January 2002 E.B. 2002 - 04

PROJECTING CASH FLOWS ON DAIRY FARMS

By
Eddy L. LaDue

$$$ Agricultural Finance and Management at Cornell
Cornell Program on Agricultural and Small Business Finance $$$
Department of Applied Economics and Management
College of Agriculture and Life Sciences, Cornell University, Ithaca, NY 14853-7801

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Good financial management of farm businesses frequently requires projections of cash flows for future periods. To assess the advisability of making changes in the business, or the financing of those changes, an estimate of the cash flows after the change is usually necessary. A good lender will usually demand such projections. Progressive management of a business generally involves preparation of budgets to indicate the planned performance of the business for the next period (month, quarter or year), and then, comparison of those planned budget values to actual performance.

The quality of the investment, financing or management decision depends upon the quality of the cash flow projections. Quality of cash flow projections varies widely. They can be easily manipulated for a predetermined outcome, if the person doing the cash flows is so inclined. This has led some lenders and farmers to discount projections. However, because a job can be done poorly does not mean that the farmer is better off not doing it at all. For many decisions, a good cash flow projection is the only way to assess a business change. Even if the lender will finance what ever a good farmer with a superior performance record wants to do, the farmer must collect information to the profitability and financial feasibility of proposed changes.

There are many levels of effort that may be used in projecting cash flows, depending upon the magnitude of the changes being made in the business. If little or no change is being made, last year's actual performance or last years performance adjusted for expected price changes may represent a good projection for next year. If only small changes are being made, last year's performance can be modified in those areas that are expected to be altered as a result of the changes. However, if significant changes are being made, each individual cost and return item needs to be estimated.

This publication is designed to assist in the process of projecting individual cost and return items. It is assumed that base year data on receipts and expenses for this farm are available. For most farms this would be the most recent year's experience, unless that year was not typical of normal business performance. If a new farm is being projected, average receipt and expense data from summary data reported by a University, lender, accountant or other firm can be used as a base. In such a situation it must be recognized that actual performance may differ significantly from average. In developing base year data from average farm data, it is

[1] W. I. Myers Professor of Agricultural Finance, Department of Applied Economics and Management, Cornell University. The author would like to thank Wayne Knoblauch and Jason Karszes for thoughtful reviews and many useful suggestions.

important to carefully consider each change and have a clear justification for each modification.

The estimation procedures suggested in this publication may be most easily incorporated in projections when a spreadsheet is being used in estimating cash flows.

In the following discussion individual cost and return items are discussed one at a time. These projection procedures are most applicable to dairy farms in northern climates.

Returns

1. Milk sales

For dairy farms an accurate estimation of milk receipts is very important to a good budget. Projected milk sales are a function of the level of milk production per cow, number of cows and milk price. Throughout this publication number of cows refers to the number of milking age females, including milking and dry, not just milking animals. Direct estimation from the base year's milk sales can be calculated as: base year milk sales x (1.0 + percent change in milk per cow, in decimal form) x (1.0 + percent change in average number of cows, in decimal form) x (1.0 + percent change in milk price, in decimal form). For example, if herd size is increasing from 100 to 170 cows, production is expected to decline 5 percent during the expansion year being projected, milk price is expected to increase by 8 percent over the base year and base year sales were $300,000, milk sales would be projected as $300,000 x 1.70 x 0.95 x 1.08 = $523,260. Notice that you cannot add the percent changes together and then multiply. In our example, 70 – 5 + 8 =73 and $300,000 x 1.73 = $519,000. Or more dramatically, if herd size was increasing 50 percent and price was expected to decline 50 percent, adding them together results in no change, i.e. $300,000. But, $300,000 x 1.5 x 0.5 = $225,000. Adding the percentage changes together assumes that the change in price only applies to the base year sales and not the sales resulting from increased herd size.

The change in the price of milk should include changes from all sources, including volume premiums, quality premiums and all other premiums or discounts. Changes in business size or market often alter price through these mechanisms.

The increase in herd size should be the average for the year, not the herd size that is being expanded to during the year. Allowance should be made for normal culling of existing and added animals. If a number of animals are added at some point during the year, it is often advisable to estimate the average number of animals each month of the year and then average those monthly values. The average number of animals should be calculated for both the base and planned years.

Milk production generally declines during the year of a major expansion. The business is disrupted. Animals and humans are adjusting to new routines. Some take time to adapt. Culling may be delayed to build cow numbers. Feeds may change or be of lower quality. While production may increase as the result of the changes being made in the business, that increase usually does not occur during the year of the change. If production is expected to increase during an expansion, there should be a very specific and dependable reason for it. Some herds experience slow growth in production levels of one to three percent. If this is expected, be sure to increase feed use, utility costs and other costs appropriately.

2. Culled livestock

Culled livestock sales can be estimated as: base year culled livestock sales x (1.0 + percent change in number of cows, in decimal form) x (1.0 + percent change in culling rate, in decimal form) x (1.0 + percent change in cull prices, in decimal form). For example, if the base year cull livestock sales was $15,000, herd size was increasing from 100 to 170 cows, culling rate was expected to increase from 30% to 33% and cull cow prices were expected to decrease by 10 percent, culled livestock sales could be estimated as: $15,000 x 1.70 x 1.10 x .90 = $25, 245. This procedure assumes that the proportion of dead animals remains constant. If a higher or lower percentage of animals are expected to die, the number of animals sold should be modified accordingly.

If you are starting from a total accrual livestock sales that may include change in inventory as well as actual sales (as often found with Dairy Farm Business Summary accrual data), be sure to remove the increase in inventory from the total before projecting sales.

An alternate procedure for projecting culled livestock sales is to estimate the number to be sold and multiply by the expected average price per animal. If this procedure is used, remember that some animals are sold in less than perfect condition.

3. Breeding livestock

Breeding stock sales are a function of the breeding and marketing program maintained for breeding livestock. If the herd is being expanded, sales may decline as replacements are used to increase herd size or replace expansion animals that must be culled.

