

IMPROVING PROTEIN NUTRITION OF DAIRY CATTLE IN THE TROPICS

The case of East Africa

In East Africa, dairy production is growing at an average rate of 2.7% per year. The increasing demand for milk may offer considerable income opportunities for small- to medium-scale dairy farmers, and thereby alleviate vulnerability and poverty, especially among rural populations. However, producers face significant challenges, mainly related to the limited availability and low nutritional quality of feed resources for their livestock and thus the high dependency on the purchase of partly expensive feedstuffs to improve animal health and performance.

This policy brief therefore highlights important challenges and possible options for an improved cattle nutrition in order to sustainably intensify dairy farming in the Tropics.

Challenges in dairy cattle nutrition in the Tropics

Dairy cattle feeding in East Africa is mainly based on grazing native pastures and the feeding of a few cultivated forages, crop residues and agro-industrial by-products. Seasonal fluctuations in feed availability and nutritional quality negatively affect animal health as well as productive and reproductive performances. Low concentrations and poor degradability of protein in locally available feed resources are the main factors that limit diet digestibility, feed intake and performance of tropical cattle. Although high-quality concentrates are available for use as feed supplements, purchasing them requires additional capital and increases feeding costs. These may account for 60-80% and sometimes even 100% of variable costs for milk production on small- to medium-scale dairy farms in the Tropics. Moreover, supply of protein beyond the animals' requirements results in great losses of nitrogen in feces and urine, which contribute to environmental emissions either as ammonia or nitrous oxide into air, or as nitrate in soil and ground water. Consequently, small- to medium-scale dairy farming in tropical coun-

tries is associated with greater environmental emissions per kg of milk produced than intensive dairy systems in the Northern hemisphere.

Hence, there is an urgent need for a sustainable intensification of dairy farming in tropical countries to meet future milk demand, enhance food and income security of small- to medium-scale dairy farmers in East Africa, and to minimize the associated negative environmental impacts.

Priorities in dairy cattle protein nutrition in East Africa

The use of concentrate mixtures to increase protein intake of grazing dairy cows can greatly improve protein use efficiency, i.e. decrease nitrogen losses to the environment and increase the proportion of feed protein used for milk production. Such feeding strategies may thus contribute to improve feed conversion in tropical ruminants and minimize feeding costs, while lowering environmental emissions.

Tropical forage legumes could reduce the dependence of small- to medium-scale dairy farmers on commercial concentrates in the region. Forage legumes such as silverleaf desmodium (*Desmodium uncinatum*) and velvet beans (*Mucuna pruriens*) could replace almost 50% of the protein concentrates used in dairy cattle diets without affecting milk yield and composition, while reducing daily feeding costs per cow by up to 14%. Thus, forage legumes can be a cheaper, locally available source of protein and energy for improving dairy cattle and over-all productivity in the region.

It is also important to bear in mind that protein nutrition and metabolism in domestic ruminants in temperate areas differ from those in warm climates. For instance, the efficiency of rumen microbial protein synthesis (i.e. main source of protein for the cattle) for tropical ruminant diets is much lower than repor-



ted for temperate ruminant diets and cattle breeds. Also, current equations used to estimate the different protein fractions in temperate ruminant feeds are not valid for use in tropical forages. Such knowledge is required to adequately match feed protein supply to the requirements of dairy cows in the Tropics. Therefore, improved knowledge on protein metabolism for the region is needed.

Policy recommendations

Local forages should receive more research attention in order to compensate for the marked seasonal fluctuations in availability and nutritional quality of local feedstuffs. This will involve identifying improved forage legume and grass varieties best adapted for production, storage, and feeding to dairy cattle in the Tropics during feed shortages. Such locally adapted and productive forage resources would then be promoted in a participatory approach including the different stake holders.

There is a need to develop and validate energy and nutrient requirements for dairy cattle in tropical regions. Currently, protein requirements developed for cattle in temperate regions are also being applied to dairy cattle in the region even though their require-

ments differ. Establishing the protein requirements in tropical dairy cattle will allow for more accurate diet formulation and improve nutrient use efficiency. Consequently, efforts must be made to support research focused on animal nutrition in the Tropics and strengthen cooperation between research institutions, industry partners, and dairy farmers.

Small- to medium-scale dairy farmers in the Tropics should be accompanied using knowledge generated from research related to their specific contexts, and presented in a format that they can use.

Accompanying research should employ options like the rapidly spreading information and communication tools to increase access of dairy farmers to knowledge such as improved diet formulation and available feed resources.

Lastly, local governments must also “put their hands to the plough” to overcome the challenges associated with protein nutrition in the Tropics. From funding research, creating incentives for dairy farmers to adhere to certain standards (e.g. feeding and manure management), and enforcing environmental policies, local governments need to step up such efforts to contribute to solving the aforementioned challenges.

This Policy Brief is based on the studies:

Dickhoefer, U., Glowacki, S., Gómez, C. A., Castro-Montoya, J. M. (2018). Forage and protein use efficiency in dairy cows grazing a mixed grass-legume pasture and supplemented with different levels of protein and starch. *Livestock Science*, 216, 109-118.

Wassie, S. E., Ali, A. I. M., Korir, D., Butterbach-Bahl, K., Goopy, J., Merbold, L., Dickhoefer, U. (2019). Effects of feed intake level on efficiency of microbial protein synthesis and nitrogen balance in Boran steers consuming tropical poor-quality forage. *Archives of animal nutrition*, 73(2), 140-157.

Salazar-Cubillas, K., Dickhoefer, U. (2018). Validation of prediction equations to estimate rumen-undegradable crude protein in tropical feedstuffs using protein fractionation technique. In: *Proceedings of the 10th International Symposium on the Nutrition of Herbivores*. Clermont-Ferrand, France: Cambridge University Press, p. 526.

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