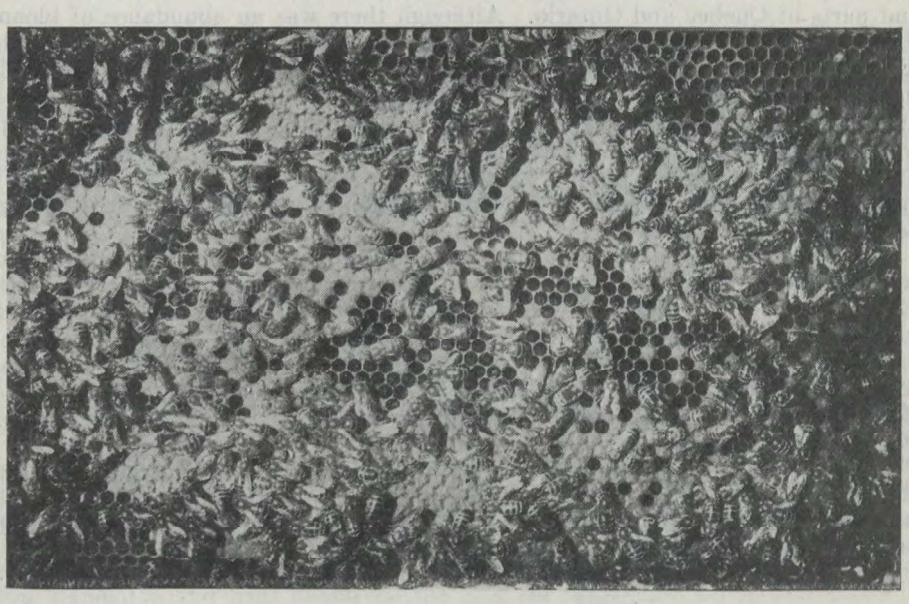
DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

BEE DIVISION

REPORT OF THE DOMINION APIARIST

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

FOR THE YEAR 1922



Bees on Comb of Brood

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DIVISION OF BEES

Report of the Dominion Apiarist, C. B. Gooderham, B.S.A.

THE SEASON

The season of 1922 has again demonstrated the fact that Canada offers the most favourable natural conditions for beekeeping. These conditions briefly summarized are: an abundance of nectar secreting plants which yield a honey of unsurpassed quality; favourable weather conditions for nectar secretion and the gathering of it by the bees, and the steady, cold winters which enables the bees to rest quietly, when properly prepared to resist them.

The winter of 1921-22 at Ottawa was fairly steady throughout and the bees wintered well with a small percentage of loss. The spring of 1922 opened early and the bees were seen bringing in pollen from alders on April 10. Willows and maples were yielding both nectar and pollen abundantly on April 24. This stimulated the bees to early brood production, especially those that were wintered outside. The weather conditions during early summer, however, were decidedly unfavourable for nectar secretion, especially in the Maritime Provinces and parts of Quebec and Ontario. Although there was an abundance of bloom, the bees were unable to work it owing to the cool, wet weather. With the exception of one or two localities, the honey crop in these regions was extremely light. In other parts of Quebec and Ontario, and throughout Manitoba, Alberta, and British Columbia, very good crops were obtained; in fact, phenomenal crops were obtained in parts of Manitoba and British Columbia. At the Morden Station in Manitoba, the highest yield from one colony was 507½ pounds; and in spite of the extreme drought in British Columbia, some colonies stored as high as 660 pounds surplus.

During the year, two new apiaries were started, one at La Ferme, Que., and the other at Beaverlodge, Alta. Bees are now kept at eighteen of the Experimental Farms, as follows: Charlottetown, P.E.I.; Nappan, N.S.; Kentville, N.S.; Fredericton, N.B.; Ste Anne de la Pocatiere, Que; Lennoxville, Que.; La Ferme, Que.; Kapuskasing, Ont.; Morden, Man.; Lethbridge, Alta.; Lacombe, Alta.; Beaverlodge, Alta.; Fort Vermilion, Alta.; Invermere, B.C.; Summerland, B.C.; Agassiz, B.C.; Saanichton, Vancouver Island, B.C., and the Central Experimental Farm, Ottawa.

