How To Do More With Less
A review of More Beekeeping With ZEST by Bill Summers

This revised and updated second edition of Bill Summers' "manifesto for bee health" is likely to prove a challenge to anyone steeped in the hand-me-down concepts of frame hive beekeeping that are routinely referred to as "traditional" in the UK and elsewhere. Such is the conservatism of the beekeeping establishment that little of significance by way of beekeeping hardware has changed in 150 years, save the relatively recent introduction of hives made from high-density polystyrene, still regarded with suspicion by many. So the idea of using lightweight concrete insulation blocks as a hive construction material may be a step too far for those still fretting over the demise of the WBC. As Bill says, "This is not a book for the timid and faint hearted."

The ZEST concept is the result of its inventor having been a practising architect and applying the principle of using insulation to modulate temperature and humidity inside a living space: the better insulated your house, the less energy input it requires in order to maintain a temperature comfortable for human habitation. In the case of bees, this means the less honey they need to consume in order to maintain their desired brood temperature. Clearly, this benefits both the bees and the beekeeper. The contrast between a ZEST hive and a standard National or Langstroth in this respect is one of night and day: a couple of centimetres (if you're lucky) of western red cedar does not begin to compare in performance with 100mm of Thermalite (a type of aerated concrete).

Of course, there is a downside: the ZEST is an immovable monolith of a hive, which must be permanently sited and becomes part of the landscape. Once built, it is going nowhere. This may, of course, be perfectly acceptable if you are building an apiary with your grandchildren in mind, or you are not planning to move house for a decade or two. Its bulk and uncompromising, tomb-like shape may also be off-putting to some, although this can be mitigated by the creative application of paint. Back on the upside, one of the principal advantages of the ZEST over almost any other hive is its low cost per unit volume: Bill claims that it is less than one third the cost of a wooden National pro rata. Add in the lack of box-lifting, zero requirement for out-of-season box storage, simplicity of management and – if Bill's claims are correct – freedom from parasites and diseases, then this hive starts to look more and more attractive.

But wait – I hear you say – is Bill Summers saying that the ZEST hive removes the requirement to treat for diseases and *Varroa* mites? Well yes, he does, and this surprising claim bears close examination, especially as Bill admits that it was an unexpected bonus outcome of his design, as he only set out to eliminate *Acarine* (nowadays rather uncommon: an infestation of a tracheal mite, *Acarapis woodii*) and *Nosema (N. apis and N. ceranae*, species of fungal parasites), for both of which he claims success. I will come back to this, but first I must make a slight diversion.

If you were a user of the (now defunct) Natural Beekeeping Forum hosted on my web site back around 2010, you may have come across a post by a German beekeeper, who had somehow turned up an almost century-old essay by an American commercial beekeeper by the name of Ed H. Clarke entitled "Constructive Beekeeping", who sought to overturn the received wisdom of his day by proposing that hives should not have any form of top ventilation, but should be effectively sealed around the roof in order to maintain a high humidity inside, which, Clarke claimed, was what the bees really needed for optimum health and energy efficiency, since they actively employed evaporation and condensation in their production of honey from nectar. Apparently ignored since its publication in 1918, the document was greeted with enthusiasm by forum readers and much discussion ensued about its implications and potential application to our various hive designs. Unfortunately, Clarke seems not to have published any follow-up reports to show how his idea performed in practice.

Simply stated, Clarke's claim was that, since nectar is always stored for processing above brood, the rising warm air from the brood area flows across the surface of the exposed nectar, evaporating excess water and carrying it to the top of the container, where it encounters a solid, warm surface, and having no other escape it must, as it cools, flow to the sides of the hive, where it meets a cooler surface onto which it condenses, running harmlessly away down the walls, in the process releasing its heat back into the hive atmosphere, thus maintaining a high energy efficiency. In contrast, a hive with a low entrance and top ventilation creates a "chimney" effect, allowing this humid air to escape, thus causing bees considerable extra work by having to replace the heat energy thereby lost to the outside world. Having tested many hive designs over the years, I have observed on every occasion when I provided high level ventilation that bees quickly propolize the vent completely: they seem to hate upper ventilation exactly as Clarke predicted. Yet such is the obstinacy of hive manufacturers that at least two of them routinely fit upper ventilation, which bees routinely seal up in short order.

