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The Economics of High-Quality Forage

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Introduction

Feed, whether home-grown or purchased, is often the single largest variable cost on a dairy farm. While this expense is necessary, the difference between a good forage harvest and a poor one can mean an increase in purchased grain, decreased milk production, and cows that never quite perform up to their potential. Despite these financial and management implications, forage quality remains an underutilized tool for improving farm profitability. This article examines what differentiates high-quality forage from low-quality forage, and its impact on milk production, herd health, and feed costs.

Defining Forage Quality

Forage in the Northeast typically consists of grass and corn silage, providing the energy, fiber, and protein that make up the base of the ration, with grain filling in the remainder.

The simplest way to assess quality is a forage analysis, using either wet chemistry or near-infrared spectroscopy (NIR) to evaluate the nutritional components. Breaking those results into fiber, energy, and protein makes them easier to interpret.

Fiber is the most limiting nutritional factor and is measured as Neutral Detergent Fiber (NDF) and Acid Detergent Fiber (ADF). NDF reflects the total fiber content; a lower NDF means the cow can consume more of the forage before feeling full. ADF captures the least digestible fiber fractions, cellulose and lignin, so a lower ADF means higher energy density.

NDF digestibility (NDFd), measured over a set time such as 30 or 48 hours, is often a more useful indicator than NDF alone, since it predicts how much of that fiber the cow can actually use and, in turn, how much she is likely to eat.

Starch is the primary energy source in corn silage and, like NDF, can be evaluated for digestibility to show how effectively it is utilized in the rumen. In grass forages, non-fiber carbohydrate (NFC) reflects starch and sugar content and is highly digestible. Protein, supplied mainly by grasses and legumes such as alfalfa, is measured as crude protein (CP). The usability of protein depends on how it breaks down in the rumen. Rumen degradable protein (RDP) feeds rumen microbes, while rumen undegradable protein (RUP) bypasses the rumen and is digested in the small intestine. Both fractions are necessary to properly balance a lactating cow's diet.

Ash and silage fermentation acids round out the picture. Ash reflects non-nutritional material, mainly soil contamination, that dilutes energy density and raises the risk of clostridial contamination and butyric fermentation, which can suppress intake and, in some cases, cause serious illness. Silage acids and pH indicate fermentation quality: a low pH dominated by lactic acid signals a good fermentation, while a high pH and elevated butyric acid signal a less than optimal fermentation.

Species, maturity at harvest, and storage all shape these values. Grass and alfalfa lose NDF digestibility if harvested even a few days late, as lignin accumulates with plant maturity, and corn silage loses starch digestibility past its ideal harvest window. Storage is equally important as harvest timing. Slow bunk filling, poor packing density, and a poorly sealed cover can all contribute to yeast and mold growth that cause spoilage and heating at feedout.

The Economic Case for High-Quality Forage

Improving forage quality is more than just better numbers on the forage analysis; it translates to more milk in the tank, healthier cows, and less purchased grain.

Milk production is the most direct effect. Forage is the foundation of a balanced diet: it drives intake, feeds rumen microbes, and supplies the energy a cow converts into milk.

Underlying that production response is dry matter intake, the link between forage quality and the increase in milk. Highly digestible fiber moves through the rumen more quickly, reducing rumen fill and enabling the cow to consume more feed overall. Two forages with similar NDF content can support very different levels of intake and milk production depending on how digestible that fiber actually is, since rumen fill is what signals a cow to stop eating. This combination of more digestible fiber and increased intake enables a cow to access more of the energy and protein necessary to maintain higher levels of production.

Forage quality also impacts the rumen environment. Highly digestible forage supplies more of a cow's energy needs, reducing reliance on the rapidly fermenting starches and sugars in grain. Diets that lean too heavily on rapidly fermentable carbohydrates can lead to a lower rumen pH and predispose cows to subacute ruminal acidosis (SARA), which can reduce intake, depress butterfat, and cause other health issues.

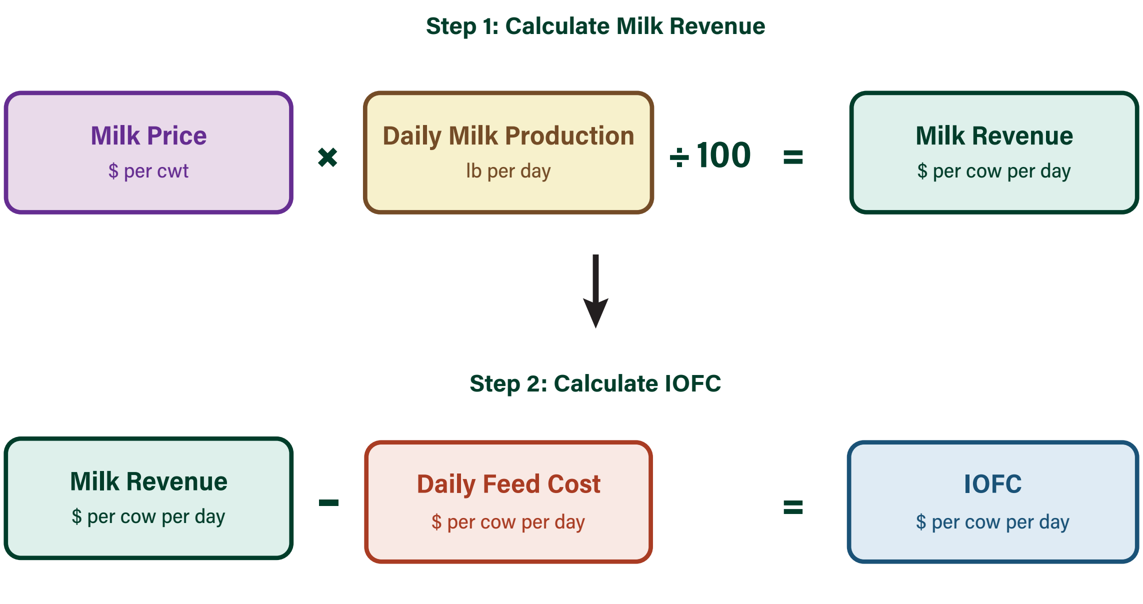
These effects also extend to metabolic health, particularly during the transition period, when cows are most susceptible to negative energy balance. Highly digestible forage supports increased feed intake during the transition period when energy demand is high and appetite is suppressed, reducing how much body fat a cow must mobilize to meet her energy requirements. Excessive fat mobilization is closely linked to ketosis and fatty liver, both of which delay a return to positive energy balance, normal cycling, and conception.

