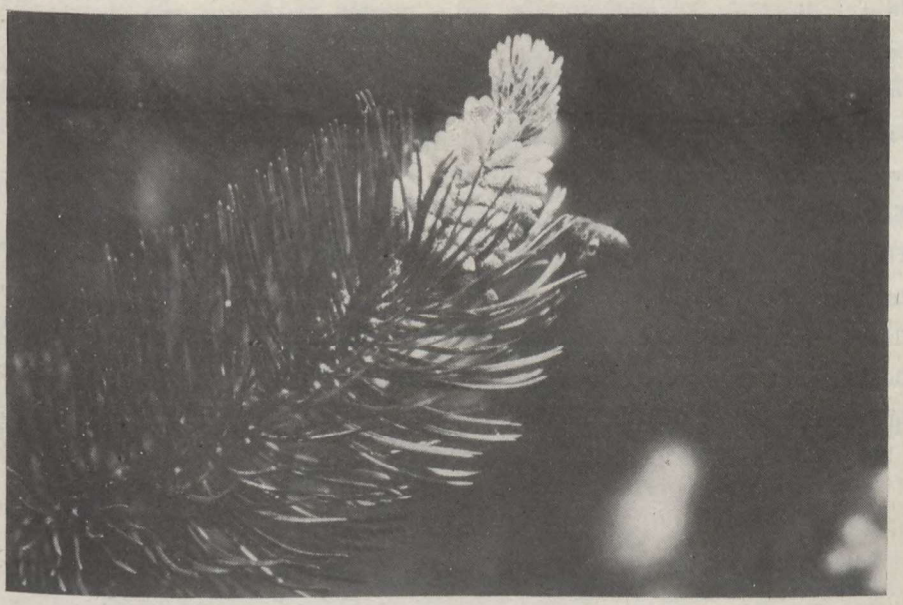
DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

BEE DIVISION

REPORT OF THE DOMINION APIARIST

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

FOR THE YEAR 1928



Gathering her load of pollen from Scotch pine. These trees yield an abundance of pollen in some seasons.

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TABLE OF CONTENTS

BEE DIVISION

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GENERAL NOTES

The season of 1928 was not a favourable one for honey production over the greater part of Canada, for although bees, on the whole, wintered very well and built up to good strength during the spring and early summer, unfavourable weather conditions during the time in which the main honey crop is usually gathered not only reduced yields, but in many localities affected the quality of the honey produced. While it is true that in many localities the crops were well up to average, in the majority of places it was below normal, and in a few places no surplus crop was harvested at all. In the Maritime Provinces fair crops were gathered and the total yields of these provinces is about equal to those of the previous year. In Quebec, Ontario, and British Columbia the crops were very patchy, ranging from good average crops in some localities to practically nothing in others. In Manitoba and Saskatchewan good crops were promised during the summer, but early frosts during the month of August cut the sweet clover flow off entirely. In Alberta conditions were good, and real good crops were obtained. As a matter of fact, Alberta is the only province that shows an increase over the previous year's production.

Throughout Ontario and the East the winter of 1927-28 was exceptionally easy on bee life, and winter losses were very light. In the Prairie Provinces the early part of the winter was very severe, but the latter part and early spring were fair. Winter losses were on the whole light in Manitoba and Saskatchewan, but rather heavy in Alberta. British Columbia as usual suffered very little.

With the exception of the St. Lawrence River valley the clovers, which are the chief source of honey in the East, were badly winter killed. Lack of snow, which acts as protection to these plants during the winter, is given as the cause. In the St. Lawrence River valley there was an abundance of snow throughout the winter and well on towards spring and the clovers wintered well, with the result that this district produced an excellent crop of alsike and white clover honey.

The spring weather was rather treacherous with fine weather during April, which induced considerable activity amongst the bees, but later, when the early sources of nectar began to bloom the weather turned wet and cool, so that the bees were unable to take advantage of the early flowers. Considerable spring feeding was necessary to keep the colonies from starving and to encourage brood rearing.

The cool weather continued throughout the spring and early summer in Eastern Canada, thus retarding the honey flow, with the results that the white honey crop was greatly reduced. In the West summer conditions were ideal for nectar secretion and the ingathering of the same, but frosts during the month of August shattered the hopes for another bumper crop in Manitoba and Saskatchewan. In the greater part of British Columbia weather conditions during the honey flow were fair to good, but in the Fraser River valley dull weather during the clover bloom, followed by extremely hot, dry weather, prevented a surplus from being gathered.

The fall of 1928 was favourable for the feeding and preparation of the bees for the winter of 1928-29.

The total honey crop of Canada for 1928 is estimated to be approximately twenty million pounds.

HONEY PRODUCTION AT OTTAWA AND AT THE OUT-APIARY

Despite the unsettled nature of the winter of 1927-28 the bees of the apiary at Ottawa and those of the out-apiary at Britannia wintered well.

The weather from late fall to early spring was not all that could be desired for good wintering. November, a dull month, had but one day, the fourteenth, on which the bees had a good flight. December was fair with but little snow and moderate temperatures. January and February were variable, both having mild spells accompanied by rain and severe spells when temperatures went well below zero. March brought sunny days on which the bees had frequent opportunities for flight, but April was one of the coldest Aprils in many years.

The good wintering, therefore, is attributed to the quality of the stores given which were sugar syrup, and to good packing backed up by adequate protection from the cold winds.

Although the colonies wintered well, they built up slowly, owing to the weather during the entire spring building up period being unfavourable for flight, thus the bees lacked the stimulating sources of nectar and pollen. April and May were exceptionally cool months and June, one of the wettest Junes on record, had less than the normal amount of sunshine.

The bees had their first good cleansing flight on March 12, after which there were frequent opportunities for flight. An April 30, sixteen days later than last year, the first pollen of the season, which was from willow, was observed being brought in.

During the blooming period of dandelion, plum and apple, losses instead of gains were made by the colonies on scales, though undoubtedly the bees gathered a certain amount from these sources, as when the weather permitted, they were observed to be working fairly well. This plainly demonstrates the fact that the early sources of nectar are not always sufficient for the maintenance of the colonies and is an outstanding case which shows the advisability of providing the bees with sufficient stores for not only the winter but also the spring as well.

On June 25, the main flow started and lasted until August 27, a period of sixty-four days. Though the flow was longer than normal, the crop produced was far below the average, owing to the daily gains during the entire season being but small.

The following table shows the length of flow from the different sources, the number of days on which gains and losses were made, and the average gains and losses:—

Flows	Sources	Gains on	Average daily gain		Losses on	Average daily loss	
			lb.	oz.		lb.	oz.
From June 25 to July 21.....	Alsike and Dutch clovers...	22 days	2	9	5 days	0	15
From July 22 to July 31.....	Alsike, Dutch and sweet clover	8 days	1	13	2 days	0	12
From August 1 to Aug. 27...	Sweet clovers.....	18 days	1	2	9 days	1	4

Considering the season as a whole, there were forty-eight days on which an average daily gain of 1 pound 14 ounces was made and sixteen days on which 1 pound 1 ounce was lost.

On July 13 the highest daily gain of 5 pounds 10 ounces was made.

The total crop produced at Ottawa and the small outyard at Britannia amounted this year to but 5,017 pounds 8 ounces. This amount is about 3,000 pounds less than that produced last year from approximately the same number of colonies.