Clarke never had to deal with *Varroa destructor*, but his idea of providing a means by which the bees can manage hive temperature and humidity – was an influence on Bill Summers' thinking about hive design, as he puts great store on the ZEST hive being a "bucket of high humidity"; albeit the exact inversion of Clarke's design by way of having high entrances with no ventilation below them. Since humid air is less dense than dry air (lighter water molecules displacing heavier nitrogen and oxygen) one could reasonably expect that the water-laden air would simply leak from the high entrance holes, to be replaced by air leaking in through the small gaps between the blocks. If we could seal the space entirely and close all draughts – which I have seen the bees in fact do themselves over time using propolis – then we have an interesting problem for a HVAC engineer to solve.

Does the ZEST design have special properties that somehow suppress the reproductive cycle of *Varroa*? Does it have something to do with temperature and/or humidity?

Randy Oliver has conducted research on this subject and has published data on his web site[1] that shows a range of temperatures between 40°C and 47.8°C, which bees can tolerate for short periods (perhaps an hour or two) but in which *Varroa* die off in increasing numbers proportional to temperature. The author notes that there is a rather narrow range of temperatures that damage mites without harming bees. We have to ask if the ZEST or any other hive design is capable of enabling temperatures in this range unaided by deliberate electrical heating and if not, then is a slight raising of temperature above the "comfort zone" of mites for extended periods sufficient to achieve an affect, albeit less dramatic?

A recent paper (*Aldea, P, et al (2021) Heat Tolerance, Energetics, and Thermal Treatments of Honeybees Parasitized With Varroa)* concludes thus: "*Contrasting responses between control and parasitized individuals suggest that warm-acclimated honeybees are more susceptible to the impact of Varroa, presumably due to their smaller size and more restricted energy reserves."* This suggests that raising the temperature inside a hive simply makes bees more susceptible to *Varroa* predation, which negates any detrimental effect of the raised temperature on the mites.

Nevertheless, Bill does maintain that his hive appears to have the effect of suppressing the reproduction of Varroa mites as a matter of simple observation over many years, by himself and other ZEST hive users. As he puts it: this hive is "functionally free from *Varroa*". So we have to ask if there are any other factors at play that may facilitate this outcome, if the temperature/humidity theory is not easily supportable. Its depth and overall volume are the most obvious features that distinguish the ZEST from a "standard" wooden hive, although there are other deep, long hives around, such as the Layens, which is also typically well-insulated with double walls, but with low

1 https://scientificbeekeeping.com/a-test-of-thermal-treatment-for-varroa-part-1/

entrances and no top ventilation. I believe that Layens users have also reported low mite counts, so this could be a useful comparison.

Bill does present data in his book that clearly demonstrates the superiority of the ZEST hive in its ability to mediate ambient temperature fluctuations, compared with a standard wooden National hive. Most interestingly, it also demonstrates an inverse relationship between ambient humidity and interior humidity in the ZEST, while the wooden hive maintains a linear relationship. That is to say: when the outside humidity goes up, it also goes up in the wooden hive, but *down* in the ZEST and vice versa. I am still struggling to formulate an explanation for this, but it could well contain an important clue to the puzzle. It perhaps suggests that, while air at ambient humidity is drawn into the wooden hive through the low entrance and is vented via the crown board, thus minimizing any difference between internal and external measurements, the much slower flow of air through the ZEST puts it 180° out of synchronisation with the ambient conditions, thus creating a paradoxically "inverted" state. There is much scope here for further research into the potential benefits of "super-insulated" cavities for bees.

I gave up counting mites many years ago, but I can say that my ZEST hive has so far survived five seasons (and still looking good in its 6th) without any treatments of any kind and with only minimal inspections. They may have swarmed during this period, but the hive has certainly been continuously occupied with no help from me. So having visited Bill's apiary some years ago, having built and operated my own ZEST hive and having recently visited another ZEST apiary operated by a skilled and experienced beekeeper, it would be hard to argue that this hive does not deserve a place in the official canon of beekeeping. It is easy and inexpensive to build, with the possibility of making your own deep frames using Bill's bamboo recipe making for further potential savings. On his web site[2] Bill has generously provided free, downloadable plans for building your own ZEST hive using either British National or Langstroth dimensions, although he says that Thermalite blocks are not currently available in the USA. I recommend the downloadable PDFs over the diagrams as printed in the book, which are hard to read due to the reduction in print size.

If you have a permanent site and you prefer not to be lifting heavy boxes of bees and honey, while having bees on frames that are easy to inspect, the ZEST hive is certainly worth considering. And even if you decide to go in another direction, Bill's book is still worth reading for his original thinking and challenging ideas.

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https://biobees.com

2 https://www.thezesthive.com