Co-grazing horses and cattle requires appropriate management to provide its expected benefits

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Abstract

Co-grazing different herbivores at pasture is assumed to increase vegetation use because of the complementarity of their feeding choices, and to reduce parasitism as the result of a dilution effect. Here, we compare the effects of mixed horse-cattle grazing and monospecific horse grazing (1.4 lifestock units ha^{-1}) on animal foraging behaviour, sward characteristics and horse parasitism in a mesophile grassland (central France). In both treatments, animals alternatively grazed two subplots, each for 15 to 21 days. All horses selected short (≤4 cm) and intermediate (5-8 cm) high-quality patches and avoided reproductive and dead herbage areas contaminated by their faeces. Cattle, which are more constrained by sward surface height, selected intermediate and tall (≥9 cm) vegetative swards. They used short vegetative patches proportionally to their availability as the alternate stocking management enabled short patches to regrow before animals entered the subplots again. Cattle avoided reproductive and dead herbage areas which limited their ability to remove parasitic larvae from the environment. Co-grazing horses and cattle did not reduce sward structural heterogeneity and thus did not enhance herbage quality. We conclude that understanding and optimizing ecological processes in mixed grazing systems is required so that these systems can provide their expected benefits.

Keywords: agroecology, mixed grazing, diet selection, herbage quality, parasite dilution

Introduction

Enhancing diversity within animal production systems is a key principle of agroecology to improve livestock sustainability. While several studies have reported the ability of mixed grazing between horses and cattle to preserve biodiversity in semi-natural habitats, references are lacking in more productive grasslands which support saddle horse systems. Here, we compared co-grazing of saddle horses and beef cattle with horses grazing alone at the same stocking density in a mesophile grassland of central France. We hypothesized that the strong selection of short high quality patches by horses would constrain cattle that are more limited by sward surface height to switch onto taller vegetation and thus to consume grass close to horse latrine areas. Conversely, cattle are assumed to use dicotyledons more than do horses, as they are better able to detoxify their secondary compounds (Ménard *et al.*, 2002). Co-grazing by cattle and horses is thus assumed to homogenize sward structure and enhance herbage quality, and to remove parasites from the environment, both processes beneficial for horse nutrition and health.

Materials and methods

The study was carried out at the French Horse and Riding Institute (IFCE) experimental farm in Chamberet (440 m a.s.l) over three grazing seasons (April to October 2015-2017). The horses were drenched each year with pyrantel before pasture turn-out. Comparison of treatments (mixed grazing by two 2-yr old saddle horses and three heifers vs grazing by four horses; 1.4 lifestock unit (LU) ha^{-1} with 1 LU = 600 kg liveweight) was replicated in three blocks. In both treatments, animals alternatively grazed two subplots A and B of 1.35 ha each for 15 to 21 days. Sward surface height (SSH) was measured

with a stick each time the animals entered and were turned out from a subplot (200 sampling points). Dietary choices were observed by scan sampling at 10 min intervals in May, July and September, with one observation-day (from dawn to dusk) per subplot A and per season. Bites were recorded according to sward height type (vegetative short, VS, ≤4 cm; vegetative intermediate, VI, 5-8 cm; vegetative tall, VT, ≥9 cm; reproductive and dead herbage) and dominant botanical family. We also recorded the presence of horse dung within one metre around each bite location, as most of small strongyle larvae move less than 1 m from dung (Fleurance *et al.*, 2007). Diet selection was quantified with Jacobs' indices: $S_i = (c_i - a_i) / (c_i + a_i - 2c_ia_i)$ where c_i and a_i are proportions of component i in the diet and in the subplot A, respectively. Data for individuals within each species were aggregated per day and were then related to this bite type abundance in subplot A (400 sample points). S_i varies from -1 (never used) to +1 (exclusively used), with negative and positive values indicating avoidance and selection, respectively. We estimated overall biomass and herbage quality (CP, NDF) close to dietary choice measurements in May, July and September: six samples were cut at ground level in each sward height type and overall biomass and herbage quality were estimated from the sward height types' proportions in the subplot. Horse parasite burden was estimated from monthly individual faecal egg counts (FECs). Animals were weighed on two successive days at the start and end of each grazing season. Finally, we recorded agonistic behaviours between horses and heifers using focal observations during daylight three weeks per month. Jacobs' indexes in horses and sward characteristics were analysed using the Anova procedure of SAS for repeated measurements including the effects of grazing management, date, grazing management × date, block, year and block × year. Jacobs' indexes in horses and cattle grazing mixed plots were analysed for the effects of species, date, species × date and year. Jacobs' indexes were compared to zero using Student's t-test. Individual FECs and horse daily liveweight gains were analysed using a mixed model with individual as a random effect and grazing management, date (FECs), grazing management × date (FECs), block, year and block × year as fixed effects.

