Haylage Cost of Production

A Technical Report for Evaluating Forage Economics, Feed Value, and Water Quality Considerations in Vermont Dairy Systems

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Alternative Feed Studies Technical Report 1

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Main Question	What is the true cost to produce hay crop silage, and how can that information guide feed, nutrient, labor, storage, and water quality decisions?
Case-study design	Two farms contributed. Farm 1 provides the financial cost case. Farm 2 provides production-system and management context.
Purpose	Establish the haylage benchmark needed before a project evaluates high-quality versus low-quality hay, double-cropping practices, and other feed alternatives. Establish a replicable framework to find key cost outputs.

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About This Project

This report is part of a series developed by the UVM Extension Agricultural Business Team (ABT) and Northwest Crops and Soils Team (NWCST) as an Alternative Feed Studies project for the Clean Water Improvement Program (CWIP) at the Vermont Agency of Agriculture and Food Markets (VAAFM). The work examines the cost of producing homegrown dairy forages in Vermont and connects those costs to the crop and nutrient decisions that also shape agricultural water quality. The series addresses three subjects in turn: the cost of production of haylage, the cost of production of corn silage, and how to use cost of production analyses to make management decisions.

Several farms contributed to the gathering of information for this project. Two farms, one a smaller Medium Farm Operation (MFO) and the other a larger MFO, participated in in-depth interviews that provided background on crop management decisions and on their feelings and concerns about the costs and risks of managing agricultural water quality while maintaining productive homegrown forages. Those conversations inform the management perspective throughout the report. They capture practices and farmer judgment rather than measured environmental outcomes, and the report treats them accordingly.

The project rests on a straightforward idea. The decisions that govern water quality on a dairy, nitrogen rate and timing, manure placement, cover and rotation, and investment in a given field, are the same decisions that govern the cost and quality of homegrown feed. Farmers do not experience them as environmental practices added onto the business. They experience them as feed, cost, weather, labor, and land decisions. Better cost and forage information helps move the economically sound choice and the water-protective choice toward the same answer.

To keep the analysis useful and reproducible, the report works from a hypothetical farm rather than from any participating farm's figures. Examples use the case of a hypothetical 200-milker dairy with youngstock, replacement heifers, dry cows, and some beef-on-dairy, running roughly 200 acres of corn and 400 acres of hay. All numbers used in the worked examples are rounded and illustrative. They are not drawn from any individual farm, and they are meant to be replaced by a reader's own figures. The report begins with information available on a farm's Schedule F tax form, shows how to build a first-pass cost estimate from it, and then shows how to sharpen that estimate with records from invoices, custom-hire slips, and field data as they become available. The closing sections turn the analysis toward decision making, and the appendices offer templates that farmers and service providers can use in the field.

Evidence Status Used in the Report

Due to the depth of the analysis that was performed after farmer interviews and meetings, information considered to be "evidence" was not all directly related to the information that was gathered on the farm. Information was gathered by the Agricultural Business Team (ABT) with the support of members from the Northwest Crops and Soils Team (NWCST) in 2025 and early 2026. We will highlight what information came from farm records, results calculated from farm records and interviews with farmers, assumptions that were made, and research-supported interpretations that we had to create from secondary data. The appendices explain our definitions and rationales.

Data Collection with the Farms

The findings that follow come primarily from on-farm interviews conducted with each case-study farm, supported by farm financial records, forage inventories, and nutrient-management documentation where available. The interviews and "follow-ups" were the central instruments. Each visit followed a long-form intake structure covering farm identity, land tenure, production goals, cropping and cutting practices, fertility and manure management, harvest and storage operations, feed quality, and water-quality context, but the conversations were allowed to move where the farmers took them. That approach traded some uniformity for depth, and it surfaced management reasoning that a fixed questionnaire would have missed.

The style of information gathered through interviews shapes how it should be read. Much of what farmers shared was practice and perception: what they do, what they have observed, and what they believe is working. Some figures, including certain acreages, shrink estimates, and allocation percentages, were worked out verbally during the visit and represent working estimates rather than measured or reconciled values. Throughout the findings, statements drawn directly from farm records are distinguished from interview observations and from working assumptions, and figures that require verification against records or laboratory results before quantitative use are marked. This distinction protects the integrity of the analysis and keeps producer perception, which is valuable in its own right, from being mistaken for measured fact.

Interviews capture management practices, not environmental outcomes. The conversations documented what each farm does with cover, nutrient timing, rotation, and storage, and they recorded the farmers' own sense of whether those practices help. They did not measure runoff, leaching, soil organic matter, or erosion. The water-quality findings should be read in that light: as a record of practice and plausible pathways, not as demonstrated water-quality results.

Evidence Label	Meaning
Farm Record	Expense, inventory, acreage, or herd data supplied by the farm.
Calculated result	Advisor calculation based on farm records and stated assumptions.
Interview observation	Management practice or interpretation reported by a case-study participant.
Working assumption	Temporary value used because direct records were unavailable.
Research-supported interpretation	External guidance used to interpret a farm observation without claiming a measured farm effect.

Table 1. Description of terms used to describe the evidence included in the study

Executive Summary

This report establishes a baseline cost of producing hay crop silage on a Vermont dairy, the reference point the Alternative Feed Studies project needs before it can fairly evaluate high-quality versus low-quality hay, double-cropping, and other feed alternatives. Without a haylage baseline, an alternative can look cheaper simply because one cost category is lower while added labor, machinery, storage, shrink, or ration effects go unmeasured.

The analysis draws on two kinds of information, kept deliberately separate. Two Vermont dairies, one a smaller Medium Farm Operation (MFO) and the other a larger MFO, contributed in-depth interviews that supply the management perspective throughout the report: how experienced farmers reason through cutting, fertility, harvest, storage, and the tradeoffs among cost, quality, and water quality. The cost figures, by contrast, are built on a single hypothetical farm rather than on any participating farm's records, so that the method can be shown openly and reused. That example farm is a 200-milker dairy with youngstock, replacement heifers, dry cows, and some beef-on-dairy, running roughly 400 acres of hay and 200 acres of corn. Every dollar figure in the report is rounded and illustrative.

The method starts where nearly every farm already keeps its numbers: the Schedule F tax form. Because a Schedule F reports whole-farm cash expenses without splitting them among enterprises, the report shows how to allocate each expense category to hay using transparent, documented percentages, and then how to sharpen those first-pass estimates with invoices, machinery hours, payroll detail, and field records as they become available. Applied to the example farm, this produces a combined allocated cash cost of about $301,000 for the hay enterprise, which works out to roughly $752 per hay acre and about $75 per as-fed ton at an illustrative yield of ten as-fed tons per acre. Repairs and hired labor together account for about 44 percent of that cost, which matches what farmers named as their heaviest hay cost pressures: keeping harvest equipment running and getting the crew through repeated cuttings on time.

Two of the report's cost figures are presented as ranges rather than single numbers, and the reason is central to how the results should be read. Cost per ton of dry matter runs from about $188 to $251 depending on moisture, because the example farm has not measured dry matter directly. Cost per ton of usable feed runs from about $79 to $89 depending on shrink, the share of the crop lost between the bunker and the bunk. These are not weaknesses in the analysis; they mark exactly where a farm's own measurements would convert an estimate into a decision-grade cost. The four unit costs form a ladder from most certain to least certain, and the path from a Schedule F estimate to a confident cost per unit of feed runs through three farm measurements: yield, dry matter, and shrink.

