

#24-14a November 2025

Cost of Forage Production

1. Introduction

This analysis examines the cost structure and external drivers of forage production across Canadian benchmark farms. The forages examined include:

- Hay
- Corn silage
- Corn for grazing
- Cereal silage
- Greenfeed

Key questions addressed:

- What are the estimated costs of producing major forages?
- How do homegrown costs compare to market hay prices?
- What role do regional and land productivity differences (yields) play in cost variation?
- How do farm size and economies of scale influence unit costs?

2. Data

We used Cost of Production (COP) Network benchmark farms that produced the above forages. A total of 59 farms were included in the analysis. Data from 2020-2024 were used.

- **Direct input costs** (e.g., seed, fertilizer, herbicide, contract labour) were reported on a **per-hectare basis** and could be applied directly in cost-of-production calculations.
- **Cash overhead, depreciation, labour, and land costs** were reported on a **per-cow basis**. These costs covered both the grazing and winter-feeding periods of the cow-calf cycle and therefore required allocation to forage production.

Cost Allocation Methodology:

1. **Non-feeding Days Allocation:** Overhead, depreciation, labour, capital and land costs were first distributed to forage and feed production according to the share of **non-feeding days** in the one-year production cycle. This step isolated the portion of costs attributable to the forage production period which is used as a proxy of the cost of total forage production.

2. **Forage-Specific Allocation:** Within winter feed, costs were then allocated to specific forage types based on their **acreage share of total forage production area**.

Alternative Approaches Considered but Not Used:

- **% of Total Tonnage Produced:** This was not used because many resources (e.g., fuel, machinery wear) are tied to land use rather than yield or tonnage. For example, cultivating 100 acres consumes similar fuel regardless of whether yields are high or low.
- **% of Total Market Value:** This was also not used because the market value of certain forages, such as corn silage or standing corn for grazing, are limited. Like the tonnage method, it does not accurately reflect the resource use tied to land and equipment.

By using acreage as the allocation basis, the analysis better aligns with how fixed and overhead resources are consumed in forage production.

Table 1. Cost Components of forage production cost calculations

Category	Formula / Components
Total Cost	Direct Cash Costs + Cash Overhead + Depreciation + Opportunity Costs
Direct Cash Costs	seed + fertilizer + herbicide + contract labour + energy + other costs
Cash Overhead	land improvement + machinery & building maintenance + insurance + taxes + office expenses + others
Other Cash Cost	paid labour + land rent + liability interest
Depreciation	machinery depreciation + building depreciation
Opportunity Costs	rental value of owned land + unpaid labour + interest on owned capital

3. Results by Forage Type

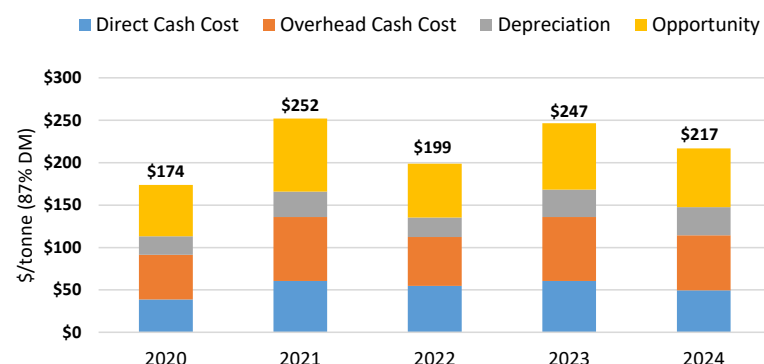
3.1 Hay and Haylage

Data from 50 farms were analyzed to estimate hay production costs, after outliers (lowest 5%, highest 10%) were removed from the original sample. Nine farms (MB-3a, AB-3, AB-2, SK-10, AB-5, SK-5, LL-2, ON-1, BC-7) were excluded from the final calculation. The final data set included herds ranging from 37 to 950 cows with an average of 199 cows.

Costs were standardized to 87% dry matter (DM). The average cost was \$217 per tonne at 87% DM, equivalent to \$249 per dry tonne. Regionally, costs averaged \$224 per tonne in the West and \$200 per tonne in the East, though the difference was not statistically significant.