4. Feeding livestock

The planned feeding program determines feeding livestock sales. Receipts can be estimated as the number of animals to be purchased x (1.0 minus the mortality rate) x expected average weight x expected price per pound. For example, if 400 animals are purchased, the mortality rate is 5 percent, they are sold at 1,000 pounds each and the expected price is $.50 per pound, feeding livestock sales would be 400 x .95 x 1,000 x $0.50 = $190,000.

Alternately, base year sales could be adjusted by the expected changes in the same items. Thus, expected livestock sales would be calculated as base year sales x (1.0 + percent change in number of animals purchased (or sold)), x (1.0 plus the percent change in weight per animal) x (1.0 + the percent change in expected price. For example, if last year's sales were $200,000, 20 percent more animals were to be purchased, average weight at sale was expected to be 5 percent higher (1050 instead of 1000 pounds) and the price was expected to be 10 percent higher, estimated feeding livestock sales would be $200,000 x 1.2 x 1.05 x 1.10 = $277,200.

5. Calves

Calf sales are a function of the number of cows (animals freshening), the proportion of calves raised and cull calf prices. While all, or practically all, bull calves are sold, the number of heifer calves sold depends on the heifer raising practices of the farm. Calf sales can be estimated as: base year sales x (1.0 + percent change in herd size, decimal form) x (1.0 - 0.5 x change in percent of live healthy heifer calves raised) x (1.0 + the percent change in calf prices). For example, assume base year calf sales were $5,000, herd size was increasing by 70 percent, percent of live healthy heifer calves raised will decline from 100% to 80%, and calf prices are expected to decrease by 10 percent. A possible rationale for the decrease in percent of heifers raised is that 100 percent have been raided in anticipation of an expansion, but fewer will be needed to only maintain cow numbers. Calf sales would be estimated as $5,000 x 1.7 x 1.10 x 1.10 = $10,285.

6. Market Crop sales

Estimating the value of crops grown for sale, not feeding, can be estimated based on expected acreage, yields and prices. For an individual crop, this can be calculated as the expected acreage x expected yields (of crop sold) x expected price. If the plan is to plant 100 acres of winter wheat, 60 bushels of wheat are expected to be sold per acre and the projected price is $2.50 per bushel, market crop sales would be estimated at $15,000 (100 x 60 x $2.50). Similar calculations are made for all market crops and summed.

Alternately, each crop sales can be estimated from last year's sales modified by the expected percent change in acreage, yields and prices. The equation becomes: last year's sales x (1.0 + percent change in acreage, in decimal form) x (1.0 + percent change in yields, in decimal form) x (1.0 + percent change in prices). If last year's sales of wheat were $10,000 and acreage was expected to increase by 20 percent, yields were expected to be 10 percent lower and prices were expected to be 5 percent higher, sales would be estimated at $12,540 ($10,000 x 1.20 x .95 x 1.10). This procedure has the advantage that exact data on yields and prices are not needed, and misestimation of the specific yields and net prices for this farm do not bias the results.

7. Feed crop sales

Sales of feed crops often result from harvesting more feed than is needed for the animals. Often this results from harvesting enough acreage to insure sufficient feed in poor growing years, which provides excess feed in average or good crop years. Feed crop sales may also result from increasing acreage ahead of increases in herd size. In a few cases, feed crops are grown explicitly for sale.

If feed crops are grown explicitly for sale, the procedures for estimation of market crop sales can be used to estimate sales.

If feed crop sales result from a good crop year or expanding acres before cows, extreme care must be used in projecting feed crop sales. In most of these cases feed crop sales will not be expected and projected sales should be zero. They may occur in good years, but should not be planned on.

It should also be remembered that accrual feed crop sales will include changes in feed inventory. In most cases, projection of feed crop sales should start by subtracting out the change in inventory. As indicated above, these inventory changes often result from variability in production and should not be counted in feed sales.

On farms where major expansions are taking place, the real question is whether there will be sufficient forage for the herd. Use of a procedure as outlined on page 12 can be used to estimate production and use. If that process results in an estimated excess production and some part of that excess is expected to be sold, feed crop sales can be calculated as the excess production multiplied be the expected price of the feed to be sold.

8. Government receipts

Government receipts depend upon the particular government programs that are providing the government payments. The first step is to determine if there are expected to be changes in the programs offered to this farm. The expected changes in the program can then be used to estimate projected receipts.

Many government program payments are a function of the prices received by farmers for products sold. Be sure that the level of government payments assumed is consistent with the level of prices used in projecting crop and livestock receipts. For example, government payments could be high in the base year because crop prices were low in that year. If your projections of crop receipts assume that prices will recover from those levels in the planned year, this may mean that government receipts will decline.

9. Custom work income

Estimation of custom work income requires a listing of the major custom work activities to be conducted by the farm and the rates to be charged for those activities. Expanding businesses frequently have less time for custom work activities with the added responsibilities of a larger business. Care must be exercised in assessing the capacity and likely amount of custom work to be done.

10. Miscellaneous receipts

Miscellaneous receipts can be estimated using one of two equations:

(1) Misc. receipts = .0121 x total receipts excluding miscellaneous receipts.
Or
(2) Misc. receipts = 34.66 x number of cows + 5.18 x acres of cropland

These equations were developed from 1998-2000 Dairy Farm Business Summary data and both explain about 36 percent of the variance in miscellaneous receipts. Because exactly what is included in miscellaneous receipts varies from farm to farm, it is recommended that the equations be used to determine the change in miscellaneous receipts for the individual farm being projected.

Equation 1 implies that the percent change in miscellaneous receipts is a function of the change in receipts excluding miscellaneous receipts. For example, assume total receipts excluding miscellaneous receipts were \$300,000 in the base year and \$500,000 in the planned year and base year miscellaneous receipts were \$5,000. Planned year miscellaneous receipts would then be 500,000/300,000 = 1.60 x \$5,000 = \$8,000.

