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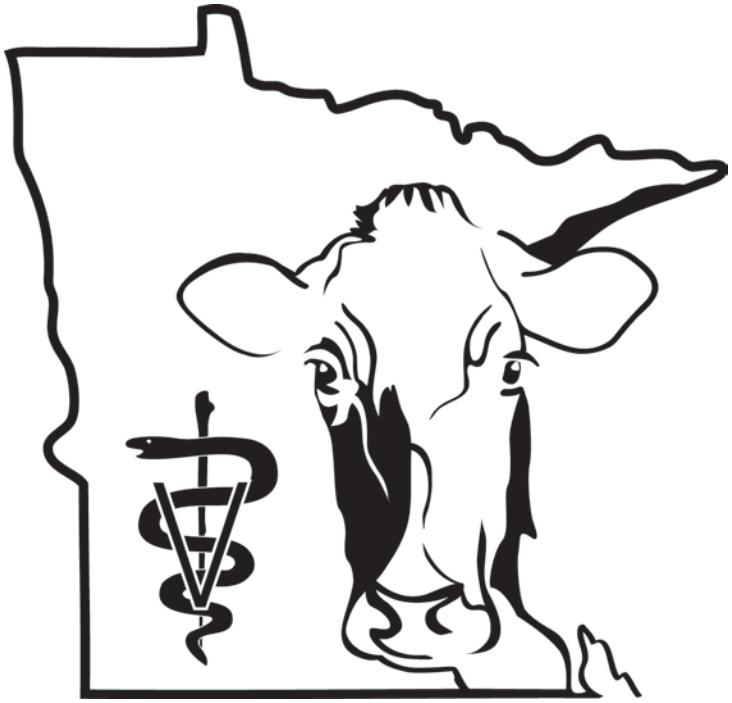

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Intensive rotational grazing for Pennsylvania dairy farms

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The increased profit potential of well-managed and intensively grazed pastures as a primary source of forage for dairy cows has been recognized by Pennsylvania farmers. Current economic and market conditions are motivating many farms to find new ways to increase efficiency and enhance profits. Pastures offer farmers an opportunity to make efficiency gains by reducing feed costs, which range between 45 and 55 percent of total cash costs on dairy farms. Pastures also may decrease costs associated with breeding, herd health care, and labor. However, requirements for management of feed and pasture are greater, and milk quantity and quality levels may also be affected. The exact interactions of these variables differ from farm to farm.

Current state of grazing

A recent Penn State survey of 1,200 Pennsylvania dairy farm operators indicated more than 29 percent of these farmers use pasture as a primary source of forage during the pasture season. More than 16 percent of the total respondents use a rotational grazing system on pasture. The survey results indicate farmers make even greater use of pasture in five agricultural statistics districts delineated by the Pennsylvania Agricultural Statistics Service in the western and northern-tier counties of Pennsylvania. More than 40 percent of the total respondents in those districts use pasture for their primary forage source during pasture season, and more than 20 percent use intensive grazing. However, farmers in the southeastern part of Pennsylvania make relatively little use of pasture; fewer than 20 percent use pasture as a primary source of forage, and roughly 8 percent use intensive grazing methods. These survey results indicate Pennsylvania farmers have great interest in the use of pasture, with use varying by specific geographic regions. Further, more than 18 percent of all survey respondents indicated that they intend to increase their use of pasture within the next five years.

A second study of "grazing dairy farm" operators in five northeastern Pennsylvania counties that use pasture heavily also indicated an interest in increasing their use of pastures. Three of every five of those farmers were either adding more pasture acres or managing for more intensive use of existing pasture, while only one of every five of those farmers was reducing the use of grazing.

Early in 1993, operators of 60 dairy farms with grazing herds were selected from five northeastern Pennsylvania counties for analysis of their cattle grazing systems and successes. The farmers were randomly selected, from more than 300 with herds managed as rotational grazing herds, and can be viewed as "typical" dairy operations. Information on farm finances and production

achievements during the crop year 1992 was collected in personal interviews during February, March, and April of 1993.

No standard approach to grazing existed. Few farmers had adopted "textbook" grazing methods, and four of every five were in the process of changing their approach to or use of grazing systems. Thus, the typical farm operators in this survey were trying to refine or customize grazing methods for better performance in the future. Management of a grazing system can be thought of as "trial and error" and learning by doing, particularly in the early stages of adoption. None of the farmers took forage samples of the pasture. Most of the farmers had too few paddocks to rotate their cattle in the most effective fashion. Thus, the typical farms in this study were characterized by expansion or change in grazing methods and by widely differing degrees of adoption.

