IMPORTANCE OF HIVE INSULATION FOR WINTERING, DEVELOPMENT AND HONEY YIELD IN NORWAY

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Introduction

The claims to a good bee hive can be divided into the following two points :

A. The hive shall give a good home to the bees as well in winter as in summer time.

B. The hive shall be cheap, simple in use and suitable for migratory beekeeping.

These claims may be difficult to combine, and today this is a real problem.

During the last 100 years the importance of hive insulation has been discussed, and this discussion carreies on today.

There are still different opinions as to the importance of hive insulation in cold climate.

1. Wintering and spring development

During the years of 1955—60 wintering and spring development of colonies in hives with different insulation were compared in Institute of Beekeeping. In these four winters the following types of hives were used :

1. Double walled, 60 mm walls, K-value = 0.75 (Scheibler)
2. Double walled, 45 mm walls, K-value = 1.15 (N. B. model)
3. Single walled, 22 mm walls, K-value = 3.00 (Sem-hive)

Last winter colonies in four single walled hives packed together in an outer casing, were taken into the experiment too.

The results are given in Table 1.

Table 1

WINTERING AND SPRING DEVELOPMENT OF MEDIUM STRONG COLONIES
AVERAGE VALUES PER COLONY IN 1953/54—1956/57

Type of hive	Decrease in weight during winter		Colony strength in frames			Area of brood in frames		
	kilo	Proportional	Sept.	April	May	Sept	April	May
Double walled, 60 mm	8.5	87	7.5	6.0	8.6	+	2.3	6
Double walled, 45 mm	9.8	100	8.2	6.3	8.4	+	1.8	6
Single walled, 22 mm	11.8	120	8.5	6.3	6.7	+	1.5	5.3

The decrease in weight during winter (approximate food consumption) was in all years greater in single walled hives than in double walled hives. On an average the difference between single walled hives and the best insulated hives was 38%. Colony strength and brood area were calculated in number of frames (combs) completely covered with bees and/or brood.

As a rule the decrease in strength (loss of bees) during winter was greater, and area of brood in spring-time was smaller in single walled hives. An exception was 1955/56 with strong colonies in spring and fine weather in April-May.

In 1957/58 we tried another method to find the difference in food consumption of colonies in hives with and without insulation. In a foreperiod several colonies, all in single walled hives with insulation cases, were controlled as to decrease of weight. The two most similar colonies were chosen for the experiment. In three trial periods, with control periods between them, an insulation case was placed alternately on one of the experimental hives. The results are given in Table 2. The differences in food consumption are not the same all periods, depending on differences in temperature.

What is really the reason for the greater food consumption in single walled hives ? Is it directly only due to greater loss of heat through the hive walls, or is

it also due to greater temperature variations inside the hive, which are stated by means of temperature registrations ? Temperature variations may cause disturbance in winter cluster, and during these experiments we have noticed that bees in single walled hives more frequently get in a temper.

In another experiment in the same year all the colonies were kept at nearly constantly — 18°C in a cold storage plant. Colonies in not insulated hives consumed 16 and 31% more food in two different periods compared with equal colonies in insulated hives.

Our answer to the question mentioned above will be that at out-door wintering about 1/3 of the increased food consumption in poor insulated hives is due to greater temperature variations. In the same experiment in a cold storage plant, there were formed 2—3 times as much rime and ice inside the walls, and there was a significant greater loss of bees in single walled hives. In another experiment at low temperature and high relative humidity, all colonies in single walled hives got dysentery, whereas none of the colonies in insulated hives did.

2. **Honey yield during summer and autumn flow**

In a two-years' investigation in a private apiary in Hedmark (East-Norway), colonies in single walled and double walled hives were compared concerning spring development and honey yield during summer and autumn (heather) flow.

The single walled hives were placed together in big outer casings in autumn and left there till the pollen flow started next spring. Then the hives were moved to an out-apiary and they were kept without insulation during spring and summer-time.

Equal groups of colonies were chosen to the investigation in the spring. About the 1st June colony strength and area of brood were controlled. Extracted honey from each colony was weighed. The results are given in Table 2.

Table 2

DEVELOPMENT AND HONEY YIELD IN MEDIUM-STRONG COLONIES
(AVERAGE VALUES PER COLONY)

Year	Type of hive	Control in May		Honey yield in kilo		
		Bees in number of combs	Brood in cm²	Summer	Autumn	Total
1965	Double walled	7.9	4890	29.8	6.9	36.7
	Single walled	6.8	4297	25.6	9.3	34.9
	Difference	1.1	593*	4.2	—2.4	1.8
	Difference in %	14	12	14	—35	5
1966	Double walled	7 2	4886	21.0	25.1	46.1
	Single walled	6.6	5044	16.8	32.5	49.3
	Difference	0.6	—158	4.2	—7.4	—3.2
	Difference in %	8	3	20	—29	—7

* Significant difference

None of the differences in honey yield were significant due to great variation.

The conclusion from this investigation still will be that the colonies in single walled hives developed slower in the spring, which resulted in smaller honey yield during summer flow. In the autumn flow, however, these colonies caught up with the others, so there was no difference in total honey yield.

In an investigation in Vest-Agder (South-Norway 1965—66) equal groups of colonies in single and double walled hives were set up at the beginning of the heather flow. No significant differences in honey yield during heather flow were found.

3. **Development of weak colonies in spring and summer-time**

This experiment is parts of a more wide-ranging investigation about development of bee colonies of different sizes through the year.

In three years (1971—73) 1/2 kg package of bees with sister queens were produced in the last part of June. In each series (two series a year) three swarms were hived in single walled hives and three other ones in good insulated hives (50 mm styropor).

Strength of bees was stated by weighing and brood area by measuring every three weeks.

In 1973 and 1974 the development of these swarms was followed further next spring, after wintering in a cellar.

Results are given in Table 3.

Table 3

DEVELOPMENT AND HONEY YIELD OF WEAK SWARMS AND WINTERED WEAK COLONIES

(I — Insulated hives, N — Not insulated hives)

Year	Insulation of hives	After start of egglaying				Honey yield in kg (Increase in weight)	
		3 weeks		6 weeks			
		Bees Kilo	Brood cm²	Bees Kilo	Brood cm²	Summer flow	Heather flow
Swarms 1971—73	I	0.33	1541	0.70	1691		3.1
	N	0.36	1232	0.67	1395		1.9
	Difference	—0.03	309*	0.03	296*		1.2
	„ in %		20		18		
Wintered in cellar 1973—74	I	0.48	1382	0.85	3009	16.5	15.8
	N	0.45	910	0.70	2076	11.0	16.3
	Difference	0.03	472*	0.15	933*	5.5	—0.5
	„ in %		34		31	33	—3

* Significant differences

As you see in the table it is a significant effect of hive insulation on the development of weak colonies. The differences are greatest in spring-time when the temperature is relatively low. But also in good summer temperatures you get a better development in insulated hives, anyway when the colonies are weak.

The difference in honey yield of wintered weak colonies correspond very well with results in Table 3 concerning medium strong colonies.

Results

1. Wintering and spring development were better in good insulated hives than in single-walled hives without insulation. Criteria used were food consumption, hive humidity, frequency of dysentery, and colony strength and brood area at different times in the season.

2. In good weather conditions no significant differences were found in development and honey yields in good colonies of equal strength.

3. Weak colonies, however, developed always better in well insulated hives.

4. Colonies equal in spring, gathered more honey in insulated hives during summer flow. During autumn flow, however, the colonies in single-walled hives gathered better (probably because the latter developed more slowly and culminated in strength later in the season).