Using equation 2, the percentage change can be estimated as shown in Table1. In this case planned year miscellaneous receipts would be estimated as \$5,000 x 1.59 = \$7,950.

Table 1. Calculation of Percent Change in Total Miscellaneous Receipts					
		Base Year		Planned Year	
Item	Coefficient	Number	Value	Number	Value
Cows	34.66	100	3466	170	5892
Acres	5.18	300	1554	400	2072
Total			5020		7964
Projected receipts as percent of base (planned value/base value)					1.59

An alternate approach to estimating miscellaneous receipts is to look at the items included in this category and assess whether and by how much each item will change. This can be a superior approach when data and analysis time are available

Costs

1. Hired Labor

Hired labor can be estimated by first determining the total months, or full time equivalents, of labor used on the farm during the base year, including operator and family labor. Remember that some workers, particularly operators, may work more than a reasonable full time equivalent. Use of a standard, such as 2760 hours per full time equivalent, may be helpful in realistically determining the full time equivalents used on the farm. This total is then increased by the proportional increase in business size to obtain the new total labor requirement. The expected level of operator and family labor is subtracted from the new total to obtain the new hired labor requirements. The hired labor cost is then determined as the new hired labor requirements multiplied by the expected average wage of hired labor. In some cases, the average hired labor expense per month or full time equivalent, adjusted for expected inflation in wage rates, is a good estimate of the average future costs.

For example, assume a farm with one full time operator, 6 months of family labor, 22 months of hired labor, a total labor expense in the base year of $44,000 and a 5 percent expected increase in labor costs, that is increasing herd size and number of acres by 50 percent. Using the above procedure, labor costs in the planned year would be $88,200. Total labor months in the base year is 40 months (12 operator + 6 family + 22 hired). Total months in the planned year would be 60 (40 x 1.5). With no change in operator and family labor, the months of hired labor would be 42 (60 – 18). Base year labor costs were $2,000 per month ($44,000 / 22). Planned year costs per month are $2,100. Hired labor cost estimated at $88,200 (42 x $2,100).

The above example assumed no increase in efficiency as a result of the expansion. If increases in efficiency are expected, the total labor requirement can be reduced by the effects of the efficiency change. For example, if a 10 percent increase in labor efficiency is expected in our example above, the total labor requirement would be 54 months (60 months x .90) and the hired labor expense would be $75,600.

The example also assumes that the managerial, or other capacities, of the labor to be hired will not change. If an expansion requires addition of middle management or hiring of labor with greater management responsibilities, the cost of that labor will usually be higher and that should be reflected in the total costs. In our example, if one of the added employees was expected to cost $500 more per month ($2,600 instead of $2,100), the added $6,000 should be included in total labor costs.

It is often easier for operators to directly estimate the added labor that will be required with a change, particularly if efficiency is expected to change. In that case, the operator estimates the number of added laborers that will be needed to accomplish the work to be done and the amount that each of those laborers will cost. This approach requires that careful attention be given to insure that the added labor for all crop and livestock tasks are included. It is often easy to think about the added milking and feeding time and forget the added crop and manure handling time. Remember that significant increases in labor efficiency often take considerable time to achieve.

When the number of livestock and acres of crops are not increasing proportionately, the results of a regression of months of labor use as a function of cows, heifers and acres can be used. This regression is expressed by the equation: Total labor months = 11.37 + .152 cows + .040 heifers + .032 crop acres. This equation was developed using 2000 Dairy Farm Business Summary data and explains 94 percent of the variation in labor use. It is suggested that this equation be used to estimate the percent change in labor use, such as shown in Table 2. It should be remembered that the equation coefficients use in Table 2 include the normal efficiencies resulting from changes in size that are reflected in the DFBS data.

Table 2. Calculation of Percent Change in Total Labor Use

		Base Year		Planned Year	
	Coefficient	Number	Value	Number	Value
Constant	11.37	1.0	11.37	1.0	11.37
Cows	.152	100	15.2	170	25.84
Heifers	.040	70	2.8	40	1.6
Acres	.032	300	9.6	400	12.8
Total			38.97		51.61
Projected use as a percent of base (planned value/base value)					1.32

If the farm shown in Table 2 was operated by an operator and two full time employees (36 months equivalent) in the base year, total labor needed would increase to four (3 x 1.32) and hired labor would increase by one full time laborer.

Do not estimate labor costs as a straight per cow, per hundredweight of milk or per acre increase. The existence of operator and family labor make such calculations incorrect. For example, an operator with one full time employee who doubles the size of the business will need to hire two added employees. However, the labor bill for the prior year will be for the one employee (say, $20,000). Doubling the labor bill consistent with doubling the herd size will result in estimated costs of $40,000 when the true cost will be $60,000.

2. Feed Costs (concentrates)

Feed costs should be divided into concentrate feed costs and forage costs. Forage costs are discussed in the next section.
Feed concentrate costs will increase in proportion to the increase in the herd size only if the feeding program (and thus, the production per cow), feed prices and ratio of cows to heifers on the farm remain the same and the acres of grain crops used for feed increase proportionately to the increase in herd size. This rarely occurs.

A comprehensive approach to estimation of feed use is suggested when major changes are being made. Use of a table such as that found on page 12 allows a comprehensive analysis that takes into consideration most of the variables that will change feed costs.

If no concentrates were grown on the farm in the base year and none are expected to be grown in the planned year and the ratio of cows to heifers remains constant, the following procedure can be use to estimate concentrate feed costs:

Table 3. Simple Calculation of Feed Concentrate Costs		
Base year feed costs		$80,000
% change in herd size (decimal form), plus 1.0	x	1.7
	=	$136,000
% change in feed use (decimal form), plus 1.0	x	1.04
	=	$141,440
% change in feed prices (decimal form), plus 1.0	x	1.10
Planned year feed costs	=	$155,584

In the example, herd size is expected to increase from 100 to 170 cows, production is expected to increase by three percent resulting in a four percent increase in concentrate feed use and feed prices are expected to increase by 10 percent. Notice that you cannot add the percent changes and make one calculation, 1.84 (.70 + .04 + .10 = .84) x $80,000 is $147,200. Such a procedure assumes that the change in feed use and prices applies only to the feed for the base year cows.

