TRIAL REPORT

ON THE

‘‘HAPPYKEEPER’’ BOTTOM BOARD

January 2006 to June 2007

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Preamble

The Happykeeper company, represented by Mr. LE PABIC, requested that the CFPPA of Vesoul carry out an experiment
The protocol has been proposed by the Happykeeper company.
This experiment has been partly funded by « Région Ile de France ».

Introduction

Beekeepers using the Happykeeper bottom boards say they are satisfied but their findings are not sufficient to validate the true benefit of the boards to the colonies.
Some hives have been fitted with tubes bottom boards so that we could make the comparison with hives fitted with mesh bottom boards in order to verify what the beekeepers say :

- bottom board stays permanently clean,
- considerable fall of Varroa mites,
- earlier development of the colony.

Study site

The studied hives are configured as fixed production hives, in a mixed farming and breeding area.

Equipment

The study has been carried out on 20 Dadant 10 frames hives, 10 being fitted with tubes bottom boards and 10 with mesh bottom boards whose screen surface correspond to the inner surface of the hive body.
Hives fitted with tubes bottom boards are randomly mixed with those fitted with mesh bottom boards. This constitutes a production apiary. All parts, except the bottom boards are identical on all the hives.

Tubes bottom board description

Indicated dimensions are those of the Dadant 10 frames hives which are used for the trials. The tubes bottom board consists of a 50 mm tall wooden frame whose open surface is 450 by 380 mm, the same as the inner surface of the hive body. The ten tubes are 450 mm in length, 34 mm in diameter and 3.5 mm apart , each one located underneath a brood frame, occur in this open space. The tubes are held together by three struts which slip into grooves cut along the frame sides.

Full screen bottom board description

These full screen bottom boards consist of a wooden frame 450 mm by 526 mm. A central batten 55 mm wide devides a 3 mm mesh stainless screen into 2 parts, each being 205 mm deep.

Bees colonies

Bees are black bees. Queens are sisters and naturally mated.

The last anti-Varroa treatment was performed in autumn 2005 with Apivar strips, the treatment period was 10 weeks. No anti-Varroa treatment was applied over the duration of the experiment.

Protocol

Varroa mite fall counts

Counts began one week after fitting the boards, that is to say on January 24th 2006

Varroa mite fall counts were scheduled as follows :
- once per week for 4 weeks ;

- then once per month all in the same week until April 2007

After the infestation measurement for September, 4 hives from each group were fitted with boards from the other group for one week, in order to verify that boards changes had an influence on Varroa mites falls. The 4 most infested hives on mesh boards were fitted with tubes boards from the least infested colonies. The duration of this exchange was one week, during which mite fall counts were taken. After that, the boards were fitted again on the original hives.

The landing surface of Varroa mites is 19 cm under the boards and does not interfere with ventilation, thanks to breeze blocks which support the boards frames.

It is made of a 3 mm thick plastic sheet, whose surface corresponds to the Varroa mite falls surface.

Each surface is greased with milking grease, cleaned up and greased again for each count.

Varroa mites are counted visually.

Infestation measurement

The applied method is the one described in the book « Varroa et varroatose » whose author is P. Robeaux.
This method consists of taking a few hundred bees (between 200 and 500) from several brood frames in order to get a homogeneous sample and to sink them in a jar containing 70% alcohol. The number of the hive from which the bees come is written on each jar.

To count bees and mites, the following operation is carried out three times :
- each jar is agitated in order that the mites get separated from the bees . Then the mixture (bees, mites and alcohol) is poured in a container equipped with a screen to make the count.
Varroa mites are counted each time.

The bees count is made by weighting them, on the basis of a mean weight of each individual bee.

The infestation rate is calculated by the formula :

Number of Varroa mites x 100
---------- = Infestation rate
Number of bees

Two measurements will be carried out, one in autumn 2006 and one in spring 2007.

Colonies strength evaluation

These evaluations must provide for comparison of development of different colonies according to the type of board.

