

# More Milk at Lower Feed Cost: Balanced Feeding Using Local Feed Resources

Suman Usman Butt\* and Ameer Hamza

University of Veterinary and Animal Sciences, Lahore, Pakistan

\*Corresponding Author: [sumanusman1212@gmail.com](mailto:sumanusman1212@gmail.com)

## ABSTRACT

Feed cost is a major factor in dairy production, however, reducing feed costs is beneficial only when it does not negatively affect milk yield and quality. Local feed products (crop residues, agro-industrial by-products, and food-processing co-products) can partially substitute for conventional feed, depending on the nutritional value, inclusion rate, and performance effect. Wheat and rice straw, potato co-products, citrus pulp, brewer grains, distiller grains, and former food products have proven to be beneficial in dairy cows, but inappropriate substitutions can decline milk production. The idea, therefore, is not to purchase the least expensive feed, but to formulate a feed that results in more milk production at a lower cost.

**Keywords:** Dairy cattle; feed cost; local feed resources; milk yield; feed efficiency

**To cite this article:** Butt SU & A Hamza. More Milk at Lower Feed Cost: Balanced Feeding Using Local Feed Resources. Biological Times. 2026. September 5(9): 5-6.

## Introduction

In smallholders and resource-limited dairy farms, the nutritional quality and quantity of feed available to lactating cows are key determinant in dairy production. Natural grasses, crop residues and other locally available forages makeup the largest proportion of the feed resources in these systems, but many of these feeds are low in crude protein and high in fiber and can limit milk production when supplementation is inadequate [1]. Improved feeding practices can increase milk production considerably on these farms, although this adoption is often constrained by limited access to quality feeds and insufficient knowledge of nutritional requirements and feed management [1].

However, locally available feeds differ widely in their nutritional value and should not be assumed to be interchangeable. For example, feeds sampled in northern Rwanda ranged from 4.4% crude protein (CP) in banana pseudo-stem to 34.8% in elderberry, with estimated metabolizable energy (ME) of 4.2-10.7 MJ/kg DM [2]. The large differences indicate that the nutrient value of each ingredient should be evaluated before it is used in dairy rations, particularly when low-quality roughages are combined with protein- or energy-rich supplements.

Balanced feeding means more than simply increasing concentrate supply or substituting a more expensive ingredient for a cheaper one. Recent research indicates that agro-industrial by-products can be used effectively at appropriate inclusion rates. A meta-analysis of 12 studies showed that including brewer grains decreased DM intake by 0.5 kg/day (from 20.2 to 19.7 kg/day) and improved the feed efficiency by 0.1 kg FCM/kg intake (from 1.40 to 1.45 kg), with milk yield responding positively when brewer grains were included at up to 20% of the diet [3].

In contrast, inappropriate substitution can potentially result in lower productive performance. Completely replacing soybean meal with reduced-fat wheat distiller grains (13% of dietary DM) in high producing dairy cows reduced milk yield by 2.06 kg/day, along with milk-protein concentration from 3.18 to 3.02%, and milk yield from 1.31-1.19 kg/day [4]. The results demonstrate that the value of an alternative feed dependent not only on its price but also on ability to supply the nutrients required for milk production. The economics of the replacing feed ingredients also play a major role. When wheat straw was substituted into a densified complete feed block at a 40:60 straw-to-concentrate ratio, the cows produce more milk (8.5 vs 7.9 L/cow/day) at a lower feed cost (169.54 vs 202 birr/cow/day), giving a higher net profit (113.36 vs. 101.30 birr/cow/day) than the conventional hay-based diet [5]. Similarly, supplementing brewery waste to Jersey crossbred cows increased milk yield by 0.73 kg/animal/day and raised total returns relative to conventionally fed controls [6]. These findings show that the cheapest ingredient is not the only factor, feed cost must be evaluated together with milk response and return.

Balanced feeding using local resources therefore needs to be considered in terms of nutrient composition, processing, inclusion level, nutrient replacement, milk response, feed efficiency, and economic return. This study summarizes recent evidence on local feed resources and their strategic use to enhance milk production at competitive feeding cost.