If the relative number of heifers to cows changes or the relative number of heifers of different age groups change, feed use will not change directly in proportion to number of cows. The change in herd size used in Table 3 must be modified to reflect the changed herd composition. This is accomplished by calculating the change in cow equivalents as shown in Table 4. The units per animal are taken from Table 5 and represent the relative feed concentrate consumption of various animals in herds with different production levels. For example, in herds producing 18,000 pounds per cow, bred heifers consume about 23 percent as much concentrate feed as cows.

The percent change in cow equivalents from Table 4 is substituted into Table 3 as the percent change in herd size. In our example, the change in feed use due to change in herd size is 53 percent instead of 70 percent. Thus, 1.53 replaces the 1.70 in Table 3, and projected feed costs are $140,126.

Table 4. Calculation of Cow Equivalents					
		Base Year		Planned Year	
	Units per animal[a]	Number of animals	Total units	Number of animals	Total units
Cows	1.0	100	100	170	170
Bred heifers	.23	20	4.6	10	2.3
Open heifers	.18	30	5.4	10	1.8
Calves	.53	20	10.6	20	10.6
Total cow equivalents			120.6	XXXXXXX	184.7
Planned herd size as percent of base (planned yr./base yr.)					1.53

[a] Values from table 3 for correct production level.

Table 5. Relative Concentrate Feed Use Factors (Units)[a]				
Milk Per Cow	Cows	Bred Heifers	Open Heifers	Calves
15,000	1.0	.28	.22	.64
18,000	1.0	.23	.18	.53
21,000	1.0	.19	.15	.44
24,000	1.0	.16	.12	.36
27,000	1.0	.14	.11	.32

[a] Average from ration budgets from Cornell and Ohio State. Calves are defined as up to 6 months of age, open heifers from 6 to 17 months, bred heifers from 17 to 26 months. Data assume one year of feeding for each age group, so these numbers should be applied to average numbers of animals for the year.

If the acres of grain crops grown and fed to the herd does not change in proportion to the change in herd size (cow equivalents), feed costs must be adjusted for that change. One way to do this is to calculate the feed value of the grain crops produced in the base year, add that to the base year feed costs in Table 3 and then subtract the feed value of the grain crops planned to be grown in the planned year. In that case Table 3 is modified as shown in Table 6. For example, assume 100 acres of corn grain producing 100 bushels per acre and valued at $2 per bushel were grown in the base year. That represents $20,000 of feed that was grown and fed in the base year. If 50 acres of that corn is being converted to corn silage, it is clear that grain acres are not increasing in proportion to the herd size change. Thus, the $20,000 should be added to feed costs in Table 3, resulting in base year feed costs of $100,000. Feed costs using Table 3 would be $175,032 ($100,000 x 1.53 x 1.04 x 1.10).

Table 6. Simple Calculation of Feed Concentrate Costs		
Base year accrual feed costs		$80,000
Base year value of concentrates grown on the farm & fed		$20,000
Total value of concentrates fed		$100,000
% change in herd size (decimal form), plus 1.0	x	1.53
	=	$153,000
% change in feed use (decimal form), plus 1.0	x	1.04
	=	$159,120
% change in feed prices (decimal form), plus 1.0	x	1.10
Planned year total feed costs	=	$175,032
Planned year value of concentrates grown on the farm		$10,000
Planned year accrual feed costs		$165,032

Notice that you cannot add the decline in feed purchased ($10,000) to the feed costs calculated without consideration of the change in crops grown ($140,126).

Some things to keep in mind:

1. Feed costs generally increase more than proportionately with increases in production per cow. For example, if milk production is expected to increase by 3 percent, feed costs will normally increase more than 3 percent. This is the result of the law of diminishing marginal returns.
2. Feed costs generally decline less than proportionately with decreases in production per cow. If production is expected to decline 3 percent, feed costs will likely decline less than 3 percent. This occurs because the farmer tends to feed for past (and hoped for) production rather than actual production in these cases.
3. Forage quality changes result only from real changes in the growing and harvesting of forage. An expected change in quality needs to be carefully defended. Many farmers will need to involve a nutritionist in assessing the effect of changes in forage quality on feed use, and thus, costs.

If the composition of the herd and the relative acreage of crops are changing, a comprehensive approach to feed cost estimation may be required. In that case, the worksheet on the following page could be used. Use the top of the worksheet to determine base year use per animal unit and then use that data with planned year production data on the bottom of the page to determine planned year feed cost. Relative feed use per animal unit can be taken from Table 5 above.

NAME Adirondack Valley Farms (George Brush and sons) Projections for Ave. Future

CONCENTRATE FEED PRODUCTION BALANCE

BASE YEAR

Concentrate or feed crop (UNIT)		Purchased feed dollars	High Moist. corn Tons	Corn grain (dry) Bushels		
Production:						
Acres			115	685		
Yield/acre			3.5	115		
Amount produced	(a)		403	78775	0	0
Beginning inventory	(b)	0	350	51900		
Purchases	(c)	244900				
Sales	(d)	0		78500		
End inventory	(e)	0	360	49800		
Amount used (a+b+c-d-e)		244900	393	2375	0	0
Base year animal units		284	284	284	284	284
Base year use/animal unit		862.32	1.384	8.363	0.000	0.000
1+ % change in plan year use		1.00	1.00	1.00		
Planned year use/ animal unit		862.320	1.384	8.363	0.000	0.000
Planned year animal units		461	461	461	461	461
Total planned year use	(f)	397530	638	3855	0	0