The work at many of the branch Farms is seriously handicapped owing to the difficulty in getting experienced men to take care of the bees. This not only prevents experimental work from being carried on satisfactorily, but tends to smaller crops owing to faulty management.

The following table shows the number of colonies at each farm in the spring of 1922, the average crop per colony spring count and the average yield for the number of years bees have been kept, up to six years:—

NUMBER OF COLONIES KEPT AND CROP PER COLONY

Farm	Spring Count, 1922	Average Crop per Colony, Spring Count, 1922	Average crop for period	
			Average Crop	Period
		lbs.	lbs.	
Charlottetown, P.E.I.	6	29·1	35·2	1917–22
Nappan, N.S.	11	165·3	78·3	1917–22
Kentville, N.S.	41	41·1	51·5	1917–22
Fredericton, N.B.	8	.....	65·8	1917–22
Ste. Anne de la Pocatiere, Que.	26	17·0	44·5	1921–22
Lennoxville, Que.	2	22·5	36·2	1919–22
La Ferme, Que.	2	.....	.....	— 1922
Kapuskasing, Ont.	5	32·0	74·4	1920–22
Ottawa, Ont.	63	57·7	130·5	1917–22
Morden, Man.	7	272·6	159·5	1917–18–21–22
Lethbridge, Alta.	7	127·7	118·2	1917–22
Lacombe, Alta.	5	55·5	62·7	1917–22
Beaverlodge, Alta.	1	.....	.....	– 1922
Fort Vermilion, Alta.	1	5·0	8·5	1921–22
Invermere, B.C.	5	93·0	91·1	1917–22
Summerland, B.C.	4	165·0	86·6	1917–22
Agassiz, B.C.	3	194·0	55·1	1917–22
Saanichton, Vancouver Island, B.C.	5	62·9	63·0	1917–22

The above table shows that very high averages were obtained at some of the farms for the past year, especially in the western provinces and at Nappan in N.S., while others show only a low average. The low averages were, in some cases, due to poor management, in others to unfavourable weather conditions. At Ste. Anne de la Pocatière, the low crop was chiefly due to the large increase made. At Fredericton all the colonies were run for increase, this apiary being increased from 8 to 33 colonies; no honey was produced. The average yields over a number of years indicate that bees can be kept with profit in any of the above localities.

HONEY PRODUCTION AT OTTAWA

The past season was decidedly unfavourable for honey production at Ottawa. Although the bees had an excellent start during the early spring and built up rapidly during the time the willows and maples were yielding and again when dandelion and fruit trees were in bloom, they received a severe check at the beginning of June owing to unfavourable weather which lasted until several days after the clover was in bloom. Brood rearing was checked and the bees were unable to leave their hives in large numbers to gather nectar for several days at the beginning of the clover blossom, thus shortening the period of gathering. The following table shows the time and length of the honey flow from dandelion and fruit bloom for the past six years:—

HONEY FLOW FROM DANDELION AND FRUIT BLOOM

Year	Date flow started	Length of flow	Date flow ended	Highest Yield in one day	Number of days during flow on which no gains were made
1917	May 16	29 days	June 13	4¾ pounds	13
1918	" 17	15 "	May 31	3½ "	0
1919	" 24	13 "	June 5	2¾ "	0
1920	" 15	20 "	" 3	4½ "	2
1921	" 18	5 "	May 22	1 "	0
1922	" 18	11 "	" 29	3¼ "	4

No nectar was brought in from May 29 to June 23, a period of 25 days; in fact, the five colonies on scales averaged a loss of 5 ounces each day for the 25 days and the bees were on the verge of starvation. This was a common occurrence in many parts of Ontario, Quebec and the Maritime Provinces. Alsike and White Dutch clover was first noticed in bloom on June 5 and 10, respectively; but the bees were not seen working on it until June 13 and then only in small numbers owing to the cool, wet weather. The colonies on scales did not make a gain in weight until June 23, when a gain of one pound per colony was registered. White sweet clover began to yield on June 27. The peak of the flow was reached on July 11 when the average gain for the day was 8 pounds 5 ounces. The accompanying table shows the time and length of the clover honey flow for the past six years:—

