DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

BEE DIVISION

REPORT OF THE DOMINION APIARIST

C. B. GOODERHAM, B.S.A.

FOR THE YEAR 1927

Apiary at the Experimental Station, Invermere, B.C.

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BEE DIVISION

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GENERAL NOTES

In many respects the season of 1927 was rather a peculiar one from the standpoint of the beekeeper, yet, on the whole, it proved to be a very satisfactory one. In the Maritime Provinces and parts of Quebec honey crops ranged from fair to good, while in other parts of Quebec and in Ontario good yields were obtained. The four western provinces, Manitoba, Saskatchewan, Alberta, and British Columbia, secured the largest crop of honey in their history, the increase being greatest in the three Prairie Provinces, especially in Manitoba, where the total production was estimated to be 7,386,575 pounds, as against 3,522,512 pounds in 1926.

The fall of 1926 was exceptionally favourable for the preparation of the bees for winter and they were put away into winter quarters in a very good condition. It is true that in a few localities feeding operations were carried out under adverse weather conditions but such conditions were exceptional.

Throughout Ontario and provinces east, the winter of 1926-27 was a very easy one on bee life and winter losses were comparatively light. Cold weather started at about the normal time and remained fairly steady during the latter part of November, December and January, but warm weather and bright sunshine during February and March enabled the bees to take several good cleansing flights. On the other hand, this early activity while there were no supplies to be gathered from the fields, tended to a general weakening of the colonies and a heavier consumption of stores. In the provinces west of Ontario winter conditions were the exact opposite, for the weather was very severe and heavy losses were experienced.

Throughout Canada the early spring was very promising. Warm days, with long hours of sunshine, encouraged early brood rearing and caused the first sources of nectar to open early. Unfortunately, however, as soon as these early sources of nectar began to yield the weather turned wet and cool and remained so throughout the spring and early summer. Brood rearing was retarded because of this change in weather and in many places feeding had to be resorted to in order to prevent the bees from starving to death. Furthermore, the colonies, already weak, built up very slowly and were not able to reach normal strength by the time the main sources of nectar were in bloom, and it was feared that little or no honey would be gathered. About mid-summer, however, the weather changed and nectar-secreting plants yielded readily and heavily, with the result that a heavy crop of honey was harvested.

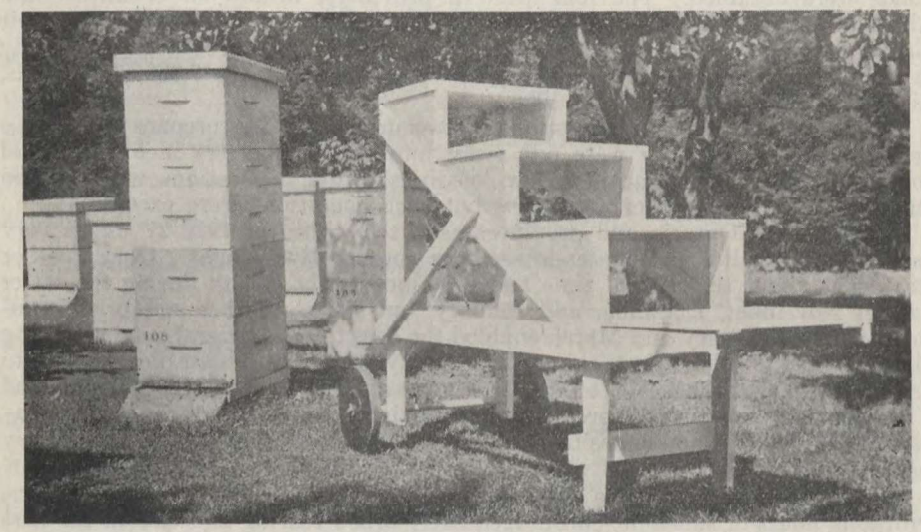
With the exception of a few localities, the fall of 1927 was, from a general standpoint, favourable for the preparation of bees for the winter of 1927-28, and they were put away in a fairly good condition and so far appear to be wintering very well.

HONEY PRODUCTION AT OTTAWA AND AT THE OUT-APIARY

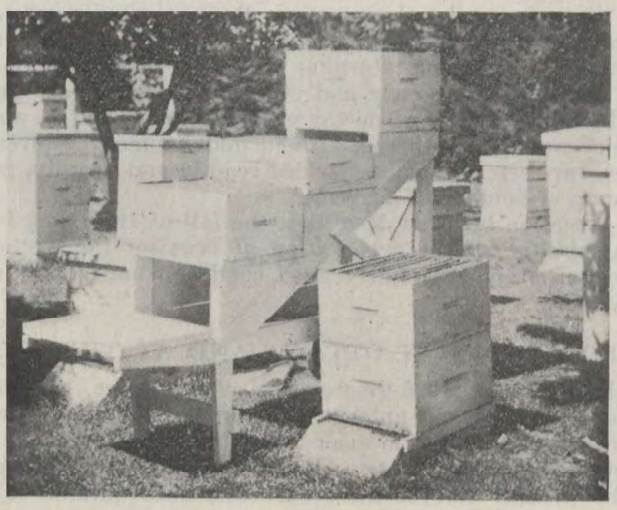
Though the winter of 1926-27 was not a severe one, the colonies in the apiary at Ottawa and the out-apiary at Britannia did not winter well. The bees came through the winter in poor condition, which fact is attributed to the poor quality of the natural stores left with them. And, though the spring came early, the weather for the most part was unfavourable to the building

up of the colonies. The first fairly good cleansing flight was on February 24 after which, throughout the month of March, the bees had frequent opportunities for flight. The first pollen was observed being brought in on April 14, which was seventeen days earlier than in the previous year. Owing to unfavourable weather during the period when the early sources of nectar were in bloom, the bees had very little opportunity of working them; then when dandelion and fruit bloom came, much the same weather prevailed.

The colonies on scales made but slight gains from the early flow, which started on May 20 and finished May 30. During this period of eleven days the total average gain was one pound five ounces. For the next eighteen days, May 31 to June 17, losses were registered with but two exceptions where slight gains were recorded. From June 18 to 30 the gains were from white Dutch and alsike clovers; then on July 1 sweet clover started and continued to yield until



A device to save heavy lifting being tested.



The device to save heavy lifting in operation.

August 14. The highest average gain from white Dutch and alsike was on June 29, when 6 pounds 13 ounces was recorded. Later, on July 9, when all three, white Dutch, alsike and sweet clover, were contributing to the yield, the highest average gain was 9 pounds 7 ounces. The highest average gain from sweet clover in the previous year came on July 13 when 4 pounds 8 ounces was harvested. From August 14 until feeding time, the colonies gradually and continuously lost weight.