PLANNED YEAR

Production:						
Acres			175	580		
Yield/acre			3.8	125		
Amount produced			665	72500	0	0
Beginning inventory		0	500	43500		
Purchases	(accrual)					
Sales				68500		
End inventory		0	500	43500		
Amount available plan year(g)		0	665	4000	0	0
Planned use - available	(f-g)	397530	-27	-145	0	0
Planned year price per unit		1.07	75	2.4		
Planned year excess / deficit		425357	-2025	-348	0	0
Planned year cost ($)						

Total planned year feed cost (sum of individual concentrates and crops) 422984

ANIMAL UNITS		Base Year		Planned Year	
Animal	units/animal	Number of Animals	Total units	Number of Animals	Total units
Cows	1	259	259	420	420
Bred heifers	0.07	55	4	100	7
Open heifers	0.02	73	1	120	2
Calves	0.29	70	20	110	32
Total units			284		461

3. Purchased Forage costs

Farms that purchase most or all of their forage should use the techniques discussed under concentrate feed purchases to estimate forage purchases. For those farms that grow most or all of their forage, the basic question is whether the forage production plans are sufficient to meet the needs of the herd. To assess this situation, use of a procedure such as that outlined on the following page is suggested. Relative use coefficients can be taken from Table 7 or developed from the feeding program of the farm.

Table 7. Relative Forage Use Factors (Units)[a]

Milk Per Cow	Cows	Bred Heifers	Open Heifers	Calves
15,000	1.0	.63	.55	.19
18,000	1.0	.60	.52	.18
21,000	1.0	.57	.49	.17
24,000	1.0	.57	.49	.17
27,000	1.0	.55	.48	.17

[a] From ration budgets from Ohio State. Calves are defined as up to 6 months of age, open heifers from 6 to 17 months, bred heifers from 17 to 26 months. Data assume one year of feeding for each age group, so these numbers should be applied to average numbers of animals for the year.

Cost estimates must allow for storage and feeding losses. Calculating costs directly from animal ration needs without accounting for harvesting, storage and feeding losses will always underestimate forage use. Such losses are often in the 10 to 30 percent range, and may be more depending on the procedures used.

The worksheet on page 14 bases forage use and needs on dry matter. While dry matter does not completely represent all of the nutritional contents of forage, it is reasonably accurate in representing total forage amounts and can be used to indicate whether or not forage availability will be close to needs. The procedure shown has the advantage that consistently overestimating or underestimating yields or dry matter contents will have only a modest affect on the results. For example, if a farmer consistently overestimates yields, base year consumption per animal unit will be high, but will correctly indicate the number of added acres of crops needed for increased animal numbers.

In completing the worksheet, begin by entering all crop and production information for the base year in the left column. Then enter animal unit data from Table 7 and calculate the base year dry matter used per animal unit. Adjust this for the change in level of feed use expected in the planned year. Enter the planned year crop production data to determine the tons of dry matter that will be available. Determine the amount needed in the planned year and compare. The deficit indicated, plus any planned purchases, indicate the forage purchases that will need to be purchased.

NAME Adirondack Valley Farms (George Brush and sons) Projections for Ave. Future

FORAGE PRODUCTION BALANCE

BEGINNING OF YEAR INVENTORY

Crop	BASE YEAR Tons	% Dry Matter (decimal)	Dry matter on hand		PLANNED YEAR Tons	% Dry Matter (decimal)	Dry matter on hand
Haylage	785	0.45	353		1550	0.45	698
Corn silage	1830	0.32	586		2240	0.32	717
			0				0
			0				0
			0				0
Total tons dry matter			939	a			1415

PRODUCTION DURING YEAR

Crop	BASE YEAR Acreage	Tons / acre As fed	% Dry Matter	Dry matter Produced		PLANNED YEAR Acreage	Tons / acre As fed	% Dry Matter	Dry matter Produced
Haylage	165	11.11	0.45	825		270	11.5	0.45	1397
Corn silage	95	20	0.32	608		160	21	0.32	1075
				0					0
				0					0
				0					0
				0					0
Total tons dry matter				1433	b	Total tons dry matter			2472

FORAGE PURCHASES DURING YEAR

Crop	BASE YEAR Tons	% Dry Matter	Dry matter Purchased		PLANNED YEAR Tons	% Dry Matter	Dry matter Purchased
			0				0
			0				0
			0				0
Total tons dry matter			0	c	Total tons dry matter		0

FORAGE SALES DURING THE YEAR

Crop	BASE YEAR Tons	% Dry Matter	Dry matter Sold		PLANNED YEAR Tons	% Dry Matter	Dry matter Sold
			0				0
			0				0
			0				0
Total tons dry matter			0	d	Total tons dry matter		0

END OF YEAR INVENTORY

Crop	BASE YEAR Tons	% Dry Matter	Dry matter on hand		PLANNED YEAR Tons	% Dry Matter	Dry matter on hand
Haylage	770	0.45	347		1550	0.45	698
Corn silage	1775	0.32	568		2240	0.32	717
			0				0
			0				0
			0				0
Total tons dry matter			915	e	Total tons dry matter		1415
Total tons dry matter used (disappearance) (beg.+ produced + purchases - sales - end)(a+b+c-d-e)			1457	f	Total tons of dry matter available (h+i+j-k-l)		2472

ANIMAL UNITS

Animal	units/animal	BASE YEAR Number of Animals	Total units		PLANNED YEAR Number of Animals	Total units
Cows	1	259	259		420	420
Bred heifers	0.6	55	33		100	60
Open heifers	0.34	73	25		120	41
Calves	0.08	70	6		110	9
Total units			323	g		530

Base year dry matter used (f)	1457	Planned year dry matter per animal unit		4.51
Base year number of animal units (g)	323	Planned yr. no. of animal units (n)	(x)	530
Base year dry matter per animal unit (f/g)	4.51	Planned year dry matter use		2390
1.0 plus percent change in feed use in planned year (x)	1	Planned year dry matter availability	(-)	2472
Planned year dry matter per animal unit	4.51	Deficit (or excess) tons dry matter		-82

4. Machine Hire

The amount of machine hire expense is particular to each specific farm. It depends on the specific machines hired. Changes in the business may increase or decrease machine hire, and in some cases will have no influence on those costs. Estimating machine hire costs involves knowing the farm situation and plans well enough to know what machines will be hired in the projected year and what use of those machines will cost.

