Better-B newsletter

First issue – March 2024

***Embracing harmony and balance**, within honey bee colonies as well as their environment provides a solid foundation for **resilient beekeeping**. Better-B aims to help beekeepers to better protect their colonies from the anticipated environmental changes to come, because of climate change. Extreme and more frequent climatic events, for example heat waves, will impact the ability of honey bee colonies to regulate hive temperatures (thermoregulation).*

We know that reducing temperature stresses lessens honey bees energy expenditure and in turn improves brood development and disease resistance. One aspect being investigated within the Better-B project, will be beehive construction and its effect on in-hive temperatures. We focus on this topic for this first newsletter. Other newsletters outlining different aspects of the project will follow. Our work on beehive designs will provide beekeepers with advanced science and knowledge, and solutions to better maintain thermoregulation of their hives. The COA Team (CoActions, France) and UM Team (University of Montpellier, France) will use automated monitoring systems and computer simulations to develop adapted hive designs considering local materials and knowledge.

Understanding the hive and its environment

Independently of honey bees, hive temperatures are governed by heat transfers with the surrounding air (convection) and the sun (radiation) (Fig.1). These two forms of heat transfer are influenced by the immediate environment of the hive - for example, shading, local weather conditions, etc. (Fig. 2) and by the physical properties of beehive construction - for example, its volume, insulation, colour, etc.

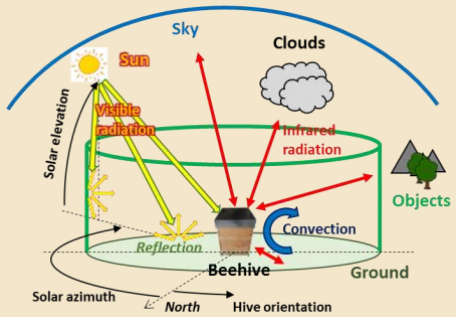


Figure 1: Convection and radiation heat transfer between the hive and its environment

Figure 2: Infrared view of the thermal environment around the hive: blue sky, clouds, trees exhibit different temperatures.

The construction, its placement and configuration of a hive are important factors when it comes to improving the thermal characteristics of honey beehives, whether this means (1) stable in-hive temperatures, (2) fast reaction time to external temperature changes or, (3) high thermal insulation efficiency. We are convinced construction improvements and adaptations can increase a colony's resilience to seasonally varying temperatures and productivity for the beekeeper.

Hive coatings for better thermoregulation.

Pollinator ecology

In an experimental apiary, the colour of the walls and roofs of empty hives were changed to observe the effect of different colours on temperatures at different locations in the hive. Different paints are tested (white paint, black paint, Thermopeint®) and compared to a reference hive (unpainted).

Reference (unpainted/steel top),

(White painted roof).

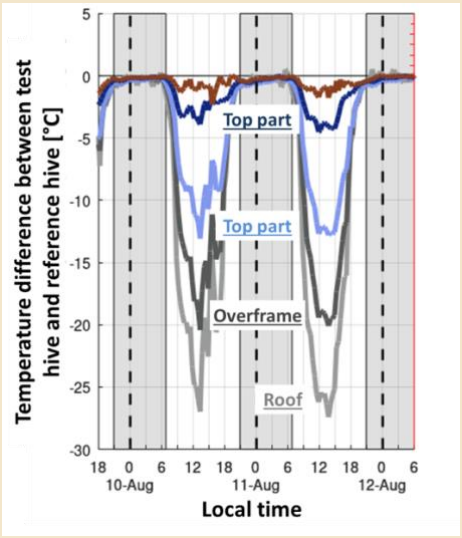


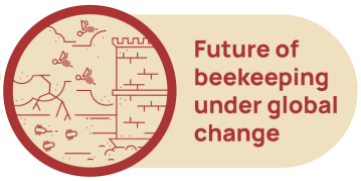
Figure 3: Temperature changes induced by a white paint on the roof at different positions in the hive

Our main results show a significant temperature decrease in summer with the white-painted roof (Fig. 3). At midday, the roof temperature dropped by 27 degrees °C and the in-hive temperature dropped by 4 to 12 degrees °C, respectively for the bottom and top parts. **White roof paint appears to be an inexpensive solution for lowering the temperature inside a hive.**

Additional tests were carried out to test the effect of paints on the hive walls. We found no or very little effect. The maximum effect was with white paint on walls, giving a momentary decrease of 4 degrees °C at around 9am when the sun is still not very high in the sky.