As some of the colonies contributed but small amounts to the above crop, owing to the nature of the experimental projects for which they were used, a fair average cannot be struck for the entire apiary. The average, however, of a group of twenty-four colonies, run on a commercial basis, was 50 pounds 6 ounces. Though it might be thought that the main sources of nector surrounding the Ottawa apiary are abundant, it must be remembered that the most important of these, the clovers, are often cut about the time that they begin to yield the most. At the Britannia apiary, however, the bees were not so handicapped; there the crop from eight colonies was 699 pounds 8 ounces or an average of 87 pounds 7 ounces. Compared with the crop harvested last year of 1,207 pounds, it will be seen that there, too, there was a heavy reduction.

As a result of the various manipulations during the season, the number of colonies in the Ottawa yard was increased to 120, but since this number was thought to be too large for the location, 11 were united to others, and now there is one less in the yard than there was at this time last fall.

BEES AND POLLINATION

As last year, so this year, experiments were carried on by the Bee Division in conjunction with the Horticultural Division to determine the value of honey-bees as cross-pollinators of black currants. Although last year's work seemed to indicate that bees were not necessary for the cross-pollination of black currants, it was decided to repeat the experiments again this year, in order to secure further data on this subject.

From this experiment, information was secured not only regarding the value of honey-bees as pollinators, but also regarding the part that wind and other insects smaller than honey-bees play in the cross-pollination of black currants.

On May 4, the erection of the tents was started, but in order that the bushes might benefit by the direct sunlight as long as possible, nothing more than the framework of the tents was constructed at that time. Owing to the weather being quite cool, thus retarding all growth, it was not necessary to cover the framework with cotton until May 15.

The layout of the work this year was as follows: Tent No. 1, otherwise known as "The Wire Gauze Tent," enclosed two bushes; it was constructed of wire gauze of such a mesh that honey-bees were excluded but smaller insects could pass through. Tent No. 2, or "The Bee Tent" also enclosed two bushes; it was constructed entirely of cotton which excluded all insects. In this tent a mediumly strong colony of bees was placed when the bushes began to bloom. Tent No. 3, enclosed two bushes; it was entirely of cotton and excluded all insects. Tents No. 4 and 5 enclosed but one bush each and excluded all insects.

As a check on the tented bushes, two bushes outside the tents were used.

Two varieties of currants were used, namely, the Kerry and the Magnus. With the exception of tents No. 4 and 5, which covered a single bush of each variety all tents enclosed two bushes each. The bushes were standing in rows 6 feet apart and running north and south and were the last two rows on the extreme east side of the plantation, the Magnus variety being in the outside row. The check bushes were on the south end of the row, and going north were followed by tents No. 1, 2, 3, 4 and 5 respectively as will be seen by the sketch on page 6.

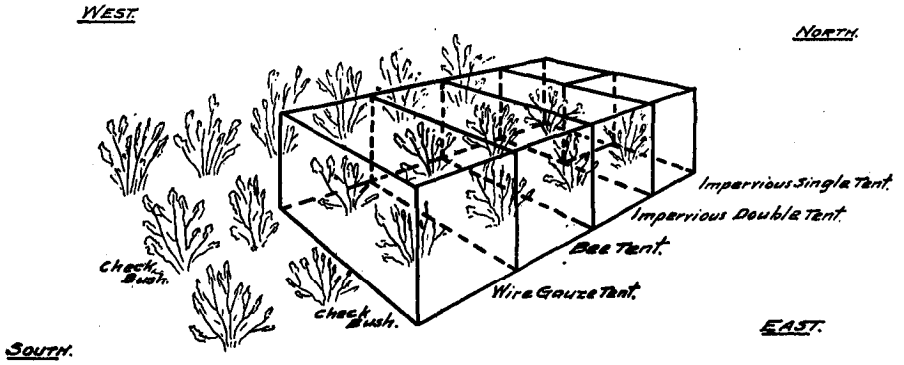
For five days following the construction of the tents work was held up by bad weather and not until May 21 was it possible to tag the bushes.

The tagging procedure was similar to that of last year; it consisted in counting the number of blossoms in a cluster and attaching a tag bearing both the number of the cluster and the number of blossoms on it. Sixty tags were placed on each of the ten bushes used in the experiment.

On May 21 a mediumly strong colony of bees was placed in tent No. 2, known as the "Bee Tent", and remained there until June 11, when it was removed and the tents demolished.

While the experiment was underway the weather was not at all good. Dull weather predominated, there being eleven out of fifteen days on which there was practically no sunshine.

In the following calendar will be seen the weather conditions during the experiment, the development of the bloom, and the work done by both honey bees and other insects.



— LOCATION OF BUSHES —
IN
— POLLENATION EXPERIMENT —

Sketch of tents showing layout of the work.

BEE CALENDAR, 1928

Date	Weather	Tent No. 1—Wire gauze tent. (Insects smaller than honey bees)	Tent No. 2—Bee tent (Honey-bees).
May 21.....	Bright most of day though very humid.	.....	Bees placed in tent.
" 22.....	Dull with rain .....61°F.	3 per cent bloom open. No insects present.	6 per cent bloom open. A few bees working.
" 23.....	Dull to fair.....50°F.	12 per cent bloom open. No insects present.	20 per cent bloom open. No bees working.
" 24.....	Dull with light rain....55°F.		
" 25.....	Dull with heavy rain.....		
" 26.....	Dull to fair.....57°F.	72 per cent bloom open. No insects present.	77 per cent bloom open. No bees working.
" 27.....	Bright for short time, then dull .....68°F.		
" 28.....	Bright nearly all day..64°F.	90 per cent bloom open. No insects present.	87 per cent bloom open. A few bees working.
" 29.....	Dull with short bright period.....53°F.	94 per cent bloom open. A few insects present.	92 per cent bloom open. A very few bees working.
— 30.....	Dull to bright, then hazy... 60°F.	97 per cent bloom open. A few insects present.	96 per cent bloom open. A few bees flying but none working.
" 31.....	Fair to dull.....62°F.	99 per cent bloom open. A few insects present.	99 per cent bloom open. No bees working.
June 1.....	Dull and threatening rain... 64°F.	100 per cent bloom open. No insects present.	100 per cent bloom open. No bees working.
" 2.....	Dull .....60°F.	100 per cent bloom open. A few insects present.	100 per cent bloom open. No bees flying.
" 3.....	Bright nearly all day...67°F.		
" 4.....	Bright.		
" 5.....	Fair to dull.....68°F.	100 per cent bloom open. No insects present.	100 per cent bloom open. No bees flying.

Fair means neither bright nor dull.

Commencing May 22 and continuing on until June 5, daily visits were made to the tents and notes taken regarding the development of the bloom, the work of the honey-bees and other insects, and the presence of any factor which might have an influence on the result of the experiment.

After sufficient time had elapsed for the imperfect fruit to drop, the count for set was made on June 15, at which time all the fruit in the tagged clusters was counted.

The procedure when any tag was missing was to cancel it, and also the bud count made for that tag number.