Owing to many producing colonies in the Ottawa yard being drawn on for brood for experimental purposes, some heavily and others to a lesser degree, it is impossible to give a fair average for the 6,941 pounds 4 ounces produced there. At the out-apiary, however, no such handicaps occurred. The crop from eight colonies was 1,207 pounds or an average of 150 pounds 14 ounces per colony. Last year's average from this apiary was but 88 pounds 11 ounces per colony.

All colonies lost or united during the season were replaced by increase made, and the apiary at Ottawa was enlarged by two colonies.

BEES AND POLLINATION

This is the fifth year that pollination experiments have been carried on in conjunction with the Horticultural Division, to determine the value of bees as agents in cross-pollination. In 1923 and 1924 apple trees were used, in 1925 and 1926 plum trees, and this year, 1927, black currant bushes.

On April 21, the erection of the following tents was started and was finished on April 23:—

Tent No. 1, which inclosed 4 bushes and excluded all insects.

Tent No. 2, which inclosed 3 bushes, also excluded all insects.
(A mediumly strong colony of bees was placed in this tent when the bushes began to bloom.)

Tent No. 3, which inclosed 4 bushes, was constructed of wire gauze that excluded honeybees but permitted smaller insects to enter.

Tent No. 4, which inclosed 2 bushes and excluded all insects. In this tent also, a mediumly strong colony of bees was placed when the bushes began to bloom.

Besides those tented, five check bushes in the open were used. The bushes were 5 feet apart in the rows and 6 feet between rows.

Following the construction of the tents, the weather became very unfavourable to growth and the bloom developed but slowly. Not until May 13, twenty days later, was the bloom far enough advanced to start work, when the following bushes were tagged:—

Two bushes in Tents Nos. 1, 2 and 3 were tagged with 60 tags each.
The two bushes in Tent No. 4 were tagged, one with 45 tags and the other with 15.
Five check bushes in the open were tagged, two with 30 tags and three with 20 each.

Tagging consists in counting the number of blossoms in a cluster and attaching a tag bearing the number of that cluster and the number of blossoms in it.

Though the blooming period of the bushes lasted approximately 18 days, the bees remained in the tents 24 days, after which they were removed and the tents taken down.

During the blooming period, the weather was rather cool and also dull most of the time, so that the insects could not work the bloom to the fullest extent. The bushes were visited once daily for the purpose of noting the development of bloom, how it was being worked by insects and any other factors which might have a bearing on the results. A few blossoms started to open on May 16, and by June 4 they all had opened.

The following calendar shows the weather conditions, the development of bloom and the work done by the bees in tents No. 2 and No. 4:—

PROGRESS OF THE POLLINATION EXPERIMENT

Date	Weather	Tent No. 2	Tent No. 4
May 16....	Dull and threatening with occasional sunshine.	2 per cent bloom open. No bees working.	2 per cent bloom open. A few bees working.
May 17....	Dull and cool to bright and clear	8 per cent bloom open. No bees working.	4 per cent bloom open. A few bees working.
May 18....	Dull and misty with occasional rain	13 per cent bloom open. No bees working.	8 per cent bloom open. No bees working.
May 19....	Morning was cloudy, afternoon bright and clear	23 per cent bloom open. Many bees working.	15 per cent bloom open. A few bees working.
May 20....	Dull to fairly bright	37 per cent bloom open. A few bees working.	25 per cent bloom open. A few bees working.
May 21....	Bright and clear	60 per cent bloom open. Bees working well.	42 per cent bloom open. A few bees working.
May 22....	Clear sun with frequent clouds	.....	.....
May 23....	Dull to fair	80 per cent bloom open. A few bees working.	55 per cent bloom open. A few bees working.
May 24....	Bright and clear but cool	.....	.....
May 25....	Dull with heavy rain	92 per cent bloom open. A few bees working.	77 per cent bloom open. A few bees working.
May 26....	Fair to dull	.....	.....
May 27....	Cloudy with north wind; quite cold	95 per cent bloom open. No bees flying.	82 per cent bloom open. No bees flying.
May 28....	Bright and clear but cool	96 per cent bloom open. No bees flying.	87 per cent bloom open. No bees flying.
May 29....	Bright and clear all day	.....	.....
May 30....	Cloudy	98 per cent bloom open. No bees working.	92 per cent bloom open. No bees working.
May 31....	Dull with light rain	99 per cent bloom open. No bees working.	99 per cent bloom open. No bees working.
June 1....	Bright	99 per cent bloom open. A few bees working.	99 per cent bloom open. No bees working.
June 2....	Bright	100 per cent bloom open. No bees working.	100 per cent bloom open. No bees working.
June 3....	Bright and clear all day	.....	.....
June 4....	Dull with fairly heavy rain in afternoon	100 per cent bloom open. No bees flying.	100 per cent bloom open. No bees flying.

To give sufficient time for imperfect fruit to fall, the count of the set was not made until July 13. In making this count, when it was found that a few of the tags had fallen from the bushes, no attempt was made to identify the spurs from which they had fallen. They were simply omitted. The results of the experiment are:—

RESULTS OF POLLINATION EXPERIMENT

Location	Bush No.	Number of spurs tagged	Number of spurs on which tags were found	Number of blossoms counted	Number of fruit set	Percentage of fruit set
						per cent
Tent No. 1	1	60	60	374	116	31
	2	60	60	361	122	33
Tent No. 2	1	60	60	408	124	30
	2	60	60	483	194	40
Tent No. 3	1	60	60	345	120	34
	2	60	58	332	135	40
Tent No. 4	1	15	15	106	36	34
	2	45	43	258	52	20
Two check bushes	1	60 (30 tags each)	53	307	175	57
Three check bushes	.....	60 (20 tags each)	58	425	258	60

Tent No. 1 excluded all insects but permitted free circulation of wind; thus there was ample opportunity for wind pollination. In Tent No. 2, in which a colony of bees was placed, the percentage of fruit set, though good, was little better than that in Tent No. 1 where all insects were excluded. In fact, the percentages of fruit set in the bee tents Nos. 2 and 4 were the smallest, with the exception of Tent No. 1. In Tent No. 3, which excluded honey-bees but permitted insects smaller than them to enter, such as wild bees, very few insects of any kind were seen on the bushes, yet the set of the bushes in this tent exceeded that of those in the bee tents. Tent No. 4, in which a second colony of bees was placed, gave the poorest set of all the groups. The check bushes in the open, which were free to the visits of all insects, gave the highest sets. Although it would seem from the above summary that bees play little or no part in the pollination of black currants, it must be noted that the bees and other insects had little chance of working, as the weather during the blooming period was unfavourable to their work. Furthermore, the data as given above are the result of only one year's experiments with this particular variety of fruit and as such cannot be taken as conclusive. So far we have failed to show that honey-bees are necessary for the cross pollination of black currants.