TIME AND LENGTH OF CLOVER HONEY FLOW

Year	Date flow started	Length of flow	Date flow ended	Highest average gain made in one day	Number of days during flow in which no gains were made
				lbs. oz.	
1917	June 25	39 days	Aug. 2	9 4	4
1918	" 25	36 "	July 30	15 0	11
1919	" 14	42 "	" 25	13 4	7
1920	" 10	51 "	" 30	5 12	17
1921	" 5	44 "	" 18	11 4	1
1922	" 23	28 "	" 21	8 5	4

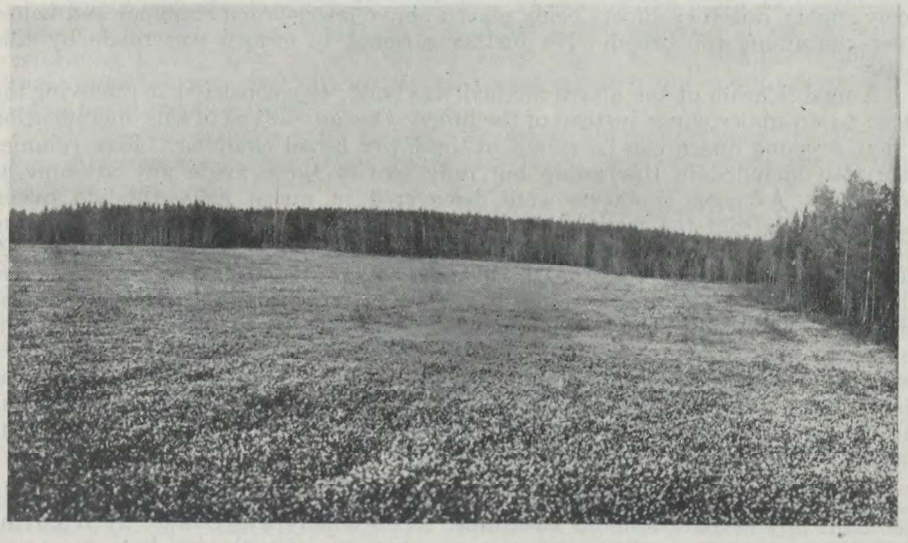
The above table shows clearly that the actual number of days the bees were able to gather nectar in 1922 was 19 days less than in 1921 and from 1 to 11 days less than in previous years; also that, with the exception of 1920, which was also unfavourable, the highest average gain for one day was lower.

Enough nectar was brought in by the bees from July 21 to August 17 to stimulate brood production, but after August 17 the colonies lost weight continually and had to be fed during the middle of September to prevent them from starving.

INCREASE

Of the 74 colonies placed in winter quarters during the fall of 1921, two were lost during the winter; one of these died of starvation and the bees migrated from the other to an adjacent hive. In the spring 4 weak colonies were united, three sent to branch Farms and two to the provincial queen breeding apiary,

leaving a spring count of 63 colonies. During the season these were increased to 103 colonies. Of the 15 double colonies that were put away for the winter in 1921, 10 contained two queens in the spring; three of these queens were used to replace drone-laying queens and to requeen colonies that had become queenless during the winter. The colonies from which the queens were taken reverted to singles. The other 7 colonies were divided between May 3 and 17, thus increasing the number of colonies to 70. Seven nuclei were made up by removing the queen and one frame of emerging brood with adhering bees from colonies that made preparations for swarming during the flow; at the end of the flow 26 more



Alsike clover. The source of the finest honey

nuclei were made with queen and two frames of brood with adhering bees from extra strong colonies. These nuclei consisted of the combs of emerging brood, one frame of honey, and filled out with drawn combs. Owing to lack of nectar, all colonies had to be fed during the month of September. By the latter end of September, 30 of the nuclei were in good condition for wintering; the other three were considered too weak, so were united. A few of the best queens were left in these hives but the majority were replaced with young laying queens of selected parentage. The net increase then, during the summer, was 37 colonies.