5. Machinery repair costs

Machinery repair costs change with acres of crops and number of animals. If acres of crops and animals are increasing proportionately, the percent change in size can be used. If acres of individual crops and animals do not change proportionately, the differences in costs between various crops and cows need to be taken into consideration.

The different cost levels of different enterprises can be taken into consideration by using change in the corn equivalent cost from the base year to the planned year. This can be accomplished using a procedure such as that shown in Table 8 making use of relative cost coefficients in Table 9.

Table 8. Estimation of Corn Equivalents for Repair Costs					
		Base Year		Planned Year	
Crop	Coefficient [a]	Acres	Corn equivalent	Acres	Corn equivalent
Corn grain	1.00	50	50	0	0
Corn silage	1.33	100	133	200	266
Hay	1.67	40	66.8	40	66.8
Hay silage	2.32	80	185.6	160	371.2
Wheat	0.78	30	23.4	0	0
Cows	1.10	100	110	170	187
Total		300	568.8	400	891
Projected cost as percent of base (planned equivalent/base equivalent)					1.57

[a] From Table 9.

For our example, if base year repair costs were $20,000 planned year costs would be estimated at $31,400 ($20,000 x 1.57)

6. Fuel and oil

Fuel and oil costs can be estimated using a procedure similar to that for repairs and using the fuel and oil coefficients from Table 9.

Table 9. Relative Cost Factors for Repairs and Fuel
(Corn Grain = 1.0)

	Repairs	Fuel & Oil
Corn Grain	1.00	1.00
Corn Silage	1.33	1.37
Soybeans	0.81	0.81
Oats	0.82	0.81
Wheat	0.78	0.99
Alfalfa Hay	1.67	1.55
Alfalfa Haylage	2.32	1.75
Grass Hay	1.08	0.80
Intensive Pasture	0.41	0.39
Dairy cows	1.10	0.49

[a] Crop costs based on crop budgets from The Pennsylvania State University, The Ohio State University and The University of Minnesota. Costs for the three states were averaged and the average cost for each crop expressed as a percent of the average cost for corn. Dairy cow costs from ERS, USDA cost of producing milk compared to the cost of producing corn for each cost item.

7. Replacement livestock

If all replacements are purchased, purchased replacements should increase with herd size.

If all replacements are raised in the base and planned year, replacement stock purchases will be zero. However, replacements often need to be purchased in the planned year when herd size is increased in the planned or prior year, ever if all replacements have been raised in the base year. Calves born to expansion cows cannot be raised to freshening in much less than two years. Thus, replacement stock needs to be purchased to replace expansion animals being culled.

For example, if herd size was increased by 100 cows in year 1 and the herd has a 30 percent culling rate, about 30 replacement animals will have to be purchased in the year following expansion. Depending upon the time of year in which the expansion takes place and the normal age at calving, up to 30 replacements will likely be needed in the second year following expansion.

It is often necessary to estimate for each month the number of animals milking, the number of animals dry, number to be culled, the number expected to die and number of heifers freshening, in order to determine the number of animals that will need to be purchased.

8. Purchased feeding stock

Purchased feeding stock will depend upon number of feeder cattle that are planned to be fed during the year.

9. Breeding costs

Breeding expenses can be estimated on a per cow basis. If herd size in increasing from 100 to 170 cows, breeding expense can be increased by 70 percent. If expansion of the herd results in a change in breeding practices, cost per cow may rise of fall. For example, a registered herd that is expanding with grade animals may have lower breeding costs on the grade herd. If this occurs, per cow costs will need to be modified for the expansion animals.

10. Vet and Medicine

Veterinary expenses can generally be estimated on a per cow basis. However, costs per cow do increase slightly with increases in herd size and production per cow. An analysis of 1997-99 Dairy Farm Business Summary data found the following relationship:

Vet expense per cow = .064 cows - .000026 cows squared + .00053 production per cow + .00000015 production per cow squared. This relationship can be used to estimate the change in vet expenses per cow with a change herd size or production level using a procedure shown in Table 10. Total vet expenses can then be estimated by multiplying base year expense by the percent change in cow numbers and cost per cow.

Table 10. Estimation Procedure for Vet Expenses

Variable	Coefficient	Base Year		Planned Year	
		Number	Value	Number	Value
Cows	+.064	100	6.4	170	10.88
Cows squared	-.000026	10,000	-.26	28,900	-.75
Milk/cow	+.00053	20,000	10.6	21,000	11.13
Milk/cow squared	+.00000015	400,000,000	60	441,000,000	66.15
Estimated vet expenses per cow			76.74		87.41
Projected expense as percent of base (planned/base)					1.14

If vet expenses in the base year were \$10,000, planned year expenses can be estimated as \$10,000 x 1.70 x 1.14 = \$19,380.

11. Bedding

Bedding expense can be estimated on a per cow basis. If the change in the business results in a change in the type of bedding used, costs will need to be modified accordingly. For example, as switch from stanchions to free stalls may also result in a change from straw to sand for bedding.

12. Livestock supplies

Livestock (milking) supplies can be reasonable estimated on a per cow basis. However, an analysis of 1997-99 Dairy Farm Business Summary data does show a slight decline in livestock supplies per cow as herd size increases. The relationship can be expressed as:

Livestock supplies = $74.26 - .0073 (number of cows).

Clearly, unless the herd size change is large, estimating costs using the change in herd size will be quite appropriate. If the equation is used, it is suggested that it be used to estimate the percent change in livestock supplies expense per cow as shown in below.