The cost structure consisted of 53% cash, 15% depreciation, and 32% opportunity costs. Within

Estimated Hay Production Cost 2020-24



Source: Canadian Cow-calf Cost of Production Network

cash costs, 23% were direct inputs such as seed, fertilizer, energy, and contract work, while 30% were overhead costs including land rent, paid labour, and machinery maintenance.

More than half (26 of 50) of the benchmark farms produced hay below AFSC's 2024 average market price of \$220 per tonne; however, 48% had higher costs, suggesting that purchasing hay might be more economical for some operations when hauling and quality differences are excluded.

Over the 2020 to 2024 period, hay production costs in the western provinces were notably influenced by droughts in 2021 and 2023, while eastern costs rose steadily over the five-year period.

3.2 Corn Silage

The corn silage dataset included six farms, with outliers (MB-1, MT-3, MT-1) excluded. Farms using corn silage tended to be larger, averaging 307 head, though one farm had 50 cows, another 120, and the remaining four ranged from 225 to 950 cows.

Costs were standardized to 35% DM. The average cost was \$63 per tonne at 35% DM, equivalent to \$180 per dry tonne, with regional averages of \$60 in the West and \$66 in the East.

The cost structure comprised 70% cash, 10% depreciation, and 20% opportunity costs. Cash costs included 48% direct inputs and 22% overhead. Although corn silage had lower total costs than hay, the direct cash cost per dry tonne (\$86) was higher than hay's \$57, potentially impacting liquidity.

Over the 2020 to 2024 period, production cost in the Western provinces surged during the 2021 drought, and fertilizer prices drove cash cost peaks in 2022. Eastern costs showed a gradual upward trend.

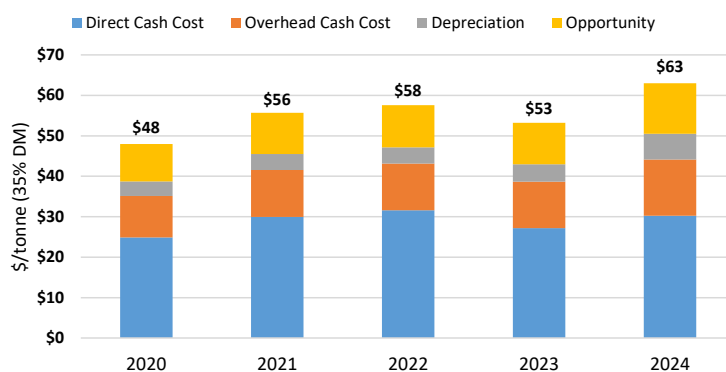
3.3 Corn Grazing

Five farms were included in the corn grazing analysis, after removing one high-cost outlier (SK-4). Average herd size was 230 cows, ranging from 46 to 350 cows.

Costs were standardized to 35% DM. The average cost was \$54 per tonne (35% DM), equivalent to \$153 per dry tonne, with Western and Eastern averages of \$54 and \$50 per tonne respectively, though the eastern sample was limited.

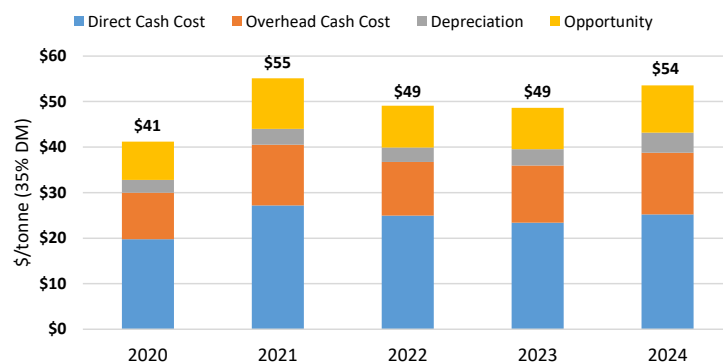
The cost structure included 72% cash, 8% depreciation, and 19% opportunity costs. Within cash costs, 47% were direct inputs and 25% were overhead. Direct cash costs (\$72 per dry tonne) were

Estimated Corn Silage Production Cost 2020-24



Source: Canadian Cow-calf Cost of Production Network

Estimated Corn for Grazing Production Cost 2020-24



Source: Canadian Cow-calf Cost of Production Network

lower than those for corn silage, reflecting reduced input requirements. The five-year trends mirrored those of corn silage, with drought and fertilizer prices being key drivers.