Farm financial motivations

Bank regulators have strictly enforced conservative lending practices during recent years, making new loans more difficult for many Pennsylvania farmers to obtain. Capital rationing, or having a loan application turned down by a lender, has forced many small- and medium-size dairy farms to scale back investment plans. For example, farmers may not have the necessary financing to replace worn machinery with new models; in addition, many farmers are reluctant to take out new loans given the difficulty of repaying loans when milk prices are not rising and competition is intense. The inability and/or reluctance to borrow new capital is a stimulus to consider a low-cost technology such as intensive grazing systems.

A statistical analysis by the Department of Agricultural Economics and Rural Sociology was conducted on information from the 60 grazing herds to determine what factors encouraged dairy farmers to expand rotational grazing acres. The statistically significant factors were high debt, poor cash flow, and more pasture available. The nonsignificant factors were milk production per cow, farmer's education level, and crop expense per cow. The results confirmed that financial factors were important to the decision to increase rotational grazing acres. Rotational grazing represents one of the few new technologies or systems that does not require large investment outlays per cow. Beginning farmers with high debt and low equity view rotational grazing as a way to produce low-cost feed. About 40 percent of the farmers in this sample listed debt reduction as a business goal. Increased productivity was the second major goal among the farmers in the study.

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Feed costs

Poor cash flow and high debt make cost-cutting activities a necessity in today's agricultural setting. The costs and returns for the major crop enterprises (intensive pasture, other pasture, hay, and corn silage) on the sampled farms are presented in Table 1. Estimates of pasture yields were based on the nutrient requirements of the cows and their milk production levels. The value of pasture was based on the amount of harvested hay saved because the cows were on pasture. Yields were calculated on a dry-matter basis to permit comparison of production levels across several enterprises.

Nonintensive pasture averaged 1.48 tons of dry matter per acre, substantially lower than any other crop. The pasture's hay value of $112.30 per acre was only 35 percent of the in-field value of corn silage. The low yields and the consequent low-gross returns of traditional pasture are the primary reasons that Pennsylvania farmers reduced pasture use in the past and shifted to more use of confinement feeding systems. With improved dairy nutritional knowledge and pasture management techniques, dairy farmers can now use pasture to provide forage for dairy livestock with considerable cost savings. Farmers in this survey limited their direct costs for intensive pasture to less than $20 per acre, illustrating the responsiveness of managed grazing systems to the need to lower costs. Further, the cost per ton of dry matter produced (after storage losses) is significantly less for the pasture enterprises than for the harvested crops.

Whole-farm analysis

The production of low-cost forage is only one component of a whole-farm dairy forage system utilizing pasture. The effects on forage costs, capital investment, and debt load have already been addressed. Equally important are effects on purchased concentrate costs, milk production levels, variable costs associated with the milking herd, the performance of the farm during the confined feeding season, and long-term relative yield variability among alternative forage crops. Further, it is important

Table 1. Surveyed enterprise budgets for pasture and common forage crops

COSTS PER ACRE	INTENSIVE PASTURE	OTHER PASTURE	ALL HAY	CORN SILAGE
Yield (tons of dry matter adjusted for storage loss)	2.29	1.48	1.81	3.61
Fertilizer expense	$7.37	$1.10	$21.67	$46.68
Total direct costs	$19.48	$7.19	$53.47	$129.02
Total overhead costs	$36.11	$20.10	$74.45	$58.62
Total allocated costs	$56.83	$27.64	$127.93	$184.66
Estimated operator labor	$7.07	$7.33	$27.89	$15.86
Total cost (per ton of dry matter)	$27.90	$23.64	$86.09	$55.55

Table 2. Comparison of three cropping systems

ITEM	NO PASTURE	PASTURE WITH CORN	PASTURE W/OUT CORN
Corn silage acres	31	32	0
Corn grain acres	78	64	0
Alfalfa acres	74	27	55
Grass hay acres	21	21	42
Pasture acres	0	60	60
Land rented out	0	0	47
Milk sales	$126,700	$126,700	$126,700
Livestock sales	$15,051	$15,051	$15,051
Corn sales	$4,050	$0	$0
Land rent income(@$25/acre)	$0	$0	$1,175
Total returns	$145,801	$141,751	$142,926
Crop expenses	$33,205	$29,512	$13,595
Purchased feed expense	$26,067	$20,316	$40,176
Other farm expenses	$52,800	$48,900	$48,900
Total farm expenses	$112,072	$98,728	$102,671
Net cash farm income	$33,729	$43,023	$40,255
Annual cost of fence/water	$0	$1,388	$1,388
Annual savings from sale of corn machinery	$0	$0	$2,978
Net returns over costs shown	$33,729	$41,635	$41,845

to know how the use of pasture on a farm compares to an alternative that does not utilize pasture.