The report treats this result as a working cash cost, not a complete economic cost. It does not yet include capital recovery, unpaid operator and family labor, interest on operating capital, or the opportunity cost of owned land. Naming that boundary keeps the analysis honest and marks the next step toward a full economic picture.

Beyond the cost figures, the interviews surfaced a reframing that shapes the whole project. The decisions that govern water quality on a dairy, nitrogen rate and timing, manure placement, cover and rotation, and how much to invest in a given parcel, are the same decisions that govern the cost and quality of homegrown feed. Farmers experience them not as environmental practices added onto the business but as feed, cost, weather, labor, and land decisions. One angle stood out strongly enough to flag for future study: land tenure appears to shape conservation practice as much as agronomy does, because farmers direct lime, reseeding, and drainage toward owned and secure ground and hold back on insecure rented parcels. Better cost and forage information helps move the economically sound choice and the water-protective choice toward the same answer.

Measure	Result	Evidence Status
Hay acres	400 acres	Illustrative farm parameter
Cutting system	Four cuttings	Calculated; excludes full ownership and opportunity costs
Combined allocated cash cost	~$301,000	Calculated; excludes full ownership and opportunity costs
Cost per hay acre	~$752	Calculated: allocated cost / 400 acres
Cost per as-fed ton	~$75	Calculated at 10 as-fed tons/acre (illustrative yield)
Cost per dry-matter ton	~$188 to $251	Range across 30 to 40% DM; not measured
Cost per usable ton	~$79 to $89	Range across 5 to 15% shrink; not measured
Largest cost drivers	Repairs and hired labor (~44%)	Calculated from allocation

Table 2. Cost of production summary, illustrative hypothetical farm

All figures are rounded and illustrative and are not drawn from any individual farm. The full report series is available at https://www.uvm.edu/extension/agricultural-business/water-quality-business-analysis.

2. Why Haylage Cost of Production Matters

Haylage is a core homegrown forage in the dairy systems observed for the project. It supplies physically effective fiber, protein, and digestible forage within the total mixed ration, while also providing perennial ground cover across a material portion of the land base. The value of haylage depends on quantity, dry matter, nutrient composition, fermentation, storage recovery, ration placement, and the cost required to produce usable feed. A major cost driver for hay crop silage is the yield level. Higher yields allow fixed costs—such as land, machinery, and labor—to be spread over more tons of forage, which lowers the cost per unit of hay crop silage produced.

Conversely, lower yields increase the cost per unit because those same fixed costs must be allocated across a smaller amount of feed.

A second driver of hay crop silage cost is the cost of producing each unit of silage. The decision to bale hay independently or hire custom operators depends on the producer's own production costs, as well as local custom rates and labor availability. Producers should compare these costs carefully to determine the most cost-effective option for their operation.

2.1 A benchmark before evaluating alternatives

Technical Report #3 (found online at: https://www.uvm.edu/extension/agricultural-business/water-quality-business-analysis) will evaluate high-quality versus low-quality hay and double-cropping practices. A baseline is needed first. Without a haylage benchmark, an alternative may appear economical because one cost category is lower while added labor, machinery, storage, shrink, or ration changes remain unmeasured. The benchmark should therefore include cost per acre, cost per represented as-fed ton, cost per usable dry-matter ton, and the feed value delivered to the herd.

2.2 Cost boundaries

Boundary	Definition	Primary use
Field cost per acre	Establishment, fertility, land, manure application, and field operations.	Field and rotation decisions
Cost delivered to storage	Field and harvest cost divided by dry matter placed into storage.	Crop and harvest performance
Cost removed for feeding	Field, harvest, and storage cost divided by dry matter removed from storage.	Storage and feedout performance
Cost consumed	Total feed-system cost divided by dry matter consumed after refusals.	Whole-farm feeding performance

The current Farm 1 analysis is a cash-cost allocation extending through harvested and inventoried haylage. It does not yet include complete capital recovery, unpaid operator labor, interest on operating capital, or an opportunity cost for owned land. USDA Economic Research Service guidance treats direct costing as preferred when enterprise records exist and uses allocation or engineering approaches when whole-farm expenses cannot be assigned directly (USDA ERS, 2026).

2.3 Ration stability and feed value

An as-fed ton is not a complete unit for comparing feed alternatives. Moisture varies among cuttings and storage units, and nutrient value can differ by maturity, species, weather, ash content, fermentation, and storage conditions. Dry matter and forage analysis are needed to compare cost and herd contribution on a common basis.

Purchased-feed implications remain conceptually relevant, but the current report does not quantify the farm's purchased-feed expense. A later analysis in Tech Report #3 will examine whether higher-quality haylage changes purchased nutrient needs, milk response, or income over feed cost.

3. Farm Systems Observed

3.1 Case-study design and Interview Summaries

The report uses a two-farm case-study design with unequal financial detail. Farm 1 is the primary economic case. Farm 2 is a complementary systems case. The distinction avoids presenting Farm 2 as an independent economic replication while retaining its value for interpreting management approaches and operational constraints.

What the Interviews Revealed

Two farms sat down for long-form interviews, one a smaller Medium Farm Operation and the other a larger MFO, and the conversations ranged well beyond a fixed questionnaire. What emerged was less a set of data points than a picture of how experienced dairy farmers actually reason through forage decisions: what they weigh, what they leave unresolved, and where cost, quality, weather, and land come together in a single call. The findings below are management practices and farmer judgment, not measured field outcomes.

Cost and quality are decided together, not separately

The clearest theme across both interviews is that farmers do not treat cost, forage quality, and nutrient management as separate questions. They arrive bundled in the same decision. The recurring example is nitrogen ahead of first cutting. Farmers described the standard recommendation to apply nitrogen for a protein and yield gain, and they also described the reason they sometimes skip it: if weather does not open a harvest window at the right maturity, the fertilizer money may not return the quality it was meant to buy. The decision to apply is at once a cost decision, a forage quality decision, and a nutrient decision, and farmers experience it as one judgment made under weather uncertainty rather than three separate calculations.

The same bundling shows up in cutting strategy. Farmers spoke about the tension between a rigid harvest interval and the feed actually standing in the field. A schedule-driven cut taken when regrowth is thin costs nearly the same to mow, merge, chop, and haul as a full one, which makes the thin cut far more expensive per ton. One practice that came directly out of this reasoning is selective late-season harvest: taking earlier cuts across all ground, then walking fields and deciding cut by cut whether enough regrowth is present to justify the pass. Fields that do not carry enough feed are left. This is cost of production reasoning performed in the field, without a spreadsheet, and it is the exact reasoning a formal cost analysis is meant to support.

