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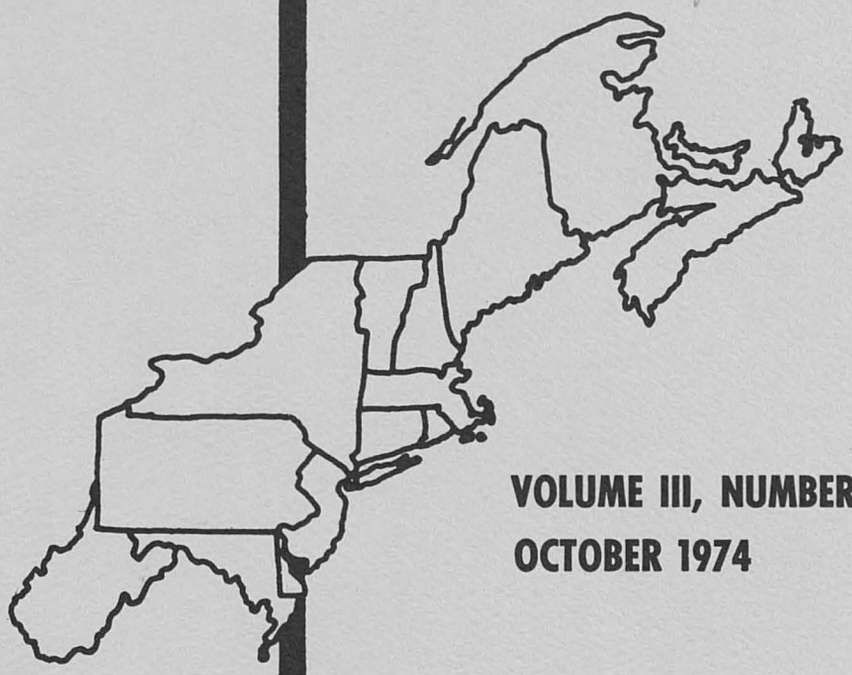

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# CROP STRATEGIES FOR NEW ENGLAND DAIRY FARMS

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## Introduction

Recent changes in feed, livestock and fertilizer prices as well as breeding and agronomic practice developments have created substantial interest in their implications on profitable dairy farm cropping programs. The movement in soybean oil meal prices from under $100/ton in early 1972 to over $400/ton in the summer of 1973 [6] increased the interest in alternatives to soybean oil meal. Dairymen searched for feed ingredients which were relatively cheap per unit of protein. As a consequence, interest in the protein content of alfalfa as influenced by variety, harvesting systems, and method of storage has been substantial in the past few months. Although soybean oil meal prices are expected to drop below the peak levels, the issues raised by the high price levels during 1973 need to be examined.

The price of corn nearly doubled during the same time that soybean oil meal prices were increasing [6]. Inasmuch as corn and soybean oil meal are major ingredients of the standard concentrates purchased by New England dairymen, the result was skyrocketing cost of purchased feed. Corn is a major source of energy; high corn prices resulted in high energy cost just as high soybean oil prices resulted in high protein cost. A new problem has arrived. The prices of phosphorus and nitrogen will be up substantially this year. Nitrogen will probably be in short supply as well as expensive. This will influence the comparative profitability between corn silage and alfalfa.

This paper analyzes cropping strategies two ways. First, the values of high protein roughages, such as alfalfa hay, are analyzed in a partial budgeting format. Secondly, the total farm profitability of such management systems as putting non-protein nitrogen (NPN) into corn silage and considering hay crop silage is analyzed in a whole farm budgeting format.

## Forage Crops Compared

Table 1 represents the essential information which a dairyman needs to compare hay, corn silage, hay crop silage, and high moisture ear corn. We have traditionally thought of these crops as yielding a certain number of

Table 1
Roughage Costs, Yields and Labor Requirements--Amounts Per Acre

| Items | Hay | Corn Silage | Hay Crop Silage | High Moisture Ear Corn |
|---|---|---|---|---|
| As Fed Yield in Tons | 3 | 15 | 7 | 3.0 |
| Total Cost in $'s | 77 | 135 | 83 | 95 |
| Percent Dry Matter | 90 | 30 | 45 | 70 |
| Percent M/cal ENE on 100% Dry Matter Basis | 44 | 71 | 49 | 99 |
| Annual Hours of Labor | 10.6 | 8.0 | 7.0 | 6.5 |
| Total M/cal ENE | 2,376 | 6,390 | 3,087 | 4,158 |
| Cost Per 100 M/cal ENE | $3.20 | $2.10 | $2.70 | $2.30 |
| Hours Per 100 M/cal ENE | .45 | .13 | .23 | .16 |
| Percent Protein on 100% Dry Matter Basis | 16 | 8.0 | 18 | 8.6 |
| Total Pounds of Protein | 864 | 720 | 1.134 | 241 |

