New free-stall barns are built on a big scale to accommodate robotic milking.

The New Hampshire Dairy Industry in 2020

The cost of production has exceeded farm income for a prolonged period, causing a continuous decline in farm numbers and putting the state's dairy industry at risk.

Historically the dairy industry was the "king" of agriculture in the state. Dairy farming is an agricultural enterprise using many thousands of acres of tillable land for crops and grazing. This maintains open space, which provides numerous environmental benefits, and gives New Hampshire the rural character enjoyed by its residents and the many tourists. A continued reduction in the industry could create a major change in the complexion of the state's countryside. Although New Hampshire could meet its needs for fluid milk with imports, consumers would lose the privilege of being able to buy a local, fresh product.

Since the last detailed documentation of the New Hampshire dairy industry in 2007, many changes have occurred which have caused further decline. This has been due in part to global milk markets and the surplus of milk worldwide, resulting in lower milk prices to all United States dairy farmers. In New England, farmers have been especially hard hit, because this region is an expensive area to farm due to the cost of transporting inputs, high labor costs, and the limited ability of farmers to find affordable land for expansion to take advantage of the economies of scale.

As a result, many have gone out of business. To put it into perspective, looking at some key benchmark dates: in 1970 there were 829 commercial dairy farms in New Hampshire; 274 in 1990; and 182 in 2000. Currently in the year 2020, there are 81 farms shipping milk commercially through cooperatives and an additional 14 which don't ship commercially, but process themselves, for a total of 95 permitted "cow" dairy farms in the state.

Because of the state's small and shrinking dairy industry, New Hampshire farmers are also faced with the lack of infrastructure to support their businesses. Often there are additional costs for bringing in out-of-state service providers like milking equipment dealers, equipment repair people and specialty services like hoof trimming and floor grooving. Farmers sometimes lose prize animals due to the lack of large animal veterinarians, and the few vets who are available cover many miles to do scheduled herd checks.

With New Hampshire's population dispersed around the state among the operating farms, farmers benefit from having customers nearby to purchase products, but neighbors can also be a hindrance to agricultural development and expansion. Dairy farmers face challenges of nearby residents resisting the smells, noises and activities that go along with agriculture. They incur increased costs of constructing new facilities, because of the approvals that may be required for zoning variances, planning board requirements, and building codes originally put in place for commercial development.

New Hampshire relies heavily on property taxes to generate revenue. Although most dairy farmers take advantage of the Current Use program to reduce the assessed value of farmland, they often see unreasonably high values placed on dairy buildings and structures. With little experience in agriculture, tax assessors often fail to discount the fact that a lot of agricultural buildings are single-use structures. They don't properly differentiate between these specialized farm structures and more permanent, multi-purpose buildings.

Due to technological developments and good management practices, farmers tend to have excess heifers which results in surplus milk production.

Dairy farmers have grown accustomed to the cyclic nature of milk prices and survived the characteristic two-year lows and one-year highs that have been a pattern in the industry, which parallels the time needed to grow a heifer to maturity to respond to supply and demand. Since the turn of the century, however, all those rules have changed, and the industry has become a national marketplace affected by what happens in other countries.

Developments like sexed semen, automated equipment, and larger cropping machines have shortened the response time to market changes and made large volumes of production quick and easy. Farmers have become the victims of their efficiency, and it is a scramble to see who can make the most milk at the least cost to survive. With high costs and a limited land base, New Hampshire dairy farmers need to place greater emphasis on brand identification and a regional pricing advantage to compete.

Cost of Production

One way to better understand the plight of New Hampshire's dairy industry is by reviewing farm financial performance and the cost of producing milk. Farm records provide the best means of measuring performance on commercial dairy farms. Unfortunately, since the 1980s, there have been no published, financial-record summaries available for New Hampshire dairy farms.

Even though there are no New Hampshire dairy farm-record summaries, a trusted source of farm-level data for the Northeast is prepared by Farm Credit East. The Northeast Dairy Farm Summary contains detailed financial and production information for commercial dairies across the region. Farm data for New England dairy farms are included in the Northeast Dairy Farm Summary; however, they represent a small fraction of dairy farms located in the region, who volunteer to participate. Despite this limitation, the numbers provide a starting point for estimating financial performance on New Hampshire farms.