Land tenure shapes what farmers are willing to invest

Both interviews surfaced the same pattern in how ownership governs management. Investments with a long payback, reseeding, renovation, lime, and drainage, are directed toward owned ground and secure leases. Short-term rented ground receives less of that attention, because improvements may not stay with the operator who paid for them. Farmers described declining to chase late-season cuttings on distant rented parcels and declining to renovate ground they might lose. In at least one case, leases were let go where the arrangement prohibited manure or fertilizer, because the ground was not worth keeping under those terms. The consequence is that the oldest stands, some in continuous hay for two to three decades, tend to persist on ground where renovation is hardest to justify, even as farmers recognize that newer seedings carry better yield and quality. Tenure, in other words, is quietly one of the strongest forces shaping both the cost structure and the condition of the forage base.

Weather is the master variable

Every other constraint the farmers named eventually routed back to weather. Yield variability, the ability to get nitrogen on before first cut, the choice to seed down or shift acres into another crop, the timing of manure, the moisture of the crop entering storage, all of it moved with the weather. Farmers spoke about being ready to harvest while a custom operator finished another farm, about a planned seeding abandoned after a wet spring and the acreage redirected to another crop, and about the constant negotiation between a target harvest date and the forecast. None of this is surprising, but it matters for how the cost analyses should be read: the figures describe decisions made under conditions the farmer does not control, and a clean per-ton number can hide a very messy season.

Storage and shrink are where quality is quietly won or lost

Farmers were candid that a meaningful share of forage value is made or lost after the crop leaves the field. They described the labor and equipment reality of packing and covering, the constraint of limited bunker capacity that forces cuttings to be mixed rather than kept separate, and the difficulty of packing steep or small piles well with a single tractor. They discussed oxygen barriers and improved covers, inoculants and acid treatments, and the persistent trouble spots at bunk walls and along faces. Shrink estimates were offered with visible uncertainty, and farmers distinguished between what is lost in the bunk and the larger loss that accumulates from field drop, truck spillage, and spoilage before feedout. The consistent message was that shrink is real, hard to measure, and worth understanding, which is precisely why the cost analyses treat it as a boundary that must be defined rather than a number to be assumed.

Farmers are already asking the whole-farm question

Beneath the specific practices, both interviews circled a larger economic question the farmers posed themselves: how much to push homegrown forage against purchased feed, and what level of production actually leaves the most money after the feed bill. Farmers framed it plainly, that the measure that matters is what remains after the grain bill, not the milk produced, and expressed interest in growing more of their own energy and protein. This is the question a cost of production analysis exists to inform, and it is notable that the farmers arrived at it on their own. The analytical work that follows is not introducing a new way of thinking. It is giving structure to a question these farmers are already asking.

The connection to agricultural water quality

Read together, these findings point to a single reframing. The decisions that govern water quality on a dairy, nitrogen timing and rate, manure placement and the window after cutting, cover and rotation, renovation and drainage on a given parcel, are the same decisions that govern forage cost and quality. Farmers do not experience them as environmental practices bolted onto the business. They experience them as feed, cost, weather, labor, and land decisions. The nitrogen a farmer chooses not to apply because the harvest window looks doubtful is both a cost saved and a loss risk avoided. The manure timed to the narrow window after a cut is both a nutrient captured for the crop and a nutrient kept out of the water. The renovation deferred on insecure ground is both a cost decision and a soil-cover outcome. This is the connection the project rests on: that giving farmers better cost and forage information moves the economically rational choice and the water-protective choice toward the same answer. The interviews did not measure water quality outcomes, but they showed something more useful for this purpose, that farmers are already making water quality decisions every season, inside decisions they think of as being about feed and money.

Farm	Primary role	Contribution
Farm 1	Financial and inventory case	2025 expenses, revised enterprise allocations, forage inventories, herd count, acreage, and interviews
Farm 2	Production-system context	Interviews covering rotation, stand age, cut management, species mix, manure timing, machinery, storage, and alternative-feed interests

3.2 Farm characteristics

Characteristic	Farm 1	Farm 2
Primary enterprise	Dairy	Dairy
Milking herd	About 200 cows	About 600 cows
Total herd reported	About 400 animals	Not fully reconciled
Halyage acres	About 350	About 500 to 550 in a typical year
Corn acres	About 220	About 800 to 900
Hay land tenure	250 owned; 100 rented	Large mix of owned and rented parcels
Cutting system	Three cuts plus selective fourth	Five-cut target on priority stands
Stand context	Some hay fields reported at 20 to 30 years old	Rotational stands plus about 200 acres of permanent hay
Harvest system	Custom hired mowing, merging, and chopping; farm performs trucking and packing	Farm performs most mowing and all chopping; hired drivers and some outside support
Storage	Multiple bunkers with oxygen barrier, plastic, and tires	Multiple bunkers with oxygen barrier, plastic, and tires

3.3 Cross-case management observations

Theme	Cross-case observation
Forage quality	Both farms identify quality and consistency as primary management goals.
Weather	Weather affects seeding, fertility timing, harvest date, moisture, yield, and the number of cuttings completed.
Stand age	Both farms report better performance from newer seedings than from older stands.
Land tenure	Rental terms affect willingness to invest in reseeding, fertility, manure, and crop rotation.
Harvest capacity	Farm 1 depends on custom operator timing; Farm 2 depends heavily on one operator and available truck drivers.
Storage	Both farms value feed segregation but face packing, capacity, labor, or wall-interface concerns.
Decision need	Both farms seek the point where improved feed value covers added production and harvest cost.

> "You've got to find that fine line on what's most cost effective." – Farm manager

4. Production System Description

4.1 Cultivar mix and varieties

Farm 1 described recent seedings as alfalfa and fescue mixtures, with seed recommendations influenced by the agronomist and seed supplier. The exact seed tag, seeding rate, and variety composition were not available in the interview and should be verified. Older fields contain a wider mix of long-established grasses.

Farm 2 reported a recent mixture of about 60% alfalfa, 25% mixed grasses, and the balance in clovers. Management values alfalfa for drought response on suitable, well-drained soils but avoids relying on it in wet or heavy fields.

Decision in Practice: Fertilizing Ahead of First Cut

THE DECISION. Whether to apply nitrogen to grass stands before first cutting in pursuit of higher protein and yield.

WHAT FARMERS WEIGH. Farmers shared that nutritionists and agronomists consistently recommend the practice, and that they have applied roughly 100 pounds of urea on grass ground in years when they expected to need the feed. They also described skipping the application in years when carryover inventory was adequate. The concern raised was timing: if weather prevents harvest at the intended maturity, the fertilizer investment may not return the quality it was meant to buy. One farmer framed the difficulty directly, noting how many variables sit between the application and the harvested crop.

WHAT THE COST ANALYSIS CONTRIBUTES. Fertilizer represents a measurable share of allocated hay cost, which means the question can be framed as a return-on-investment calculation rather than a rule of thumb. Once cost per ton and forage quality are tracked together across fields, a farm can begin to test whether the application pays under its own harvest timing rather than under ideal conditions.

4.2 Seeding and reseeding practices

Farm 1 is considering more rotation and reseeding after a period when time constraints limited field renewal. Management identified hay fields that have remained in forage for 20 to 30 years and sees newer seedings as more productive.