QUEEN BREEDING

The work of queen rearing and mating was continued this year at Ottawa and at Kapuskasing.

Because of extremely unfavourable weather conditions, the queen rearing work at Kapuskasing was of a very limited nature during the past season. In all, only 27 queens were successfully mated and distributed.

During the season a small apiary of Carniolan bees was started at Kittigan, seven miles east of Kapuskasing. It is intended in this apiary to rear queens and to finally test this race of bees in the Maritime Provinces and in the Northern regions where bees are kept. Only two queens were reared during the past season and, unfortunately, these were lost when introducing them to full colonies.

At Ottawa, the first batch of cells grafted was on May 20 and the last on July 28, the rate of grafting in the interim being governed by the room in the mating boxes. This early start was made in order to secure early queens for experimental purposes and is not recommended to private beekeepers, as it is too costly.

During the past year, the swarm-box method of starting queen-cells was used. Prior to grafting, food was given both to the colony containing the breeding queen and to that from which the swarm-box bees were taken. And, if little nectar was coming in, the finishing colony as well received some food. Though the percentage of finished cells was high, a large number of them was lost owing to the slowness of the queens to mate, which was the retarding feature of the work. The mating-methods tried included: from the top super, from the brood chamber and from the mating-box. The latter method, so far, has been found the most satisfactory.

Of seventy-eight queens successfully mated, all were used in the Ottawa yard with the exception of four which were sent to Branch Farms. Besides, seven virgins were used in the yard temporarily and eight others went to private beekeepers.

WINTERING TWO QUEENS IN ONE HIVE

Eight hives divided in the centre by a thin partition and each containing two weak colonies, one in each compartment, were placed in winter quarters in the fall of 1926. One hive, a Jumbo, was located outside in a single case. The others, consisting of three Jumbo and four Langstroth hives, were placed in the cellar.

Six of the double colonies came through the winter without loss of either queens and two had lost one queen each. Both these losses occurred in the cellar.

This method of placing 2 weak colonies side by side in one hive instead of uniting them to form a single colony, is an excellent one, as by it both queens are saved, and a spare queen early in the spring to replace a lost or failing one may be the means of saving that colony. As an instance of the excellence of this method, five queens from the above mentioned six double colonies that came through the winter without loss, were used to save five colonies that came out of winter quarters queenless.

CARNIOLAN VERSUS ITALIAN BEES

This is the fourth year that comparative tests have been carried out at the Britannia out-apiary to determine the relative value of Carniolan and Italian bees. The colonies were wintered in two full depth Langstroth hive bodies which, in turn, were packed in four-colony winter cases and protected by a windbreak. Natural stores were provided.

At the first examination in the spring, which was on May 3, it was found that the Carniolan bees covered on an average 5·5 combs, while the Italians averaged 6·5. It was also found that one of the Italian colonies was practically dead, there being present only the queen with about one dozen bees. Assistance was immediately given to this colony by drawing upon other colonies of the same group, the Italian group, for brood. Though this resulted in it building up quickly and, later, harvesting a very good crop of honey, it retarded the building-up power of the other colonies.

Throughout the season the apiary was visited every 9 or 10 days and examinations made. Particular note at these examinations was made of the number of combs covered by bees and the number of combs of brood present. Up till July 16, the Carniolans led in bees and brood present, but on this date the Italians passed them and held the lead for the balance of the season.

Swarm preparations were made by three colonies of the Italian group and by all four colonies of the Carniolan group. Again this year the Carniolans showed themselves to be more persistent in their preparation to swarm than did the Italians.

Despite the heavy handicap that the Italian group was under, its crop far surpassed that of the Carniolans, as the following table will show:—

COMPARISON OF HONEY CROP FROM CARNIOLAN AND ITALIAN BEES

Race of bees	Number of colonies in group	1924		1925		1926		1927	
		Total crop	Average crop	Total crop	Average crop	Total crop	Average crop	Total crop	Average crop
		lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.
Italians.....	4	765 4	191 5	900 0	225 0	417 0	104 4	727 8	181 14
Carniolans.....	4	348 0	87 0	825 4	206 5	292 8	73 2	479 8	119 14

EGG-LAYING CAPACITY OF QUEENS

Further work was done this year to determine the average number of eggs that a normal queen will lay daily. At the commencement of the season four colonies were chosen, of which two were headed by 1925 queens and two by 1926 queens. The two colonies headed by 1925 stock had proved themselves good

gatherers the previous season; but those of 1926 were practically unknown except that they were fairly strong. In the 1925 group, colonies Nos. 257 and 276 were in 10-frame Langstroth hives, the former having a shallow food chamber above and the latter a deep one. In the 1926 group, colonies Nos. 208 and 283 were also in Langstroth hives, No. 208 being in a single hive body, and No. 283 having a shallow food chamber above.

The brood counts were made every ten or twelve days from May 17 to September 20, after which date it became too cool to make further counts owing to the danger of chilling the brood. On October 4, however, a hurried examination of the 1926 group showed that brood was still present.

The method of taking the counts is as follows: After jarring the bees from a comb, a frame containing a sheet of glass is placed over it. The area of the brood is then traced on the glass from which it is later transferred to tissue paper. During the winter months, these areas are measured by a planimeter which gives the number of square inches present. All vacant patches are also outlined and their areas are deducted. Once the area in square inches is known, the number of occupied cells is computed and the average number of eggs laid daily is found.

DAILY AVERAGE EGG PRODUCTION OVER 21-DAY PERIOD

Colony number and age of queen	1924														
				June 11		June 20	July 2	July 14	July 23	Aug. 2					
No. 111 (1 year old queen)				*2,049*		1,992	1,900	1,604	1,282	1,170					
			June 2			June 24	July 2	July 15	July 24		Aug. 11				
No. 104 (2 year old queen)			1,264			1,318	1,520	1,644	*1,831*		1,662				

	1925														
	May 15	May 26	June 2	June 9	June 16	June 23	July 2	July 14	July 25	Aug. 7					
No. 239 (1 year old queen)	1,448	1,829	2,000	1,916	2,006	2,024	*2,234*	1,968	1,473						
No. 232 (2 year old queen)	1,147	1,346	1,409	1,504	1,587	1,759	1,904	*1,918*	1,724	1,530					
No. 211 (2 year old queen)	1,178	1,367	1,367	*1,438*	1,436	1,223									
No. 263 (1 year old queen)	996	1,161	1,252	1,311	1,383	1,510	1,783	*1,884*	1,718	1,669					