We are very interested in feedback from beekeepers or anyone who has noticed the effects of painting hives, e.g., a painted roof on the behaviour of bees. We would like to hear about your experiences, what are the benefits or drawbacks by painting or modifying beehives to improve temperature regulation (see details for direct email contact at the bottom of this newsletter).

From hive coatings to hive insulation



However, painting beehives is not the only way to modify the temperature inside the hive. Several modifications, like the use of insulating materials (e.g., air/polystyrene), the orientation of bee hives (e.g., facing south or north), will be monitored using sensors to quantify their influence on improving thermal efficiency (Fig. 4). Our philosophy is simple: "minimum modifications" for "maximum effects".

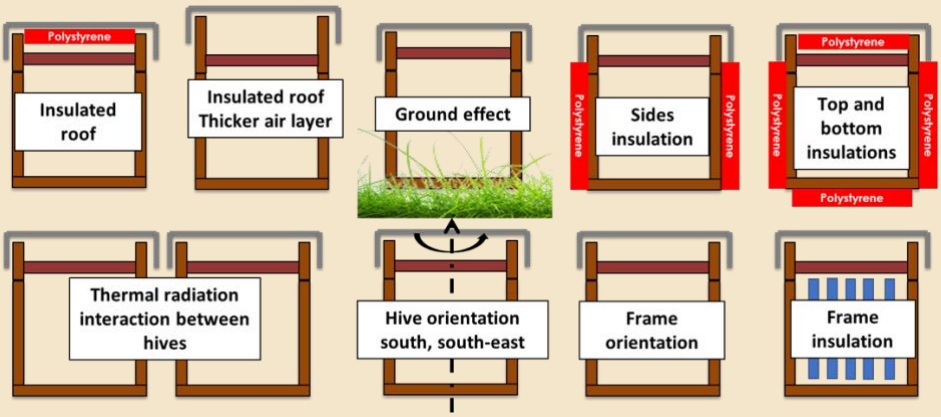


Figure 4: Future hive configurations to be tested within Better-B project

The most relevant modifications will be compared with numerical simulations. Next, hives will be populated and simulations will allow us to untangle the colony contribution from the hive contribution to in-hive temperatures. The first objective is to get a real-time estimation of a colony's energy expenditure, which could be an additional marker of its state of health for the beekeeper. The second objective is to compute in-hive temperatures for the next day and predict potential critical temperatures.

Bee' a part of the Better-b community

To complete our scientific studies, Better-B also seek input from the beekeeping community with practical experience in modifying hives thermal efficiency. The Better-B team will conduct interviews and surveys across Europe to better understand the practices of beekeepers, hive producers and providers on this topic. Experimental and numerical tests carried out subsequently will be based on surveys and interviews results, to ensure that the issues studied later in the project are as close as possible to beekeepers' concerns. Beekeepers can contact the COA team directly (with website www.alt-rd.com or email anna.dupleix@alt-rd.com) to discuss their practices. Project results will be published on the Better-B website (in English). Anyone interested is invited to get involved with Better-B. Sign-up, if you are interested in following the work and outcomes of Better-B. By registering, you will receive updates on project activities, results, and invitations to join open meetings/webinars with opportunities for you to learn and have your say about resilient beekeeping.

The first part of this work was recently presented during a conference of the Regional French beekeeping association ADAO ("Regards partagés", Nov 23-24 2023, Mèze, France) and a video is available here in French (English subtitles can be selected) https://vimeo.com/897139558

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Better-B Project

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