The figures of the experiment are found in the following table:—

RESULTS OF POLLINATION EXPERIMENT FOR 1928

Location	Bushes Number	Spurs tagged	Blossoms counted	Tags found	Fruits set	Per cent of fruit set	Per cent of fruit set for group
Tent No. 1	1	60	360	60	175	48·6	.....
(Wire gauze tent)	2	60	423	60	81	19·1	32·7
Tent No. 2	1	60	372	58	160	43·0	.....
(Bee tent)	2	60	447	59	92	20·5	30·7
Tent No. 3	1	60	395	59	138	34·9	.....
(Large impervious tent)	2	60	428	59	29	6·7	20·3
Tent No. 4, (Small impervious tent)	1	60	417	60	89	21·3	.....
Tent No. 5, (Small impervious tent)	1	60	395	60	62	15·6	18·6
Checks	1	60	403	59	315	78·1	.....
(Bush in open)	2	60	366	59	304	83·0	80·5

The accompanying table compares the averages of the different groups for the years 1927 and 1928:—

—	1927	1928
Check bushes outside the tents	59·1	80·5
Tent No. 1 permitted the entrance of insects smaller than honey-bees	37·6	32·7
Tent No. 2 contained honey-bees, but excluded all other insects	35·6	30·7
Tent No. 3 permitted wind circulation but excluded all insects	32·2	20·3

The above comparisons show that the results for both years are entirely consistent—what came first the first year, came first the second year, and so on down the scale. The check bushes in the open, which were free to the visits of all insects, came first in both years. These bushes being untented were not subjected to any abnormal conditions in relation to sunshine and air drainage, as were those in the tents, and these conditions may have affected the setting of the fruit. Moreover, they were open to the visits of all kinds of pollinating insects, whereas insect visitors were limited in the tents, and it was noted that insects were more numerous on the check bushes and were also working the bloom at times when no insects were found working in the tents. The insects visiting the check bushes had free range over the whole plantation and having access to a greater variety of foreign pollen, may have affected a more complete cross pollinization of the flowers, and thus caused a greater set of fruit. Furthermore, being untented, these bushes were also exposed to any pollen that

may have been carried by the wind. As the yield from these bushes was over 100 per cent greater than the yield of any of the other groups, we would suspect one or more of the factors mentioned above to be at least partially responsible for the heavier set obtained. It will also be noted that the yields of the two check bushes were about equal, which was not the case in any of the other groups. The fact that the yield of the west bush of the checks was high, and whereas the yield of the west bush in all other groups, which, by the way, were protected by the walls of the tents, was low, would lead one to suspect that wind pollination took place to some extent. The prevailing winds at Ottawa are from the west and northwest, and these would tend to carry the pollen from the west to east bushes. To the west of the checks there was a large number of other bushes, and thus the checks would be equally exposed to wind-borne pollen, while those in the tents were not so exposed.

In the wire gauze tent, which permitted the visits of insects smaller than honey bees, the second greatest set of fruit was obtained, but this was less than 50 per cent of the set on the check bushes and but little more than in the bee tent. Two bushes of different varieties were standing side by side, and as some insects had access to these bushes, a certain amount of cross-pollination by them would be expected. The bushes in this tent were nearer to normal outside conditions than those in tents No. 2 and 3, because one side, the south, was covered only by a wire mesh screening, therefore sunlight could penetrate more readily and wind circulate more freely in it than in the other tents. It will be noted that bush No. 1, or the east bush, gave a set of 48·6 per cent, as against 19·1 per cent for bush No. 2, or the west bush. As this phenomenon held true in all three tents, and as the prevailing winds are from the west, this would indicate that the wind passing through the tents carried the pollen from the west bush to the east bush and thus caused a greater degree of cross-fertilization on the east bushes. It might be argued that a difference in time of blooming might also be partly responsible, but the two bushes bloomed at exactly the same time. As the insects visited the two bushes indiscriminately, and as the set on bush No. 2 was so much lower than on bush No. 1, it would appear that some factor other than insects was at work. The yield on bush No. 2, however, was greater than on bush No. 2 in tent No. 3, or the bushes in tents 4 and 5, which indicates that the insects were responsible for a certain amount of set through cross pollination.

Practically the same may be said of the results obtained in bee tent No. 2. The difference in set of fruit in the two tents is negligible, but the set in both tents was over 10 per cent greater than in No. 3, in which no insects worked. It must be remembered, however, that the honey bees were working under abnormal conditions, while the insects in No. 3 were working normally.

In tent No. 3, it will be observed that the set of fruit was slightly over 10 per cent lower than in either tent in which insects worked, which would indicate that the insects may have been responsible for part of the set obtained in these tents. Here again it will be noticed that by far the largest set occurred on the east bush (No. 2), which would again support the idea that wind blowing through the tents performed a certain amount of cross pollinization.

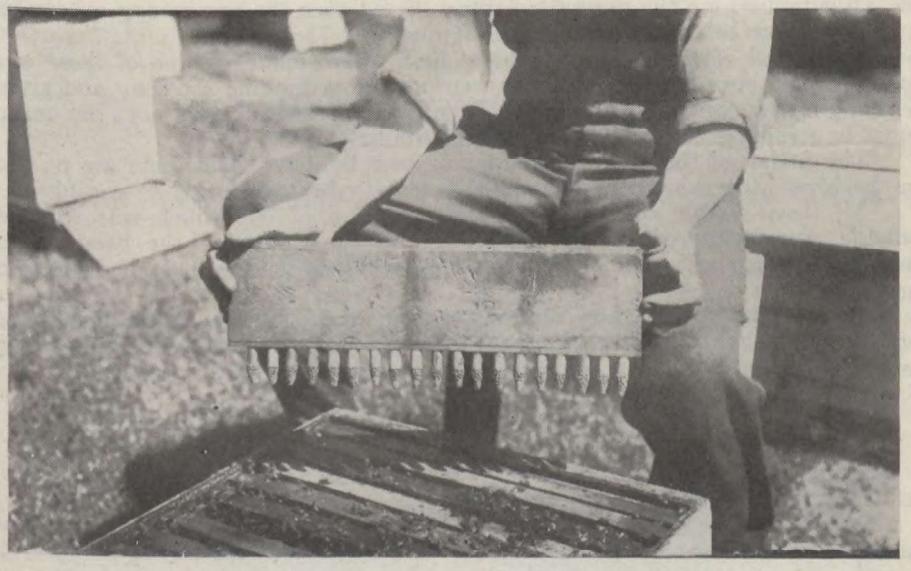
The results obtained in tents 4 and 5, in each of which a single bush was enclosed—Magnus in one and Kerry in the other—are interesting. As the two bushes were separated, there could be no interchange of pollen, either by insects or by wind, yet there was a set of 21·3 per cent in No. 4, and 15·6 per cent in No. 5, which is almost equal to that in No. 3, where an interchange of pollen could take place. This would indicate that the varieties of black currants used in this experiment were largely self-fertile and the figures obtained would also indicate that this self-fertility is sufficient for one-quarter to one-third normal crop. It will also be noted that the set of the two bushes was more nearly equal than that obtained in the tents where an interchange of pollen could take place.

QUEEN BREEDING

The work of queen breeding was continued at Ottawa with good results. It was started this year on June 18, in order to have mated queens on hand by the first week in July to requeen colonies treated for swarming. Following the first batch of cells grafted on the above date, successive batches were grafted until August 13. The frequency of grafting, during this period was governed by the speed of mating. As soon as a mated queen was removed from the mating-box and a sufficient period of queenlessness had elapsed, a ripe cell or virgin queen was given to the bees.

The kinds of mating-boxes in use were those having single, double, or triple compartments under one roof. Beside these mating-boxes, normal colonies were used from the top super of which queens were also mated.

The queenless and broodless colony method of starting cells was used throughout the season. This method consists in feeding the colony for two or three days prior to giving the cells. On the day on which the cells are given,



A batch of finished queen-cells.

the queen is found and set aside after which all the bees are shaken from the brood combs in front or into the hive on the old location. The hive, which is equipped with two frames of pollen and honey, and eight drawn combs, is then closed and the bees allowed to remain quiet for two or three hours to realize their queenless and broodless condition. The queen and brood are then placed in another hive where they remain while the cells are being started.