Source: Adapted from Field Crop Costs and Returns from Farm Cost Accounts, 1971, by Kearl and Snyder and Nutrient Requirements of Dairy Cattle, by National Academy of Sciences.

tons per acre. These four crops have very different total costs per acre to produce. Lines 3 and 4 enable us to calculate the total energy per acre of these various crops. Corn silage provides the greatest number of megacalories of estimated net energy (M/cal of ENE) while hay provides the least amount of energy per acre. When dividing the total cost by the energy per acre, it is seen that the cost per hundred M/cals of ENE is the least for corn silage and the highest for hay. Hay crop silage and high moisture ear corn are of intermediate value. Handling hay requires more labor per acre. When measured in terms of hours per hundred M/cals of ENE corn silage again is the lowest with .13 hours while dry hay is up to .45 hours.

There have been substantial shifts in prices since 1972. There is a question in the minds of nutritionists, dairy farmers, and farm management people as to whether profit maximizing crop combinations are now different.

## Maximum Profits: Partial Budgeting Messages

Feed costs make up a third to a half of the total costs on New England dairy farms [5]. One can judge the implications for total farm profit by looking only at various feeding strategies. By analyzing alternative ration costs utilizing market prices instead of production

costs a dairy farm manager can identify the more profitable and the less profitable feeding systems.

Table 2 uses this approach to the problem. A nutritionally balanced least cost ration calculator was used to calculate several rations. In Rations A & B four feeds were used to build a ration: corn grain, soybean oil meal, straight corn silage and corn silage with NPN added. With a constant corn silage price, Ration B which used the higher protein silage cost $.13 less per cow per day. For a 45 cow herd, this becomes a cost savings of $2,135 per year. For 100 cows, the annual savings is $4,745. If protein costs are to be held down by using a good quality alfalfa hay instead of fortified corn silage, Ration C represents the system. Ration C costs $.07 less per day than does ration A. Given the feed prices in Table 2, a system built around adding NPN to corn silage appears more profitable than does a system designed to handle good quality alfalfa hay.

Table 2
Daily Feed Costs With Roughages at Various Crude Protein Levels--1,350 lb. Cow, 60 lbs. of 3.5% Milk, Computed on Telplan 31

| Feed[a] | Feed Price | Ration A Straight Corn Silage | Ration B Protein Added to Corn Silage | Ration C Alfalfa Hay For Protein |
|---|---|---|---|---|
| | | Pounds Per Day, as Fed Basis | | |
| Corn Grain | $ 1.85/bu | 8.9 | 12.4 | 15.5 |
| Soybean Oil Meal-44% CP | $ 170/ton | 7.1 | 2.9 | 2.6 |
| Corn Silage 8% CP | $13.60/ton | 73.0 | 0.0 | 32.0 |
| Corn Silage 13% CP | $16.60/ton | 0.0 | 73.3 | 0.0 |
| Alfalfa Hay 18.4% CP | $48.64/ton | 0.0 | 0.0 | 13.9 |
| Cost per Cow per Day:[b] | | $1.35 | $1.22 | $1.28 |

[a] Protein percentages are on 100% dry basis.

[b] Salt and minerals are included in the rations and their values are included in the cost data.

Source: "An Economic Evaluation of Some Alternative Forage Systems for Dairy Farms," Agricultural Economics Staff Paper No. 73-38 by J. Roy Black and C. Raymond Hoglund, Michigan State University, East Lansing, 1973.

Table 3 builds upon the assumptions and calculations done for Table 2. Break-even prices (shadow prices) based on ingredient contents of the various roughages are given. When corn silage with 8 percent crude protein (8% CP) is available at $13.60 per ton, the dairyman could afford to pay up to $19.40 per ton for 13% CP corn silage. He could afford to pay up to $59.28 for 18.6% CP hay. This is true for Ration A. In Ration C, when 18.6% CP hay was available at $48.64 per ton, the value of 13% CP corn silage dropped to $16.20 per ton. The value of lower quality 14% CP hay was $33.82 per ton. Hay costs $30 to $35 per ton to produce; if 14% CP hay is the result little profit will be made. If protein levels in hay can be maintained at 16 percent or more, hay will be profitable. It costs $9 to $11 per ton to produce and store corn silage. Break-even prices in Ration B show that corn silage with 8% CP will not return much profit. The added cost of adding NPN to corn silage is usually returned, and then some, as indicated by the break-even prices in Table 3. The break-even prices in Table 3 are based on 11 different feed ingredients, not just energy and protein. Consequently, such information can be used to determine the most economical feed buys providing the prices used in Table 2 were relevant.