3.4 Cereal Silage

Data from 16 farms were used to estimate cereal silage costs. All samples were in the western provinces. Herd sizes averaged at 268 cows with a range from 135 to 950 cows.

Costs were standardized to 40% DM. The average cost was \$82 per tonne, equivalent to \$205 per dry tonne.

The cost structure consisted of 66% cash, 11% depreciation, and 24% opportunity costs, with 41% of cash costs attributed to direct inputs and 25% to overhead.

When compared to AFSC's 2024 average market price of \$77.37 per tonne, half (8 of 16) of the farms produced below market levels.

Over the 2020-2024 period, production costs in the western provinces spiked during drought years, particularly in 2021 and 2023.

3.5 Greenfeed

Ten farms were included in the greenfeed analysis after excluding one outlier (AB-5). All samples were in the western provinces. The average herd size was 188 cows, ranging from 54 to 290 cows.

Costs were standardized to 85% DM. The average cost was \$239 per tonne (85% DM), equivalent to \$281 per dry tonne.

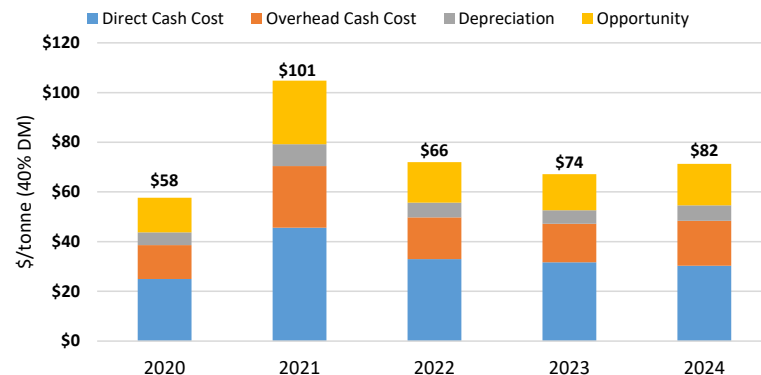
The cost structure comprised 60% cash, 12% depreciation, and 28% opportunity costs, with cash costs divided between 41% direct inputs and 20% overhead.

Compared with AFSC's 2024 market average of \$187 per tonne (dropping to \$160 in the second half of the year), benchmark costs were generally higher; only three of the ten benchmark farms produced below the market price.

Like cereal silage, production costs of greenfeed in the western provinces spiked during drought years, particularly in 2021 and 2023.

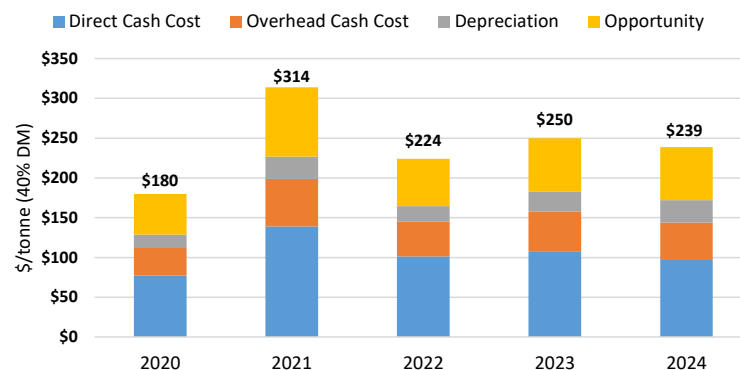
A summary of direct cash costs and total costs (expressed in both wet and dry tonnes) is presented in the table below. It's important to interpret differences in average production costs across forage types with caution. *The farms included in each forage group are not the same, meaning differences in costs*

Estimated Cereal Silage Production Cost 2020-24



Source: Canadian Cow-calf Cost of Production Network

Estimated Greenfeed Production Cost 2020-24



Source: Canadian Cow-calf Cost of Production Network

may reflect variations in farm type, herd size, management practices, or growing conditions rather than the forage type itself.