Farm 2 planned to establish about 150 acres in hay but shifted the acreage to corn after a wet spring delayed seeding. This highlights a major issue that Vermont farms face, difficult weather in the spring could keep certain fields out of grass production, a barrier to successful field rotation. The farm later discussed establishing about 130 acres from corn into hay. A newer 100-acre block reportedly performed well under a five-cut system. Farm 2's experience illustrates how weather can alter rotation, forage inventory, and the land available for perennial cover.

4.3 Fertility, manure, and lime

Farm 1 applies manure after cutting when conditions allow and may use commercial fertilizer when manure timing is not feasible. Management is reconsidering lime after a period of limited application and reported that the agronomist emphasized correcting soil pH before increasing fertilizer investment. Urea before first cutting remains an unresolved return-on-investment question because weather can delay harvest and change the value of added nitrogen.

Farm 2 reported historically heavy nitrogen use, more recent attention to potash and balanced nutrients, and greater effort to move manure farther from the barns. Priority stands may receive manure within two days after cutting, with three days described as an outside limit. A larger manure-storage structure may provide more flexibility in application timing.

UVM nutrient guidance recommends using soil tests and crop-specific nutrient needs to guide lime and fertilizer decisions. NRCS nutrient-management guidance similarly emphasizes source, rate, timing, and placement to improve nutrient use and limit loss (Jokela et al., 2018; USDA NRCS, 2026a). Lime, nitrogen, phosphate, and potash are needed in adequate amounts to produce high yields of hay as high yields of hay remove large amounts of nutrients from the soil.

4.4 Cutting schedule

System	Observed approach	Management interpretation
Farm 1 baseline	Three consistent cuttings on the hay acreage.	Provides a stable annual schedule.
Farm 1 selective fourth	Approximately 30% to 40% of fields in a favorable year.	Selected according to regrowth, field access, and expected yield.
Farm 2 priority stands	Five-cut target near a 28-day interval.	Requires an early first cutting and responsive harvest capacity.
Farm 2 older stands	Some fields cut two times and assigned to lower-requirement groups.	Intentional feed destination rather than uniform treatment.

Farm 1's selective fourth cutting is an economic screening practice. Management does not harvest fields that appear too light to justify the same mowing, merging, chopping, trucking, and storage sequence. The practice should be evaluated through incremental cost per added usable dry-matter ton, rather than through annual average cost alone.

> "If the weather's not good, I'd rather be two days early than five days late." –Farm manager

4.5 Harvest methods

Farm 1 uses a custom operator for mowing, merging, and chopping. The farm provides trucking, packing, covering, and feedout labor and equipment. The custom operator charges by operation and acre, making direct assignment possible once invoices are separated by crop and cutting. Custom harvesting reduces the need to own a full harvest line of machinery and equipment but creates timing dependence.

Farm 2 performs about 90% of mowing and all chopping. Another operator generally handles merging, and the farm uses owned trucks with hired drivers. Chopper records can provide cutter-head hours and field hours by crop. The approach offers a stronger machinery allocation basis than a single whole-farm percentage.

4.6 Storage and preservation

Farm 1 stores haylage in bunkers and reports use of inoculant, an oxygen-barrier layer, plastic, and tires. The farm wants enough capacity to keep cuttings separate, which may improve ration consistency and allow feed to be directed to suitable animal groups.

Farm 2 also values feed segregation but reported that smaller, steep piles restrict packing to one tractor and increase labor requirements for covering and uncovering. Wall interfaces, wildlife damage, and cover labor are recurring concerns. Dense packing and rapid sealing limit oxygen exposure and protect usable feed value (Borreani et al., 2018; Cornell Nutrient Management Spear Program, 2011).

5. Cost of Production Findings

The following content will use hypothetical round numbers that were informed by several farm and advisor interviews as well as recent academic publications. To keep this analysis useful and reproducible, **the worked examples do not use any participating farm's figures.** Instead they follow a single hypothetical operation, built to be typical of a Vermont dairy of its size and carried consistently through every report in this series.

The example farm is a 200-milker dairy with youngstock, replacement heifers, dry cows, and some beef-on-dairy. It crops roughly 600 acres of owned and rented ground, about 400 acres of hay and 200 acres of corn, a two-to-one ratio common on dairies that rely on perennial forage as the base of the ration and corn silage as the high-energy anchor. Hay is cut four times across the season in a typical year, with the final cutting taken selectively on fields that carry enough regrowth to justify the pass. Corn is grown in rotation with hay, with new hay seedings established as ground rotates out of corn.

Every number used in the examples that follow is rounded and illustrative. The figures are not drawn from any individual farm, and they are meant to be replaced by a reader's own records. The purpose is to show the method clearly enough that a farm or advisor can repeat it with real numbers. This is one illustrative farm, and every farm has its own parameters.

5.1 Accounting framework and scope

Cost layer	Current treatment
Variable cash cost	Custom work, fertilizer, fuel, hired labor, repairs, seed, and supplies.
Fixed cash cost	Allocated property tax and rent for land, buildings, and equipment.
Not included	Capital recovery, interest on operating capital, unpaid operator labor, and owned-land opportunity cost
Cash-flow item kept outside CoP	Loan principal and capital purchases

The report presents a revised working cash cost, not a complete economic cost. USDA ERS includes unpaid labor, capital recovery, land opportunity cost, taxes, insurance, and overhead in broader economic cost measures. Adding ownership costs would support long-term machinery and land decisions.

5.2 Cost allocation methodology – Starting with a Schedule F

Why the Schedule F is the starting point

Nearly every farm already files a Schedule F, the federal tax form that reports farm income and expenses. That makes it the most accessible starting point for a cost of production estimate, because it requires no new recordkeeping. A farm can begin building a per-crop cost picture today, from a document it already has in hand, keeping in mind that ***this is a very rough estimation method and refinement is absolutely necessary to find true cost-of-production results.***

The Schedule F reports whole-farm cash expenses sorted into standard categories: custom hire, fertilizer and lime, fuel, hired labor, repairs, seed, supplies, taxes, rent, and so on. That is its strength and also its limit. It tells the farm what it spent in total, in cash, during the year. It does not tell the farm how much of each expense belonged to hay, to corn, or to the milking herd. It carries no accrual adjustment for inventory change, and its depreciation line reflects tax rules rather than the true cost of using machinery over its working life. A cost of production estimate built from a Schedule F is therefore a cash-cost estimate, and a first approximation rather than a finished economic analysis.

The task of this section is to get from the whole-farm Schedule F to a defensible first-pass cost for a single crop. That step requires allocation.

Allocation is a documented judgment, not a fact

Because the Schedule F reports costs for the whole farm, splitting them among enterprises requires assigning a share of each category to each activity. There is no tax record that states what share of the fuel bill went to chopping hay. The farm and advisor decide that share, using the best reasoning available, and then document it. Done openly, this is a legitimate and standard practice. The integrity of the estimate rests not on the allocation being exact, but on it being reasonable, transparent, and consistent, so that anyone reviewing it can see the reasoning and adjust it.

To keep those judgments disciplined, this analysis sorts every expense category into one of three allocation approaches.