The following points shall be reported during the visit :

Brood surface - according to ellipse formula : surface = π / 4 x a (length) x b (height)

- according to : a x b in case of a rectangle

- State of the brood
- Number of frames occupied by bees,
- Date of supers installation

Honey consumption during winter : by weight.
Honey production : by weight.

Results

Although the protocol was clear, several difficulties appeared :

First, it was not possible to start the study in autumn as initially intended, but in January. As a result, the selected colonies were treated in the same way as all the rest of the colonies of the CFPPA, in case the experiment did not occur. Treatment started as usual in the middle of September with Apivar strips and lasted 10 weeks to end at the beginning of December.
As a result, Varroa mite falls and infestation were low as will be indicated later.
Moreover, winter 2005/2006 was very cold and long with snowfalls occuring until April, making difficult some operations, particularly brood surface evaluation but also weighing operations to measure honey consumption during winter.
Among other setbacks, there were health problems of the experimenter in January and March, which did not permit some Varroa mite counts and infestation measurement was done only in June 2007.

In spite of all that, the results provide for some general observation as follow :

Hives behavior

At the end of the experimentation, on 20 colonies in January 2006, 14 colonies remain, equally distributed between the colonies on tubes boards and mesh boards.

Colonies 3, 16 and 17, all on mesh boards, lost their queen during the year, in July. Colonies 16 and 17, being very weak in spring, observations have been made on them without any speculation about their evolution.
The state of hive 3 lets assume, either a handling mistake by the operator which the colony had not been able to recover from or perhaps the birth of a subsequent queen after swarming, which did not succeed.

On the Happykeeper boards, colonies 39 and 41 were found dead in spring and hive 7 was queenless in September.

Because the fitting of the boards was done in the heart of winter, it was not possible at that time to visit the colonies.
It is therefore impossible to conclude a difference in the quality of wintered over hives from these data.

TABLE 1

	Hive number	YEAR 2006												YEAR 2007	
		JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	FEB	JUNE
MESH BOARDS	29														
	20														
	19														
	17				very weak			Bourdonneuse							
	16				very weak			Bourdonneuse							
	14														
	11														
	3							Bourdonneuse							
	2														
	1														New queen
HAPPYKEEPER BOARDS	39														
	40														
	41														
	50														
	56														
	58							New queen							
	37														
	35														New queen
	30														
	7									Bourdonneuse					

DEAD HIVE

Honey consumption during the season

Weather conditions did not permit weighing the hives in January, it was performed only once in April. However, after autumn feeding, colonies entered into winter with equivalent stores, which allows us to state that the results are statistically valid. They show a mean smaller weight of 5 kg for colonies on mesh boards, which indicates a stronger stock consumption than those on tubes bottom boards.
Hives 16 and 17 being very weak have not been weighted.

Table 2

	Hive number	18/04/06
MESH BOARDS	29	31
	20	22
	19	23
	17	
	16	
	14	27
	11	20
	3	25
	2	25
	1	28
	TOTAL	201,0
	AVERAGE	25,1

Table 3

	Hive number	18/04/06
HAPPYKEEPER BOARDS	39	
	40	27
	41	
	50	35
	56	30
	58	29,5
	37	33
	35	31
	30	34
	7	20
	TOTAL	239,5
	AVERAGE	29,9

Varroa mite falls follow up

This data shows more numerous mites falls on hives fitted with Happykeeper boards and an interesting evolution of the ratio between mite fall numbers on hives fitted with Happykeeper boards and hives fitted with mesh boards. This ratio allows us to better visualize the mite falls differences between the two.

