact:
USDA–NRCS
301 University Ridge, Suite 3900
Greenville, SC 29601
(864) 467–2755 ext. 108

No. acres:
97.6

No. pasture acres:
70

Breed(s) of cows:
Holstein

No. cows:
75 (10% dry)

No. heifers:
59 (off farm/contracted with neighbor farmer)

Average milk yield:
19,600 lb/cow/yr

No. years grazing:
15

Grazing-based dairy issues:
The herd
Facilities
Forage management
Waste and irrigation
Economics
Transition

Tom Trantham owns a 97.6-acre dairy in Pelzer, South Carolina. The dairy is 25 years old, and Tom has been farming it since 1978. The farm was struggling in April 1988, when the milk cows pushed through the confinement feeding area and began grazing a vacant field that had been scheduled for chemical burndown. The next milk pick up averaged 2 pounds more milk per cow than the previous milk pick up. Thus began Tom Trantham's transition from a confinement dairy to a grazing-based system. Prior to the "accident," the farm had been winning South Carolina milk production awards, but still could not pay the feed bills.

From 1994 to 1997, Tom participated in a Sustainable Agriculture Research and Education (SARE) research grant with Clemson University to determine the feasibility of a minimum input, financially sound grazing dairy. He has also participated in a Southern SARE Professional Development project that took him to Ireland where he learned about the importance of paddock size and irrigation for improving production.

The herd

The herd consists of 75 milk cows, 10 percent of which are dry at any time of the year, but most of which are still producing at 10 to 14 years old. Tom selects bulls of smaller stature that pass on what he calls "dairiness" traits, such as strong feet, deep barrel, and high quality udders. He also looks for bulls with a lot of white in their color pattern to help compensate for the South Carolina heat. He used to raise his own heifers, but now contracts them out at 3 months old, getting them back 2 months before their first calving. This way he can concentrate on the milk cows, and the contract farmer can concentrate on the heifers.

Milking occurs twice a day. Tom uses a side opening, single-4 milking parlor rather than the more efficient herringbone design because it places the cow broadside where he can see her entire body twice a day.

Facilities

The farm consists of 25 paddocks (2.5–3.2 acres each) surrounding the farmhouse and milking barn, a manure sediment lagoon that now only receives wash water, a trench silo now used as a well-water reserve for diluting liquid from the manure sediment lagoon, and a harvestore silo that has been converted to a milk processing plant to bottle the dairy's own milk. The perimeter fence has three to five strands of high tensile wire. Fence along the lanes has two strands, and one strand is used for temporary cross fencing. All fences are electric. The rest of the essential equipment consists of an 80–HP tractor, manure spreader, no-till planter, and rotary mower.

Forage management

The paddocks are typically managed as follows. New forage is no-till planted into each paddock where the recently grazed crop is no longer productive. After the cows move off, any remaining ungrazed pasture is cut and baled for dry cows and heifers. The timing of each task depends on weather, maturity date of the crop, and how much the cows graze the paddock during the growing cycle. Knowing the crop maturity date is critical to the management system. Different forage crops mature at different rates, and once they mature their value for grazing is diminished. The exception is alfalfa, which maintains its nutrition throughout its life cycle. Tom's rule of thumb for the pasture is to graze when the crop is below the knee and bale when it is above the knee.

The forage crops planted on Trantham Dairy Farm include corn (grazing maize), trudan, millet, small grains, alfalfa, and clover. Tom continues to experiment with forage crops, looking for crops with the right vigor, nutrition, and growing season to improve the grazing system. He uses a notebook to keep track of the planting and grazing schedule. He monitors the soils regularly for nutrient imbalances and applies lime periodically to offset the export of calcium in the milk. He also monitors the forages closely to determine the need for supplemental feeding. Tom estimates that currently about 50 percent of the cows' nutrients come from supplemental feeding, though a lot depends on the weather.

Animal comfort, waste, and irrigation

Most of the paddocks have some natural shade. In hot weather, early morning grazing is scheduled in those paddocks without shade.

Cows are watered from 300-gallon Rubbermaid® troughs on geotextile pads in each paddock. A 40-foot-long watering trough is also supplied along the path as cows leave the milking parlor. Tom is experimenting with a variety of materials for his laneways, which need to be mud-free for animal health.

Manure is scraped daily from the cement milking and feeding areas. Solids are separated out and spread on pastures weekly using a calibrated side-opening spreader. Cows are kept off freshly manured paddocks for 5 to 25 days. The wastewater is stored in the waste lagoon along with wash water from the milking parlor. The trench silo currently holds well water. A suction hose and gate valves connect the two reservoirs and allow for mixing. Newly planted or freshly grazed paddocks receive more manure and less water. During droughts, paddocks receive more water and less manure. Of the 25 paddocks, 16 are fitted with an irrigation system that carries water underground from the trench silo/waste lagoon. The system is currently being expanded to collect all runoff water from the farm and store it in a newly constructed reservoir that can be pumped back to the paddocks.

Transition

Tom shares his experiences with other dairy farmers considering transition to grazing. "I believe the farmers of today have the responsibility of leaving things in better shape for the next generation of farmers," he says. "What I've learned would go to waste if it stopped with me." He recommends the first step in a transition is to "get the herd grazing." A good place to start in his region might be to plant a winter grazing crop, such as rye, after the corn harvest. Milk production may initially drop, but TMR costs immediately go down, and over time production should increase as the system develops. As profit margins increase with each transition stage, more improvements can be made, but the job is never done. "That's the beauty of this kind of dairying," says Tom. "Every day you wake up with more ideas you want to try."

**Information for this case study was gathered from a former web site before the current updated and expanded one listed here: http://www.southernsare.uga.edu/twelve/trantham.html with permission from Tom Trantham.*