In France, silvipastoral arrangements in grasslands can mitigate moderate heat stress in sheep

Mickaël Bernard, Robin Russias, Cécile Ginane, André Marquier, Urbain Kokah, Léa Ottmann, Sophie Tournier, Pascal Walser, Emma Chanet, Bruno Moulia, et al.

▶ **To cite this version:**

Mickaël Bernard, Robin Russias, Cécile Ginane, André Marquier, Urbain Kokah, et al.. In France, silvipastoral arrangements in grasslands can mitigate moderate heat stress in sheep. 6th European Agroforestry Conference, Consorzio Universitario Nuoro, May 2022, Nuoro (Université de Sassari), Italy. 10.4267/2042/56863 . hal-04181917

HAL Id: hal-04181917
https://hal.inrae.fr/hal-04181917v1

Submitted on 16 Aug 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

In France, silvipastoral arrangements in grasslands can mitigate moderate heat stress in sheep

EURAF 2022
Agroforestry for the Green Deal transition. Research and innovation towards the sustainable development of agriculture and forestry

Corresponding Author:
mickael.bernard@inrae.fr
cecile.ginane@inrae.fr

Mickaël Bernard[1], Robin Russias[1], Cécile Ginane[1], André Marquier[2], Urbain Kokah[1], Léa Ottmann[1], Sophie Tournier[1], Pascal Walser[2], Emma Chanet[1], Bruno Moulia[2], Marc Saudreau[2]

[1] *INRAE, UE Herbipôle, Saint-Genès-Champanelle, France*
[2] *Université Clermont Auvergne, INRAE, VetAgroSup, UMR Herbivores, Saint-Genès-Champanelle, France*

Theme: Quality, safety and sustainability of agroforestry productions (processes and products)

Keywords: Heat stress, ruminants, trees, grassland, global warming

Abstract

In the coming years, with the multiplication and intensification of the effects of climate change, the European livestock farming systems will have to adapt and gain in resilience to maintain their production. For those livestock systems that largely rely on grazing, the augmentation of climatic hazards and the associated periods of drought and heat waves (Moreau 2015), will have both direct consequences on animal welfare and production (Polsky et al. 2017; Herbut et al. 2018), and indirect ones on grass production and quality. The presence of silvopastoral facilities in grasslands could be a way of adaptation to climate change by providing a more favourable microclimate and limiting the thermal stress of animals. The objective of this study, conducted in the mid-mountainous French region Auvergne, was to assess the impacts of the presence of trees on the thermal load and behaviour of sheep submitted to different tree arrangements, thanks to the use of a set of different sensors.

The experimental set-up was composed of three 0.8-ha permanent pasture plots: a control plot C, composed of a single tree and two trees plots: HT composed of a hedge (7.6 trees/ha) and IPT composed of an intra-plot tree plantation (60 trees/ha). In each plot, 12 dry adult ewes were grazed during the entire grazing season (2020: between June 6 and September 5; 2021: between May 12 and September 9). During this period, each animal was equipped with a bolus measuring ruminal temperature, an activity collar and a Hobo® light data logger positioned on the animal's withers to assess whether it is in shade or sun. A weather station was installed on each plot to characterise the intra-plot environment. The statistical treatment of the data was based on mean homogeneity tests carried out according to mixed ANOVA or Kruskal-Wallis-tests.

From the 183 days available, we created 4 classes based on climatic conditions: 1=cool and humid day; 2=cool and sunny; 3=hot day (>25°C) and cool night (<19°C); 4=hot day and warm night (>19°C). The main results show that animals in IPT have a lower ruminal temperature (39.4°C) than animals in C and HT (39.5°C) (pvalue =0.001). This is confirmed with the results of Figure 1 below, the ruminal temperature of the animals increases according to the daily classes from 1 to 3 for the three treatments. In class 4, although this is the most thermally stressful class, the ruminal temperature of the ewes is equivalent to classes 1 or 2. The analysis of their activities shows that the animals had a behavioural adaptation between classes 3 and 4 by decreasing their ingestion time (13%) and spending more time in the shade (19%). However, the environment of the IPT plot seems to be more favourable for the animals to effectively decrease their ruminal temperature.

In our context, these results show that agroforestry systems can play a positive role in adapting to climate change by providing a more favourable microclimate for animals, allowing them to better regulate their internal temperature and thus improve their welfare under stressful conditions.

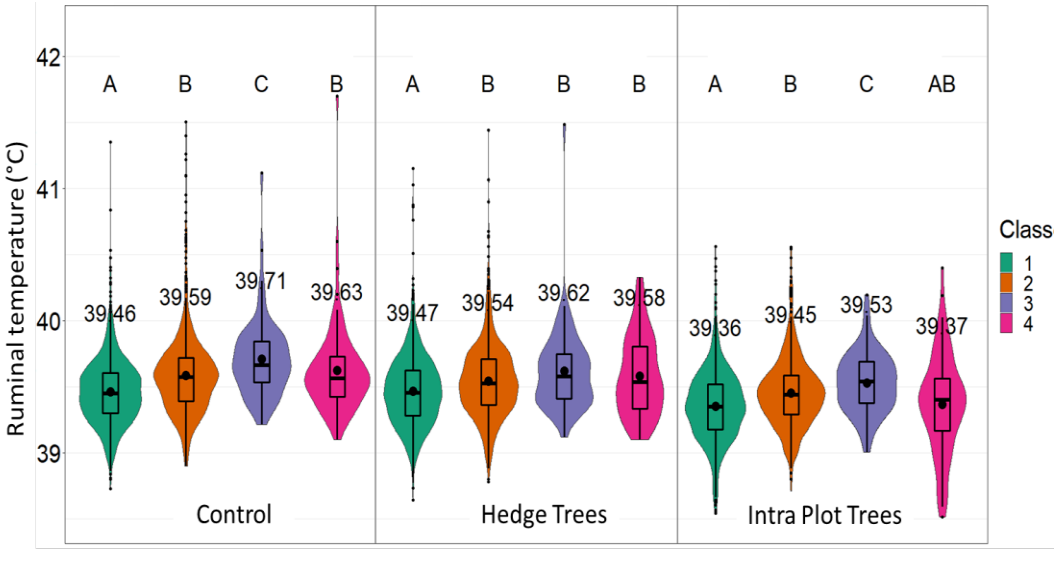

Figure 1. Comparison of the average ruminal temperatures of ewes on the three plots, according to the daily weather classes (statistical comparison by plot)

Acknowledgement

This work was funded by the ISite project 16-IDEX-0001 (CAP 20-25). The authors thank all the people who participated in the realization of this study.

References

Herbut P, Angrecka S, Walczak J (2018) Environmental parameters to assessing of heat stress in dairy cattle—a review. International Journal of Biometeorology 12: 2089-2097.

Moreau JC (2015) Les systèmes d'élevage d'herbivores face au changement climatique en France : quelques conclusions d'une série d'études menées de 2006 à 2009 (projet Acta/Mires). Bulletin de l'Académie Vétérinaire de France. https://doi.org/10.4267/2042/56863

Polsky L and Von Keyserlingk M A-G (2017) Invited review: Effects of heat stress on dairy cattle welfare. Journal of dairy Science 100: 8645-8657.