	1926														
	May 12	May 26	June 5		June 15	June 25	July 5	July 15	Juyl 25	Ayg. 5	Aug. 16	Aug. 26	Sept. 7		
No. 295 (1 year old queen)	721	1, 611	1,833		1,790	1,442	1,796	*2,167*	1,947	1,695	1,709	1,655	1,038		
No. 275 (2 year old queen)	1,098	2,037	*2,405*		2,362	1,972	2,174	2,211	2,017	1,727	1,993	1,926	1,394		

	1927														
	May 17	May 30		June 9		June 21	July 5	July 18	July 28		Aug. 10	Aug. 22	Sept. 2	Sept. 20	Oct. 4
No. 208 (1 year old queen)	1,145	1,192		951		937	1,320	1,646	*1,771*		1,502	1,234	903	93	51 (approx)
No. 283 (1 year old queen)	1,577	1,477		1,350		1,538	*1,924*	1,625	1,735		1,458	1,114	1,020	682	123 (approx)
No. 276 (2 year old queen)	742	976		824		916	1,332	*1,510*	1,388		1,482	1,301			
No. 257 (2 year old queen)	1,361	1,559		1,166		1,300	1,806	*1,809*	1,583		1,469	1,382			

In the preceding table, each figure given represents the daily average number of eggs laid for the 21 days just before the accompanying date. The italicized figures represent maximum averages.

During the season of 1924, the one-year-old queen of colony No. 111 laid the greatest number of eggs in a 21-day period. Her highest daily average of 2,049 eggs is for that period preceding July 11, which was just 7 days before the main flow started. In the same season it will be noticed that the two-year-old queen of colony No. 104 did not reach her maximum average of 1,831 eggs until just before July 23. This latter colony, therefore, did not have as strong a field force of bees for the flow as the former one, which fact is borne out by the smaller crop it produced.

In 1925 the highest daily averages for colonies Nos. 239, 232 and 263 were 2,234, 1918 and 1884, respectively, which were made just prior to July 2 and 14. These averages were made in the early part of the main flow which came somewhat later than in 1924. It is readily seen that these maximums came too late in the season for best results. Though the maximum of colony No. 211 is the lowest one of the four due to the queen falling off prior to her being superseded, it comes at a time when its influence is felt in the crop produced.

In 1926 the 2-year-old queen made a higher daily average than did the 1-year-old one. Just before June 5, the 2-year-old queen in colony No. 275 made her highest average of 2.405 eggs daily, after which there was a depression in her egg laying for twenty days, followed by a rise until on July 15 she made her second peak of 2,211 eggs daily. The one-year-old queen in colony No. 295 did not reach her maximum of 2,167 until July 15, the same time as the second peak of the colony No. 275 queen. It will be noticed that the peak of the two-year-old queen, before June 5, is desirable, whereas that before July 15 was entirely too late to be of use. It must also be noted, however, that colony No. 295 was unsatisfactory as to brood count, as it made repeated attempts to swarm.

In 1927, the peak of all four colonies brood counted came late, that is, between the end of June and the middle of July. This may be accounted for by the fact that the colonies did not winter well and the spring and early summer were unfavourable, hence, they were late in building up. The maximum of 1924 eggs for colony No. 283 was made prior to July 5, that of Nos. 257 and 276 just before July 18 and that of No. 208 at the end of July.

From the foregoing table it will be seen that the highest daily average over the four years was made by the queen of colony No. 275 in the season of 1926, when she laid an average of 2,405 eggs a day for the twenty-one days preceding June 5. In 1924, 1925 and 1927 the highest averages were 2,049, 1,968 and 1,924, respectively.

PACKAGE BEES AS A MEANS OF STRENGTHENING WEAK COLONIES IN THE SPRING

The experiment to determine whether package bees from the south added early in the spring to weak colonies will aid them in building up and increase the crop of honey produced, was continued this year.

Of the five weak colonies chosen for this experiment, two were wintered outside and three inside. The inside wintered colonies were removed from the cellar to their summer stands on April 16. Owing to unfavourable weather conditions, after their removal, it was impossible to examine them until April 28. On May 2, as ordered, the two-pound packages with queens accompanying arrived from a well-known southern dealer. All were in very good condition. Upon their arrival, the bees were fed with a thin syrup of sugar and water which was painted on the screening of the cages; they were then placed in the cellar until they had quieted down, after which they were united to weak colonies.

The method of uniting was to remove four empty combs from the hive and to slide the remaining ones to one side. Then, after removing the cap of the shipping cage, a few bees were shaken into the hive and the cage was placed in the space formerly occupied by empty combs which had been removed.

The package bees then gradually left the shipping cage for the combs of the hive and united with the bees of the colony without any fighting. The addition of two pounds of bees to each weak colony increased its strength by approximately 10,000 bees. Besides the five weak colonies strengthened by package bees, five other colonies of equal strength were set aside as checks.

Following the arrival of the packages, the weather during May and part of June was dull and unfavourable to the building up of the colonies.

The results of the experiment are summarized in the following table:—

STRENGTHENED VS. UNSTRENGTHENED COLONIES

Strengthened colonies						Unstrengthened colonies (checks)						Only packages	
Colony No.	Number of combs covered by bees on April 28	Weight of bees added	Number of combs covered by bees on June 21	Number of combs containing brood on June 21	Crop	Colony No.	Number of combs covered by bees on April 28	Weight of bees added	Number of combs covered by bees on June 21	Number of combs containing brood on June 21	Crop	Colony No.	Crop
		lb.			lb. oz.						lb. oz.		lb. oz.
104	3	2	7	5	52 0	129	3	0	4	4	44 12	224	22 0
125	1	2	4	4	36 8	119	2	0	2	2	24 8	235	38 0
229	4	2	6	4	51 8	268	2	0	3½	2½	21 8	240	5 0
241	2	2	3	3	16 0	212	2	0	6½	6½	124 8	278	14 0
277	1½	2	2	2	.....	247	2½	0	3	2	22 8	295	41 0
												296	.....
												A	.....
Total for group..	11½	10	22	18	156 0	Total for group	11½	0	19	17	237 12	Total for group	120 0
Average	.....	.....	.....	.....	31 3	.....	.....	.....	.....	.....	47 8	.....	17 2

It will be seen in the above table that on April 28, four days before the package bees were united to the weak colonies, both groups of colonies were very weak and that the total number of combs covered by both was exactly the same. At the commencement of the flow, on June 21, the group which was assisted by the addition of 2-pound packages led in the number of combs covered by bees and those containing brood by a very slim margin of 2 and 1 combs, respectively. It would seem, therefore, that when the weather is unfavourable for flight, package bees are not of much assistance to weak colonies.

