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Metabolic assessment of parasite dilution and forage niche sharing in sheep/cattle mixed-grazing

F. Joly¹, P. Nozière¹, P. Jacquet², S. Prache¹, B. Dumont¹

¹Université Clermont Auvergne, INRAE, VetAgro Sup, UMR Herbivores, 63122 St-Genes-Champanelle, France

²IHAP, Université de Toulouse, INRAE, ENVT, 31076 Toulouse, France.

frederic.joly@inrae.fr

Mixed-grazing by sheep and cattle is the simultaneous or sequential grazing of a pasture by both species. It can improve lamb liveweight gain through parasite dilution (PD) and/or forage niche sharing (FNS). Here, we assessed the relative strengths of the two mechanisms through a novel metabolic approach. We used recently published equations to model the infection cost of gastrointestinal nematodes in metabolizable energy (ME) and crude protein (CP). By comparing infection levels in mixed and monospecific grazing, we quantified the gains of PD in ME and CP. We also used feed value tables to assess the gains in ME and CP, resulting from sheep diet improvement through FNS.

We applied this approach to the dataset of an experiment, comparing sheep monospecific grazing to simultaneous mixed sheep-cattle grazing. We also applied it to a generic situation where we studied the relative gains in ME and CP, along gradients of increasing strength of PD and FNS.

The approach applied to ewe lamb in our experimental data revealed that i) infection by gastrointestinal nematodes can represent 100% of ME and 75% of CP requirements in monospecific grazing, ii) mixed-grazing can reduce these costs to 25% and 15% of requirements, respectively and iii) PD was more important than FNS in terms of ME gains, whereas it was the opposite for CP. However, meeting CP requirements was less constraining than meeting ME requirements in our experimental conditions, which puts into perspective the importance of CP gains. With the generic approach, most of the situations modelled also identified PD as the main mechanisms of ME gain (79%), whereas it was FNS for CP (70%), with the same observation that CP requirements were less difficult to meet. Both our experiment and generic approach thus suggest that PD matters more than FNS in mixed-grazing, owing to the greater difficulty in meeting ME requirements.

We proposed a novel approach to assess the roles of two contrasting mechanisms through common metrics. It can help improve the comprehension of the biological processes involved in agroecological practices, such as mixed-grazing.