When using this information, it is important to recognize that the New England farms included in the Northeast Dairy Farm Summary represent progressive, above average dairy operations. In fact, average cows per farm and milk production per cow are higher than the typical New England and New Hampshire farm. More representative estimates of cow numbers per farm and milk production per cow for New Hampshire are reported in the Annual Statistical Bulletin published by the New England Agricultural Statistics Service. (See www.nass.usda.gov/Statistics_by_State/New_England/.)

New Hampshire Dairy Farm Profile

What has the financial picture looked like on New Hampshire dairy farms in recent years? Before examining the cost of producing milk, it may be useful to understand the nature of receipts and expenses on a typical New Hampshire dairy farm. Table 1 shows a financial profile for a New Hampshire dairy farm by averaging five years of information.

This profile was developed using 2015 through 2019 New England farm data reported in the Northeast dairy summaries adjusted for average New Hampshire farm size, milk production levels, and milk prices. Cows per farm, milk production and milk price were based on New Hampshire data reported by the New England Agricultural Statistical Service.

The average herd size for the New Hampshire profile is 120 dairy cows. With total farm receipts at $572,400 and farm expenses at $558,000, annual net income averaged $14,400 per farm. Since the typical New Hampshire dairy is an owner-operator family farm, net income is the dollar amount available to cover the owner's labor and management costs, any unpaid family labor, and a charge for owner's equity.

With tie-stall barns, the cows are hitched in place where they are fed and milked.

(Jessica Matras photo)

Some old barns still use tie-stalls like the Jones Farm in Chichester.

Most cows are housed in free-stall barns, where they roam freely to loaf and get feed.

Table 1. New Hampshire Dairy Farm Profile (Based on 2015 to 2019 financial performance).

Units	Per Farm	Per Cow	Per Hundredweight of Milk Solid
Average number of cows	120	---	---
Pounds of milk sold	2,520,000	21,000	---
Crop acres	274	2.3	---
Worker equivalents	2.85	---	---
	Receipts, Expenses and Net Income		
Milk sales	$466,200	$3,885	$18.50
Cattle sales	39,600	330	1.57
Crop sales	8,400	70	0.33
Other	58,200	485	2.31
Total receipts	$572,400	$4,770	$22.71
Chemicals & sprays	$3,600	$30	$0.14
Custom hire	15,600	130	0.62
Depreciation	42,000	350	1.67
Feed purchased	177,600	1,480	7.05
Fertilizer & lime	17,400	145	0.69
Freight & trucking	30,000	250	1.19
Gasoline, fuel & oil	19,800	165	0.79
Insurance	7,800	65	0.31
Interest paid	15,600	130	0.62
Labor hired	81,600	680	3.24
Rent	10,200	85	0.40
Repairs	38,400	320	1.52
Seeds & plants	11,400	95	0.45
Supplies	27,600	230	1.10
Taxes	7,200	60	0.29
Utilities	13,200	110	0.52
Veterinary & medicine	21,000	175	0.83
Other	18,000	150	0.72
Total expenses	$558,000	$4,650	$22.14
Net farm income	$14,400	$120	$0.57
Family living expenses & income taxes paid	$32,400	$270	$1.28
	Assets, Liabilities and Equity		
Total farm asset value	$1,556,400	$12,970	---
Total farm liabilities	404,400	3,370	---
Owner's equity	$1,152,000	$9,600	---

Milk sales were 81 percent of total farm receipts. The amount of milk sold per cow averaged 21,000 pounds (2,442 gallons); with milk receipts per cow at $3,885. This resulted in an average milk price of $18.50 per hundredweight ($1.59 per gallon). Farm receipts also included cattle sales, crop sales and other non-milk items. Other non-milk items consisted of service and product sales from secondary enterprises such as maple syrup, cordwood, compost, custom work and agri-tourism, as well as cooperative dividends and government program payments. Combining all sales, total farm receipts rose to $4,770 per cow or $22.71 per hundredweight.