Results and discussion

Only seven agonistic interactions were reported in horses towards heifers. Horses, whether they grazed alone or with cattle, exhibited typical patterns of diet selection (Ménard *et al.*, 2002). They selected VS and VI patches and preferred bites dominated by grasses (Figure 1 for mixed plots). They used VT swards and legumes in proportion to their availability and rejected forbs, reproductive swards and dead herbage. Cattle selected VT swards and used VS patches proportionally to their abundance (Figure 1). This result contrasts with previous studies in which cattle were excluded from the short patches (1-4 cm) created by horses (Cornelissen and Vulink, 2015; Ménard *et al.*, 2002). Here, the strong use of the VS patches by cattle probably resulted from the alternate stocking management, which let short swards regrow to an average of 3.9 cm before animals entered the subplots again. An additional explanation can be found in the high selectivity of Limousin cattle (D'Hour *et al.*, 1995). No differences in selection between the two species were found for the other bite types (Figure 1). Mean SSH (14 cm) and herbage biomass (198 g m^{-2}) were comparable in both treatments. A consequence of the similarity between horses and cattle choices is that the SSH coefficient of variation, an indicator of sward heterogeneity, did not differ between treatments (on average 55%). Cattle, by avoiding the reproductive and dead herbage areas, as did horses, did not improve herbage quality (mean crude protein: 115 g kg DM^{-1}, neutral detergent fibre: 599 g kg dry $matter^{-1}$). Moreover, we could not find evidence any reduction of parasite egg excretion in horses grazing with cattle (difference of 11 eggs g^{-1}). 40% of the horse faeces were recorded in the reproductive and dead herbage areas. By selecting vegetative regrowth, the cattle avoided grazing close to horse dung (S_i=-0.17±0.06, P=0.006) and thus ingested few parasitic larvae. While Forteau *et al.* (2020) have reported that co-grazing with cattle could reduce strongyle infection in young horses, we suggest that it would require an appropriate management of herds and plots. Consistently, average horse liveweight gains were similar in both treatments (378 g d^{-1}).

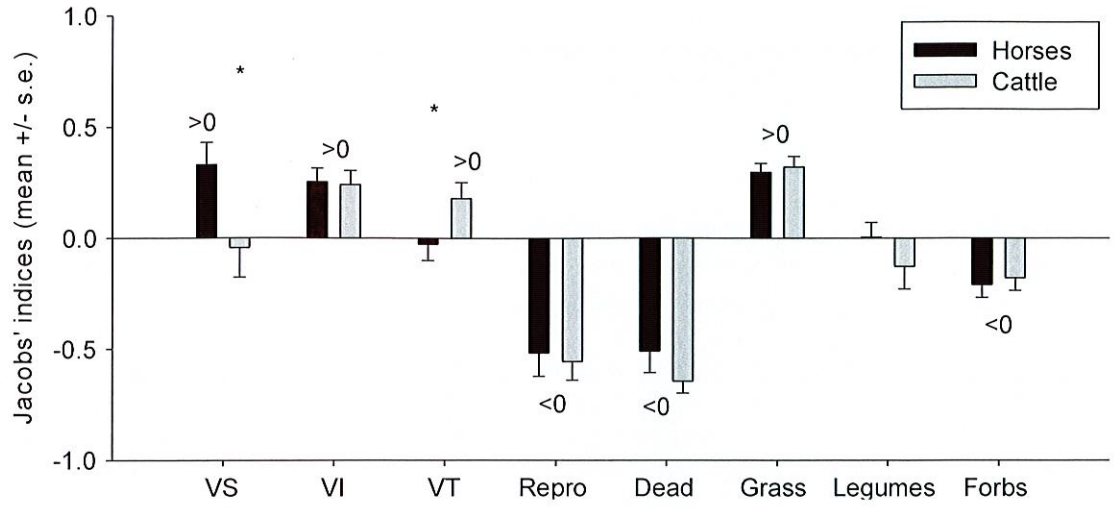

Figure 1. Diet selection by horses and cattle in mixed plots according to sward height type and dominant botanical family. Species effect: *$P<0.05$; >0 and <0 is for significant selection for or against this bite type.

Conclusions

We conclude that rather than considering mixed grazing as a turn-key solution, its management needs to be adapted to support the complementarity of horses and cattle dietary choices and thus provide the expected benefits of multi-species grazing.

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References

Cornelissen P. and Vulink, J.T. (2015) Density-dependent diet selection and body condition of cattle and horses in heterogeneous landscapes. *Applied Animal Behaviour Science* 163, 28-38.

D'Hour P., Petit M. and Garel J.P. (1995) Components of grazing behaviour of 3 breeds of heifers. *Annales de Zootechnie* 44, 270.

Fleurance G., Duncan P., Fritz H., Cabaret J., Cortet J. and Gordon I.J. (2007) Selection of feeding sites by horses at pasture: testing the anti-parasite theory. *Applied Animal Behaviour Science* 108, 288-301.

Forteau L., Dumont B., Sallé G., Bigot G. and Fleurance G. (2020) Horses grazing with cattle have reduced strongyle egg count due to the dilution effect and increased reliance on macrocyclic lactones in mixed farms. *Animal* 14, 1076-1082.

Ménard C., Duncan P., Fleurance G., Georges J.Y. and Lila M. (2002) Comparative foraging and nutrition of horses and cattle in European wetlands. *Journal of Applied Ecology* 39, 120-133.