The same mechanisms that support production and rumen health also reduce a farm's reliance on purchased feed. When forage supplies more usable energy and protein on its own, less grain is needed to provide a balanced ration. This is key since grain and other purchased feeds are the most expensive components of the ration on a per-pound basis. Unlike home grown forage, their cost is directly impacted by commodity markets, leading to pricing variability based on global markets and availability.

Higher production and lower purchased feed costs together drive milk income over feed cost (IOFC). IOFC is calculated as milk revenue minus feed cost per cow per day. Because forage quality increases milk revenue while reducing feed costs, it is one of the more effective levers for improving herd profitability. A relationship that the sample comparison in the next section examines in more detail.

IOFC: Step-by-Step Calculation

How milk revenue and feed cost combine into income over feed cost



cwt = hundredweight (100 lb)

Putting a Dollar Value on Quality

The relationship between forage quality and profitability moves from theory to applicability when applied to a real-world example. Consider three otherwise identical rations differing only in forage quality:

	High-Quality Forage	Medium-Quality Forage	Low-Quality Forage
Milk Yield (lb/cow/day)	95	85	75
Milk Price ($/cwt)	20.00	20.00	20.00
Milk Revenue ($/cow/day)	19.00	17.00	15.00
Feed Cost ($/cow/day)	8.24	8.46	8.68
IOFC ($/cow/day)	10.76	8.54	6.32

Milk yield and milk price values for illustration: a 10-pound production spread between forage-quality tiers and a milk price of $20/cwt. Feed costs are reported directly from ration analyses on dairies in the Northeast.

The high-quality ration yields the greatest IOFC, at $10.76 per cow per day, compared to $8.54 for moderate-quality and $6.32 for low-quality forage. Even the gap between high- and moderate-quality forage, $2.22 per cow per day, compounds across a herd over a year to a substantial sum. That figure excludes the added health and reproductive costs discussed above. In an industry operating on increasingly narrow margins, differences in forage quality that look modest on a lab report can translate into real gains or losses in profitability.

Finding the Right Balance

Not every animal on the farm requires the same quality of forage, and understanding where quality matters most allows a farm to allocate forage inventory strategically.

Transition cows, both close-up dry and fresh, should be the top priority. This is the period of greatest risk for both health and maximizing production potential for the remainder of the lactation. Since dry matter intake is the most limiting factor during this period, these cows benefit most from forage with the highest NDF digestibility and energy density, since every additional pound of feed consumed translates directly into milk and allows the cow to return to a positive energy balance more quickly. High-producing cows follow closely behind transition cows, since maximizing intake is key to allow this group to continue high levels of production.

As cows move later into lactation, their protein and energy requirements decrease. Later-lactation and far-off dry cows can perform well on moderate or lower-quality forage.

Growing heifers, often given the lowest-quality forage on the farm, are better served by a moderate-quality forage that supports steady growth without the excess energy that can lead to overconditioning.

Conclusion: Key Takeaways

Forage quality is not an abstract concept only applied to ration formulation. It is one of the most consequential financial variables on a dairy farm. The values that define forage quality, NDF, ADF, NDF digestibility, starch, NFC, CP, ash, and silage acids, determine how much of a forage's nutrient content is available to the cow. This has a direct impact on production, dry matter intake, rumen health, metabolic health, and reproductive efficiency.

As the sample comparison illustrated, the difference between high-, moderate-, and low-quality forage can amount to several dollars of IOFC per cow per day, a gap that compounds daily and with herd size, and likely understates the true cost once health and reproductive impacts are included.

Capturing that value takes more than a good crop. It requires testing forage frequently, understanding how harvest timing and storage can impact nutrient values, and prioritizing allocation of high-quality forage to the animals that will benefit most. A ton of low-quality forage is never truly low cost, the cost is simply deferred, showing up later in unrealized milk production, increased grain, and reduced herd health. Treating forage quality as a manageable, measurable input is one of the most effective ways a dairy farm can improve the bottom line.

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