In comparing the crops harvested, it will be seen that a third group of 7 packages, which arrived at the same time, May 2, is also considered. The average crop produced by the "strengthened group" was 31 pounds 3 ounces, that of the "unstrengthened" 47 pounds 8 ounces and of the 7 packages, 17 pounds 2 ounces. In the first and last mentioned groups, there were 1 and 2 colonies, respectively, which produced nothing.

It is thought that considerable drifting took place from No. 241 of the "strengthened group" to colony No. 212 of the "unstrengthened group", hence the large crop produced by this particular colony.

HIVES

The comparison of different sized hives was continued this year. With this object in view, groups of colonies in different makes of hives were observed in regard to their rapidity in building up, swarming tendencies, crop production and wintering. The hives used were the 10-frame Langstroth, the 10-frame

Jumbo and the 11-frame Dadant. All colonies were wintered in single brood chambers, but in the spring, when those in the Langstroth hives needed room for brood rearing, shallow supers were added. No extra room was given to the colonies in either the Jumbo or Dadant hives, which are considered large enough for the brood of a good queen.

As in previous years, the hives of all the groups were placed in four-colony cases of similar construction, and were packed with 3 inches of planer shavings underneath, 4 inches about the sides and 6 inches on top. On September 17, after the hives were placed in the winter cases and packed underneath and about the sides, the colonies were fed. On September 27 the top packing was added. Further protection was given by a good windbreak which surrounded the apiary on all four sides. Not until May 30 were the colonies removed from the winter cases, without any loss. Though these colonies had sugar stores, it was found in the spring that they were none too strong. The mild winter and much early flying might account for this.

At the first thorough examination on May 10, the average number of combs covered by bees was for Langstroth 6·8, Jumbo 6·5 and Dadant 6·0. Owing to unfavourable weather conditions during the spring and early summer, the colonies were slow in building up. This applies as well to all other colonies in the apiary.

All colonies were examined once every ten days throughout the season to note how they were building up and whether there were any tendencies to swarm, also to provide extra room where necessary for storing of nectar.

During the early part of the flow the Jumbo colonies were leading in the amount of bees and brood present, the Langstroth's being second and the Dadant's third. Towards the end of the flow, the order was Langstroth, Jumbo and Dadant.

The only swarm that issued was from the Dadant group, the cause of which was attributed to lack of room for the storing of nectar.

For comparison, the results of this experiment for the past three years are tabulated below:—

COMPARISON OF HIVES—1925

Group	Number of colonies in group	How wintered	Combs covered at first examination	Number of colonies swarmed	Average crop per colony		Combs covered at last examination
					lb.	oz.	
Langstroth	8	Outside	8·0	0	138	0	9·0
Jumbo	8	"	6·9	0	130	4	9·2
Dadant	8	"	6·6	1	106	11	9·7
1926							
Langstroth	8	Outside	7·2	0	49	3	9·4
Jumbo	8	"	5·4	0	39	4	9·2
Dadant	8	"	6·2	0	42	8	9·9
1927							
Langstroth	8	Outside	6·8	0	99	5	8·6
Jumbo	8	"	6·5	0	127	6	8·2
Dadant	8	"	6·0	1	71	15	8·5

NOTE.—As some of the colonies in large hives did not yield any surplus, the results of only 5 colonies in each group are given in the table for 1926.

Owing to unfavourable weather conditions in both 1926 and 1927, the colonies did not build up in time for the main flow; therefore, the average yields are lower than those of 1925.

In 1925 and 1926 it will be noticed that the Langstroth group produced the highest average crop per colony; this year, however, the Jumbo group leads by a substantial margin.

EXPERIMENT TO DETERMINE FIELD FORCE OF COLONY

This is the third year in which experiments were conducted to determine the approximate field force of a normal colony of bees. As in previous years, the method employed was to separate the field force from the other bees of the colony by changing the location of the parent or original colony and then, from weights taken, to calculate the number of flying bees.

The three tests made during the season were, early in the flow, near the middle, and towards the end.

On the day preceding that of the test, preparations were made in the evening by forming a nucleus with the queen of the colony undergoing the test, two frames of brood and eight empty combs. After placing on the normal colony a bee-escape so arranged as to prevent the upward passage of bees, the nucleus was set on top. Early the following morning, before any bees were flying, that part of the original colony below the nucleus was moved to a new location, where it was immediately weighed, and after the nucleus had been placed on the old location to catch the returning field bees, supers were added to make the hive resemble the original one.

Provided the weather during the day was bright and warm. and nectar was coming in, it was thought that the entire field force of bees would leave the original colony on its new location and return to the nucleus on the old one. Should, however, the weather prove unfavourable, it meant starting the test anew.

The first weight of the original colony was taken, as mentioned above, *before* the field bees left, by a special scale reading to quarter ounces, and then on the following morning, about 7 o'clock, it was again taken *after* the field bees had left. As there are about 5,000 bees in a pound, the approximate field force can be readily figured from the difference.

The first test, which was made early in the flow, gave a difference of 4 pounds, 7 ounces. This, when multiplied by 5,000 gave approximately 22,187 field bees. Though this figure may seem low, it must be remembered that the colonies did not winter well and that unfavourable weather prevented their building up readily. At the second test, near the middle of the flow, the difference was 6 pounds 13 ounces, which reduced gave 34,062 fielders. Toward the end of the flow, the difference in the third test was 7 pounds 13 ounces, or 39,062 bees.

In the following table will be found for comparison the figures for the past three years:—

FIELD FORCE

1925		1926		1927	
July 9	32,500	July 20	33,125	July 15	22,187
July 27	32,500	July 27	35,312	July 26	34,062
				Aug. 6	39,062

It must be borne in mind that the above figures were obtained from weights, and are, therefore, only approximate, and that it was impossible to determine what slight loss might be incurred through evaporation or the consumption of stores.

DISEASE

During the past year, 1927, a greater number of samples of dead brood were received for analysis than for any one of the six preceding years. In all, there were 92 samples received, of which 48 were infected with American foulbrood, 27 with European foulbrood and 17 in which no sign of disease could be found, the brood likely dying of chilling or starving.

In the following table, for the sake of comparison, are shown the number of cases received during the past seven years:—

DISEASE

Disease	1921	1922	1923	1924	1925	1926	1927
American foulbrood	.....	8	25	24	8	22	48
European foulbrood	.....	7	16	6	9	28	27
Sac brood	.....	1	.....	3	.....	.....	.....
No disease	.....	10	9	5	2	11	17
	20	26	50	38	19	61	92

NOTE.—All samples of brood are examined free of charge.