The cells, when well started by this method are given to a normal colony to finish; that is, they are placed into the top super of a normal colony into which emerging brood has previously been raised.

During the season, 192 cells were started by the above method and 149 or 77 per cent were finished. Of those finished, 113 were placed into mating-boxes, 16 into top supers above normal colonies, and 20 into nursery cages.

The matings from mating-boxes were 73 or 64 per cent and those from above normal colonies 13 or 81 per cent. A few of the excess virgin queens in

the nurseries went to private beekeepers. Of the mated queens, all with a few exceptions were used to requeen colonies in the home yard at Ottawa and the outyard at Britannia.

TWO QUEEN SYSTEM

The ultimate object of the "Two Queen System" is to have spare queens to replace winter losses, in the early spring, when it is practically impossible to secure them.

With this object in view, the housing of two queens in one hive was again experimented with at Ottawa during the winter of 1927-28. In former experimental work two weak colonies were brought together in one hive; the same result, however, was obtained, by starting two strong, two frame nuclei in the same hive. The time to start these nuclei is towards the end of the flow when colonies are being requeened. At this time strong colonies can be drawn on for the necessary brood and the old queens which have been removed from colonies requeened and which otherwise would be destroyed can be used. Later on, after requeening the normal colonies, should there be any young queens left over they may be used to requeen these nuclei.

In the fall of 1927 eleven double colonies were made. Seven of these were made in the above manner and four were made by dividing a colony and giving a young laying queen to each half. If the latter method is used, both the queens must be strangers to the hive or loss will result.

The fitting of the division board may best be done when there are no bees in the hive, after which the frames of bees may be transferred to the hive.

All these double colonies, with the exception of one which was wintered outside, were wintered in the cellar, and all came through the twenty-three weeks of confinement alive, though one was found, at the first examination, to be queenless.

Two of the queens thus wintered were used to replace winter losses and, but for the fact that spare package queens replaced five other losses, there would have been a total of seven colonies saved by the "Two Queen Systems".

CARNIOLAN VERSUS ITALIAN BEES

During the year 1927-28, tests were continued at the Britannia out-apiary to determine the relative value of Carniolan and Italian bees.

As all colonies had been transferred to special double-walled hives earlier in the season, comparatively little work was necessary in the fall to prepare the bees for the winter. On September 29 a deep super of natural stores was given to each colony and the final packing put in place, after which a slatted board windbreak was set up and nothing further was seen of the bees until spring.

All colonies came through the winter strong. At the first examination, on May 9, it was found that the Italian bees covered on an average $10\frac{3}{4}$ frames and the Carniolans $9\frac{1}{4}$ frames.

Shortly after this examination the Carniolan group was seriously handicapped through one of the colonies losing its queen and developing laying workers, which occurrence resulted in the colony producing next to no crop.

Besides comparing these two races of bees, it was decided to test out the following system of management at this yard. This is a swarm control measure which, in brief, consists (1) in giving a second brood chamber of dark combs when the first one is fully occupied, (2) in putting the queen below at the first of the flow, and (3) in separating the queen and brood by raising the latter, ten days later. Since all the colonies were already in two brood chambers, they had sufficient room until June 5 when a third super was given. On July 4 all queens were put down and on July 13 nine days later, they were separated from the brood.

In so far as the Italian group is concerned, this method of control seemed to work, though one colony did throw a swarm, owing to a virgin queen having emerged in a super of raised brood. In the Carniolan group, however, queen cells were found in one colony before the test started, while in another they were found before the queen was put down. It would seem, therefore, that this system will need revision to suit the Carniolans which have again shown greater swarming propensities than the Italians.

The following table shows the crops produced for the past five years:—

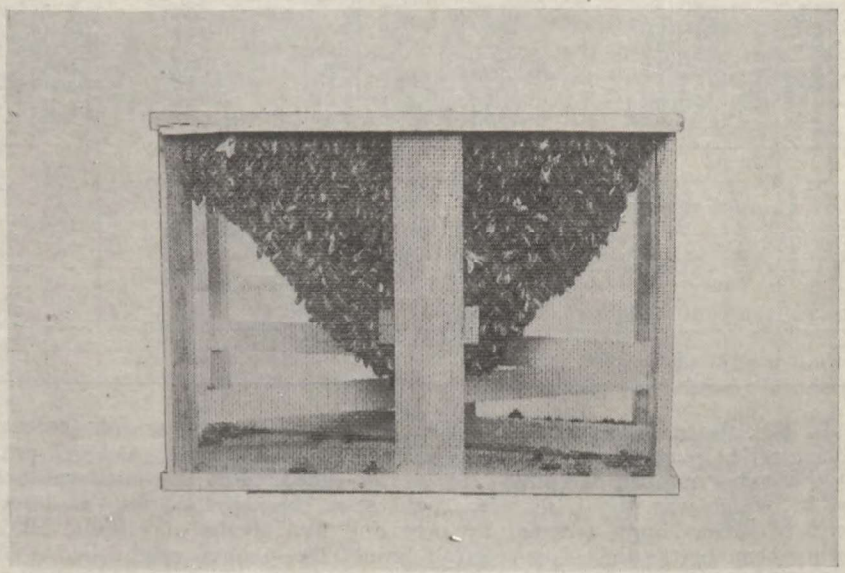
COMPARISON OF HONEY CROPS FROM CARNIOLAN AND ITALIAN BEES

Races of bees	Number of colonies	1924		1925		1926		1927		1928	
		Total crop	Average crop	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.	lb. oz.	lb. oz.
Italians	4	765 4	191 5	900 0	225 0	417 0	104 4	727 8	181 14	465 8	116 6
Carniolans	4	348 0	87 0	825 4	206 5	292 8	73 2	479 8	119 14	234 0	58 8

The crop produced by the Carniolan group in 1928 is not a fair comparison, since this group, as before mentioned, was handicapped.

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

The experiment of adding two-pound packages to weak colonies was continued this year with the object of learning to what extent such treatment will increase the productivity of weak colonies over other colonies not so treated, and whether such treatment is profitable.



A two-pound package of bees as received in good condition.

The experiment started on May 1 when the weak colonies were removed from the cellar where they were wintered.

At the first examination on May 5, the average number of combs covered by bees was $2\frac{3}{5}$. On May 9, four days later, twelve two-pound packages with queens were received in good condition from a southern dealer.

Incidentally, it may be mentioned that according to instructions half the queens were shipped without attendant bees in the cages and the other half with them. No marked difference between the two batches has, so far, been noted.

As is the custom, the bees, upon their arrival, were immediately fed with thin sugar syrup which was painted on the wire screening of the cages. They were then placed in the cellar and left there until they had quieted down, after which they were removed to the apiary and united to the weak colonies.

The method of uniting was similar to that practised last year, namely, six frames on which the bees of the weak colony were clustered were moved to one side of the hive to leave space for the shipping cage.

After removing the feeder can and queen the cage was inverted and placed in the space left for it, care being taken to block it up slightly, that the bees might get out and unite with those of the hive. This they did without fighting. As it is usually estimated that in a two-pound package there are about 10,000 bees or the equivalent of two full combs, the strength of the weak colonies was practically doubled.

Of the twelve two-pound packages received, five were used in this experiment to strengthen weak colonies. As a check on these "assisted" colonies, a similar number of weak "unassisted" ones were used. In addition, the results of five straight packages were also noted for comparison.