## Use By-Products at the Right Level

Food-processing by-products may serve as a source of useful energy or protein, but the benefit depends on inclusion level. A recent study reported

that energy-corrected milk (ECM) increased from 40.6 to 42.9 and 43.9 kg/day, and feed efficiency from 1.61 to 1.75 and 1.77, respectively, when 100 g/kg of dietary DM barley was replaced with heated potato-slice waste or French-fries waste [7]. In that study, frying increased the fatty-acid content of French-fries waste from about 5 to 198 g/kg DM, suggesting that processed feeds should be evaluated by their actual fatty-acid content rather than their source. This dose-dependency was confirmed in a meta-analysis of citrus-pulp feeding trials, where milk yield and ECM increased from 29.0 to 30.9 and from 26.2 to 28.2 kg/day, respectively, at low inclusion (>0–10% of dietary DM), while milk yield decreased to 28.0 kg/day at inclusion above 20% [8]. These studies demonstrate that food-industry by-products can replace part of the dietary grain and can even increase feed efficiency and milk yield, provided that the inclusion level is matched to the characteristics of each by-product and to the response obtained.

## Replacement Must Match Nutritional Function

Choosing a byproduct to replace a traditional feed ingredient should not be based only on cost or on the nutrients calculated in the formulation, since an animal response often differs from what a nutritionally complete formulation suggests. According to the previous study, DMI, milk production, milk protein concentration, and income over feed cost all decreased when citrus pulp replaced 60% of the corn meal in isocaloric, isonitrogenous diets for lactating dairy cows [9]. However, because dietary energy and protein were the same across treatments, these reductions were not due to the level of energy and protein but due to differences in the digestibility and type of nutrients supplied. In contrast, other by-products have maintained production. When part of the conventional feeds fed to Holstein cows was replaced with 4 kg/d of wheat distiller grains and 3 kg/d of a former foodstuff product, dry matter intake (22.30 vs. 22.92 kg/d) and milk yield (32.45 vs. 32.70 kg/d) were not affected, but milk fat concentration decreased [10]. In the same way, feeding a combination of wheat straw and dried distiller grains instead of alfalfa hay maintained average DMI and milk yield (19.5 and 29.6 kg/d, respectively), and only the highest inclusion level tended to reduce energy-corrected milk and milk-fat yield [11]. These differing results demonstrate that the value of a byproduct as a feed depends on the digestibility and functional value of the nutrients it provides, and that this value can only be determined from measured performance, not assumed from formulation values.

## Feed for Profit: Make Every Rupee Spent on Feed Count

Once a feed ingredient has been shown to maintain ration balance and animal performance, the next question is whether it is economical. The most practical comparison for farmers is the feed cost per liter of milk. The simplest indicator at farm level is:

**Feed cost per liter of milk = daily feed cost per animal / daily saleable milk yield per animal**

All major ration components, such as green fodder or silage, wheat straw, concentrate, oilseed cakes, bran, by-products, and mineral supplements, should be included in the daily feed cost. This value should be recorded before and after a ration change to see whether a cheaper ration is actually lowering the cost of producing milk.

Farmers should also check whether the extra milk income covers the extra feed cost:

**Income over feed cost = daily milk income – daily feed cost**

For example, increasing concentrate can be worthwhile when it raises milk yield, but only if the value of the extra milk outweighs the higher feed cost. It is particularly useful when concentrate prices are high or feed is scarce. Purchased concentrate can also be used more strategically within the herd. Additional concentrate increases milk production, but the size of this response differs with stage of lactation and level of production. A recent study reported a response of 1.3 kg energy-corrected milk (ECM) per kg of supplementary concentrate DM in early lactation (first 12 weeks), compared with 0.9 kg ECM/kg in late lactation (weeks 12–24) [12]. These results suggest that when concentrate is limited or costly, it gives a higher return if fed to the most responsive cows rather than to all lactating animals equally. Nevertheless, concentrate should remain an integral part of a balanced feeding. The following factors such as milk yield and response, forage quality, stage of lactation, body condition, feed availability, and animal health should also be considered when deciding to changes in supplementation. Overfeeding, or offering too much at one time, should be avoided.

#### Monitor the Response After Every Feed Change

Any change in ration should be evaluated from the animal response under farm conditions, not from feed or formulation cost alone. Farmers should monitor feed intake, milk yield, body condition score (BCS), feed refusals, fecal consistency, and overall animal health after supplementing a new by-product or changing the inclusion level of any feed ingredient. Where records are available, changes in milk fat and protein can provide additional information whether the ration is nutritionally balanced.

The response should be assessed over several days of milking rather than after a single milking or one day of feed intake. Feed offered, feed refused, milk yield, and daily feeding cost can be recorded easily and used to determine whether the ration change has improved milk production and economic performance. A lower feed cost is not beneficial if cows reduce feed intake, milk yield, or feed efficiency, or if body condition score declines.