WINTERING

At Ottawa, one hundred and six colonies were prepared for the winter of 1926-27. Of this number, eighty-two remained outside in various kinds of winter cases and twenty-four were placed in the cellar. All colonies were weighed on September 16, after which feeding was commenced on September 21 and finished about September 26. The weather being favourable, during the time of feeding, the syrup was taken down and stored away speedily. All colonies received sufficient stores to carry them through the winter and early spring until nectar was coming in.

WINTERING OUTSIDE IN 1926-27

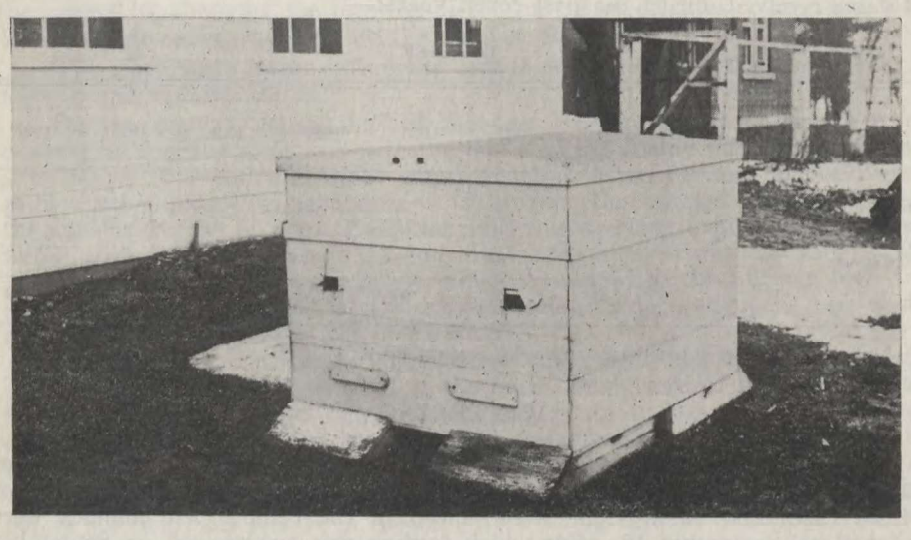
The winter cases used were the 4-colony case, the 2-colony case and the single case. Of the eighty-two colonies wintered outside, sixty were in 4-colony cases, twelve in 2-colony cases and ten in single cases. The latter group contained Kootenay, Krause and Ottawa cases; also Chrysler and Ottawa double-walled hives.

The packing used in all the cases was planer shavings, of which 3 inches was placed under the hives, 4 inches about their sides and 6 inches to 8 inches on top.

Both honey and sugar syrup were given as winter stores. Thirty-eight colonies wintered on honey while 44 were given sugar syrup. Of those wintered on honey, thirty received shallow food chambers and eight received deep ones.

With the exception of a few low temperatures in mid-winter, the weather throughout the winter was not severe. Between November 8 and February 24 the bees had no opportunity for a good flight, but on the latter date, however, they were flying well.

On April 28, when a preliminary examination was made, it was found that the colonies had not wintered well, and that those wintered on honey were in worse shape than those of the sugar-syrup group. This bears out the results of previous winters which indicate that honey alone cannot always be depended upon as a safe food for bees during the winter, especially where the winters are long and cold. Eight of the colonies wintered outside died, of which six received honey and two sugar syrup. It is thought that the bees, in the latter group, may have consumed the sugar stores and come onto the honey below which last season was not of good quality and that this was the cause of their death. On May 10, at the first examination, the number of frames covered by bees averaged 6·5 in this yard.



Quadruple wintering case with upper entrances, Ottawa.

At the Britannia out-apiary, 4-colony cases were used. The hives were packed in the same way as those at Ottawa and they were further protected by a board windbreak from the north winds. The four Italian and four Carniolan colonies located there all came through the winter alive, though one of the Italian group was so weakened that it needed assistance. Natural stores were given in deep food chambers. At the first examination, on May 3, there was an average of 6·8 frames covered by bees.

WINTERING IN CELLAR 1926-27

On November 10, twenty-four colonies well supplied with sugar stores were placed in the cellar. During the period of slightly over twenty-two weeks that the bees were confined there, they remained very quiet. The temperature throughout the winter was kept at approximately 45° F.

No dysentery was present in any of the colonies, but starvation caused the loss of one. On April 16, when the outside wintered bees were bringing in nectar and pollen, the cellar-wintered colonies were carried out and placed on their summer stands. On May 10, at the first examination, these colonies covered on an average 5·3 frames.

WINTERING 1927-28

One hundred and eighteen colonies in good condition and well supplied with stores, were put away for the winter of 1927-28. Outside, 98 colonies remained in 4, 2 and 1 colony cases and double-walled hives.

In one of the 4-colony cases the colonies are provided with an entrance at the top of the hives instead of at the bottom. The flight holes in the case are directly in front of the upper entrances.

Inside, 20 colonies were placed in the cellar.

HONEY INSPECTION

The growth of beekeeping as a commercial enterprise has led to the need for developing an export trade in Canadian honey. Because honey is so varied in colour, aroma, flavour and consistency, it is necessary that it be graded or classified before being placed on the market. To this end, since as yet there are no government standards, the Ontario Honey Producers Co-Operative, Limited, have set definite standards that their members are expected to follow when putting up their product for the market.

On account of the large number of producers shipping honey through the Co-Operative from a variety of districts, it was found necessary to inaugurate an inspection service to check up on the grading as done by the producers. The reports received dealing with this inspection fully demonstrated the need for checking up the producers' grading. It was found necessary to reclassify some of this honey while other honey, owing to its quality, had suffered spoilage. Any incorrectly graded honey or any spoilt honey allowed to reach the market would have a derogatory influence on the Canadian honey trade. Though the system of inspection is not yet fully perfected, there are indications from the outside markets that the service is proving beneficial to the industry.

The inspection covered 902,490 pounds of light honey, 590,740 pounds of light amber honey, 285,100 pounds of dark amber honey, and 414,350 pounds of dark honey, making a total of 2,192,680 pounds of honey inspected during the year commencing December 11, 1926, and ending December 31, 1927.

This inspection is conducted in the warehouses used by the Co-operative to accumulate their shipments. These warehouses are selected as being convenient to the parts from which shipments are to be made. They are at St. John, N.B., Montreal, P.Q., and Toronto, Ont. Various other warehouses are in use for accumulation of stock and when any considerable quantity of honey is to be moved from such warehouses an inspection is also made in them.

The inspection consists of opening a suitable quantity of each man's shipment. If the grade name on the outside of the case does not accurately represent the honey contained, then the grade name is changed to correspond to the honey. This would entail opening every crate in the shipment. A report shows the condition of the honey, the tin and the crate, also the suitability and correctness of the marking on the package. This report is made out in duplicate, one copy being retained at Ottawa and the other sent to the shipper.