In the following table will be seen the result of these groups:—

Assisted Colonies						Unassisted Colonies						Straight Packages					
Colony No.	Number of combs covered by bees on May 5	Weight of bees added	Number of combs covered by bees on June 28	Number of combs of brood on June 28	Crop	Colony No.	Number of combs covered by bees on May 5	Weight of bees added	Number of combs covered by bees on June 28	Number of combs of brood on June 28	Crop	Colony No.	Number of combs covered by bees on May 5	Weight of bees added	Number of combs covered by bees on June 28	Number of combs of brood on June 28	Crop
		lb.			lb. oz.						lb. oz.						lb. oz.
211	3	2	6	5	52 0	228	2	0	6	5	42 0	103	.....	0	5	5	.....
214	3	2	8¼	7	68 0	246	3½	0	7	5	25 0	294	.....	0	6	5	17 0
217	2	2	8¾	7	47 8	254	2	0	7	6	30 8	255	.....	0	6	5	6 0
221	3	2	7	6	32 8	287	3	0	6	6	15 0	279	.....	0	4	3	4 0
228	2	2	8	7	45 8	299	3	0	5	5	6 0	270	.....	0	6	5	25 8
Total for group	13	10	38	32	245 8		13½	0	31	27	118 8		.....	0	27	23	52 8
Average	.....	.....	.....	.....	49 1	.....	.....	.....	.....	.....	23 11	.....	.....	.....	.....	.....	10 8

In the above table it will be seen that early in the season, before the addition of the package bees, the assisted and unassisted groups covered practically the same number of combs. After the addition of the package bees on June 28, which was about the first of the flow, the assisted group had secured a lead of seven combs covered by bees and five combs of brood. Had the weather been better the assisted group would likely have established a bigger lead, which is very necessary to make the addition of package bees to weak colonies worth while.

Comparing the crops of the assisted and unassisted groups, we find that they are consistent; that is the assisted group strength was practically doubled by the addition of the two-pound packages and the crop produced by that group was slightly more than double what the unassisted group gave.

The difference between the crop of the assisted and unassisted colonies determines whether the addition of package bees is profitable.

This year the difference, 25 pounds 6 ounces, was so small that adding two-pound packages was not profitable, for say 25 pounds of honey at 15 cents would be but $3.75 from which $3, the approximate cost of a two-pound package, would leave but 75 cents profit or the price of a five-pound pail of honey. The above figures do not include cost of transportation or of feeding in the spring.

It will also be noticed in the above table that the straight packages did not harvest enough honey to pay for their original cost.

In considering the above results, one must constantly bear in mind that the season in this locality was a very poor one.

HIVES

For the past four years a comparison of different sized hives has been made with the object of ascertaining to what extent, if any, the size of the hive affects the colony. Since this experiment started in 1925, the same twenty-four colonies divided into three groups of eight each have been under observation. The hives used during that time were the 10-frame Langstroth, the 10-frame Jumbo and 11-frame Dadant.

These groups were run on a commercial basis, and special note was made of the wintering, the building up in the spring, of swarming tendencies, and crop production.

During the past year all colonies were wintered in single brood chambers. These, as in previous years, were placed in four colony cases and packed with three inches of planer shavings underneath, four inches about the sides, and six inches on top. After weighing, the hives were placed in the cases on October 4, with under and side packing in place, and on October 10 they were fed a two to one sugar syrup. Four days later, on October 14, the top packing or final packing was added. Besides the packing material, additional protection from the cold winds was given by windbreaks which surrounded the apiary on all sides.

All colonies came through the winer strong with the exception of two of the Dadant group which covered but four and five frames respectively. At the first examination on May 4 and 5, the number of combs covered by bees in the Langstroth group was 62, in the Jumbo 63, and in the Dadant 56; or an average of 7¾, 7¾, and 7 frames respectively.

To overcome the handicap of the Dadant group, a two-pound package was added to each of the weak colonies on May 9.

All colonies were examined every nine or ten days during the season and note was made of their rapidity in building up, swarming tendencies, if any, and of any fact that might have a bearing on the results. At the same time, when it was found necessary, extra room was given for brood rearing to the colonies of the Langstroth group by the addition of a second brood chamber. No room, however, was given to the colonies in either the Dadant or Jumbo hives, as they are supposed to contain ample room for the brood of the most prolific queen.

Owing to the backwardness of the season, the colonies did not build up rapidly. The average strength of each group at seven successive examinations between May 28 and August 9 was as follows:—

STRENGTH OF GROUPS OF HIVES ON DIFFERENT DATES

Date	Frames covered by bees			Frames of brood		
	Langstroth	Jumbo	Dadant	Langstroth	Jumbo	Dadant
May 28	8·5	7·8	7·8	8·2	7·6	7·1
June 18	10·5	9·1	8·6	9·2	7·8	7·2
June 26	10·3	9·7	8·7	8·7	7·3	7·0
July 5	10·5	10·1	9·4	8·5	7·7	7·0
July 16	15·5	13·7	11·5	10·1	8·1	7·1
July 25	19·1	19·2	14·3	10·7	9·6	7·8
August 9	19·6	19·3	14·1	8·8	7·3	8·0

This shows the Langstroth group to have held the lead in both bees and brood during the entire season with the exception of on July 25, when the Jumbo group was but a fraction of a frame of bees ahead. The Langstroth group, however, was ahead again at the next examination. It must be borne in mind, however, that since the Jumbo comb is deeper than the Langstroth there may have been as much brood in the Dadant and Jumbo hives on a lesser number of combs. No preparations to swarm were found in any of the groups.

This is the third year of poor crops in this district. But even though the crop was poor, all colonies were subjected to like conditions, so the relative values hold.

The largest crop was produced by the Langstroth group, with the Jumbo group second. That produced by the Langstroth colonies was 484 pounds 12 ounces, by the Jumbo 439 pounds, and by the Dadant 286 pounds 4 ounces, the averages being 60 pounds 9 ounces, 54 pounds 14 ounces, and 35 pounds 12 ounces respectively.

The following tables show the results of this experiment for the past four years:—

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
1928						
Langstroth	8	Outside	7¾	0	60·9*	8·6
Jumbo	8	"	7¼†	0	54·14	8·5
Dadant	8	"	7	0	35·12	9·2

FIELD BEES

Further tests to determine the approximate field force of a normal colony were made during the past season. The method used in making these tests is based on the principle that field bees, if moved to a new location within their range of flight, will return to the old one.

Owing to the slowness of the colonies in building up, the first test was not made until July 10, or toward the end of the flow, from white Dutch and alsike clovers. Following this, the second test was made on July 19 and the third on July 25 when white sweet clover was in bloom.

The details of the procedure are as follows: When the weather forecast for the morrow was fine, preparations were started by placing the queen of the tested colony with two frames of brood and eight empty combs into a super. This nucleus was then placed above and separated from the hive by a bee-escape board with the escape so set as to prevent the upward passage of bees.

Next morning, before any bees were flying, the hive was drawn backward several feet and turned so that it faced at right angles to the direction it formerly did. The nucleus was removed and set on the old stand, and sufficient supers added to give it the appearance of the old hive. The parent colony was next weighed before any of the field bees had a chance to fly out and return to the nucleus on the old stand. Throughout the day the strength of the parent colony was gradually depleted by the loss of the fielders until all were gone. The first thing next morning weights were again taken. When the weather forecast was wrong, and bad weather prevailed, it was necessary to return the colony to its normal condition and to allow it to rest awhile before again making preparations for the test.