Table 3
Break-Even Prices for Roughages at Various Crude Protein Levels: Results Based on Table 2 and Its Assumptions

| Feed | | Price Per Ton at Which the Feed Would Be Substituted[a] into: Ration A | Ration B | Ration C |
|---|---|---|---|---|
| | | | - dollars - | |
| Corn Silage | 8% CP | [b] | 9.80 | [b] |
| Corn Silage | 13% CP | 19.40 | [b] | 16.20 |
| Alfalfa | 22.6% CP | 72.58 | 52.32 | 62.32 |
| Alfalfa | 18.4% CP | 59.28 | 48.64 | [b] |
| Mixed Hay | 16.1% CP | 49.20 | 40.66 | 41.04 |
| Hay | 14.0% CP | 42.80 | 33.82 | 33.44 |

[a] It would partially replace some other feed. Another computation would be required to determine the actual number of pounds in the given ration.

[b] This feed was included in the ration. See Table 1.

Maximum Profits: Whole Farm Budgeting Messages

Whole farm budgets were prepared to analyze the impact on management income of selected cropping strategies. The budget calculations included feed balance equations. Hay equivalent, energy and protein needs for dairy cows and their replacements (33 percent cull rate) on an annual basis were matched against roughage produced on the farm. Short falls in feed production were made up by purchasing 16% CP hay at $45 per ton, number 2 yellow corn at $2.00 per bushel and a 20 percent concentrate costing $120 per ton. The protein supplied by the roughage (grown and purchased) was subtracted from the animal protein requirements and the remainder came from the 20 percent concentrate. The concentrate energy needs not met by the 20 percent concentrate were purchased in the form of corn. The 1973 costs from farm averages [5] were adjusted to expected 1974 levels. Prices received included $8.50 per hundredweight for milk and $300 per head for cull cows. Given those assumptions, the results in Tables 4 through 6 were calculated. The farm size and cropping strategies were subjectively selected to illustrate different approaches. None of the whole farm budgets represent the optimum solution such as one would get by linear programming. In all budgets, a 22 percent total feed loss in harvest, storage, and feeding is assumed.

Table 4
Management Income Levels for Extensive Acreages
45 Cows, 13,500 lbs. Milk Sold, 150 Crop Acres

| Crop[a/] | Cropping Systems A | B | C |
|---|---|---|---|
| Corn Silage 8% CP | 50 | -- | 20 |
| Corn Silage 13% CP | -- | 50 | -- |
| Hay 16% CP | 65 | 65 | 100 |
| Pasture | 20 | 20 | 20 |
| New Seeding | 15 | 15 | 10 |
| Management Income[b/] | -6,500 | -3,100 | -2,700 |

[a/] Crop yields: corn silage, 15 tons; hay 3 tons; pasture, 1 ton.

[b/] Cash income minus (cash expenses, depreciation, interest on investment and $3.00 per hour for operator labor).

Table 5
Management Income Levels for Intensive Acreages
50 Cows, 13,500 lb. Milk Sold, 50 Crop Acres

| Crop[a] | Cropping Systems A | B | C |
|---|---|---|---|
| | -acres- | | |
| Corn Silage 8% CP | 50 | -- | 20 |
| Corn Silage 13% CP | -- | 50 | -- |
| Hay 16% CP | -- | -- | 22 |
| New Seeding | -- | -- | 8 |
| Management Income[b] | 2,700 | 9,000 | 4,700 |

[a] Crop yield per acre: corn silage, 25 tons; hay crop silage, 16 tons; high moisture ear corn, 3.5 tons.

[b] Cash income minus (cash expenses, depreciation, interest on investment and $3.00 per hour for operator labor).

Table 6
Management Income Levels for Extensive Acreages
100 Cows, 13,500 lb. Milk Sold, 250 Crop Acres

| Crop[a] | Cropping Systems D | E | F | G | H |
|---|---|---|---|---|---|
| Corn Silage 8% CP | 150 | --- | 50 | 50 | 50 |
| Corn Silage 13% CP | -- | 150 | -- | -- | -- |
| Hay 16% CP | 80 | 80 | 70 | 70 | 40 |
| Hay Crop Silage 21% CP | -- | -- | 100 | 00 | 100 |
| Hay Crop Silage 5% CP | -- | -- | -- | 100 | -- |
| New Seeding | 20 | 20 | 30 | 30 | 30 |
| High Moisture Ear Corn | -- | -- | -- | -- | 30 |
| Management Income[b] | -7,000 | 3,200 | 9,400 | -9,500 | 6,900 |

[a] Crop yields: corn silage, 15 tons; hay, 3 tons; hay crop silage, 7 tons; high moisture ear corn, 2 tons.