Base year: 100 cows x -.0073 = -0.73 + 74.26 = 73.53
Planned year: 170 cows x -.0073 = -1.24 + 74.26 = 73.02
Percent change = 73.53 – 73.02 = 0.51/73.53 = -.007 = -.7%

If base year livestock supply expenses were $8,000, planned year expense would be estimated to be $8,000 x 1.7 x 0.993 = 13,599

13. Cattle lease and rent

Cattle lease and rent expense must be estimated from the number of animals to be leased and the expected lease rate.

14. Custom boarding

Custom boarding is estimated as the number of animals times the boarding rate.

15. BST

If the level of bST use is expected to remain constant, bST expense can be estimated by multiplying the base year expense by the change in herd size. If the level of bST use is changing, multiplication by the percent change in level of use (plus 1.0) is added to the calculation.

16. Other livestock expense

Other livestock expense per cow tends to decline slightly as herd increases and increase as production per cow increases. For many situations, estimating these expenses on a per cow basis will be adequate. However, 1997-99 Dairy Farm Business Summary data show the following relationship between other livestock expense, herd size and production per cow:

Other livestock expense per cow =– 0525 (number of cows) + .0000125 (cows squared) + .0021 (milk per cow) - .000000023 (milk per cow squared). If this equation is used in estimating expanses, it is recommended that it be used to determine the percent change expected with the change in herd size and production level planned. A procedure such as that outlined in Table 11 can be used.

Table 11. Estimation Procedure for Other Livestock Expenses					
Variable	Coefficient	Base Year		Planned Year	
		Number	Value	Number	Value
Cows	-.0525	100	-5.25	170	-8.93
Cows squared	.0000125	10,000	.13	28,900	.36
Milk/cow	+.0021	20,000	42.0	21,000	44.1
Milk/cow squared	+.000000023	400,000,000	9.2	441,000,000	10.14
Estimated other livestock expense/cow			46.08		45.67
Planned expense as percent of base (planned/base)					.99

If other livestock expense in the base year was \$6,000, planned year costs could be estimated as \$6,000 x 1.7 x .99 = 10,098.

17.Marketing

Marketing expense on dairy farms generally contains two kinds of costs. One is the selling costs paid to sell cull livestock. This is generally a relatively small cost and can be expected to change with the number of animals culled, which will change with herd size unless the culling rate changes. The second cost included in marketing is milk hauling, which will vary with the amount of milk sold.

Because the cull sales cost is usually quite small and varies with number of cows, an estimation of these costs based on milk production should cause little error. Thus, total marketing costs can be estimated as a function of the amount of milk sold.

If livestock marketing expense is a significant expense, an improved estimate of costs may be obtained by separating marketing costs into the two components and estimating each separately.

18. Fertilizer and lime

Fertilizer and lime costs are direct functions of the crops grown. If the proportions of all crops remain the same, fertilizer and lime costs can be estimated based on the change in crop acres and prices. However, if the relative acreage of crops change, the fact that more fertilizer is used on some crops than others must be recognized in the calculations.

One way to recognize the difference in costs for different crops is to use the relative cost coefficients from Table 12. Table 12 presents the costs for each item for the various crops as a percent of the costs for corn. Similar coefficients could be developed for the farm for which costs are being estimated. For example, if the per acre fertilizer costs for corn, corn silage and hay were $50, $60 and $20, respectively. The coefficients would be 1.0, 1.2 and .4, respectively.

Table 12. Relative Crop Costs [a]

	Chemicals	Seed Cost	Fertilizer	Other Crop Expense
Corn Grain	1.00	1.00	1.00	1.00
Corn Silage	1.02	1.01	1.01	1.89
Soybeans	0.87	0.63	0.33	0.82
Oats	0.06	0.42	0.55	0.96
Wheat	0.43	0.47	0.69	0.61
Alfalfa Hay	0.76	0.39	0.59	1.87
Alfalfa Haylage	0.75	0.38	0.69	1.59
Grass Hay		0.06	0.45	1.55
Intensive Pasture	0.03	0.05	0.35	

[a] Based on crop budgets from The Pennsylvania State University, The Ohio State University and The University of Minnesota. Costs for the three states were averaged and the average cost for each crop expressed as a percent of the average cost for corn.

The coefficients in Table 12 are used by calculating the corn equivalent fertilizer costs for the base year, and the future year, as illustrated in Table 13.

A second way to recognize the differences in costs for various crops is to directly estimate the amount of fertilizer and lime to be used on each crop and multiply by the number of acres of the crop and by the expected price for the fertilizer or lime to be used.

19. Seeds and Plants

The estimation procedures used for fertilizer and lime can be used for seeds and plants.

20. Chemicals and sprays

The estimation procedures used for fertilizer and lime can be used for chemicals and sprays.

Table 13. Estimation of Corn Equivalents for Fertilizer Costs					
		Base Year		Planned Year	
Crop	Coefficient	Acres	Corn equivalent	Acres	Corn equivalent
Corn grain	1.0	50	50.0	0	0.0
Corn silage	1.02	100	102	200	204.0
Hay	.48	40	19.2	40	19.2
Hay silage	.58	80	46.4	160	92.8
Wheat	.69	30	20.7	0	0.0
Total		300	238.3	400	316.0
Projected cost as percent of base (planned equivalent/base equivalent)					1.33

21. Storage and drying

Storage and drying costs are generally related to only a few crops. These costs can be estimated directly from the cropping plans for those crops that are stored off the farm or are dried.

22. Other crop Expense

The estimation procedures used for fertilizer and lime can be used for other crop expense.

23. Real Estate Repairs

Real estate repairs are generally a function of the amount of building investment on the farm. Although some repairs are to real estate (tile drains, fences), most are for building repair. One large problem in estimation of this cost is that most farms do not have a good estimate of the amount of investment in buildings separate from the land. One way to get an estimate of this is to subtract the value of the land from the value of the real estate, and use the remainder as the value of the buildings.