For taking the weights, the scale used reads to quarter ounces; this means that the approximate figures are quite close to the actual ones. Having the weights before and after the outgoing of the fielders from the parent colony, one next determines the difference and then secures the field force figure by multiplying this difference by 5,000 which is the approximate number of bees that go to a pound. For example, in the first test this year the difference between weighings was 6 pounds 11 ounces. This amount multiplied by 5,000 gives 33,437, the number of fielders that left the parent colony.

In the following table will be found the figures for this year's tests in comparison with those of the three preceding years:--

FIELD FORCES

1925		1926		1927		1928	
Date	Bees	Date	Bees	Date	Bees	Date	Bees
July 9.....	31,250	July 20.....	33,125	July 15....	22,187	July 10....	33,437
July 27.....	31,250	July 27....	35,312	July 26....	34,062	July 19....	34,062
				Aug. 6....	39,062	July 25....	39,687

In the above table it will be noticed, that though this season's tests were made slightly earlier than those of last season, the figures are much alike. It must be remembered that the above figures were arrived at through weighings, therefore they are as before mentioned, only approximate. Further, no allowance is made for any slight loss that there may be from evaporation or consumption of stores.

TOP ENTRANCE

Top entrance hives have for the past two years been tested at Ottawa. In 1927 two of the strongest colonies in the yard were given top entrances, and in 1928 five colonies were used which covered on an average 7.0 combs at the first examination in the spring.

The average crops harvested were, for 1927, 88 pounds 12 ounces, and for 1928, 35 pounds. Both these crops were below the yearly averages of the lower entrance hives, which were 99 pounds 11 ounces and 50 pounds 6 ounces respectively.

On occasions when the hives were examined to determine their progress considerable trouble was experienced from incoming bees looking for the entrance which had been removed. This trouble might be obviated by the use of a stand on which the top chamber with entrance could be set. Such a stand would of necessity require to be so constructed as to permit the entrances being set at any height to accommodiate the different height of the hives.

Further trouble was experienced when the honey was removed. First it was found that when the top entrances were lowered through the removal of the crop, the colony's bees found the entrance with difficulty, whereas robber bees located it very quickly. This occasioned more trouble from the few top-entrance hives than the rest of the yard of over 100 colonies. Then it was found that several of the colonies had brood distributed in nearly all the supers of the hive. Despite these adverse features, this experiment with top-entrances will be continued next season.

Apart from the above experiment a colony of black bees was housed to facilitate manipulations in a top-entrance hive. The trouble in this case was that in the fall the lowest super was found to be alive with wax-moths.

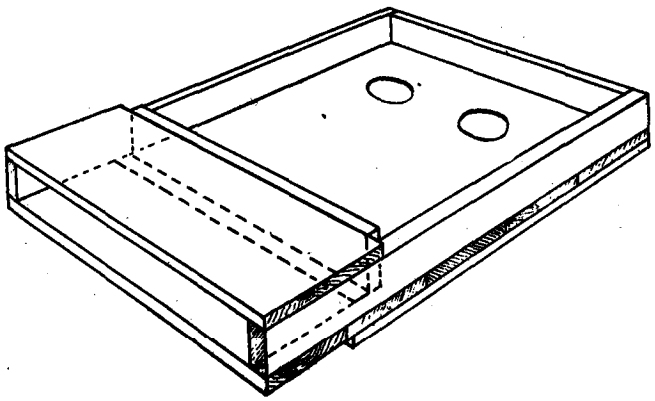
In this connection mention might also be made of an experiment devised in 1926 in which the bees enter the hive just above the brood chambers.

In this experiment no excluders were used as it was hoped that the $\frac{7}{8}$ space left between the brood chamber and the supers would deter the queens' going above. Such a gap, however, was not satisfactory, as in the back portion of the hive, bridge combs were built and in one case a queen went above.

Comparing the average crop of the middle entrance hives with those of the lower entrance and "top entrance," we have 56 pounds 12 ounces, 50 pounds 6 ounces, and 35 pounds respectively.

WINTERING CASE WITH UPPER ENTRANCES

In last year's report of this division an illustration was given of a quadruple wintering case equipped with upper entrances in place of lower ones. This change of entrance location is the outcome of the thought that bees can regulate the hive temperature better from above than from below.



Top entrance board as used in cases for winter.

The only extra equipment necessary to convert an ordinary winter case into one with upper entrances is upper entrance boards, one for each hive. These boards are very simply constructed, as may be seen by the above sketch. After the hives have been side and bottom packed, the convertion consists in putting the upper entrance boards in place, cutting slots in the case opposite these entrances, and closing the lower ones.

Doubt was expressed as to how the bees were wintering but when the case was unpacked on May 22, although there were a few dozen dead bees outside the case, not a single dead bee could be found inside the hives, and the colonies were all of good strength.

This experiment was continued during the winter of 1928-29.

BROOD COUNT.

During the past season an attempt was made to determine from day to day, throughout the season, the actual number of young bees that emerged in a normal colony.

Owing to complications having arisen in the method of conducting this experiment no results can be given at this time.

Further work, however, will be done on this project next season.

DISEASE.

When a beekeeper is in doubt of what disease he has discovered in his yard, he should send a sample of the infected brood to the Bee Division, Central Experimental Farm, Ottawa, for analysis. A large number of beekeepers took advantage of this privilege last year. Sixty samples were received from all parts of Canada. Of this number, twenty-seven were found to be infected by American foulbrood, twenty-one by Europeau foulbrood, and twelve in which no trace of disease could be found. A sample of diseased brood should never be sent in a tin box unless it is pierced by many nail holes to permit free circulation of air, for in air-tight packets the samples usually arrive in too filthy a condition for one to do anything with them. All such packets go through the mails free of charge. Simply mark O.H.M.S. in the place where stamps are usually placed. Examinations are free of charge.

In the following table are listed for comparison the number of cases of disease received during the past eight years.

NUMBERS OF CASES OF DIFFERENT DISEASES

Disease	1921	1922	1923	1924	1925	1926	1927	1928
American foulbrood	.....	8	25	24	8	22	48	27
European foulbrood	.....	7	16	6	9	28	27	21
Sac brood	.....	1	0	3	0	0	0	0
No disease	.....	10	9	5	2	11	17	12
	20	26	50	38	19	61	92	60

WINTERING.

During the winter of 1927-28 there were, all told, one hundred and eighteen colonies wintered by this division. At the Ottawa apiary ninety colonies packed in various kinds of cases were wintered outside, while twenty others were placed in the cellar. At the Britannia apiary eight colonies passed the winter in double-walled hives.

With the object of securing as large a force of young bees as possible, the first preparation for the winter was started towards the end of the main flow by requeening all colonies that did not already possess a vigorous queen.

After weighing the colonies, feeding was commenced on October 5, and was finished by October 14, at which time sufficient stores were given to carry the colonies through the winter and early spring until the spring sources of nectar were available.

OUTSIDE WINTERED COLONIES, 1927-28

Prior to the feeding of both the outside and inside wintered colonies, those wintered outside were placed in their cases. Of the different kinds of cases used, there were the four, two and one colony cases, besides which there were permanently packed hives.

Ninety colonies were wintered outside, sixty-eight were in quadruple cases, twelve in doubles and ten in singles. The last mentioned group contained: Kootenay, Krause and Ottawa cases, also Chrysler and special double-walled hives.

