Alfalfa and Corn Silage Systems Compared on Michigan Dairy Farms

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Introduction

Primary forages for Michigan dairy herds are corn silage and alfalfa. Feeding trials generally demonstrate similar milk production from corn silage and alfalfa based diets when the forages are properly balanced and fed. Given that similar milk production can be attained, overall farm performance and economics become key issues in forage selection. Past studies do not conclude that one forage is always better than the other using economic criteria. A new look at this comparison is needed due to recent changes in the dairy industry. These changes include higher herd lactation averages and the increasing importance of nutrient management. Also, computer technology can now provide better analyses through simulations that integrate weather risk and the many interactions among farm components. A study was conducted to determine the best combinations of alfalfa and corn forage for representative Michigan dairy farms considering machinery and labor utilization, nutrient loss to the environment, and overall farm profitability.

Methods

DAFOSYM was used to compare the relative merits of forage systems when 0, 1/3, 2/3 and all of the forage requirements on a dairy farm came from corn silage with the remainder from alfalfa. Primary comparisons were the net return above feed and manure costs, but manure management issues and labor requirements were also considered. DAFOSYM simulates the growth, harvest, storage, and use of alfalfa and corn along with manure production, collection, storage, and application to crop land on representative dairy farms. Simulation over many years provides a distribution of annual values of farm performance, costs and economic returns as influenced by weather. This study required the simulation of representative farms synthesized through expert opinion and surveys and a sensitivity analysis to determine the impact of major assumptions.

The primary farm studied included 120 lactating and dry cows, but farms of 60, 250 and 400 cows were also used to determine effects of farm size. Milk production goals were selected to represent above average (8,000 kg/cow/yr) and very high (10,500 kg/cow/yr) production levels. The farms were simulated for 26 years of historical weather for East Lansing, Michigan. Soil types chosen were representative of clay loams and sandy loams in Michigan. Silo and machinery sizes were selected to maximize farm net return under each cropping strategy. Manure handling, storing, and application were represented by three systems: solid, spread slurry, and injected slurry. Slurry was chosen as the primary manure system for this analysis to make best use of manure nutrients.

A partial budgeting analysis was used to compare forage systems. Major factors included in the analysis were the labor, machinery, supplies, and energy associated with growing, harvesting, storing and feeding crops as well as handling and applying manure. Long term relative prices were used for feed and milk to mitigate the impact of fluctuating prices. Historical prices were used to establish the long-term price ratios of hay, soybean oil meal, and milk relative to corn.

Results and Discussion

A comprehensive comparison of forage systems representing a range from all alfalfa to all corn silage tended to show the highest net return over feed and manure costs with all alfalfa systems. Relative differences in net returns among the ratios of corn silage and alfalfa studied were small compared to the year-to-year variation in net return caused by weather. These differences are not large enough to encourage a sudden reallocation or reinvestment of resources.

Farm size did not have much effect on the comparison of the four forage systems. Systems using 2/3 or all corn silage had the lowest net returns over feed and manure costs (Table 1). The all alfalfa system remained the most economical, but differences across systems were small. The standard deviation or variance in the net returns across years of weather decreased as farm size increased. Reasonable changes in soil type, milk production level, relative prices, and other major assumptions used in the analysis had small effects on the

differences in net return across systems and the relative ranking of systems. These changes sometimes greatly reduced the differences in net return across systems, and never provided a substantial increase in these differences.

For best use of labor and manure resources on the farm, a forage ratio of 1/3 to 2/3 corn silage was needed. Use of more than one forage crop spread labor requirements more uniformly throughout the cropping season. An all alfalfa system required most of the manure to be applied to alfalfa; a practice that is normally discouraged to promote weed control, stand persistence, and thus maximum yield. All alfalfa also produced large amounts of excess nitrogen. If this nitrogen does not reduce nitrogen fixation by the alfalfa crop, ground water contamination may be an environmental concern. Given the lack of a strong economic advantage among the forage systems, the practice of having 1/3 to 2/3 of the forage requirement provided by corn silage is favored to improve manure and labor management.

Conclusion

Although all alfalfa forage systems may provide a slight economic advantage, labor and manure nutrient utilization issues confirm that between 1/3 and 2/3 of the forage requirement on Michigan dairy farms should come from corn silage.

Table 1. Net returns per cow over feed and manure costs for four farm sizes and four portions of corn silage and alfalfa.*

Corn silage (CS) portion of total forage								
Farm	No CS		1/3 CS		2/3 CS		All CS	
size	mean	CV†	mean	CV	mean	CV	mean	CV
60 cow	$1,574	7.6%	$1,544	7.6%	$1,487	8.7%	$1,519	8.6%
120 cow	1,727	5.8	1,665	6.2	1,646	7.4	1,658	7.8
250 cow	1,817	5.2	1,783	5.4	1,769	6.4	1,755	7.2
400 cow	1,846	5.1	1,816	5.2	1,794	6.3	1,784	7.1

*Numbers represent differences between means averaged over 26 years of historical weather.
†CV is coefficient of variation or 100 times the standard deviation divided by the mean.