

The Honeybee winter cluster is warm and cosy, but uses a lot of energy

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Provided that the hives contain plenty of honey or sugar feed provided by the beekeeper, no intervention by the beekeeper is needed during winter. Bees can take care for themselves, even when it is very cold outside. The honey and sugar feed serves as their fuel to heat the cluster. Heat is produced by controlled movements of their wing muscles, just enough to produce little labour and enough heat. They keep a high density and packing to reduce heat loss. As soon as the bees become more active (more movement, brood production) the consumption of energy goes up. Generally it is almost spring then. However, this mild winter, which was preceded by a long warm autumn, many colonies have become active very early and depleted their stocks more than expected....

Tjeerd Blacquièrè, researcher at Bees@wur: "the majority of my forty experimental colonies at the Grebbedijk apiary in Wageningen showed to be very active in the beginning of February, and moreover almost had finished their sugar stock in the combs. Unfortunately I even had to find one of the colonies already succumbed due to starvation! This was the first time in my beekeeping life to experience such thing. The colonies that had lack of feed I gave all a 2.5 kg bag with liquid sugar feed (Api-invert) Since it was relatively warm weather and because the colonies were as yet active they are able to take up this sugar. Colonies that had not yet run out of food, and that were strong enough to start a brood nest soon, were given a bag with sugar dough (Fondabee)." From several beekeepers of the Dutch Beekeepers Association (NBV) similar reports were heard.

It is not easy decided how to explain that even very experienced beekeepers during this winter have been confronted with colonies almost starving. Has it been caused by insufficient feeding in autumn, or is more at hand? Possibly it is the coincidence of a very nice late summer, which produced strong winter colonies, followed by a warm autumn which kept colonies very active and induced a high consumption of sugar. After that we encountered an extreme mild winter, in which some of the colonies and queens already have started a brood nest. The latter demands a lot of extra energy. Apparently everything together has caused a higher energy consumption than regular.

A good idea about the effect of the temperature outside the hive on the energy use of honeybees in the winter cluster is given by the experiments of Free & Spencer-Booth ([1959](#)). They investigated the behaviour and the sugar usage of bees kept in cages in the laboratory at different environmental temperatures. It was shown that at 10°C 99% of the bees clustered together, at 15°C 80% did so, and at 20°C less than 50% clustered. The energy use was lower at 10°C than at 15°C. According to literature bees start clustering around 13,9°C (Corkins & Gilbert, [1932](#)). The latter authors did extensive experiments with complete winter clusters of 12.600 through 16.500 bees. They observed the temperature regulation of the clusters in some kind of a normal bee hive, placed inside a refrigerator / freezer, and followed the energy consumption through measurement of the CO₂ evolution. It was found that the energy consumption at an outside temperature of 3°C only was 53% of the use at 13,6°C (the latter is just around the clustering temperature level). If a colony was kept for a longer period at a temperature of ~6°C, it lasted about two days until the in hive temperature around the cluster reached a stable (rather low) level (need to state that the centre inside the cluster was kept at a temperature of 31-32°C throughout). After the two adaptation days the energy consumption of the cluster stabilized at a low rate. Still another noteworthy observation: a similar experiment done with bees in June showed that those bees were also able to regulate their cluster temperature in a cold cabinet, but they needed to do so between three and four times more energy!

Energy consumption of a winter truss calculated

From the observed energy consumption of the bees in the cluster the authors calculated the amount of consumed honey (80% dry matter) per bee per day. At the low temperatures (3°C) the use was 2,6 mg per bee, at 13,5°C (start of cluster formation) 6 mg per bee per day. Calculated for a cluster of 10,000 bees this translates at 3°C to 26 gram/day, 780 gram per month, and 4.7 kg for a winter of six months length. At the higher temperature (13,5°C) 60 gram/day, 1800 gram/month, and 10.8 kg/winter. The conclusion that a frugal beekeeper and his bees are more at risk in a winter with many days above 10°C appears to be fully valid. The calculated amount of honey needed in a mild winter (10.8 kg) is not too far from the generally recommended amount of 14 kg sugar syrup for a normal sized colony.

Back to practice:February 2016!

Apart from being a bit 'economically' fed, it is very well possible that the colonies of Bees@wur have been using sugar at a higher rate than normal. Due to our experimental work with the colonies we needed to do several activities inside the colonies rather late in autumn, which may have caused higher activity of the bees and retarded clustering. Other colonies of Bees@wur showed to be in better supply of food stores, and the same was true for our 'own' colonies at home.

Nevertheless, beekeepers are alerted: by checking their colonies regularly, also during winter, they can if needed avoid starvation by giving an emergency feeding. Additional information about feeding bee colonies during winter see the web site of the NBV (in Dutch):

<http://www.bijenhouders.nl/blog/bijvoeren-in-de-winter>