Farm expenses equaled $4,650 per cow or $22.14 per hundredweight of milk before considering the value of unpaid labor and management, and a charge for owner's equity. Purchased feed and hired labor costs were the two largest expenses equaling 46 percent of the total. Other top expenses were depreciation, repairs, freight and trucking, supplies, and veterinary and medicine costs. If combined, crop production costs (fertilizer and lime, seeds and plants, and chemicals and sprays) would be listed among the top farm expenses.

Net farm income of $14,400 equaled $120 per cow or $0.57 per hundredweight. Based on the information provided by farmers in the Northeast Dairy Farm Summary, average family living expenses and income taxes paid by this size operation were $32,400. Since family living expenses and income taxes paid were $18,000 greater than net farm income, dairy farms likely covered this deficit using nonfarm sources of income, not fully paying for farm expenses, and/or selling unneeded assets.

Total farm asset value for a typical New Hampshire dairy farm was a little over $1.56 million dollars with total farm liabilities of approximately $404,400, resulting in an owner's equity of approximately $1.15 million or $9,600 per cow. Seventy-four percent of the farm's value was owned by the farm family clear and free of debt. Given the source of the farm data, these estimates were likely higher than those for a typical New Hampshire dairy farm.

As evidenced by the low net farm income, recent years have been particularly difficult for small dairy farms. From 2015 to 2019 the number of dairy farms in New Hampshire decreased nearly 20 percent, dropping from 120 to 97 operations. Many of those remaining in business have increased cow numbers and relied on their farm equity and nonfarm income to survive. The cost of producing milk calculations in the next section will identify milk prices that would have been needed in the past five years to cover all costs of production.

Cost of Producing Milk in New Hampshire

The cost of producing milk is determined by dividing farm expenses by the quantity of milk sold. The calculation is simple; however, difficulties arise in identifying all appropriate costs and dealing with the costs of producing livestock, crops and other items that give rise to farm receipts.

Calculations for the cost of producing milk on New Hampshire dairy farms from 2015-2019 are shown in Table 2. As with the profile in Table 1, these estimates are based on the 2015 through 2019 New England farm data reported in the Northeast Dairy Farm Summaries adjusted for average New Hampshire farm size and milk production levels.

Table 2. Cost of Producing Milk from 2015 to 2019, New Hampshire Dairy Farms.

Year	2015	2016	2017	2018	2019
Cows per farm	117	117	118	120	130
Milk sold, pounds	2,356,730	2,398,500	2,478,000	2,490,000	2,812,680
Direct (variable) farm expenses	$384,771	$366,115	$418,332	$400,741	$468,313
Plus: Overhead (fixed) farm expenses	144,981	140,200	154,562	169,599	169,664
Plus: Value of unpaid labor & management	82,707	83,564	75,868	90,810	100,336
Plus: Interest on equity capital (4%)	50,029	46,808	46,710	45,353	41,928
Minus: Cattle sales, crop sales & other non-milk receipts	99,558	111,460	100,881	125,604	93,854
Equals: Cost of milk production per farm	$562,930	$525,226	$594,592	$580,899	$686,387
Divided by: Hundredweight of milk sold	23,567	23,985	24,780	24,900	28,127
Equals: Cost of producing milk per hundredweight	$ 23.89	$ 21.90	$ 23.99	$ 23.33	$ 24.40
Per gallon cost of producing milk	$ 2.05	$ 1.88	$ 2.06	$ 2.01	$ 2.10

Farm expenses may be classified any number of ways. Direct or variable expenses generally change directly with changes in volume of milk sales during the year; these costs can be eliminated by ceasing production. Direct expenses per farm in 2016 were $366,115, reaching a high of $468,313 in 2019. Over the five-year period, total direct farm expenses rose about 22 percent. More than half of this increase was due to a greater number of cows per farm and more milk sold per cow.

Overhead or fixed expenses shown in Table 2 include depreciation, insurance, interest paid on loans, repair costs, taxes, rent, utilities, and a portion of other expenses. Often these expenses must be paid regardless of the amount of milk sold in the year. Overhead expenses per farm ranged from a low of $144,981 in 2015 to a high of $169,664 in 2019.

Since the New England dairy farm data from the Northeast Dairy Farm Summaries represent financial information for farms operated as sole proprietorships, expenses do not include charges for the owner's labor and management, unpaid family labor, and owner's equity. Estimates of these missing expenses are needed to get an accurate calculation of the cost of producing milk.