- **Allocation by crop acreage** is used where an expense scales mainly with land, such as property tax and land rent. The crop share divides two-to-one between hay and corn, following the 400 and 200 acre base.
- **Allocation by crop-input intensity** is used where an expense scales with how heavily a crop is planted, fertilized, and sprayed. Seed, fertilizer, and chemicals fall here, and they weight toward corn.
- **Allocation by harvest activity** is used where an expense scales with how hard the machinery and crew work. Fuel, repairs, hired labor, and supplies fall here, and they weight toward hay because of its repeated cuttings.
- **Allocation by the nature of the expense** is used where a cost belongs to a crop for a structural reason, such as seed, fertilizer, chemicals, and custom hire.

The allocation table

The following working percentages apply the three approaches to the example farm. This is one illustrative farm, and every farm sets its own parameters; the value of the table is the reasoning it makes visible, not the specific numbers. Costs that belong partly to the milking herd and every business carry a "dairy-and-other"-operations share before the remainder is divided between crops.

Schedule F expense category	Haylage	Corn silage	Dairy & other	Basis
Custom hire and professional fees	55%	45%	0%	Nature: hay harvest services plus corn chopping, planting, tillage
Seed	15%	85%	0%	Nature: corn seeded annually; hay seed for establishment only
Fertilizer and lime	33.3%	85%	0%	Crop-input intensity: corn fertilized annually and heavily; hay ~once/yr
Chemicals (spraying, pesticides)	15%	85%	0%	Nature: corn is the sprayed crop; established hay little to none
Fuel and oil	57.1%	17.8%	25%	75% cropping; crop share by harvest activity
Repairs and maintenance	57.1%	17.8%	25%	75% cropping; crop share by harvest activity
Hired labor	30.5%	9.5%	60%	60% dairy; remaining 40% by harvest activity
Supplies	57.1%	17.8%	25%	75% cropping; crop share by harvest activity
Property tax, farm share	33.3%	16.7%	50%	50% dairy; crop share by acreage
Land and building rent	40%	20%	40%	40% dairy; crop share by acreage

Two crop-split bases, pulling opposite directions

Two crop-split bases run through this table, and they pull in opposite directions by design. Machinery-related costs divide by harvest activity, about 76 percent hay to 24 percent corn, because hay is cut four times a season while corn is harvested once, so hay drives far more field passes even though corn's single pass is heavier. Annual crop inputs divide by input intensity, about 33 percent hay to 67 percent corn, because corn is seeded, fertilized, and sprayed every year while an established hay stand receives fertilizer or lime only about once a year. On this farm, established hay's per-acre input intensity is taken at roughly one quarter of the corn's. The result is: hay carries the harvest work, corn carries the annual crop inputs.

Manure is embedded

Manure application does not appear as its own line. On most farms its cost is not separately recorded on the Schedule F; it lives inside fuel, repairs, labor, and custom hire. On the example farm, manure is spread on hay after each of the four cuttings and on corn once after fall silage harvest, so the cost of applying it concentrates on hay and follows the same harvest-activity pattern as the machinery categories that carry it. Breaking manure out as a separate line would risk double-counting cost already captured in those categories, so it is left embedded and noted here.

The largest single assumptions

Two categories carry the largest single assumptions. Hired labor is placed 60 percent to the dairy, because milking, feeding, and daily animal care make up the core of paid hours on a 200-milker operation, with cropping labor concentrated in seasonal windows. Custom hire is split 55 percent hay to 45 percent corn rather than heavily to hay, because on this farm corn draws real custom work for chopping, planting, and tillage alongside the repeated hay harvests. A farm whose situation differs, more custom work on one crop, in-house harvest of another, should adjust these shares and record the reason.

Two categories from a standard Schedule F are handled specially. Equipment and livestock rent is not carried as a cost line for this farm. Chemicals are shown because corn is sprayed, even though the source cases reported no separate chemical line; a farm that reports chemical expense assigns it to the crop that received the application.

5.3 Sharpening the Estimate with Records

The percentages in Section 5.2 are provisional management estimates, not audited enterprise costs. They are meant to produce a reasonable first-pass number quickly, from a document every farm already has. They are also meant to be replaced. As better records become available, each broad allocation gives way to a more accurate figure, and the estimate moves from a defensible approximation toward a measured cost.

The point is not that the Schedule F method is wrong. It is that the Schedule F gets a farm started, and its own records make the estimate precise. A farm does not need to wait for perfect data to begin. It can produce a first number now and sharpen it over time, replacing judgment with measurement one category at a time.

The table below shows the path for each category: what the first pass looks like from the Schedule F, and what sharpens it.

Cost category	First pass (from Schedule F)	Sharpen with
Custom hire	A single whole-farm total split 55/45 by judgment	Actual per-service invoices priced by the acre for mowing, merging, chopping, planting, and tillage, assigned to the crop that received them
Fuel and oil	Whole-farm fuel, 75% to cropping, then split by estimated harvest activity	Machinery hours logged by the equipment itself (cutter-head and field hours), converted to fuel by machine and crop
Repairs	Same activity split as fuel	Repair invoices coded to the machine, then assigned by that machine's crop hours
Hired labor	60% to dairy, remainder by activity	Payroll detail sorted by role and task, with cropping hours timed to harvest and manure windows
Fertilizer, lime, chemicals	Split by crop-input intensity	Field-level input records and application maps showing what was applied where, at what rate and cost
Seed	Split 15/85 by the annual-versus-establishment rule	Seed invoices tied to the fields and crops actually planted that year
Land and taxes	Dairy share removed, crop share by acreage	Parcel-level records: which fields grow which crop, owned versus rented, with actual rent and tax by parcel

Where sharpening matters most

Not every category rewards the same effort. Three are worth chasing first, because they carry the most cost and the most uncertainty on a dairy of this size.

- **Machinery hours.** Fuel and repairs together are a large share of crop cost, and the harvest-activity split that governs them is an estimate. A chopper that logs cutter-head and field hours turns that estimate into a measured crop split, and it does so for the single most expensive operation on the farm.

- **Custom hire.** Where custom work is billed by the acre and by the service, the invoices already contain the exact allocation. Pulling them replaces the 55/45 judgment with the real number at almost no cost in effort.
- **Labor.** The 60 percent dairy share is the largest single assumption in the table. Even a rough timesheet that separates milking and animal care from field and harvest work would materially improve the whole estimate.

Fertilizer, seed, and chemical records matter too, and field-level input data is the natural bridge to the nutrient-management and water-quality questions this project cares about. A farm that already keeps a nutrient management plan has much of this information in hand.

What the Schedule F still cannot give you

Even sharpened, a cost built this way remains a cash-cost estimate. It does not include the cost of using owned machinery over its life, unpaid operator and family labor, interest on money tied up in the operation, or the opportunity cost of owned land. Those belong to a complete economic cost, and they are addressed separately. Naming them here keeps the boundary of this analysis honest: what follows is a defensible, improvable cash cost of growing the crop, not the full economic cost of the enterprise.

Start with the Schedule F to get a first number today. Sharpen it with invoices, machinery hours, payroll detail, and field records as they become available. Keep the cash-cost boundary clear. And remember this is one illustrative farm; every farm sets its own parameters and should document its own reasoning.