Table 2. Estimated cost of production 2024

	Sample size	Adjusted dry matter%	Direct Cash Cost (\$/dry tonne)	Direct Cash Cost (\$/wet tonne)	Total Cost (\$/dry tonne)	Total Cost (\$/ wet tonne)	AFSC 2024 price	Cost** structure
Hay	50	87%	\$57	\$49	\$249	\$217	\$220*	53-15-32
Corn Silage	6	35%	\$86	\$30	\$180	\$63	N/A	70-10-20
Corn Grazing	5	35%	\$72	\$25	\$153	\$54	N/A	72-8-19
Cereal Silage	16	40%	\$84	\$34	\$205	\$82	\$77	66-11-24
Greenfeed	10	85%	\$114	\$97	\$281	\$239	\$187	60-12-28

* AFSC 1st cut grass hay. Other data sources: \$271/tonne based on AB Agriculture farm input price report; \$229/tonne based on AFSC 1st cut grass hay, alfalfa hay average.

**cash cost % - depreciation % - opportunity cost %

4. Drivers of Forage Production Cost

To understand what drives differences in forage production costs across benchmark farms, two complementary analyses were used:

- **Principal Component Analysis (PCA)** – to identify key cost patterns and relationships among cost subcomponents. Regression analysis was then applied to examine how these cost structure components (PCs) relate to total direct cash cost.
- **Regression analysis using external farm characteristics** – to see how farm characteristic factors (e.g., yield, herd size, acreage) affect costs.

Both approaches were applied to two cost measures:

- **Direct Cash Cost** – direct cash expenses of forage production such as seed, fertilizer, and fuel.
- **Total Cost** – total production cost including cash costs, depreciation, and opportunity costs for owned land, labour, and capital.

4.1 Drivers of Direct Cash Cost

4.1.1 Subcomponent Drivers

A Principal Component Analysis (PCA) was conducted on a 2024 dataset of 106 observations. The analysis included six cost subcomponents of direct cash cost: seed, fertilizer, herbicide, energy, labor, and other direct cash costs. The key components' relationship with direct cash cost was also examined.

The PCA identified two main components explaining variation in direct cash costs. The first component (PC1), which accounted for 40% of the variance, was dominated by seed, fertilizer, herbicide, and contract labour expenses. This component showed a significant ($p < 0.01$) positive relationship with direct cash cost, indicating that operations spending more on purchased inputs and contract labour tend to have higher overall direct costs.

The second component (PC2), associated with energy and other costs, explained 19% of the variance but was not statistically significant predictor to direct cash cost.

Overall, the analysis shows that the main differences in direct cash costs stem from the intensity of input use. Farms that rely more heavily on fertilizer, seed, and herbicide inputs generally face higher direct costs per tonne.

Table 3. PCA result of direct cash cost subcomponents

Component	Dominant Cost Drivers	Variance Explained	Significance	Interpretation
PC1	seed, fertilizer, herbicide, contract labour	40%	***	Strong and significant driver. Operations that spend more on purchased inputs and contract labour have higher total direct costs.
PC2	Energy, other cost	19%	n.s.	Not a significant driver.

*** p < 0.01 ** p < 0.05 * p < 0.10 n.s. = not significant

4.1.2 External Drivers

In addition to internal cost structures, we also tested whether external factors could explain direct cost variation. A regression analysis examined the influence of the following factors:

- Dry Matter Yield
- Cow-calf revenue share
- Cow herd size
- Cow-calf forage acreage

The results showed that none of these factors had a statistically significant relationship with direct costs per tonne. This counterintuitive finding, particularly for yield, suggests that higher yield doesn't always mean higher cost efficiency. For example, farms that achieve higher yields may also spend more on fertilizer and seed. The increase in yield may simply offset these higher costs rather than reduce cost per tonne.