Charges for operator labor and management and unpaid family labor can be estimated by referring to USDA milk production costs for the Northeast region of the United States. Adjusting for differences in farm size and accounting for hired labor costs, annual estimates for the value of unpaid labor and management on New Hampshire farms ranged from $75,868 to $100,336 over the five-year period.

A charge for owner's equity is determined using the rate of return that could be earned by the farmer's money invested in the dairy had the farmer invested the money elsewhere. This charge recognizes that there is a cost associated with tying money up in capital assets over many years.

Historically, traditional farms earn rates of return on equity from 4 to 6 percent. There are many reasons why farmers are willing to accept this low rate of return. Among them are personal satisfaction associated with the farming way of life; and anticipation of long-term gains in the value of real property. For the purpose of determining the cost of producing milk on New Hampshire farms, a four percent rate of return was applied against the farmer's equity.

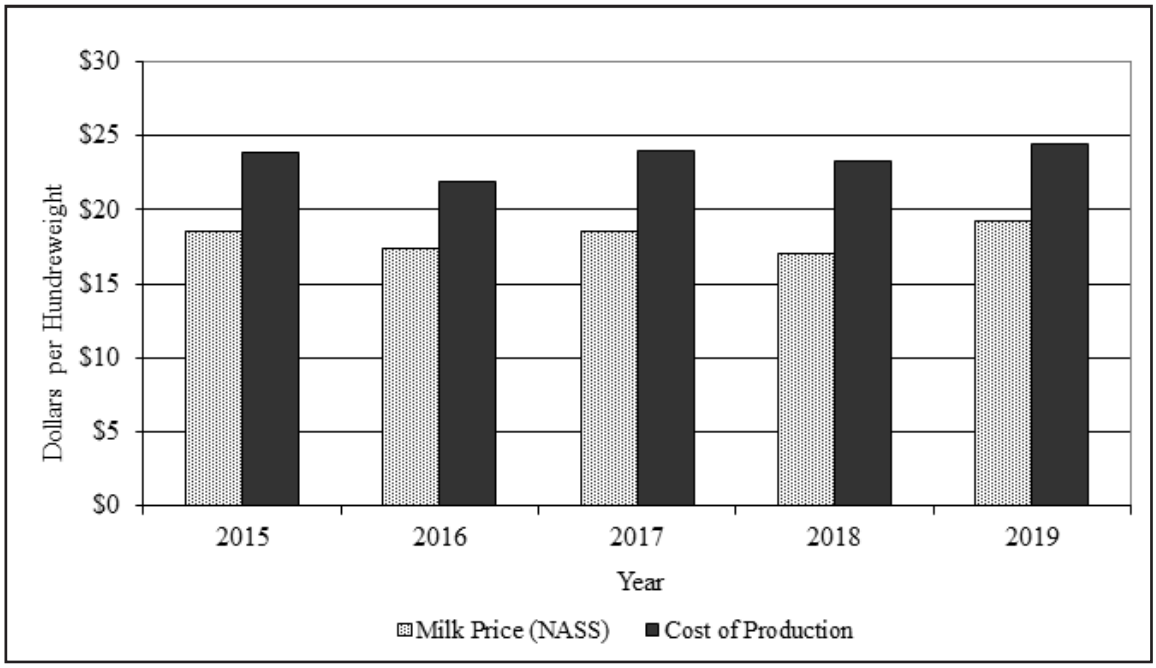
Dairy farmers have a large investment in the equipment needed for operating the farm and harvesting crops. Some farms are having their crops contract-harvested to reduce the investment in machinery.

When determining the cost of producing milk, the issue of non-milk receipts does not pose a significant problem for the typical New Hampshire dairy farm since non-milk receipts are seldom more than 10 to 20 percent of total farm receipts. Therefore, total farm expenses may be credited for non-milk sales by adjusting expenses downward by an equivalent dollar value. This calculation assumes that non-milk products incur expenses equivalent to their receipts.

Following through the above calculations, the cost of producing milk on New Hampshire dairy farms was $562,930 per farm in 2015, climbing to $686,387 per farm in 2019. Dividing the cost of producing milk by the corresponding amount of milk sold results in costs of producing milk that ranged from $21.90 to $24.40 per hundredweight ($1.88 to $2.10 per gallon).