Allocating Whole-Farm Expenses to Hay

Applying the percentages from Section 5.2 to the example farm's whole-farm expenses produces a first-pass cost of producing hay crop silage. The table below shows round, illustrative whole-farm figures for the 200-milker farm, the hay allocation percentage for each category, the dollars that fall to hay, and each line's share of the total hay cost. Every figure is rounded and illustrative, and none is drawn from any individual farm.

Schedule F expense category	Whole-farm expense	Hay allocation %	Hay allocation ($)	Share of hay cost
Custom hire and professional fees	$75,000	55.0%	$41,000	13.6%
Seed	$60,000	15.0%	$9,000	3.0%
Fertilizer and lime	$90,000	33.3%	$30,000	10.0%
Chemicals (spraying, pesticides)	$20,000	15.0%	$3,000	1.0%
Fuel and oil	$60,000	57.1%	$34,000	11.3%
Repairs and maintenance	$125,000	57.1%	$71,000	23.6%
Hired labor	$200,000	30.5%	$61,000	20.3%
Supplies	$40,000	57.1%	$23,000	7.6%
Property tax, farm share	$20,000	33.3%	$7,000	2.3%
Land and building rent	$55,000	40.0%	$22,000	7.3%
Total hay allocation			**$301,000**	**100.0%**

Two features of this result stand out. First, repairs and hired labor together account for about 44 percent of allocated hay cost, the two largest lines by far. That matches what farmers consistently described as their heaviest cost pressures on hay: keeping harvest equipment running and getting the crew through repeated cuttings on time. Second, seed and chemicals sit near the bottom for hay, at 3 and 1 percent. This is the mirror image of what the corn silage analysis shows, and it confirms that the two crops carry genuinely different cost structures: hay is defined by repeated harvest work, corn by annual crop inputs.

5.4 Unit-cost results

A total allocated cost becomes useful for decision-making when it is expressed per unit: per acre, per ton harvested, and per ton of feed actually delivered to the animal. Each unit answers a different question, and each carries its own assumptions. The figures below convert the $301,000 hay allocation into unit costs for the example farm.

Cost per acre

Across 400 hay acres, the allocated cash cost works out to about **$752.50 per hay acre.** This is the most stable of the unit costs, because it depends only on the allocation and the acreage, both of which the farm knows with confidence. It is a useful figure for comparing fields, planning rented ground, and sizing the hay enterprise against the rest of the farm.

Cost per ton harvested

At an illustrative seasonal yield of 10 as-fed tons per acre, the farm harvests about 4,000 as-fed tons of haylage, and the allocated cost comes to roughly **$75 per as-fed ton.** This figure is more sensitive than cost per acre, because it depends on yield, and yield moves with weather, stand age, and cutting decisions. A weaker year spreads the same cost over fewer tons and raises cost per ton, even when nothing about the spending changed.

Cost per ton of dry matter

As-fed tonnage is a poor basis for comparing feeds, because haylage is mostly water and its moisture varies. Cost per ton of dry matter is the fairer comparison, but it requires knowing the dry-matter content, which the example farm has not measured directly. Rather than assume a single value, the cost is shown across the range haylage normally occupies.

Dry-matter content	Dry-matter tons	Cost per DM ton
30% DM	1,200	$251
35% DM	1,400	$215
40% DM	1,600	$188

The spread is wide, from about $188 to $251 per dry-matter ton, and it is driven entirely by an assumption the farm has not measured. That is the point: until dry matter is measured directly, cost per dry-matter ton is a range, not a number. Measuring dry matter at harvest is one of the highest-value records a farm can add, because it turns this range into a single defensible figure.

Cost per ton of usable feed

Not everything harvested reaches the animal. Storage and feedout losses, together called shrink, remove a share of the crop between the bunker and the bunk. The cost of growing the whole crop is spread over only the usable portion that survives, so every unit of shrink raises the true cost of the feed actually fed.

Storage and feedout loss	Usable as-fed tons	Cost per usable ton
5% loss	3,800	$79
10% loss	3,600	$84
15% loss	3,400	$89

Moving from 5 percent loss to 15 percent loss raises the cost of usable feed by about $10 per ton, roughly 13 percent, on feed that cost nothing more to grow. This is why farmers spoke about packing, covering, and face management as economic decisions rather than housekeeping. Shrink is real cost, and it is one of the few cost drivers a farm can reduce after the crop is already in the ground.

Reading the unit costs together

The four unit costs form a ladder from most certain to least certain. Cost per acre rests on figures the farm knows. Cost per as-fed ton adds a yield assumption. Cost per dry-matter ton adds a moisture assumption. Cost per usable ton adds a shrink assumption. Each step toward the animal is more useful for ration and feed-purchase decisions, and each is also less certain until the farm measures the underlying quantity. The path from a Schedule F estimate to a decision-grade cost runs directly through those three measurements: yield, dry matter, and shrink.

6. Feed Quality and Herd Performance

6.1 Herd context

Animal Group	Head
Milking cows	200
Dry cows	30
Bred heifers	60
Calves	110
Total herd	400

The herd inventory provides a denominator for feed-system context but does not replace ration records. For a herd of this size, a farm can convert its own measured inventory disappearance into as-fed pounds per animal as a planning check. Because haylage is distributed across animal groups and the inventory method contains uncertainty, the ***figures should be used for inventory planning rather than ration formulation.***

6.2 Farmer perceptions of quality and consistency

Farm 1 identifies forage quality as a primary objective. Management monitors changes in feed appearance, bucket weights, cow intake, manure consistency, and milk response. Forage testing was described as occurring at least every other week, with additional testing when the feed changes. The interview also raised interest in routine on-farm dry-matter testing to stabilize dry-matter intake.

Farm 2 values segregating cuttings so the nutritionist can formulate with a more consistent forage source. The farm intentionally directs older or more mature forage toward dry cows or other lower-requirement groups.

6.3 Role of haylage in the TMR

Forage class	Potential use
High-quality first cutting or priority-stand forage	High-producing or fresh groups, subject to nutritionist formulation
Later high-quality cuttings	Production groups according to analysis and inventory
Older or intentionally mature grass forage	Dry cows, heifers, or other lower-requirement groups when suitable
Very wet or unusual forage	Blend according to dry matter, fermentation profile, and ration fit

6.4 Herd performance indicators for improved accuracy

Indicator group	Record
Milk	Daily milk per cow and total shipped milk during each feedout period
Components	Fat and protein percentages and pounds
Intake	TMR offered, refusals, and estimated dry-matter intake by group
Feed efficiency	Energy-corrected milk or component-corrected milk per pound of DMI
Ration change	Haylage inclusion rate and purchased ingredient changes when storage units change
Health and consistency	Manure scores, sorting, rumen-health observations, and fresh-cow performance
Economics	Income over feed cost (IOFC) or marginal milk value linked with ration periods

This topic is currently out of the scope of the current project, but future research should consider these data points. No measured milk production or feed-efficiency series has yet been matched with the inventory interval. The present report therefore describes herd context and producer observations without attributing a production response to a specific cutting or storage unit.

7. Soil Health and Water Quality

7.1 Perennial cover

Farms hay acres maintain perennial vegetation through much of the year. Perennial cover limits the duration of exposed soil relative to annual row-crop systems and can support infiltration, root activity, and erosion control. NRCS identifies year-round soil cover, living roots, reduced disturbance, and diverse rotations as soil-health principles that can reduce erosion and improve water management (USDA NRCS, 2026b).