EXPERIMENTAL WORK

SWARM CONTROL

The work on swarm control fell under two heads: (1) management, (2) breeding. This work was not only done at Ottawa but at some of the larger apiaries on the branch Farms.

Owing to weather conditions and an extremely light flow of nectar, the swarming problem during the past year was not at all a serious one at Ottawa, as only 9 of the 63 colonies required treatment for swarming. Although the methods used in swarm control did not receive a fair test as to their efficiency, an outline of the experiments is given.

PREVENTION OF SWARMING BY MANAGEMENT

(1) *By Separation of Brood and Queen.*—This method is commonly known as the Demaree system and consists in removing all the brood from the brood chamber at the first appearance of active queen cells. For this experiment 5 colonies were used but, owing to weather conditions and the small flow of nectar, only one colony of this group made any preparations for swarming. As soon as larvae were found in queen cells, all combs containing brood were removed from the brood chamber and placed in a super. The lower brood chamber was then filled with empty, drawn combs, the queen being left below on these combs. The super containing the brood was then placed on top of the colony above the honey supers, queen excluders being placed above lower brood chamber and below super containing the brood. No further attempt to swarm was made by this colony.

A modification of the above method was tried; this consisted in removing the queen to an upper super instead of the brood. One advantage of this modification is that a young queen can be raised in the lower brood chamber. Five colonies were also included in this group but only two of these made any attempt at swarming. As soon as larvæ were discovered in queen cells, the old queen was removed from the brood chamber with one frame of brood and adhering bees and placed in a super containing drawn combs above the honey supers. A queen excluder was placed beneath this super to prevent the queen going down. All cells except one were destroyed in the lower brood chamber at the time the queen was removed. As the bees in one of the colonies destroyed the cell left below, a young laying queen was given. The super containing the old queen was then removed to a new stand. In the other colony a young queen was reared below, and as soon as she was mated and laying, the super containing the old queen was removed to a new stand. No further attempt at swarming was made by either of these colonies.

(2) *Dequeening and Requeening.*—(*a*) Of nine colonies in this group, only one made any preparations for swarming. This colony was treated by removing the old queen and one frame of emerging brood with adhering bees to a new hive on another stand at the time the first larvæ were found in queen cells and destroying all the cells except one. No further attempt was made to swarm and a young laying queen was found in the colony eighteen days after treatment. This method, while satisfactory to the average beekeeper, does not allow for requeening from special stock and improving the strain of bees kept.

(*b*) Of five colonies in this group only two built queen cells. These colonies were treated by removing the queen and one frame of brood as in (*a*). In this case all queen cells were destroyed at the time the queens were removed and six days later all queen cells were again destroyed and a ripe cell of select parentage was introduced to each colony. Both virgins emerged but one was lost in mating; so a laying queen was introduced. No further swarming preparations were made.

(*c*) In this group of five colonies, two made preparations for swarming and were treated by removing the queen and one frame of emerging brood, as in the two previous experiments. All queen cells were destroyed at the time the queen was removed and again ten days later, when a young laying queen was introduced. Swarming was effectively controlled in both colonies and they had the advantage of having laying queens ten days after the old queen was removed.

3. *By Raising Brood.*—In five colonies two or three frames of capped brood were removed from the brood chamber to a super, as required, in order to ascertain if swarming could be prevented by keeping the queen constantly supplied with empty combs and relieving congestion of the brood chamber. Of

the five colonies one made preparations for swarming, three or four times in succession. This method, like the destruction of queen cells every week, requires too much labour and time.

METHODS USED FOR DETECTING SWARMING

(1) The queens in 10-frame Langstroth hives were allowed to breed in shallow supers in addition to the regular brood chambers. These shallow supers were given in the spring as soon as the bees were covering nine combs in the regular brood chamber—May 15 to June 8. No queen excluder was used.

Supers were placed over 40 colonies. These colonies were examined every nine or ten days during the season by tipping the supers. If no queen cells containing larvae were seen along the lower edges of the shallow combs, the brood chamber was carefully examined to see whether queen cells were started in the lower chamber first.