How do the costs of producing milk compare with the actual prices received? Figure 1 shows the average annual milk price reported by New England Agricultural Statistical Service (NASS) compared to the cost of milk production for New Hampshire dairy farms over the past seven years. Over the entire period, farmers have been producing milk at less than their production costs.

Figure 1. Milk Price vs. Cost of Milk Production, New Hampshire Dairy Farms.



Converting the milk price received per hundredweight to gallons, the prices farmers received for milk ranged from $1.46 to $1.65 per gallon during the 2015 to 2019 period; whereas, the cost of producing a gallon of milk averaged from $1.88 to $2.10 over the same period. (See Table 2.)

How can dairy farmers continue to produce milk if they do not cover their costs of production? The reason lies partly with the nature of the expenses incurred. Earlier, farm expenses were classified as variable (direct) and fixed (overhead). Over a short-run period such as a year, variable expenses fall under the "farmer's control", i.e. they can be eliminated by stopping production, but the farm operation would still incur fixed costs if they held onto the farm. Therefore, as long as a farmer is able to generate receipts greater than variable costs, it is a wise economic decision to produce milk in that short-run period because the receipts in excess of variable costs will defray some fixed expenses. With several years of total production costs exceeding revenue, many New Hampshire farmers have survived by selling unneeded assets, relying on off-farm income, or extending credit repayment terms in hopes of paying off loans in better times.

In 2020, the COVID-19 virus had quite an impact on the dairy industry. With schools closing and limited dining-out options, a big segment of dairy-product consumption evaporated almost immediately. Public hoarding of food, including milk, coupled with industry on-demand supply-chain practices added to milk sales problems. Many supermarkets and grocery stores were unable to keep products on shelves, despite the abundance of milk on farms. Internationally, COVID-19 reached pandemic status. Foreign economies came under stress with fears there would be less money available for importing goods, threatening U.S. exports of milk products.

The result of these uncertain times during the COVID-19 outbreak was an oversupply of milk. There were news reports of milk being dumped down the drain at farms and processing plants. Milk prices plummeted and cooperatives scrambled to find places to sell milk.

Many cooperatives implemented self-imposed, supply-management programs or quotas on their members. Depending on the cooperative, members' quotas range from 85 percent to 94 percent of recent past sales. Cooperative member farms receive the "milk market price" for their quota production levels. Any milk over that amount is penalized with a significantly reduced price, possibly as low as $7 per hundredweight, with handling fees charged back to the farmer.

Farmers quickly complied by culling cows, reducing the nutritional density of the ration, switching from 3X to 2X (three times a day to twice a day) milking, drying cows off early (stopping production early in their lactation cycle), feeding calves whole milk instead of milk replacer, or selling raw milk directly to customers at the farm. In addition, there were some state COVID-19 relief and Federal Milk Marketing insurance programs which kicked in to provide some assistance to farmers. The Governor allocated $4.5 million for the 79 eligible dairy farms, which was a lifesaver for most of our dairy farms, and it helped to compensate for the falling milk prices and cuts to production ordered by the cooperatives. As the economy opened, prices gradually rose to near normal market levels; however, with the virus still present, there was a lot of uncertainty in the market.

It should be obvious that this situation is not sustainable. If it exists for many years, farms start to show signs of deterioration and farm families become stressed, as they are unable to make sufficient income to cover family living expenses. In the long run, dairy farmers exit the industry and seek employment elsewhere. The land and farm property are sold, and often become used for other ventures.

The Status of the New Hampshire Dairy Industry

To survive in this unstable milk pricing climate with periods of tight margins, dairy producers have had to become financially savvy. This means increasing emphasis on record keeping and regularly studying the numbers to keep expenses under control, finding creative options for bringing more income onto the farm, adopting new technology to reduce labor, and becoming more actively involved in the marketing of their milk and dairy-policy development.

Some farmers have assembled farm management teams made up of their veterinarian, feed consultant, banker, and Extension Educator to evaluate the production practices and finances of the farm.