The case data do not measure runoff, phosphorus loss, nitrate loss, soil organic matter change, or infiltration. The report can identify plausible pathways and management opportunities, but it cannot claim a measured water-quality improvement from the hay acreage.

7.2 Nutrient timing and use efficiency

Both farms apply manure after hay harvest when weather, labor, and storage conditions allow. Applying nutrients near active crop demand can improve the opportunity for plant uptake, while rainfall timing and field condition affect loss risk. The economic analysis should link manure and fertilizer cost with soil tests, realistic yield goals, nutrient removal, and application timing.

Farm 1 brought up a question about applying urea before first cutting illustrates an economic and environmental connection. Added nitrogen may raise yield or protein when the crop can use it, but a delayed harvest, weak yield response, or unfavorable weather can reduce the return and increase loss exposure. A field comparison should track applied nitrogen, dry-matter yield, crude protein, weather, and cost per usable dry-matter ton.

7.3 Rotation, stand renewal, and land tenure

Rotation can renew forage stands, redistribute manure, and interrupt continuous corn. It also introduces tillage or termination periods that may temporarily increase erosion exposure if soil cover is not maintained. Cover crops, nurse crops, reduced tillage, and timely establishment can reduce the uncovered period.

Short-term rental creates a practical barrier to lime, drainage, and reseeding investments. Farm 1 avoids some fourth-cut and renovation expense on rented ground because the payback period may exceed the secure tenure period. Farm 2 mentioned that rental agreements vary depending on the preferences and relationships with owners. These agreements directly affect what land management practices take place on these parcels. Water-quality recommendations should therefore distinguish owned land, secure leases, restricted leases, and parcels where management rights are uncertain.

Regarding feedback from farmers, our research team believes that there could be a new angle for examining water-quality improvements on farms:* LAND TENURE*. A broader study should look at the differences in land management (conservation practices, seeding management, drainage, etc.) between pasture/hay land that is owner versus rented.

7.4 Water-quality planning relevance

The table below connects haylage management decisions with their potential water-quality implications and identifies the records needed to evaluate each pathway at the farm level. Perennial cover can support year-round soil protection, living roots, and soil organic matter, while nutrient timing can improve the alignment between manure or fertilizer applications and crop uptake. Rotation decisions require balancing stand renewal with erosion protection during termination and establishment, and storage management affects the risk of silage leachate or contaminated runoff leaving the feed-storage area. Field-performance records add an economic dimension by identifying low-yield fields receiving relatively high nutrient or production inputs. Together, the categories provide a practical framework for documenting how forage management, nutrient use, storage, and field productivity may influence water-quality outcomes without assuming that any specific benefit has already been measured.

Planning area	Potential pathway	Record needed
Perennial cover	Maintain soil cover and living roots, improve SOM	Acres in hay; duration of stand; decisions to improve or leave a stand "as-is"
Nutrient timing	Match manure and fertilizer with crop demand	Application date, source, rate, rainfall, and field condition
Rotation	Balance stand renewal with erosion protection	Termination method, cover crop, tillage, and establishment success
Storage runoff	Prevent silage leachate and contaminated runoff	Storage design, runoff capture, and inspection records
Field performance	Identify low-yield fields receiving high inputs	DM yield, soil test, nutrient rate, and cost per usable ton

8. Management Risks and Bottlenecks

The table below summarizes farmer feedback about the main operational, agronomic, and accounting risks that can affect haylage cost and performance across the two case-study farms. Weather and harvest timing influence forage maturity, moisture, yield, and the number of cuttings completed, while labor and equipment arrangements create farm-specific exposure through custom-operator dependence at Farm 1 and reliance on a single primary operator at Farm 2. Low yield per cutting raises unit cost because the same harvest sequence is spread across fewer tons, and missed seeding windows can reduce future haylage inventory. Land tenure, packing capacity, and storage segregation also shape investment decisions, feed preservation, and labor requirements. For Farm 1, inventory estimation and whole-farm expense allocation add analytical uncertainty because fixed density assumptions, missing dry-matter data, and shared accounts can distort the reported cost per ton. Together, the risks show that haylage economics depend not only on field production, but also on timing, labor, storage, recordkeeping, and the accuracy of enterprise cost assignments.

Risk or bottleneck	Farm	Business effect
Weather and harvest window	Both	Changes maturity, moisture, yield, field loss, and the number of cuttings available.
Custom operator availability	Farm 1	A delay can reduce quality or alter moisture at harvest.
Single-operator dependence	Farm 2	One person performs most mowing and all chop-ping.
Low yield per cutting	Both	The same harvest sequence is spread across fewer tons, raising unit cost.
Missed seeding window	Farm 2	Hay acreage shifts to corn and reduces future hay-lage inventory.
Short-term rented land	Farm 1	Limits the payback horizon for lime, renovation, drainage, and added harvest.
Packing capacity	Both	Harvest flow may exceed the ability to spread and compact forage.
Storage segregation	Both	Improves feed identity but can require more storage area and cover labor.
Inventory estimation	Farm 1	Fixed density and missing DM can distort tons and cost per ton.
Expense allocation	Farm 1	Whole-farm accounts can overstate or understate enterprise cost.

9. Recommendations

9.1 Immediate priorities

Building on the report's observations, the immediate recommendations focus on improving the accuracy and usefulness of future haylage cost-of-production analyses. The first priority is to verify the production denominator by reconciling crop year, carryover inventory, storage units, used-ton records, and the method used to estimate tonnage. Routine dry-matter testing by storage unit should then be added so as-fed inventory can be converted into dry-matter tons and compared more reliably across cuttings and feed sources. Bunker density should also be measured or periodically verified with scale weights and safe core sampling rather than relying only on the current 45-pound-per-cubic-foot assumption. On the financial side, custom-harvest invoices should be assigned directly by crop and cutting, while payroll records should separate herd management, milking, crop work, maintenance, and general management labor. Collectively, these recommendations will strengthen the cost per acre, cost per ton, shrink, and enterprise-allocation results developed in this report. We understand that many of these practices already take place on most farms, this report is meant to reinforce known practices and to provide the reader with general knowledge on recommended practices.

Priority	Action	Reason
1	Verify the production denominator	Confirm crop year, carryover, all storage units, used-ton logic, and whether tonnage is based on scale weights or volume.
2	Measure dry matter by storage unit	Use routine on-farm DM checks and laboratory results to convert as-fed tons to DM tons.
3	Measure or verify bunker density	Use scale weights and core sampling where safe and practical; retain the current 45 lb/ft3 only as an assumption.
4	Reconcile custom invoices	Assign mowing, merging, and chopping directly by crop and cutting.
5	Separate payroll roles	Divide herd management, milking, crop, maintenance, and general management labor.

9.2 Production and field-management priorities

- Track each field and cutting with acres, harvest date, as-fed tons, dry matter, forage analysis, labor hours, and intended animal group.
- Evaluate selective cutting through an incremental budget that compares added usable DM and feed value with added harvest and storage cost.
- Compare newer and older stands using seasonal DM yield, forage quality, **maintenance cost,** and expected years remaining.
- Prioritize multi-year lime and reseeding investments on owned land or secure leases; **use shorter payback tests on year-to-year rentals.**
- Test urea before first cutting through paired field comparisons or consistent field-year records rather than relying on annual impressions.