Table 4

	Hive number	YEAR 2006													2007
		31/01/06	7/02/06	16/02/06	23/02/06	4/04/06	15/05/06	16/06/06	13/07/06	18/08/06	15/09/06	24/10/06	21/11/06	19/12/06	16/02/06
MESH BOARDS	29	0	0	0			0	0	0	0	7	24	1	10	0
	20	1	0	0	1	0	0	0	0	0	0	7	3	6	1
	19	0	0	0	0	0	0	0	2	0	10	5	6	6	1
	17	2	0	0	1	0		1							
	16	1	0	1	0	1	0	1							
	14	0	0	1	0		0	0	0	1	5	5	12	8	1
	11	0	0	0	1	0	0	0	2	3	8	8	1	10	2
	3	0	0	0	1	1	0	0							
	2	1	1	0	0	1	0	0	0	0	1	4	3	25	3
	1		0	0	0	1	0	1	0	0	0	8	0	1	1
	TOTAL	5	1	2	4	4	0	3	4	4	31	61	26	66	9
	AVERAGE	0,556	0,1	0,2	0,444	0,5	0	0,3	0,571	0,571	4,429	8,714	3,714	9,429	1,286
	STD. DEVIATION	0,726	0,316	0,422	0,527	0,535	0	0,483	0,976	1,134	4,117	6,921	4,152	7,525	0,951
HAPPYKEEPER BOARDS	39	2	1	0	2	1									
	40	0	0	0	0	1	0	1	0	2	30	47	27	16	13
	41	1	1	0	0	1									
	50	0	0	0		1	0	2	1	0	6	6	5	8	0
	56	0	0	0	0	1	1	0	0	0	25	22	6	11	5
	58	0	0	0	0	0	0	0		0	12	10	11	12	2
	37	0	0	1	0	0		0	0	0	12	8	10	1	5
	35	0	1	1	0	0	0	0	0	1	49	61	3	8	8
	30	0	0	1	0	0	0		0	1	48	67	12	19	13
	7	0		0	0	0	0	0	1	0					
	TOTAL	3	3	3	2	5	1	3	2	4	182	221	74	75	46
	AVERAGE	0,3	0,333	0,3	0,222	0,5	0,143	0,429	0,286	0,5	26	31,57	10,57	10,71	6,571
	STD. DEVIATION	0,675	0,5	0,483	0,667	0,527	0,378	0,787	0,488	0,787	17,43	26,22	7,976	5,88	5,062
RATIO ON TOTALS HK/Mesh		0,6	3	1,5	0,5	1,25		1	0,5	1	5,871	3,623	2,846	1,136	5,111

The bigger this ratio, the higher the falls through the tubes boards compared to the falls through the mesh boards.

As an example, in September 2006, in one week, Varroa mite falls were nearly 6 times more numerous with the Happykeeper boards than with the mesh boards. This ratio is 3.62 in October, 2.85 in November and 5.11 in February 2007.
During the observation period, this ratio is the highest in September.

It can also be seen that the number of falls on tubes boards is the highest in October and also the most random around the mean counts, which indicates significant differences between the colonies and therefore heterogeneous populations.

The same can be observed on mesh boards but values of standard deviation do not vary so much between the individual counts.

To conclude, falls are the most numerous in October, on both batches but they increase much more considerably in September on the tubes boards.

Infestation rate measurement

Infestation rate measurements had been carried out in September 2006 and June 2007. Weather conditions did not permit it in spring.

Table 5

Varroa mite infestation rates 2006-2007

HIVE NUMBER		INFESTATION RATES sep-06	June 07
MESH BOARDS	29	3,67	1,69
	20	2,67	4,82
	19	3,15	4,04
	17		
	16		
	14	2,00	5,46
	11	4,22	8,12
	3	1,06	
	2	2,84	11,62
	1	1,39	3,79

HIVE NUMBER		INFESTATION RATES sep-06	june 07
HAPPYKEEPER BOARDS	39		
	40	2,44	2,24
	41		
	50	1,26	4,97
	56	5,68	3,72
	58	10,41	5,24
	37	4,53	7,22
	35	5,21	1,51
	30	2,29	6,54
	7	1,85	