HONEY GRADING

Owing to the large volume of trading done in honey and since its value varies according to its grade, it has been deemed necessary to attempt the establishment of definite grades for Canadian honey.

With the above end in view, about two hundred samples of honey were collected from representative areas throughout the Dominion.

The conclusions drawn from a careful examination of these samples were:—

(1) That owing to the great variety of nectar-secreting flora, there is a great variety in the colour, flavour and aroma of the honey produced throughout Canada. Widely differing honeys were obtained even from one area.
(2) The body or density of the honey, though not accurately tested, seemed to be very satisfactory in most cases, no area being conspicuous in this respect. Such differences as were observed are probably due to season and the methods of the producer in preparing the honey for the market.
(3) The granulation varied from very fine to very coarse. The area in which the honey was produced was not the factor influencing this feature.
(4) Because some of the honey was of such a distinctive colour and flavour, it is necessary, in establishing a system of grades, to have a classification that will not allow any confusion between the mild, light-coloured and the stronger, darker-coloured honeys.

A classification must have such a wide range that no honeys produced in marketable quantities will be excluded. The colour range must be from water-white to a very dark brown if all honeys are to be included. Having definitely established the fact that almost all conceivable colours are obtained in Canadian honey it was necessary to determine how many classes would be required, between what limits of colour the different classes would be established, and what would be the most suitable names to adopt for such classes.

Very little authentic information could be obtained through correspondence concerning colour-class recommendations for Canadian honey on the export markets. Without being definitely certain of the manner of handling honey going to the consumer, it is thought that very little of the lighter coloured honey does so unblended. But the proportion of the colours used in blending and what colours are best adapted for blending cannot easily be ascertained without intimate investigations. The fact that honey is often blended before going to the consumer would relieve, to some extent at least, the necessity of fixing the grades according to the consumers' wants, but will rather bring about the establishment of grades that blend effectively and economically. Hence, it was decided to endeavour to arrive at colour classes for honey by making a study of the honeys shipped by other countries to the agents performing the blending operations.

A number of samples of honeys imported by Great Britain were obtained through the Canadian Agricultural Products representative in London.

In order to make intelligent comparisons of the colours of various honeys, a standard had to be adopted. The most convenient and accurate-known standard that could be obtained was an extracted honey grader recently developed by the United States Department of Agriculture. This grader, to avoid confusion, was used exclusively in making comparisons in the colours of honeys.

The samples examined and compared were:—

Chilian—first, second and third grades.

San Domingo—one sample only.

Siberian—Extra fine line. First-grade line. Flower, Buckwheat.

Australian—" Golden Wattle " brand, Grade AA, Grade A, Grade B, Yellow Box, Sugar Gum.

New Zealand—Water White Special, White Special, White Prime, Light Amber Special, Light Amber Prime, Light Amber good, Medium Amber prime, Medium Amber good, Dark Prime, Dark good, " Imperial Bee " brand.

Ontario Honey Producers Co-operative, Ltd.—Water White, Light White, Light Golden, Light Amber, Dark Amber, Dark.

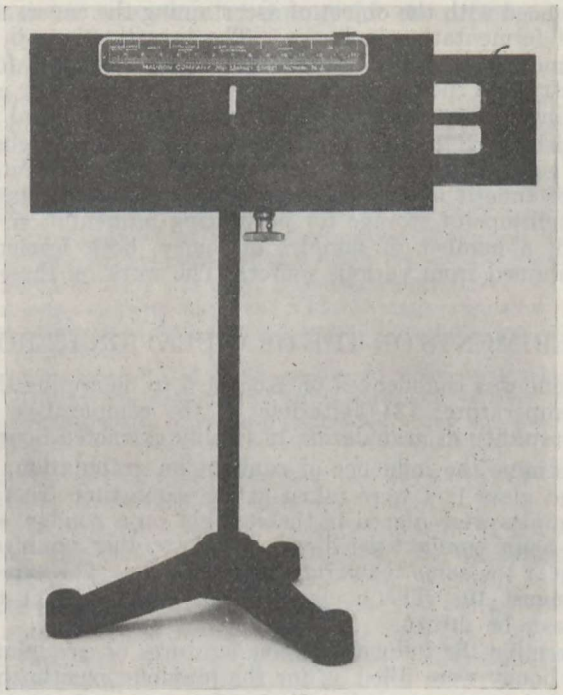
The United States' grades are: Water White, Extra White, White, Extra Light Amber, Light Amber, Amber, Dark.

Since the New Zealand, Ontario Honey Producers Limited and the United States are the only complete sets of grades represented, they are the most valuable for use in a study in establishing grades. A comparison of these three scales reveals the fact that much of the Ontario Honey Producers Co-operative,

Limited's light golden grade might be included in the white grade; and that the light amber of the same scale might be extended to take in some of the honey that it now classifies as dark amber.

The above grading was all done on a liquid honey basis. It is possible, however, that honey may have to be graded by granulated standards since this is the form in which most of the Canadian honey is shipped to the markets. Before grades can be definitely fixed, two points must be settled. The first is. should honey be graded on a liquid or granulated basis?

Identical liquid honeys granulating under different conditions may present such a difference in colour as to vary the grade when examined in the granulated condition. Thus, if honey be graded on a liquid basis when it is to be supplied



The Pfund honey grader.

to the market in a granulated form, it might seem to be improperly graded. Or, conversely, if it be graded on a granulated standard and is processed before reaching the market, it might seem that some of the grading was irregular.

The second point to decide definitely is: What are the most universally understood names for the grades of colour and what are the actual colour limits for these names?

The work on these points is still in process of completion. As soon as they are decided it will be possible to establish definite colour classes for Canadian honey.

Besides being classified according to colour, honey will be graded according to its merits. Flavour, type of granulation, cleanliness and density all have an influence on the value of honey. For this purpose a tentative form to be used when grading honey has been draughted. This form is comparable to that used in the grading of other live stock products. It completely covers the condition

of the honey. The honey will be rated by the use of a system of points, deductions being made for undesirable characteristics, when noted, in any honey being graded. It is suggested that a definite number of points be allowed for each grade, such as: Special grade, not less than 95 points as a total, with 40 points for flavour, etc.

Honey will be classified first as to its colour, and secondly as to its quality, irrespective of its colour, and this will be recognized as its grade. For example, Water White honey of the first quality may be graded as Water White Special.