9.3 Storage and feed-management priorities

- Record forage placed into each bunker, feed removed, discarded spoilage, and bunk termination dates.
- Match delivery rate with packing capacity and record packing tractor hours.
- Review whether added bunker capacity would improve cutting segregation, packing, and feed consistency enough to cover ownership and labor cost.
- Connect storage-unit changes with ration inclusion, milk, components, refusals, and manure observations.

9.4 Water-quality planning priorities

- Link nutrient applications with soil tests, realistic yield goals, field conditions, and harvested nutrient removal.
- Track the acres and duration of perennial cover within the corn-hay (or other crop) rotation.
- Use cover crops or other soil-cover strategies during stand termination and annual-crop phases where field conditions allow. This will be covered in Tech Report #3.
- Evaluate low-yield, high-input fields for renovation, rotation, reduced input, or a different feed destination. This will be covered in Tech Report #3.

10. Advisor Checklist for Future Research

Review area	Advisor question
Scope	Is the analysis field-only, delivered to storage, removed for feeding, or consumed?
Acres	Are hay acres reconciled by field, ownership, lease term, and crop year?
Stand	Are age, species mix, drainage, density, and rotation history recorded?
Cutting	Are cutting number, interval, date, height, and intended animal group recorded?
Yield	Are as-fed tons and dry matter measured for every field or load group?
Fertility	Are lime, fertilizer, manure gallons, timing, analysis, and application cost assigned by field?
Custom work	Can invoices be assigned by operation, crop, acre, and cutting?
Machinery	Are hours, fuel, repairs, capital recovery, and use percentages available by machine?
Labor	Are crop, dairy, herd-management, maintenance, and owner hours separated?
Storage	Are density, cover date, packing, storage unit, spoilage, and runoff controls recorded?
Inventory	Are remaining tons, used tons, carryover, and runout projections reconciled across snapshots?
Feed quality	Are DM, CP, NDF, digestibility, ash, sugar, and fermentation measures available?
Herd response	Are milk, components, DMI, refusals, and ration changes linked with feedout periods?
Water quality	Are soil cover, nutrient timing, erosion risk, buffers, and runoff controls documented?
Interpretation	Does each recommendation compare added value with added cost and risk?

Appendix A. Assumption Register

The assumptions below govern the illustrative figures used in this report. Every value applies to the hypothetical example farm and is rounded. None is drawn from any individual farm. A farm applying this method substitutes its own measured values.

Assumption	Value	Reason	Status
Hay acres	400	Illustrative farm parameter	Illustrative
Corn acres	200	Illustrative farm parameter	Illustrative
Cuttings per season	4	Three full cuts plus a selective fourth	Informed by interviews
Harvest-activity crop split	76% hay / 24% corn	Four hay cutting cycles vs. one heavier corn pass	Working assumption
Crop-input intensity split	33% hay / 67% corn	Corn seeded, fertilized, and sprayed annually; hay input intensity ~one quarter of corn	Working assumption
Seasonal yield	10 as-fed tons/acre	Round Vermont figure for four-cut haylage at ~35% DM	Illustrative
Base DM sensitivity	30%, 35%, 40%	Common bunker-haylage range	Not measured
Shrink sensitivity	5%, 10%, 15%	Illustrates field-to-feed loss effect	Scenario only

Appendix B. Calculation Detail

The calculations below reproduce the unit-cost results in Section 5 for the illustrative example farm. All inputs are rounded and illustrative.

Calculation	Formula	Result
Total allocated hay cost	Sum of hay allocations across categories	$301,000
Cost per hay acre	$301,000 / 400 acres	$752.50
Total as-fed haylage	400 acres × 10 as-fed tons/acre	4,000 tons
Cost per as-fed ton	$301,000 / 4,000 tons	$75.25
Cost per DM ton at 35% DM	$301,000 / (4,000 x 0.35)	$215.00
Cost per DM ton range	30% to 40% DM	$251 to $188
Cost per usable ton at 10% loss	$301,000 / (4,000 × 0.90)	$83.61
Cost per usable ton range	5% to 15% loss	$79 to $89

Appendix C. Explanation of Farm Expense Allocation Rationale

The hay allocations were developed as a transparent working method for assigning mixed whole-farm expenses to the hay enterprise when direct enterprise records were unavailable. The approach first separates expenses associated primarily with dairy operations from expenses associated with crop production. The remaining crop share is then divided between hay and corn using one of three approaches: crop acreage, harvest activity, or the nature of the expense. The resulting percentages are provisional management estimates for one illustrative farm rather than audited enterprise costs. Direct invoices, equipment hours, payroll records, and field-level input records would provide a stronger basis. Every farm sets its own parameters and should document its own reasoning.

Custom hire and professional fees were split 55 percent to hay and 45 percent to corn, because on the example farm corn draws real custom work for chopping, planting, and tillage alongside the repeated mowing, merging, and chopping of several hay cuttings. Seed was assigned 15 percent to hay and 85 percent to corn, because corn is planted every year while established hay stands remain productive for several years and require seed mainly during establishment or renovation.

Fertilizer and lime were split 33 percent to hay and 67 percent to corn by crop-input intensity, rather than by acreage. Corn is fertilized annually and more heavily per acre, while an established hay stand receives fertilizer or lime only about once a year. On this farm, hay's per-acre input intensity is taken at roughly one quarter of corn's. Chemicals for spraying and pesticides were split 15 percent to hay and 85 percent to corn on the same basis, because corn is the sprayed crop and established hay receives little to none.

Fuel, repairs, supplies, and part of hired labor were first divided between cropping and dairy operations, with 75 percent of fuel, repairs, and supplies assigned to cropping. The crop portion was then divided by harvest activity, about 76 percent to hay and 24 percent to corn, to reflect the repeated field and harvest operations of four hay cuttings against corn's single heavier pass. Hired labor was treated differently because the payroll account is dominated by herd management and daily dairy work: 60 percent was assigned to dairy operations, and the remaining 40 percent was divided by the same harvest-activity split.

Manure application does not appear as a separate line. On most farms its cost is not separately recorded on the Schedule F; it lives inside fuel, repairs, labor, and custom hire. On the example farm, manure is spread on hay after each of the four cuttings and on corn once after fall silage harvest, so its cost concentrates on hay and follows the same harvest-activity pattern as the categories that carry it. Breaking it out separately would risk double-counting.

Fixed expenses were allocated more conservatively to the hay enterprise because farm property, buildings, and rented ground also support the dairy herd. Half of property tax was assigned to dairy operations, with the remaining half divided by crop acreage. Land and building rent was assigned 40 percent to dairy operations, with the crop portion divided by acreage. Equipment and livestock rent is not carried as a cost line for the example farm.

The method balances three factors: the share of land devoted to hay, the greater number of annual harvest operations required for hay, and the need to avoid assigning dairy-related expenses to the crop enterprise. It provides a defensible starting point for estimating hay cost of production while clearly identifying where direct records would improve accuracy.

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