Table 6 : Mean infestation rates

	15/09/2006	22/06/2007
Happykeeper boards	4,63	4,42
Mesh boards	2,86	6,13

It can be observed that infestation rates are low, particularly in september 2006 on mesh boards which have a lower rate than the tubes boards
On the other hand, mean infestation rate increases on mesh boards to 6.13% in june 2007, while it slightly decreases on tubes boards from 4.63 % to 4.42 %, staying under 5 %.
These means do not take into account the broad range of individual values. Although the higher infestation rate is found in June on mesh boards, we can count the same number of hives with an infestation rate above 5% in each batch, that is to say three hives
Moreover, whereas the infestation rate increases on all mesh boards except one, decreasing on tubes boards is not uniform. It even increases on three hives, reaching a figure higher than 5 % (7.22 and 6.54) on two and it decreases on three others at values under 5%. Only one value remains the same in this batch.

Let us agree that under 5%, it is currently admitted that no treatment is necessary.

In order to see if there was a correlation between mite falls and infestation rates, a correlation coefficient has been calculated between infestation rates in September and falls in September and October. A good correlation, which compels us to say that the higher the infestation rate, the more falls, exists when the coefficient is higher than 0.9. Below this value, there are no reliable statistics, only tendencies.

Table 7

MESH BOARDS	HIVE NUMBER	INFESTATION RATE	16/09/06	25/10/06
	29	3,67	7	24
	20	2,67	0	7
	19	3,15	10	5
	14	2,00	5	5
	11	4,22	8	8
	2	2,84	1	4
	1	1,39	0	8
	Correlation coefficient		0,65	0,38

Table 8

HAPPYKEEPER BOARDS	HIVE NUMBER	INFESTATION RATE	16/09/06	25/10/06
	40	2,44	30	47
	50	1,26	6	6
	56	5,68	25	22
	58	10,41	12	10
	37	4,53	12	8
	35	5,21	49	61
	30	2,29	48	67
	Correlation coefficient		-0,2	-0,3

It can be seen that none of the correlation coefficients meet the defined specification. Therefore, there is no correlation between Varroa mite falls and infestation rate.

Board exchanges

Board exchanges were performed all in one week after the infestation rate measurements.
The most infested hives on mesh boards had been fitted with the tubes boards coming from the less infested hives.

That is to say, hives 2, 11, 19 and 29, had been fitted with a tubes board and hives 30, 37, 40 and 50, had been fitted with a mesh board.

Results are as follows :

Table 9

	Hive number	Mite falls number before change	Mite falls number after change
Mesh boards	29	7	45
	19	10	27
	11	8	18
	2	1	32
Tubes boards	40	30	13
	50	6	7
	37	12	5
	30	48	21

Implemantation of tubes boards on presumed infested populations surely involves mite falls higher than on mesh boards.

Colonies strength evaluation in spring :

The data shows that mean brood surface is clearly larger on tubes boards than on mesh boards at a 2/1 ratio. On the other hand, variance is much higher on tubes boards than on mesh boards, which underlines more heterogeneous populations.

This brood surface difference is still there in July, but there is no more than 5 %. The spring build up delay is then recovered.
An increase of the standard deviation on mesh boards and a decrease on Happykeeper boards can also be noticed.

Table 10

	Hive number	YEAR 2006 19/04/06	14/07/06
MESH BOARDS	29	2199	4394
	20	825	6774
	19	1885	6554
	17	706	
	16		
	14	1256	5451
	11	707	7565
	3	1335	
	2	393	4784
	1	471	5252
	TOTAL	9777	40774
	Average	1086	4077
	Std deviation	631	1159

Table 11

	Hive number	YEAR 2006 19/04/06	14/07/06
HAPPYKEEPER BOARDS	39		
	40	1414	5318
	41		
	50	2356	3845
	56	1649	4691
	58	1728	5982
	37	3141	5465
	35	3004	4990
	30	3141	5770
	7	314	6642
	TOTAL	16747	42703
	Average	2093	4270
	Std deviation	1004	852

Honey production

Three points can be found in the data :

- For the whole season, honey production is slightly higher on hives fitted with Happykeeper boards than on hives fitted with mesh boards.

