

Translated from the French.

## Honey Necessary to Produce Wax.

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In making the experiments which I am going to describe, I have not made it a point to ascertain whether or not bees build their combs more economically with one kind of sugar than with another, my object having been simply to arrive at the quantity of honey used by bees working in an apiary at their free will, and at a season when they take to comb building with more readiness than in any other.

The experiments hitherto made in this direction differed so much among themselves that it was impossible to arrive at a reliable conclusion. It is this fact which induced me to recommence these experiments, taking for basis the various plans previously adopted. But at the very outset two questions arise which in practice have often been confounded, but which must be distinctly separated, viz:—

1. Even when honey is plentiful, it is not advantageous to induce bees to produce wax, although it may be done at a small cost, because, in the first place, if only a few empty frames are given to a strong colony among a good supply of ready-made combs, within which to store the incoming harvest, and yet to find sufficient scope to give vent to their comb-building propensity, they would be almost sure to build drone-comb. On the other hand, if plenty of comb building is given them by reducing them, as it were, to a combless colony, they would no doubt build numerous worker-combs, but they would not have sufficient cells wherein to store the incoming honey, the production of wax not being in proportion to the collection of honey. Therefore, at the time when honey is plentiful, it is not advisable to set bees to comb building.

2. When, on the contrary, the honey yield is great, is it advantageous to have bees produce wax? This is the point I have tried to solve.

The basis of what was considered to be the best experiments made consisted, briefly put, of selecting 2 colonies, say A and B, of the same strength, one of which—A, for instance—was supplied with empty frames, and the other, B, ready-built combs. A little later on, the honey gathered by B is weighed; the same with that found in A. This done, the quantity of wax produced is ascertained; the difference between the weight of the honey compared with that of the wax produced represents the proportion between the honey and the wax. This method is, however, incorrect in several respects.

1. Even supposing that by some chance one queen were as prolific as the other, they would not lay the same number of eggs within a certain number of days, because one of the hives afforded, from the very first day, all the desired accommodation for egg laying, which would not be

the case with the colony whose combs are built at a slow pace. Therefore, at the end of the experiment there will be more brood in one than in the other; hence a difference also in the consumption of honey, a difference which is left out of reckoning, and—

2. It was generally supposed that by choosing from an apiary 2 colonies, apparently of the same strength internally, and of similar activity externally, one could compare the work done by either of them without risk offering to any great extent; but very frequently this is not the case as I will presently show.

Having examined 2 colonies, which for the present purpose I will call No. 1 and No. 2, and having, moreover, ascertained that the strength of the latter was about twice that of the former, I reduced them both to the condition of a swarm. The bees, finding themselves now free to set about bringing in their harvest, under identical circumstances—for both colonies had been deprived of their brood—at the closing of each favorable day I used to take the exact weight of the honey brought in. No. 1 had stored kilos 2,140, and No. 2 kilos 2,030, that is, nearly as much as No. 1, whereas it ought to have gathered only about half that quantity.

This year Mr. Bertrand witnessed results similar to this, in the opposite direction. A colony of his had gathered kilos 37 of honey, whilst another, of about the same strength, had brought in, during the same interval, kilos 18. The question with me now is, not to find how to explain this, but rather to show that all experiments having for basis the simple comparison of actual work done by 2 colonies of the same strength cannot be relied upon.

I will now explain, therefore, what were the circumstances I placed myself in when I undertook my experiment.

1. My colonies had been allowed to work freely in the apiary, without interferences, so that nothing could be altered in the natural order of their duties.

2. My experiments were made at a season when temperature was high (maximum at least 20° Centigrade), this being the temperature which bees, in their natural state, choose for the production of wax.

3. I had also selected for my experiments a season when honey was rather scarce, so as to be sure that the colonies which were building, as well as those which were not, had sufficient room in their combs for storing all the honey they could bring in.

4. I experimented on 2 colonies in my apiary which differed in strength as well as in quantity of brood, but which, judging from external appearance, both worked with about the same amount of energy.

Now, these 2 colonies, which I will here call A to the strongest, and B to the less stronger, were both reduced to the condition of a swarm. To A, seven built frames were given, between which I inserted empty ones. This I did in order to feel that the bees were obliged, as it were, to build,

and that at the same time there was a sufficiency of built-combs to receive the incoming honey, and that, moreover, the egg-laying propensity of the queen would not be checked for want of room. To B, I gave eight ready-built frames; here the bees could not build combs for want of space.

5. I made two experiments, one after the other, and each one lasted exactly eight days. At the end of the eighth day all the combs were taken away from the hives and replaced by others, but the order was reversed; here, then, B was placed in the necessity of building combs, whereas A was prevented from doing so. This crossing system is an important one, as it permits, whilst experimenting on any two hives, of obtaining data for comparing, by simply adding, at the end of the experiment, the differences which are noted between them.

6. At the conclusion of the experiments, the honey collected by the colonies A and B (which did not make any wax) was added together; so was also the honey of the colonies A and B (which made wax). Lastly, the quantity of wax made by the 2 colonies was added together. Owing, however, to great dampness, the honey gathered during the sixteen days of the experiment contained a considerable quantity of water, consequently at the end of the time none of the cells had been sealed up. The honey, which was very thin, contained, therefore, more water than that in the sealed-up cells. In order to neutralize this misleading circumstance, I ascertained the thickness of the sealed-up honey as well as that of the thin liquid one (honey) which had just been brought home. This done, I added a sufficient quantity of water to the honey which had been sealed up by the bees, until it had been brought to the same degree of thickness of that which had not been sealed up. By these means I was enabled to arrive at the extra quantity of water contained in the honey which had just been gathered, and I deducted this quantity of water from my calculations. Finally, the difference in quantity of honey gathered by the colonies which built combs and that of those which did not build, indicated the weight of the honey consumed in the production of a given weight of wax.

7. During the sixteen days my experiments lasted, the queens did not lay a uniform number of eggs, as they were not of identical fecundity. Nor did it happen that during the same period the laying of eggs by these two queens did progress with the same disproportion; as a result of this, in the colonies which had not been building, 16,064 eggs were laid, whereas in those which had been building, the number of eggs laid was 16,634, or as near as possible the same number. This small difference of brood represents a quantity of honey consumed the weight of which must be added to that gathered by the colonies which had been building comb. But as the eggs did not open until the end of three days, and that it was only then that they began consuming honey,