The colonies were placed into the winter cases on October 4, at which time they were under packed with 3 inches of planer shavings and side packed with 4 inches. After being fed a minimum of four pails of sugar syrup each, they were top packed on October 14 with 6 to 8 inches of plainer shavings.

All colonies with the exception of two were given sugar stores; that is eighty-eight received sugar syrup and two honey.

The weather of last winter was very changeable; as before mentioned both January and February saw zero weather broken by mild spells with rain.

Despite changeable weather during the winter, the colonies wintered fairly well. There were two losses, one died of starvation, the other migrated.

At the first examination on May 4 and 5 it was found that the average number of frames covered by bees was seven.

At the Britannia yard all colonies were wintered in two full depth chambers, the lower chamber being a special permanently packed hive, which has 4 inches of insulation. On September 29 the second chamber containing approximately 55 pounds of natural stores was given. This chamber was then side and top packed and further protection given from the north and west winds by a temporary board windbreak similar to that used by the railways.

At the first examination on May 9 the average number of combs covered by bees was ten.

CELLAR WINTERED COLONIES, 1927-28

During the month of November there were ten days on which some bees were flying, and the last and only good cleaning flight was on November 14.

As the weather on the three succeeding days was quite mild the bees were not placed into the cellar until November 18, when twenty colonies were removed from their summer stands to their indoor quarters. All the cellar wintered colonies were given sugar syrup, which is considered the safest food for colonies that over a long period have no opportunity for flight. Last winter, the bees were confined in the cellar for slightly more than twenty-three weeks, during which time they remained very quiet. The average temperature in the cellar during that time was about 45° F.

All the colonies, of which there were ten singles and ten doubles came through the winter well, the only loss being that of a queen in one of the doubles.

On May 1, one hundred and sixty-four days after putting the bees into the cellar, they were removed and placed on their summer stands. This was done when the weather had become to an extent settled and the outside bees were bringing in pollen and nectar.

At the first examination on May 4 and 5 the single colonies were found to cover on an average 7·2 combs.

COLONIES WINTERED IN 1928-29

In the fall of 1928 one hundred and seventeen colonies, all told, were put away for the winter, they at that time being exceptionally strong. After placing the ones to be wintered outside into their cases, all the colonies with but a few exceptions were fed sugar syrup. The cases used, as in other years, were of the four, two and one colony type. As during the winter of 1927-28, the case with upper entrances proved so satisfactory, this year three such cases containing twelve colonies are being tried out.

Following the last good cleansing flight on November 15 there came a few days of comparatively mild weather, after which on November 20 the cellar wintered bees were carried into their winter quarters.

To test the merits of an invert sugar called "Nulomoline," three colonies were wintered on it. The results of this test will appear in the next report.

HONEY INSPECTION

There has been a continued call for the grading and inspecting of honey intended for export. The fact that the inspection of honey proceeding to export markets is beneficial to the industry is effectively demonstrated by the success exporting countries have achieved by adopting such a procedure.

According to prices obtained from the honey market of the United Kingdom, Canadian honey, when it first figured in any quantity on that market, was the lowest priced but two. Since the institution of inspection, its price has risen until it commands a price dominated only by that of New Zealand honey, and New Zealand honey has undergone inspection for several years.

The immediate effects of grading and inspecting honey are to simplify the marketing procedure, to establish confidence in the mind of the buyer, to eliminate all undesirable samples that would give the Canadian product a bad name, and to influence the producer to take greater pains in preparing his honey for consumption. These points show their effects on the increased returns that are obtained from the inspected product.

During the year 1928 a total of 1,114,340 pounds of honey were inspected by this division. This honey was proceeding to the European markets and was classified variously as: Water White, 41,520 pounds; White, 215,820 pounds; Golden, 256,860 pounds; Light Amber, 312,140 pounds; Dark Amber, 218,720 pounds; Dark, 69,280 pounds; while 65,520 pounds were culled from these grades and held off the export market for various reasons, the chief of which was fermentation. Other factors preventing a honey from proceeding to the export market were poor straining, low density, damaged containers, foreign bodies in the honey, liquid condition, and very coarse granulation.

In order to prevent Canadian honey from proceeding to export markets in an unsuitable condition and thereby acquiring a bad reputation, provision was made under the Live Stock and Live Stock Products Amendment Act of 1927 to prescribe regulations regarding the marking, grading and inspecting of Canadian honey intended for export from the Dominion. These regulations have been draughted and have been submitted for approval.

These regulations, among other details, will probably require that no honey be exported from the Dominion unless it has been inspected by a Dominion Government inspector, and he has issued a certificate of that inspection. So far, the inspection of honey being shipped for export has been done at the request of those shipping. Though this service has covered the greater bulk of the honey exported from the Dominion, it has not covered it all. The consensus of opinion regarding export honey favours an inspection of it all before it leaves the country.

CLASSIFICATION AND GRADING OF HONEY

The conclusion arrived at in the 1927 Report of the Dominion Apiarist was that honey would first be classified according to its colour and second, graded according to its quality, the reason for this conclusion being that just as good honey is to be found in the darker coloured honeys as in the light.

It is proposed to establish six classes for honey, this classification being based entirely on colour. The names proposed for these classes are as follows:—

Water White
White
Golden
Light Amber
Dark Amber
Dark.

In each of these six classes, it is proposed to establish grades, these grades being based entirely on the quality of the honey.

In a consideration of the factors affecting the grade of a honey, a number of points arise. The grade of a honey being inspected will be determined by deducting points in accordance with the number of undesirable features presented by that honey.

The following list contains all the points that are at present considered as determining the grade of a honey. They were developed from the results of a careful examination of over four million pounds of honey, a careful survey of the market requirements, a consideration of the method of grading other agricultural products, and an inquiry into the methods used by other countries in grading honey.

Flavour and Aroma—
- Mild
- Medium
- Strong
- Objectionable
- Fermented
- Acid
- Fruity
- Waxy
- Buckwheat

Granulation—
- Smooth
- Fine
- Gritty
- Medium
- Coarse
- Very Coarse
- Semi-liquid
- Liquid

Consistency—
- Hard
- Firm
- Soft
- Sloppy
- Separated
- Watery Surface
- Watery
- Percent Moisture

Cleanliness—
- Insects, etc.
- Wax specks
- Scum on surface
- Scum throughout
- Blackening

Container—
- Overweight
- Under-weight
- Unacceptable crating
- Unacceptable tins
- Unacceptable marking
- Incorrect lot marks
- Dirty or rusty tins.

ESTABLISHMENT OF COLOUR STANDARDS

Certain definite colours must be established for the representation of the classes of honeys.

There is no universally recognized means of stating or designating a colour. To say that a honey is "amber" or "golden" is far too vague a term to use when stating what is a very definite fixed colour. Therefore it became necessary to obtain some permanent pigment or colour to which it would be possible to compare a honey for classification.

LIQUID HONEY CLASSES

The most practical and satisfactory standard for use as a basis in establishing the colour limits in a classification of liquid honey is the Pfund honey grader, developed by the United States Department of Agriculture. Unfortunately it is too slow and expensive in operation and could not be adopted as standard for Canadian honey. Furthermore, the amber wedge of the instrument may vary in manufacture and thus render it useless as an absolute permanent standard.

By means of the Pfund grader, some one hundred and fifty samples of honey were classified. Keeping in mind the market requirements, the quality of honey to be graded in this Dominion and the classes used by other countries, certain selections were made. These selections represented the minimum colour standard for each of the classes it was decided to adopt.