Other farmers have started to raise bull calves as steers for selling retail meat cuts. This can be done at a farm store or by going to a farmers' market. However, selling retail also means incurring processing expenses at facilities meeting federal inspection standards. These steers can be raised similar to heifers, but then switched to a high energy diet high in corn grain at 750 lbs. of body weight and butchered at 1300-1400 lbs. at 18 months of age.

The Forbes' Farm, in Lancaster, NH, starts their bull calves on a normal forage ration, and then switches them to a high concentrate diet to finish them for beef.

The five commercial dairy farms in the state with pasteurization facilities are processing their own milk into fluid milk, cheese, or ice cream. About eight of the fourteen noncommercial operations have small-scale pasteurization units and are selling milk products from cows' milk. There are also several micro-dairies selling raw milk directly to their customers. Keep in mind, selling directly to consumers carries additional legal risk requiring appropriate product liability coverage.

Other farms have diversified into selling other farm products. This could be adding vegetable production, hay sales, sweet corn, small grains for the brewery industry, straw mulch, or managing a woodlot. These are all attempts to capture more of the consumer's dollar and take advantage of the "buy local" movement.

Ted Sartell of Temple, NH, had a shipping container retro-fitted into a milking center which was moved onto the site.

Inside the unit it is divided into one compartment for milking and the other side is a milk room which contains the washing equipment and small bulk tank.

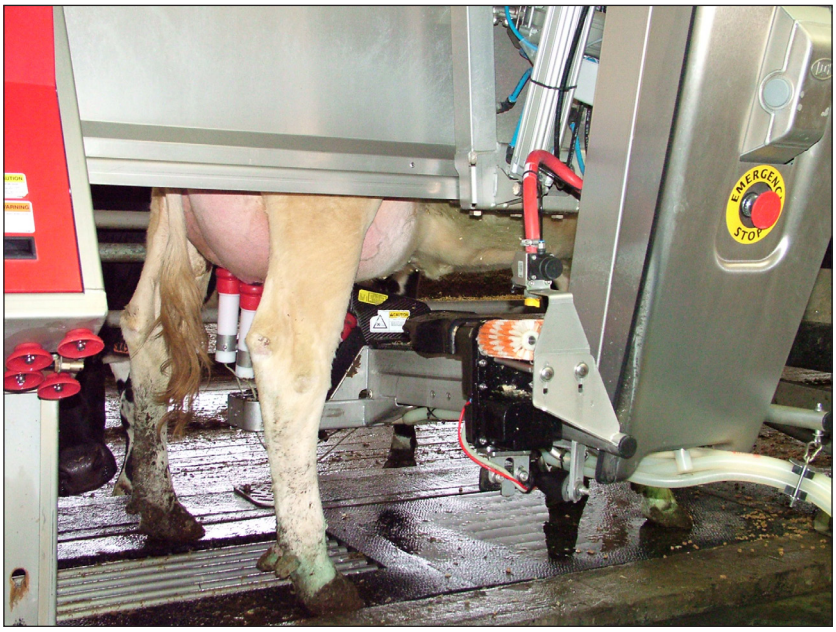
(Sarah Crete photo)

The Crete Farm, in Boscawen, NH, milks 220 head of dairy cattle and raises about 20 acres of sweet corn which is sold through their farm stand and vegetables from neighboring farms.

Some farmers' markets extend into the winter months inside heated facilities. Sherri Morrill, of Morrill Farm Dairy in Penacook, NH, sells prime dairy beef cuts and hamburger at a weekend venue.

There is a growing interest in robotic milking as a way to save labor. In new construction, it is certainly an option to explore, because it can reduce the building needs by eliminating a milking parlor and holding area. The economic benefits are close on retrofitting an existing operation due to the tight profit margins. The equipment continues to improve and go down in price, and more is understood about animal behavior and getting the cattle to voluntarily enter the milking unit multiple times per day. Another management feature still being refined is the proper use of grain in the robots to attract the cows and the use of PMR (partially mixed ration) to meet each cow's nutritional needs and maximize production.

A separate environmentally controlled room is used to contain the robots and the electronic controls.



The cows are enticed into the robot by grain and are automatically prepped, milked, and released with no human intervention.