EXPERIMENTS ON FERMENTATION IN HONEY

During the year, experiments in co-operation with the Division of Bacteriology were commenced with the object of ascertaining the causes and the methods of the control of fermentation in honey. The investigations in this connection are planned to include a study of the organisms responsible for fermentation, their mode of entry and the means to be taken to prevent their action. Furthermore. the work includes a study of the microbiology of normal honey, with the object of establishing, if possible, a suitable test which might be applied to honey before it goes into storage to determine whether fermentation will ensue and the length of time it may be safely stored before fermentation commences, also the best conditions of storage for preventing fermentation.

To this end, a number of samples of honey, both fermented and unfermented, were obtained from various sources. The work on these samples is still in progress

EXPERIMENTS ON THE GRANULATION IN HONEY

An experiment was commenced on August 5 to determine the effects of (1) sunlight; (2) temperature; (3) agitation, on the comparative size of crystals formed and the rapidity of granulation in freshly extracted honey.

(1) To determine the influence of sunlight on granulation, four samples of honey in 1-pound glass jars were taken at the same time from the same tank. Two of these samples were placed in the sunlight on a window sill. They averaged about four hours sunlight per diem. The two other samples were placed in the dark at as near the same temperature as possible. The experiment was discontinued on August 19. The honey was not granulated at this time, hence no conclusions can be drawn.

(2) To determine the influence of temperatures on granulating honey, four 1-pound jars of honey were filled as for the previous experiment.

It was decided to compare the effects of a cool and constant temperature with a warmer and more variable temperature. The reason for this choice was that both the above mentioned conditions are perhaps the most common under normal conditions of honey production.

The samples were both kept in the dark. The only difference in the two samples' condition and treatment was the temperature, hence any differences in the size of crystals formed and the rapidity of granulation would be due to temperature.

(3) To determine the effect of agitation on the granulation of a sample of freshly extracted honey: Two 1-pound jars of honey were filled. Both were kept in the light on a table. One jar had a wooden rod reaching to the bottom through a hole in the lid. Regularly, twice every day the honey was vigorously agitated by means of the rod. The other jar was untouched. No satisfactory comparisons were made between the agitated jar and the jar at rest.

Because the writer was called away to inspect honey for export shipment, no definite conclusions were reached on the above experiments. They will be continued at the next favourable opportunity.

A further experiment was commenced on October 5 to supplement the previous experiment on the rapidity of granulation and the comparative size of crystals formed in freshly extracted honey. This experiment was conducted along slightly different lines from the preceding. The two influences with which it was decided to experiment were (1) as in the previous experiment, the effect of certain temperatures; (2) the effect of the addition of about 5 per cent of finely granulated honey; also the effect of the addition of about 5 per cent of coarsely granulated honey.

Honey from the last extraction of the season was used in this experiment. Eight ounce jars were all filled from the same tank at the same time. The jars were covered by screw caps. The temperatures to which the jars were subjected were recorded daily from maximum and minimum thermometers. The appearance of each jar was recorded throughout the period required for granulating.

The conditions to which the various jars were subjected were as follows:—

Jar No. C.1.—Subjected to a rather low and fairly constant temperature.

Jar No. C.1/a.—Subjected to a rather low and fairly constant temperature for nine days. At that time it was semi-solid and opaque. It was then subjected to warm and varying temperatures.

Jar No. C.2.—One dessertspoonful of finely granulated honey was added when the jar was being filled. This jar was subjected to a rather low and fairly constant temperature.

Jar No. C.3.—One dessertspoonful of coarsely granulated honey was added when the jar was being filled. This jar was subjected to a rather low and fairly constant temperature.

Jar No. R.1.—Subjected to fairly warm and variable temperatures.

Jar No. R.1/a.—Subjected to fairly warm and variable temperatures for nine days. At that time it was becoming somewhat cloudy. It was then subjected to a rather low and fairly constant temperature.

Jar No. R.2.—One dessertspoonful of finely granulated honey was added at the time of filling the jar. This jar was subjected to fairly warm and variable temperatures.

Jar No. R.3.—One dessertspoonful of coarsely granulated honey was added when the jar was being filled. This jar was subjected to rather warm and variable temperatures.

This experiment was concluded on October 25, when all the samples under observation appeared to have completely granulated.

It is difficult to determine accurately at what point a jar of honey is completely granulated. Especially as those subjected to cool temperatures seem to granulate more completely than those remaining in warm temperatures, however long the latter may be left. If a certain stage in the granulation be reached and no change noted, then it may be assumed that the honey was completely granulated when this stage first became apparent. Such recourse was employed in making the comparisons in this experiment.

Definite conclusions cannot be drawn from a single set of results. It is only safe to summarize the results as demonstrated by the data obtained from this experiment.

SUMMARY

(1) The comparative size of crystals formed:—

The three samples (C1, C2, C3) maintained in the cool temperature throughout the entire period occupied in granulating presented a very smooth, fine granulation.

The sample that was moved from the cool to the warm (C.1/a) and the sample that was moved from the warm to the cool condition (R.1/a) together with the sample that completed its granulation under the warm condition (R.1) presented a slightly coarser type of granulation than the preceding three. Although the crystals were fine, they were distinct, whereas, in the case of the preceding samples, there was very little indication of definite crystals.

The two samples (R.2 and R.3) that granulated under warm conditions and to which had been added 5 per cent of finely granulated honey and 5 per

cent of coarsely granulated honey, respectively, were both more coarsely granulated than any of the preceding samples. Furthermore, little or no difference was noticed between the samples.

(2) The rapidity of granulation:—

In the case of the samples kept at a cool temperature, those to which 5 per cent of granulated honey had been added (C2, C3) commenced to granulate three days before that left untouched (C1) and completed granulation one day before it.

Of the two samples whose conditions were changed after a nine-day period, the one started in the cool temperature (C1/a) commenced to granulate one day before that started in the warmer (R1/a). Though the former completed its granulating in the warmer temperatures, it did so one day before that moved to the cooler temperature.

Of the three samples maintained in the warm temperature, those to which 5 per cent of honey had been (R2, R3) commenced to granulate five days before that which was untouched (R1), though granulation was complete in all three on the same day.

OBSERVATIONS

Those samples that granulated under cool conditions did so more rapidly and produced a finer granulation than did those which granulated under warm conditions.

EDUCATION

During the year, press articles dealing with different phases of beekeeping were sent out from time to time. "Apiary Reminders," which are seasonal instructions to beekeepers, were also sent out at intervals during the summer months; in all, 22,897 copies of the Reminders were distributed, as compared with 15,645 in 1926. Addresses were given at the Annual Conventions of the Ontario and Quebec Beekeepers' Associations besides various other beekeepers' meetings. A number of talks were also broadcasted from radio stations.

The apiaries at the various Branch Farms were also visited during the summer and beekeepers' field days were held at some of the Farms during these visits. Several private apiaries were also visited and instructions given.

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