- during the season, it can be noticed that hives on Happykeeper boards are more productive during honey flows in spring and during acacia flows and less on the last honey flow;

- productions standard deviations are increasing throughout the season. On the whole, it is smaller on mesh boards except on acacia. It may be explained by the fact that, during the season, swarming occurs, which leads to a lower harvest;

- spring harvest clearly shows the advantage that colonies on Happykeeper boards draw during this period, which is proportionate to the brood surfaces.

Table 12

	Hive number	YEAR 2006 SPRING	ACACIA	FOREST	TOTAL
MESH BOARDS	29	2	11	19	32
	20	0	12	18,5	30,5
	19	3	13	11	27
	17				0
	16				0
	14	5	24	26	55
	11	2	13	28	43
	3	0	8	0	8
	2	0	7	15	22
	1	2	10	7	19
	TOTAL	14,0	98,0	124,5	236,5
	AVERAGE	1,8	12,3	17,8	30,8
	SDT. DEVIATION	1,8	7,0	7,6	

Table 13

	Hive number	YEAR 2006 SPRING	ACACIA	FOREST	TOTAL
HAPPYKEEPER BOARDS	39	0,0	0,0	0,0	0,0
	40	2,0	9,0	8,0	19,0
	41	0,0	0,0	0,0	0,0
	50	3,0	16,0	6,0	25,0
	56	2,0	10,0	26,0	38,0
	58	10,0	22,0	26,0	58,0
	37	4,0	17,0	22,0	43,0
	35	6,0	20,0	12,0	38,0
	30	2,0	8,0	15,0	25,0
	7	0,0	9,0	0,0	9,0
	TOTAL	29,0	111,0	115,0	255,0
	AVERAGE	3,6	13,9	15,0	31,9
	STD. DEVIATION	3,1	5,5	8,3	

The observed difference does not allow us to conclude a major advantage on this aspect of the beekeeping season. The eventual earlier swarming should be studied further.

Boards cleanliness at the end of winter

As a consequence of the severe 2005-2006 winter, the particular sensitivity of the black bee to the mycosis has resulted in a pronounced attack. In a general way, brood was affected by mycosis in all colonies in a similar way on mesh boards as well as on tubes boards.

An accumulation of mycosis could be noticed between the tubes of the most affected colonies on tubes boards.

On the contrary, nothing equivalent was observed in 2007. Besides, tubes remain overall clean and propolis accumulation cannot be found as was the case on closed boards.
Then, we can consider that tubes boards, in normal sanitary conditions, remain clean and the black bee does not propolize them excessively. Besides, there was no propolis bridge in the bottom of the frames.

On mesh boards, there was a greater number of dead bees than on tubes boards. There is practically no propolis as on the Happykeeper boards.

Conclusion

Positive points for the HAPPYKEEPER bottom board emerge from this experiment.
A smaller consumption of provisions during wintering and a larger development of brood in spring. This results in a better harvest on the first honey flow. This advantage disappears later to finally let a mean difference of 1 kg more on the season harvest.

Varroa mite combating aspect also shows interesting points.
First, significant falls appear in autumn in a much greater proportions than what can be observed on mesh boards. Besides, after one and a half years, the mean infestation rate is slightly lower than on mesh boards.

Nevertheless, if mean values show tendencies, variability of results within like batches do not permit the drawing of final conclusions, especially because colonies had been treated in autumn 2005. Further infestation measurements should then be done in the future to confirm the observed trend.

Besides, the swarming issue was not taken into account because no prevention was conducted. Queen cell destruction being a technique used by many beekeepers, it would be interesting to observe the evolution of the infestation rate in colonies having not swarmed because it is certain that swarming changes the infestation rate.

With reference to the obtained results, it should be worth while to carry out the experiment again over a longer duration and in conditions closer to those of typical beekeeping operations (colonies production, swarming prevention, transhumance/sedentary operation, hives on pallets,...) to be able to see if using only Happykeeper boards, it is possible to stop treatments and produce as much honey as with hives treated against Varroa mites.