Regression trees for identifying synergies and antagonisms interactions among farming practices influencing milk quality indicators

L. Rey-Cadilhac, Anne Ferlay, Marine Gele, Stéphanie Léger, Claire Laurent

Regression trees for identifying synergies and antagonisms interactions among farming practices influencing milk quality indicators

L. Rey-Cadilhac[1,a], A. Ferlay[1], M. Gelé[2], S. Léger[3], and C. Laurent[1]
[1]*Université Clermont Auvergne, INRAE, VetAgro Sup, UMR Herbivores, Saint-Genès-Champanelle, France*
[2]*Institut de l'Élevage, Paris, France*
[3]*Université Clermont Auvergne, Lab. de Mathématiques Blaise Pascal, UMR6620- CNRS, Aubière, France*
[a]*Present address: PEGASE, INRAE, Institut Agro, F-35590 Saint Gilles, France*
Corresponding author: Lucille Rey-Cadilhac. Email: lucille.rey-cadilhac@inrae.fr

Introduction Farming practices can interact with each other and have antagonistic or synergistic effects on different compounds. Therefore, this study aimed to investigate the use of regression trees (RT) to study the synergies and antagonisms interactions of farming practices on milk quality indicators.

Material and methods Two hundred-thirty samples of bulk tank milk were collected in French dairy farms and analysed for milk quality indicators: vitamin B2, calcium (Ca) and sums of omega 3 and omega 6 fatty acids content. A survey on the farming practices (herd characteristics, feeding management, housing conditions, milking and milk storage conditions) applied on the day of collection was also conducted. The RT were then applied to predict the milk quality indicators from the combinations of farming practices and validated by cross-validation.

Results and discussion The RT identified combinations of practices that lead to different predicted values for vitamin B2 (R^2cv=0.39), ω6/ω3 ratio (R^2cv=0.67) and Ca (R^2cv=0.14)(Figure 1). Comparison of the RT revealed: i) a synergistic effect of the dominant breed on vitamin B2 and Ca contents, with higher levels observed in Montbéliarde herds compared to those of Holstein Friesian for both indicators; ii) an antagonistic effect of the proportion of concentrates in the total diet dry matter with increased vitamin B2 content when the proportion of concentrates was lower (<22% or < 26%) and higher ω6/ω3 ratio when concentrates accounted for less than 8% in case of corn-silage (CS)-based diets. This suggests a nutritional benefit for vitamin B2 but a nutritional drawback for the ω6/ω3 ratio; ii) an antagonistic effect of concentrate proportion on the ω6/ω3 ratio, with a lower ratio observed in CS-based diets as concentrate proportion increased, and a higher ratio observed in other forage-based diets when concentrate proportion increased.

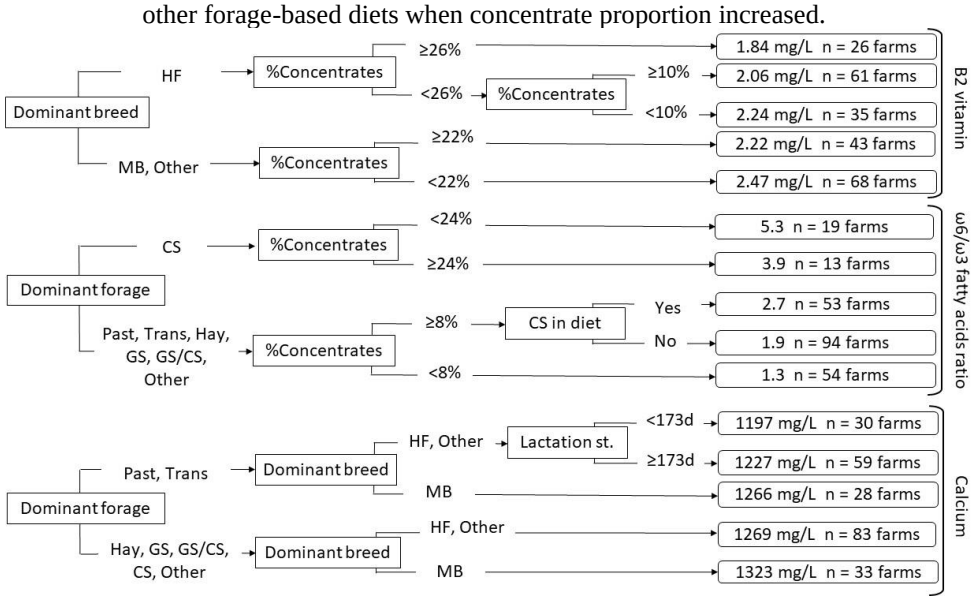

Figure 1. Regression trees predicting B2 vitamin and calcium contents, and ω6/ω3 ratio from farming practices. MB=Montbeliarde, HF=Holstein Friesian, Past=Pasture, Trans=Transition diet, GS=Grass silage, CS=Corn silage

Conclusion and implications RT allowed identifying synergistic and antagonist interactions on farming practices on a same indicator and/or on different indicators. We also developed RT for around 30 indicators. No single practice improved all indicators, meaning that various trade-offs will need to be made depending on the farmers' goals and the specific dairy sector they are part of.

Acknowledgements The authors thank B. Graulet for the analysis of the B2 vitamin and the farmers involved.

Financial support CasDAR Qualenvic project (N°1251) and OverallMilkQual project funded by the Institut Carnot France Futur Elevage