One bit of optimism on the horizon for the New Hampshire dairy industry is the passage of the Dairy Premium Program. This is legislation proposed by the Commissioner of Agriculture, Markets & Food, Shawn Jasper, which allows customers to voluntarily pay extra per gallon of milk. This premium would be passed directly on to the dairy producers.

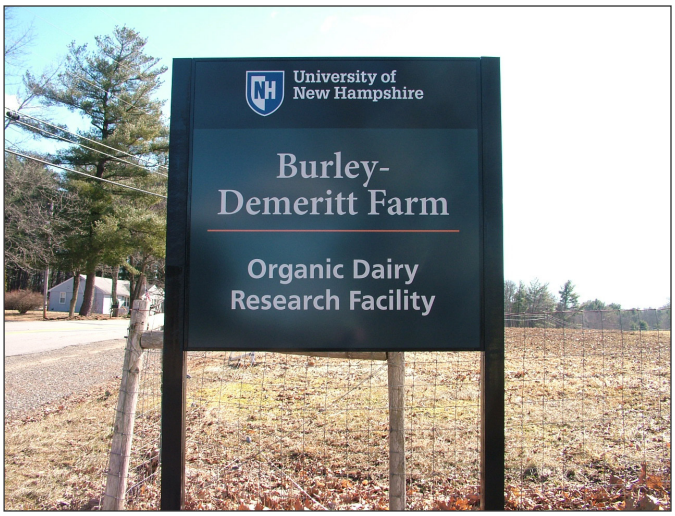
The details are being worked out, and the key issues are keeping the New Hampshire milk segregated in the marketplace and finding a processor to bottle and distribute it. Initial surveys have showed very positive responses from consumers for supporting this concept.

In July of 2019, Governor Chris Sununu signed the New Hampshire Milk Bill which will allow the additional charge for New Hampshire milk to be passed on to the state's dairy farmers. From left to right around Governor Sununu: Shawn Jasper, Commissioner of the NH Department of Agriculture, Markets & Food; Denis Ward, NH Farm Bureau President; Rob Morrill, Sherri Morrill, and Judy Aron, legislator.

(Sarah Crete photo)

University of New Hampshire Dairy Research

The Fairchild Dairy Teaching Research Center has a herd of about 100 milking cows used for conventional dairy research, and it includes the student CREAM herd.



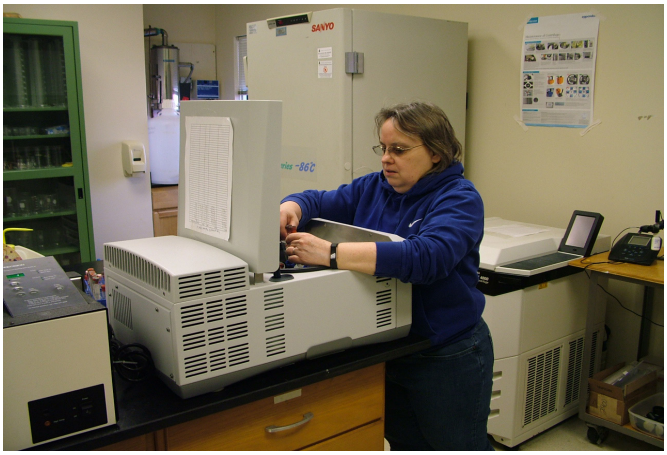
The Burley-Demeritt Organic Dairy Research Farm was the first Land Grant university in the country established to do practical research for organic dairying.

The University of New Hampshire dairy scientists have been very productive over many years. The development of the second research facility, the Burley-Demerritt Organic Dairy Research Farm, has resulted in many research projects dealing with forage feeding and supplements for cattle on pasture.

Research has continued at a constant rate at the conventional Fairchild Dairy over the last few years. Studies conducted at these facilities support local producers, but also have a global impact. Here is a brief synopsis:

1. Bioavailability of rumen-protected amino acids: to date, twenty-five products have provided bioavailability values that nutritionists use for rumen-protected amino acids. This work has also resulted in some products being removed from the market-place.

The Keener Dairy Research building was built in 2006 to replace the former Ritzman Lab and houses the animal science faculty and analytical laboratories.



