KLIMACO

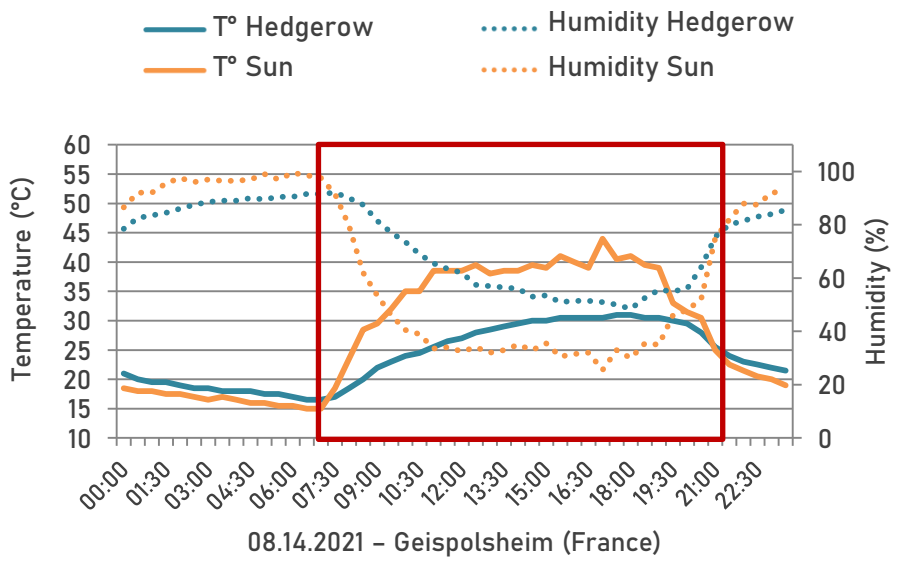
AGROFORESTRY

MICROCLIMATIC EFFECT OF HEDGEROWS n°2

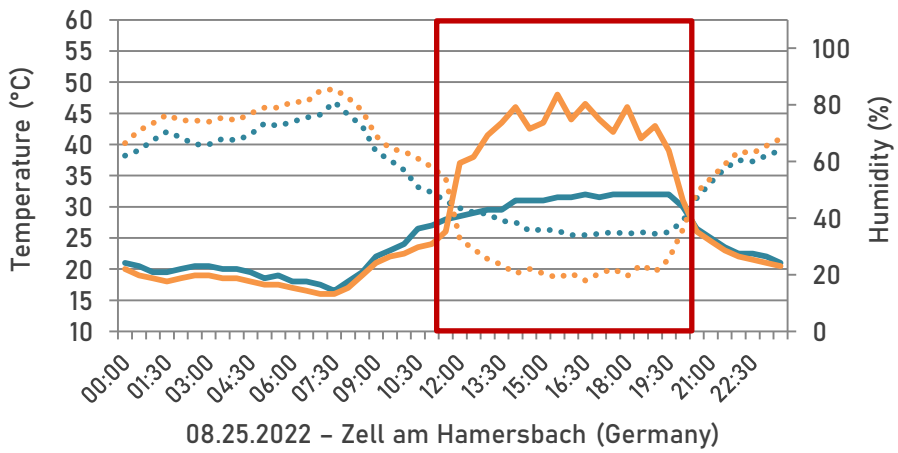
The presence of trees in pastures undoubtedly improves the well-being of the animals. The hedgerow provides essential shade for the animals during the day and limits cooling after dark.

To quantify the effect of trees on the thermal comfort of the animals, temperature and humidity measurements were carried out in five agroforestry plots (see map opposite) under shaded ("hedgerow") and full sun ("sun") conditions.

Optimising the microclimatic effect



08.14.2021 – Geispolsheim (France)



08.25.2022 – Zell am Hamersbach (Germany)

Depending on the orientation of the plot and the positioning of the hedge, the shading effect is felt earlier or later in the day and benefits the animals for a longer or shorter time.

In the Geispolsheim plot the temperature difference between the shaded area and the full sun is higher than 5°C during 11 hours (from 8 am to 7 pm) whereas in the Zell am Hamersbach plot this difference occurs during 7.5 hours and later in the day (from 12 pm to 7.30 pm).

The design stage of the planting projects is therefore essential when one wishes to optimise the microclimatic effect of future hedges and trees in the plot. Other parameters must of course also be taken into account: exposure to the wind, direction of rainwater flow, etc.

◀ Fig. 1: Temperature und Humidity over 24 hours.

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Impact on thermal comfort

The Temperature Humidity Index or THI is the indicator of thermal comfort. It is calculated from temperature and relative humidity and is used to identify whether a risk of heat stress exists and its level of intensity (Fig. 2).

THI	Stress-niveau	Symptome
< 68	no heat stress	
69-71	low heat stress	- search for shady places - faster respiratory rate - dilation of blood vessels - first effects on milk production
72-79	moderate heat stress	- increased saliva production - increased respiratory rate - increased heart rate - reduced food intake - increased water consumption - decrease in milk production
80-89	high heat stress	- discomfort due to increased symptoms
> 90	danger	- cases of death may occur

▲ Fig. 2: THI levels and associated symptoms in dairy cows.

The measurements carried out in the five plots made it possible to calculate THI in shaded ("hedge") and full sun ("Sun") conditions. The analysis of the occurrence of different levels of heat stress (Figure 3) allows the impact of the presence of trees on the thermal comfort of the animals to be quantified.

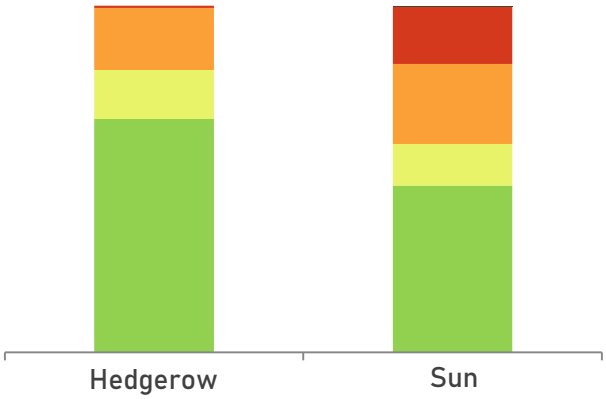
The measurements were carried out from 08.13.2021 to 09.09.2021 for the 4 plots in Alsace and from 08.11.2022 to 11.02.2022 for the plot in Baden.

25 x more high heat stress situations in the sun.

20 % of situations of moderate or strong heat stress in the shade of the hedge*

against **40 %** in the sun*.

** 27+727=751 time segments with THI>72 (Hedgerow) gegenüber 677+938+7 =1622 (Sun)*



	Hedgerow	Sun
no heat stress	67 % (2738)**	48 % (1956)**
low heat stress	14 % (574)**	12 % (488)**
moderate heat stress	18 % (727)**	23 % (938)**
high heat stress	1 % (27)**	17% (677)**
danger	0 % (0)**	0 % (7)**

** Number of 30 minutes time segments over the duration of the measurement protocol*

Fig. 3: ► Percentage of occurrence of different levels of heat stress during the day (8am-6pm) for the 5 plots (cumulative).