New buildings that replace existing buildings will lower repair costs in years after the first year following construction. In the first year, slight building modifications and completing jobs the construction only started will keep repair costs from declining. Adding new buildings will add to repair costs. While new buildings should not need repairs because they are falling apart, they will need repairs because there are added animals and more hours of skid steer loader use, etc. which will cause damage, which will need to be repaired.

Dairy Farm Business Summary data for 1998-2000 show that a linear relationship between building repairs (repairs = .0215 x real estate investment) explains 64 percent of the variation in building repairs. This implies that building repairs could be estimated to change in proportion to the change in market value of the real estate investment. Real estate investment should be measured after lost capital. For example, if a farm with $2 million in real estate asses constructs a new building costing $1 million and 40 percent lost capital, planned year real estate investment would be $2.4 million. Building repairs would be estimated at 2.4/2.0 = 1.20 percent of base year building repair costs. If base year repair costs were $10,000, projected building repair costs would be $12,000.

An alternate view of building repair costs is to say that they are caused by the animals and the activities necessary to grow crops. Dairy Farm Business summary data for 1998-2000 show that cows and tillable acres explain 71 percent of the variation in building repairs with the following equation:

Building repairs = 41.52 x no. of cows + 6.67 x acres of cropland

Again, to reflect the peculiarities of the specific farm, it is recommended that this equation be used to determine the percent change in building repair costs as shown in Table 14. If base year building repair costs were $10,000, projected costs would be $15,800.

Table 14. Calculation of Percent Change in Real Estate Repairs

		Base Year		Planned Year	
	Coefficient	Number	Value	Number	Value
Cows	41.52	100	4152	170	7058
Acres	6.67	300	2001	400	2668
Total			6153		9726
Projected cost as percent of base (planned value/base value)					1.58

24. Taxes

Property taxes will increase with the amount of owned real estate that is purchased. Adding a farm will add the taxes of that farm. Similarly, adding land will increase the taxes proportional to the value of the land added.

Construction of new buildings will not usually add to taxes. There is a 10 year exemption for new buildings. Thus, if buildings are the only real estate being added in the planned year, taxes will change only by the expected inflation in tax rates.

25. Real estate rent and lease

Real estate rent and lease expense is very specific to an individual situation. Changes in the amount of rent and lease expense will depend upon the specific changes made in the business. Specific plans for the rent or lease of land or buildings must be part of the expectations for the planned year. Land rental can be estimated by the acres of added land to be rented multiplied by the normal rental rate.

26. Insurance

Insurance includes fire insurance on buildings, livestock and machinery plus liability insurance on farm assets and some insurance against other risks. One approach to projecting insurance costs is to identify the insurance costs for each asset category and multiply it by the increase in value of the assets that are expected to occur in that category.

A second approach is to use the general relationship between asset values and insurance costs from the Dairy Farm Business Summary data for 1998-2000 shown below. This function explained 70 percent of the variation in insurance costs and an equation that included real estate investment as an explanatory variable did no better. Apparently, building insurance costs are closer related to livestock investment than real estate investment, which includes land value.

Insurance costs = $2,192 + .0090 x machinery investment + .0093 x livestock investment.

Because insurance is quite dependent upon the area of the farm and the particular insurance preferences of the operator (degree of self insurance used), it is recommended that this equation be used to determine the percent change in insurance costs, such as shown in Table 15, rather than to directly estimate insurance expenses. If the example farm insurance expense in the base year was $5,000, projected expense would be $6,300 ($5,000 x 1.26).

Table 15. Calculation of Percent Change in Insurance Expense					
		Base Year		Planned Year	
	Coefficient	Number	Value	Number	Value
Constant	2,192		2,192		2,192
Machinery investment	.0090	$150,000	1,350	$200,000	1,800
Livestock investment	.0093	$160,000	1,488	$250,000	2,325
Total			5,030		6,317
Projected cost as percent of base (planned value/base value)					1.26

27. Utilities

Utilities cost on dairy farms is primarily a function of the level of milk production. Primary costs are for cooling milk, heating water for milking and running the milking machines. Even barn lighting and many other electrical uses are generally somewhat related to number of cows or milk produced. Because of this, it is usually quite appropriate to estimate utility costs based on the amount of milk produced.

In those cases were significant amounts of electricity are used for crop drying, adjustments for changes in that use must be made.

Utilities also include telephone costs. However, these costs are usually small compared to electricity costs and are somewhat related to the level of milk production.

28. Miscellaneous

Miscellaneous expenses have been estimated as a function of all other expenses and as a function of the number of acres and livestock on the farm. 1998-2000 Dairy Farm Business Summary data show that all other expenses explain about 71 percent of the variation in miscellaneous expenses using the following equation

Misc exp. = -266 + .0148 x all other expenses - .000000002 x all other expenses squared.

This indicates that other expenses are a reasonable method of estimating miscellaneous expenses. However, the same data show that cows and acres explain 83 percent of the variation in miscellaneous expenses using the following equation.

Misc exp = 1928 + (12.06 x no. of cows) + (1.01 x no. of crop acres) + (.0073 x no. of cows squared) + (.0035 x no. of cows squared)

Because what is included in miscellaneous expenses varies from farm to farm and the level of these costs are often farm specific, it is recommended that these equations be used to determine the percent change in miscellaneous expenses from the base year value. Table 16 could be used for the calculations. If our example farm had base year miscellaneous expenses of $4,500, projected expenses would be $6,075 ($4,500 x 1,35).

Table 16. Calculation of Percent Change in Miscellaneous Expenses					
		Base Year		Planned Year	
	Coefficient	Number	Value	Number	Value
Constant	1,928		1,928		1,928
No. of cows	12.06	100	1,206	170	2050
No. of cows squared	.0073	10,000	73	28,900	211
No. of acres	1.01	300	303	400	404
No. acres squared	.0035	90,000	315	160,000	560
Total			3,815		5,163
Projected expense as percent of base (planned value/base value)					1.35

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