Nancy Whitehouse, Assistant Research Professor at UNH, has conducted amino acid research with Holstein dairy cows at the Fairchild Dairy Teaching Center. The analysis is performed at the Keener Dairy Research building.

2. An FDA-monitored project for a new organic selenium product for dairy cattle. The final report is being sent to the FDA for approval.

3. A trial evaluating the effects of naturally occurring mycotoxins on the health and production of dairy cows. When a high mycotoxin-containing diet was fed vs. a low mycotoxin-containing diet, the high mycotoxin diet-fed cows had decreased dry matter intake, higher somatic cell score, lower milk fat yields, and higher MUN. Overall, the health of the cows seemed similar but looking at blood profiles blood urea nitrogen was higher for the high-mycotoxin diet; as well as with alkaline phosphatase, a liver enzyme. This was preliminary work; some follow up work is scheduled.

The Data Ranger is a computerized feed cart used to deliver individual rations to cows and weigh-back refusals for conducting nutritional research.

The Fairchild Dairy Teaching Research Center barn is a comfort stall set up to provide individual feeding and tabulation of data. The cows are milked in a milking parlor where milk weights can be individually tabulated.

4. Research with the University of Maine found it was more profitable to feed a grass- silage based diet with separate commodities than feed a grass- silage based diet with a pelleted concentrate or a corn-silage based diet with either commodities or pelleted concentrate.

5. Lacteal-based colostrum replacer resulted in passive transfer of immunoglobulin G. In some cases, the uptake of immunoglobulin G was enhanced with the addition of sodium bicarbonate, but the results varied and could be based on the prepartum diet of the cow and its effects on the calves.

6. Feeding prepartum cows 32 g/d nicotinic acid enhanced colostrum quality and altered the colostrum such that calves fed this were more efficient when milk replacer was the primary source of nutrients (the first 3 weeks of life). The data suggest that the nicotinic acid increased microbial protein synthesis in the rumen, resulting in more amino acid transfer to the small intestine and hence better immunoglobulin production (colostrum).

7. Feeding sodium butyrate to weaned calves improved feed efficiency compared to calves not fed sodium butyrate; this is likely due to improved rumen development, as well as a reduction in coccidian oocysts.

8. Storing wet brewer's grains with salt reduced spoilage and enhanced shelf life by reducing mold formation.

9. Effects of dietary starch level and rumen-protected amino acids on milk production, plasma amino acids, and methane emissions in dairy cows: Reduced crude protein diets have been shown to lower N excretion in dairy cows. However, such diets may limit production of milk and milk protein due to deficiencies in essential amino acids (particularly methionine, lysine, and histidine), insufficient energy supply, or both. The conclusion was that enhancing dietary energy by replacing fibrous byproducts with ground corn reduced methane production and improved yields of milk and milk protein through better use of dietary nitrogen and energy and increased mammary uptake of essential amino acids; and methane production was lower.

10. Dietary energy source and rumen-protected amino acids and their effects on milk production, plasma amino acids concentration, and methane emissions in dairy cows: We investigated the interactions between energy source (starch vs. fat) and rumen-protected methionine, lysine, and histidine (MLH) on performance, plasma amino acids, and methane production. Plasma methionine and histidine increased with rumen-protected MLH. Diets did not impact methane production. In brief, substitution of ground corn with soyhulls and rumen-protected-fat improved feed efficiency and milk fat yield without changing methane emissions.

11. Milk production and methane emission in Jersey cows grazing forage canola: Forage canola (CAN) is an annual crop that can be used to extend the fall grazing season. We aimed to evaluate the effect of CAN on milk production and methane emissions in dairy cows. While milk protein content increased in CAN cows, milk protein production did not change. Methane production was lower in cows fed CAN vs. the control diet, which may be associated with decreased feed intake and presence of glucosinolates in CAN.

The Burley-Demeritt Organic Dairy Research Farm in Lee has a bedded-pack barn with cows feeding at an outdoor feed bunk. The cows wear transponders and Calan Doors are used to monitor the feed intake of individual cows for research projects.

The Greenfeed device, manufactured by C-Lock of Rapid City, South Dakota, measures methane production from respiration in a cow's breath and monitors the environmental conditions. This is being used to measure greenhouse gas emissions from various diets with a goal of formulating rations that have less impact on the environment.

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