If performance declines, the ration should be rebalanced. In particular, the quality of ingredients, nutrient balance, level of inclusion, forage quality, and the nutritional value of the ingredient being replaced should be reviewed. Rapid changes in the ration should also be avoided, especially when increasing concentrates or rapidly fermentable feeds. Slow, careful supplementation of new feeds can help minimize digestive disturbances and

help farmers identifying the feeding strategy that works best under their specific farm conditions.

#### Conclusion

Feeding cost can be reduced with local feeds when they are used at the right levels in a balanced ration. The value of an ingredient must be judged by the milk response, the performance of the animal, and the economic return, not just by the price of the ingredient. The ultimate objective is to produce more milk and profitably while maintaining animal health and ration quality.

#### References

- [1] Mukasafari MA, Mpatswenumugabo JP, Mutimura M, Ndahetuye JB, Wredle E, Bâge R, et al. Feed resources, feeding practices, and milk production at smallholder dairy farms in East African countries: a systematic review. *Sci Afr.* 2026;31:e03283. doi:10.1016/j.sciaf.2026.e03283.
- [2] Mukasafari MA, Mutimura M, Wredle E, Gonda HL. Nutritional quality of feed resources used by smallholder dairy farmers in the Northern Province of Rwanda. *Trop Anim Health Prod.* 2025;57(7):301. doi:10.1007/s11250-025-04562-w.
- [3] Chelkapally SC, Terrill TH, Ogunade IM, Estrada-Reyes ZM, Pech-Cervantes AA. Meta-analysis of the effects of the dietary inclusion of brewers grains on feed intake, milk yield, and feed efficiency of lactating dairy cows. *JDS Commun.* 2025;6(3):299-303. doi:10.3168/jdsc.2024-0626.
- [4] Comino L, Pasinato S, Revello-Chion A, Chiavazza E, Ferrero F, Tabacco E, et al. Substitution of human edible feeds with integrated use of reduced fat wheat distillers and high-quality forages in a diet for high production lactating dairy cows. *Anim Feed Sci Technol.* 2024;312:115973. doi:10.1016/j.anifeedsci.2024.115973.
- [5] Biratu K, Urge M, Kitaw G, Feyissa F, Adesogan AT. Productive performance of lactating crossbred dairy cows fed with wheat straw-based densified complete feed block. *Adv Agric.* 2024;2024(1):9943513. doi:10.1155/2024/9943513.
- [6] Kumar BR. Cost economics of brewery waste in Jersey crossbred dairy cattle under farmers' field conditions. *Indian J Vet Anim Sci.* 2025;53(1):27-34. doi:10.56093/ijvasr.v53i1.151942.
- [7] Sadq SM, Fatehi F. Fried and cooked potato co-products improve diet physical properties and milk production in Holstein lactating dairy cows. *Anim Feed Sci Technol.* 2024;315:116050. doi:10.1016/j.anifeedsci.2024.116050.
- [8] Hartinger T, Mahmood M, Khiaosa-Ard R. The impact of citrus pulp inclusion on milk performance of dairy cows: a meta-analysis. *Food Chem (Oxf).* 2024;9:100216. doi:10.1016/j.fochms.2024.100216.
- [9] Corea Guillen EE, Flores Leiva GA, Mendoza MV, Ramirez-Perez AH, Lizarazo AC, Cruz NA, et al. Citrus pulp as an alternative energy source for high-yielding dairy cows in tropical systems: effects on intake, digestibility, nitrogen balance, and dairy performance. *Animals (Basel).* 2026;16(5):806. doi:10.3390/ani16050806.
- [10] Mammi LME, Ghiaccio F, Benini E, Vecchiato CG, Fusaro I, Buonaiuto G, et al. Former food and agro-industrial by-products in dairy cow diets: effects on milk quality and cheese production. *Animals (Basel).* 2025;15(8):1113. doi:10.3390/ani15081113.
- [11] Kneell AL, Carroll AL, Judy JV, Wilson HC, Morris DL, Herrick KJ, et al. Energy utilization in lactating Jersey cows consuming a mixture of dried distillers grains and solubles and straw replacing alfalfa hay. *J Dairy Sci.* 2024;107(12):10824-37. doi:10.3168/jds.2024-25024.
- [12] Kajava S, Sairanen A, Rinne M. Evaluation of concentrate feeding strategies in an intensive grass silage-based dairy production system. *Anim Feed Sci Technol.* 2026;331:116595. doi:10.1016/j.anifeedsci.2025.116595.