The next step was to obtain some medium to represent these colours that would be permanent.

1. To use the honey itself is not possible because its colours are not fast. They may become lighter for a time, but generally they all eventually darken. Furthermore, the honey will usually tend to regranulate in time.

2. The samples of honeys accurately representing the colour classes were placed in standard sized vials. Solutions of vegetable dyes that matched these colours were then prepared. Unfortunately the colours of the dyes were not fast. Thus this method could not be used as a means of permanently representing the desired colours.

3. Solutions of ferric chloride of definite and known strength were then prepared. Even if fading or precipitation did occur, fresh solutions that would accurately reproduce the desired colours could be made up at any time. This method seemed very satisfactory for representing the dark amber class, but when it was diluted sufficiently to make it light enough to represent the light amber class, the yellow hue of the solution became so dominant that it was impossible to compare it with the light amber honey vial, and the lighter the honey it was desired to represent in this solution the worse became the comparison.

4. About two hundred and fifty samples of amber and tinted glasses were obtained from various manufacturers and importers. The colours in glass of this nature are fast. It was thought that by comparing honey in a standard sized vial to the correct colours as represented in the glass, a fairly accurate, permanent and simple method would be obtained for grading honey.

The objection to this method was that, although the required colours were obtained in the glass or combinations of glasses, the manufacturers could only supply a specific colour at a rather great expense.

5. In order to eliminate all arbitrary or variable scales in stating definite colours it was decided to establish definite readings by the Lovibond glasses to represent the desired colour classes of honey, if necessary graders can be made and also checked up from time to time by these glasses.

GRANULATED HONEY CLASSES.

An examination of the export market situation has revealed the fact that all or nearly all the honey on those markets is required to be in the granulated form; in fact it scarcely ever proceeds to the consumer in liquid form.

Since honey is sold in the granulated form, it becomes absolutely necessary to grade it in that form. Furthermore it is a very slow business, when it comes to grading honey in carload lots, to grade it in the liquid form. For this purpose work was conducted to reproduce the colours of the classes of granulated honey. This was done by obtaining duplicate samples of honey, one of which was

liquified and classified by means of the Pfund grader, while the other was left granulated. After a number of trials, samples were obtained that represented the colours of the various classes when in the granulated form. The colours of granulated honeys are scarcely more stable than are those of liquid honey. Therefore it was necessary to reproduce these colours in some way that would be permanent.

The first attempt was by means of various colour charts. Munsell's, Ridgeway's and that of Obethur, Dauthnay and Mouillefert were examined, but the exact colours were not matched. A further unsuccessful attempt was made to match the colours with standard paint samples obtained from the manufacturers. Although over seventy samples of cream, brown and amber paint samples were examined, but few approached the desired colour.

With the assistance of the Department of Natural Resources, the desired colours were reproduced on paper. From these it is proposed to have colour charts made by a lithographer, and these colours will represent the colour classes used in the classifying of honey in the granulated form.

EXPERIMENT ON THE EFFECT OF TEMPERATURE AND HUMIDITY ON THE STORAGE OF HONEY.

The object of this experiment is to endeavour to establish what are the essentials of suitable storage and what effect temperature and humidity have on a honey in storage.

A sample of honey was obtained and divided into eight parts. These eight parts were treated as follows:—

Sample No. 1 was sealed and placed in a cool, damp storage.
Sample No. 1a was a duplication of No. 1 sample.
Sample No. 2 was placed in the same storage, but having a loosely fitting cap.
Sample No. 2a was a duplicate of sample No. 2.
Sample No. 3 was sealed and placed in a warm, dry storage.
Sample No. 3a was a duplicate of No. 3.
Sample No. 4 was placed in a warm, dry storage, but with a loosely fitting cap.
Sample No. 4a was a duplicate of No. 4.

The honey used in this experiment contained 21.58 per cent moisture.

The sealing was done with several successive coats of hot paraffin wax. It is quite possible that the jars were not absolutely air-tight as this wax contracts slightly when it cools.

The details of the temperatures and the humidities to which the samples were subjected, are tabulated below.

October 16, 1927

Sample No.	Form of package	Average relative humidity	Mean temperature	Condition of honey
		%	°F.	
1 and 1a	Sealed Jar	42·5	47	Soft fine granulated.
2 and 2a	Unsealed Jar	42·5	47	Soft fine granulated.
3 and 3a	Sealed Jar	18·0	68	Soft fine granulated.
4 and 4a	Unsealed Jar	18·0	68	Soft fine granulated.

The condition of the samples were observed at regular intervals without in any way disturbing them until the termination of the experiment. These observations appear in the following table:—

OBSERVATIONS ON SAMPLES

Sample No.	Nov. 15, 1927	Dec. 4, 1927	Dec. 18, 1927	Jan. 3, 1928	Jan. 16, 1928	Feb. 1, 1928	Feb. 15, 1928	Mar. 30, 1928
1 and 1a.....	Apparently unchanged	Apparently unchanged	Apparently unchanged	Apparently unchanged	Apparently unchanged	Apparently unchanged	Scum on surface	Fermented
2 and 2a.....	Apparently unchanged	Apparently unchanged	Slight surface scum	Slight surface scum	Scum on surface	Slight fermentation	Fermented	Fermented
3 and 3a.....	Apparently unchanged	Apparently unchanged	Moist on surface	Liquid layer on surface	One-half inch of liquid on surface	Decided fermentation	Fermented	Fermented
4 and 4a.....	Apparently unchanged	Apparently unchanged	Unchanged	Apparently unchanged	Apparently unchanged	Apparently unchanged	Apparently unchanged	Slight fermentation

The reaction of the duplicates was in every case very similar to that of the four samples.

The experiment was terminated on March 30, the date on which the last observation was made, and it was found that all the samples had fermented.

The percentage moisture was determined on sample No. 4 on March 30 by the A. O. A. C. method. The result was apparently 18.85 per cent moisture. This moisture percentage will not, in all probability, accurately represented the amount of moisture in this sample since fermentation had commenced; the per cent of moisture would be slightly lower. However, this figure suffices to show that there had been a distinct loss in the per cent of moisture in this sample during the experiment, from 21.58 per cent to 18.85 per cent or more.

SUMMARY.

The unsealed jar in the cool damp storage and the sealed jar in the dry warm storage both showed signs of a change in their nature nine weeks after the experiment was started, and were badly fermented by the end of the next nine weeks. The sealed sample in the cool storage was rather slower in its action than that in the warmer temperature.

It was nearly eighteen weeks before the honey in the sealed jar in the cool storage commenced to change. It was obviously fermenting by the twenty-third week after the commencement of the experiment.

It was not until the twenty-third week after the commencement of the experiment that the unsealed sample in the warm dry storage fermented.

Of the sealed jars, that in the warm storage fermented the more quickly.

Of the unsealed jars, that in the cold damp storage fermented the more quickly.

EDUCATIONAL.

As in previous years, press articles dealing with different phases of beekeeping were sent out from time to time. During the summer, 23,226 copies of "Apiary Reminders," which are really seasonal hints to beekeepers, were sent out. Addresses were given at the Annual Conventions of the Quebec, Ontario and Manitoba Beekeepers' Associations and other beekeepers' meetings. Assistance was also given at Short Courses at Guelph, Winnipeg, Saskatoon and Regina.

The apiaries at the various branch Farms were visited during the year and beekeepers field days were held at different points during the visits. Several private apiaries were also visited and assistance given.

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