It is very difficult to address these effects with farm-level data. Several years of intensive observation on individual farms are needed to evaluate the economic effects of a transition from confined feeding to intensive grazing. Input and output price changes also must be accounted for so that changes in profitability can be accurately credited to the change in the dairy forage system, and not external economic conditions. Consequently, economic models are used to budget alternative systems under different economic scenarios. Previous research with these models has determined that the benefits of intensive grazing are in the range of $60 to $170 per cow. The following example illustrates this approach.

Two pasture systems are compared to a confined feeding system for a farm with 50 lactating cows, 10 dry cows, and 46 head of replacement animals. The farm has 204 acres of available cropland and is assumed to have above-average management. The first pasture system assumes the crop mix will be developed around the use of 60 acres of pasture. The second pasture system assumes that when pasture is used, no corn will be grown and any unused corn machinery will be sold. Land that is not required to meet the forage requirements of the dairy herd in this second pasture system is rented out at $25 per acre. Greater returns may be possible with alternative uses of this land. All concentrate feeds are purchased from off-farm sources, except when corn is grown. A third scenario is a confined feeding system where no pasture is used. Specific crop mixes for each of the three scenarios provide sufficient feed for rations that maintain milk production at an 18,100-pounds-per-cow herd average. Each scenario assumes all forage for the herd is raised on the farm. Storage and feeding losses are accounted for in the crop mixes, and 10 percent extra forage is raised to provide "a risk buffer" for years with low yields.

Budgeted costs and returns for these systems are presented in Table 2.

Total farm sales are the same for the three scenarios with the exception of income from sale of excess corn in the system without pasture and for land rent in the system without corn. Crop expenses differ significantly for the three different crop mixes. Purchased-feed expenses also vary with the forage quality in each plan and with the amount of corn provided from each crop mix. Other farm expenses include those not associated with crop production or feed purchases. It is assumed that expenses for repairs, breeding, veterinary care, bedding, and utilities are $65 less per year per lactating and dry cow than they would be in the confinement feeding system.

Net cash farm income is highest for the pasture system including corn production. However, when the reduction in machinery ownership costs associated with the sale of corn machinery is included, the pasture system without corn shows a slightly higher net return. The advantage to pasture in both cases is $158 per lactating cow or $137 per cow when allocated over both lactating and dry cows. Maintaining milk production on pasture may be difficult for some managers, particularly in the adoption stage of this new technology. However, the advantage of $158 per cow implies that milk production could fall by 1,129 pounds per cow, or about 6 percent (at a milk price of $14.00 per cwt), before the pasture systems are no longer more profitable. It is more profitable to maintain milk production at higher levels, though, as long as the added milk income is greater than the cost of attaining that added production.

There may be two other advantages to the pasture system without corn. First, there may be environmental cost savings to the farm if no corn is grown. These costs are difficult to quantify, but it is not unreasonable to expect future environmental legislation or regulation restricting cropping practices associated with corn production. Second, reductions in total cropped acreage and in the spring and fall labor requirements for corn production may allow labor to be used more intensively on the hay and pasture crops and in the dairy barn. This may result in the production of higher

quality forage and perhaps better efficiency in milk production. Consequently, the benefits shown to this cropping system may be underestimated. Of course, increased risk associated with purchased-feed prices may offset these gains somewhat, as would any constraints to the reversibility of selling corn equipment.

Summary

Typical dairy farmers who practiced intensive grazing in five northeastern Pennsylvania counties achieved competitive results with fewer paddocks and less rotation than are needed with intensive rotational grazing systems. This suggests that rotational grazing is not an all-or-nothing technology, but can be adopted gradually over time. However, more intensive use of rotational grazing systems is advisable for those farms with less available land.

Rotational grazing is viewed as a technology requiring little new borrowed capital and for that reason appeals to farmers with high debt and poor cash flow. Farmers turn to rotational grazing systems to lower their cost structure. While a rotational grazing approach lowers feed costs, it often is associated with lower milk production per cow unless dairy feeding management requirements also are increased.

Intensively grazed pastures have significant profit potential on dairy farms. An increase in profits of $150 per cow means an increase in net farm income of $9,000 per year for a 60-cow herd. This profit potential is increasingly recognized by Pennsylvania dairy farmers, and survey results indicate these farmers intend to increase their use of pasture in the future.

Pasture is a viable alternative for many, but not all, dairy farms. In addition to increased profits achieved through cost-efficiency and the associated saving of labor, the use of pastures will be attractive to many dairy farmers as a way to also increase the quality of farm life. Finally, pasture has the potential to be an important resource in improving the environmental and economic sustainability of family dairy farms in Pennsylvania ■

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