[b] Cash income minus (cash expenses, depreciation, interest on investment and $3.25 per hour for operator labor).

Extensively operated 45 cow dairy farms would realize about $3,400 more management income by adding 5 percentage points of protein to the corn silage. See Table 4. It was assumed that the added protein would cost about one dollar more per ton of silage and would require one more hour of labor per acre of corn silage per year. A profit increase of about $3,800 would be realized by moving to more good quality hay and less low protein corn silage acreage. The difference between Systems B and C is probably not significant as weather variability from year to year could erase the $400 difference. However, both strategies are probably significantly better than System A. Table 5 indicates that when land is scarce relative to cows, strategy B is superior.

Strategies for extensively operated large dairy farms are analyzed in Table 6. The price, yield and feed assumptions are the same as for Table 4. Systems D and E indicate that increasing the crude protein in corn silage would increase profit on a 100 cow dairy farm by $10,200 per year. Systems F and G compare hay crop silage with different protein contents. If acreage is shifted from silage into hay crop silage with 21 percent crude protein, profit might increase to $9,400. If only 5 percent crude protein is achieved with the hay crop silage, profit falls to $-9,500. In Michigan forage tests designed to identify available protein, carmelized alfalfa hay crop silage was often found to contain only 5 percent available protein [2]. Better managers often attained the 21 percent level. Systems F and G indicate the potential monetary differences between good and poor systems management at current price levels. Crop System H assumes high moisture ear corn and good quality hay crop silage are grown. This system appears to be profitable if the protein availability in hay crop silage is maintained.

Strategies for intensively operated large farms are shown in Table 7. System E which calls for fortified corn silage on all available land is the most profitable plan. If NPN is not available to add to corn silage, then good quality hay crop silage would be the next most profitable alternative. High moisture ear corn would be profitable, but not as much so as System E. Crop yields obtained and degree of intensity of land use influence the relative profitability of the cropping systems analyzed. If plenty of land is available and quality (protein availability) is maintained on haylage, it would pay to shift towards more alfalfa and less corn silage.

## Summary

Partial and whole farm budgeting were utilized to indicate the profitability of alternative cropping systems on New England dairy farms. Partial budgets computed with a least cost ration generator indicated that the most profitable alternative is to feed all roughage as corn silage fortified with NPN so as to attain 13 percent crude protein on a 100% dry basis. Feeding alfalfa hay with 18.4 percent crude protein is better than all corn silage with no NPN added.

Table 7
Management Income Levels for Intensive Acreages
100 Cows, 13,500 lb. Milk Sold, 100 Crop Acres

| Crop[a/] | | Cropping Systems | | | | |
|---|---|---|---|---|---|---|
| | | D | E | F | G | H |
| | | | | -acres- | | |
| Corn Silage | 8% CP | 100 | -- | 40 | 40 | 40 |
| Corn Silage | 13% CP | -- | 100 | -- | -- | -- |
| Hay Crop Silage | 21% CP | -- | -- | 45 | -- | 22 |
| Hay Crop Silage | 5% CP | -- | -- | -- | 45 | -- |
| New Seeding | | -- | -- | 15 | 15 | 8 |
| High Moisture Ear Corn | | -- | -- | -- | -- | 30 |
| Management Income[b/] | | 12,700 | 25,900 | 25,100 | 7,300 | 19,100 |

[a/] Crop yield per acre: corn silage, 25 tons; hay crop silage, 16 tons; high moisture ear corn, 3.5 tons.

[b/] Cash income minus (cash expenses, depreciation, interest on investment and $3.25 per hour for operator labor).

Whole farm budgets were computed for small and large farms which were extensively and intensively operated (2.5 acres per cow vs. 1 acre per cow). On the smaller farm, 16 percent protein hay was competitive only on the extensively operated farm. When land was scarce, the most profitable system was corn silage with added NPN. On the large farm, 21 percent protein hay crop silage was the most profitable on an extensively operated farm, and high moisture ear corn was the second choice. When land was scarce, the large farm would get the most profit from fortified corn silage. However, there was little difference in profit between fortified corn silage (NPN added) and high quality hay crop silage.

With the current situation of high protein and energy costs, New England dairy farmers should first learn to use non-protein nitrogen to get corn silage protein levels up to 12 or 13 percent. If plenty of land is available, high quality (16 percent protein or more) hay crops would be profitable. Switching to more high moisture ear corn would be a third choice, best used only by dairymen with plenty of land.

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