4.2 Drivers of Total Costs

4.2.1 Subcomponent Drivers

A Principal Component Analysis (PCA) was conducted on a 2024 dataset of 106 observations. Fifteen cost subcomponents were analyzed, including seed, fertilizer, herbicide, contract labour, energy, other direct cash cost, paid labour, unpaid labour, cash overhead, interest payment, land rent, machinery depreciation, buildings depreciation, opportunity cost on capital and opportunity costs on owned land. The key components' relationship with total cost was also examined.

The PCA identified four key components that collectively explain 65% of the variation in long-term costs. The most influential factor, PC1 (explaining 26% of variance), was dominated by cash overhead, building and machinery depreciation, and unpaid labour, indicating that efficiency in managing these components is paramount for cost control.

The second component, PC2 (17%), was characterized by direct cash inputs like fertilizer, seed, and herbicide, underscoring that input-intensive systems have significantly higher total costs.

The third and fourth components (PC3 and PC4, each explaining 11% of variance) highlight the impact of capital structure; PC3 is defined by land-related costs (both rented and owned) and capital opportunity

costs drives total cost, and PC4 characterized by interest payment on liabilities and paid labour. Both components are positively associated with total costs.

The result indicates that while various factors contribute to forage cost of production, the most critical lever for controlling total costs is the management of overhead, while input intensity and financial leverage from land and debt also play a role.

Table 4. PCA result of direct cash cost subcomponents

Component	Dominant Cost Drivers	Variance Explained	Significance	Interpretation
PC1	Cash overhead, building & machinery depreciation, unpaid labour	26%	***	Overhead, depreciation, and unpaid labour efficiency is crucial for controlling cost.
PC2	Fertilizer, Seed, Herbicide	17%	***	Input-intensive systems have higher total costs. Better agronomic efficiency reduces cost.
PC3	Land Rent, Owned Land, Own Capital	11%	***	Land-related and capital opportunity costs drive cost up.
PC4	Liabilities, Paid Labour, Land Rent	11%	**	Farms with higher debt and hired labour costs have higher cost.

*** p < 0.01 ** p < 0.05 * p < 0.10 n.s. = not significant

4.2.2 External Drivers – Yield and scale matters

Similar to the previous section, we also tested whether external farm characteristics could explain total cost variation.

The results identified two significant drivers of efficiency. First, higher **dry matter yield** was associated with lower costs per tonne, demonstrating that productivity improves efficiency by spreading costs over greater output. Second, **larger forage acreage** was also linked to lower total costs. This confirms the economies of scale in overhead and equipment use. A higher **share of revenue from livestock** was linked to increased forage costs. This is likely due to greater resource allocation toward cattle. But this factor was still less important than yield or scale. In contrast, cow herd size was not a significant predictor.

Overall, this indicates that a farm's production capacity and operational scale are the most consistent external drivers of cost efficiency.

5. Key Takeaways

- Cost variation:** Average forage production costs differ widely across crops and regions.
- Interpret with caution:** Each forage type includes a different set of farms, so cost differences may reflect farm characteristics and management rather than the crop alone.
- Relative cost:**
 - Among the benchmark farms studied, hay and greenfeed had relatively higher cost per tonne.
 - Corn silage and corn grazing are typically more cost-efficient on a dry matter basis but have higher cash requirement due to input and establishment costs.
- Regional volatility:** Western farms face higher drought-related variability in the 2020-2024 period, while eastern farms show steady cost increases.

5. **Input Efficiency vs. Yield:** Higher yield doesn't always mean higher cost efficiency, as the added expense of inputs often cancels the benefit. The goal should be input efficiency, not just maximum output.
6. **Overheads matter most:** overhead cost including cash and non-cash overhead such as depreciation and opportunity cost are the crucial contributors to total cost differences. Controlling these overhead costs is essential for protecting profitability.
7. **Productivity and scale are critical:** Higher yields and larger forage acreage reduce total costs, highlighting the importance of agronomic management and economies of scale. Improving soil health and crop management to support productivity along with strategic growth to achieve economies of scale, can help improve cost efficiency.



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