Of the 40 colonies thus treated, 29 made no preparations for swarming during the entire season. One colony developed eggs only and ten developed larvæ in queen cells.

In eight of the ten colonies that had larvæ in queen cells, practically all of them were in the shallow supers and could be seen along the lower edges of the shallow combs when the supers were tipped. In the remaining two colonies, the first cells were found in the brood chamber; these may have been supersedure cells only. A summary of the results of this experiment for the past three years is given in the following table:—

NUMBER AND RESULTS OF COLONIES USED IN TIPPING METHOD

Year	Number of colonies	Number of colonies that did not build queen cells	Number of colonies with eggs only	Number of colonies with larvae in queen cells	Number of colonies with cells in super	Number of colonies with cells in brood chamber only	Percentage of colonies in which the first active queen cells were detected by tipping super
1920.....	37	8	7	22	19	3	86·36
1921.....	39	10	4	25	22	3	88
1922.....	40	29	1	10	8	2	80

The above method of tipping supers to detect preparations for swarming is a quick and easy one and tends towards rapid examination of colonies, as it is not at all necessary to examine the combs of the brood chamber.

(2) In the ten-frame Jumbo brood chambers, a horizontal slit was made in two of the brood combs. This was done by cutting a piece of comb four inches long by half an inch wide from the centre of the combs. The frames containing these slits were marked on the top bar and placed in the centre of the brood nest; it was hoped that the first queen cells would be built along these slits. In examining the colony, these two combs were first looked at and if no queen cells were found in the slit, the remaining combs were examined to see if cells were started on them. By this method it is only necessary to handle two combs instead of ten, but although the method has proved satisfactory for the detection of queen cells, there is a disadvantage of mutilating the combs, for should no queen cells be built the bees are inclined to fill in these slits with drone cells, which is not at all desirable. The results of this experiment are summarized in the following table:—

SLIT METHOD OF DETECTING QUEEN CELLS

Year	Number of colonies	Number of colonies that did not produce cells	Number of colonies with first cells along slit	Number of colonies with eggs only	Number of colonies with larvae in queen cells	Number of colonies that produced cells other than in slit
1921	7	2	4	1	3	1 supersedure
1922	11	9	2	1	1	0

BREEDING EXPERIMENTS

The experimental work in queen breeding at Ottawa was continued, but the isolated mating of queens at Duck Island was discontinued because of the difficulty experienced in getting to the island when necessary, also owing to the unfavourable conditions for beekeeping there. In 1920, the bees were able to gather enough nectar to supply themselves with plenty of food, but in 1921 no nectar was available and they had to be fed continuously with sugar syrup.

During the past season, 4 queens of selected stock were chosen for queen mothers and 2 were chosen for drone production. In the colonies used for drone production, a number of drone combs were placed early in the season; this was to ensure a preponderance of drones in the apiary from select parentage. Drone production in all other colonies was reduced to a minimum by removing all combs in which drones might be reared.

Queen breeding was commenced on May 26, when a batch of 25 cells was started from one of the selected queens. Cells were started twice every week from then on, till early August. During the season 170 queens of selected parentage were reared at Ottawa. Of these, 104 were mated from special mating boxes, 53 were lost during the mating flight or killed by the bees, and 13 were virgins. Seventy of the mated queens were used for requeening colonies in the apiary at Ottawa; 19 were sent to branch farms; 15 to private beekeepers; the 13 virgins also went to private beekeepers. The heavy loss experienced of virgin queens sent out during 1921 evidently affected the demand for these queens.

METHODS USED IN QUEEN REARING

All queens were reared in wooden cell cups either by the swarm-box method or in queenless colonies. The swarm box used was made from an eight-frame Langstroth hive by cutting it down so as to hold only six frames and covering the bottom with wire screening. A hole three inches in diameter was made in the centre of the cover to take a large funnel into which the bees were shaken when filling the box.

Two days previous to the day on which it was intended to graft cells, four or five frames of brood—preferably emerging brood—were raised from the brood chamber to a super over each of three strong, queen-right colonies. The super was then filled up with combs of honey, leaving a space between two of the central brood combs for a carrier of cells to be given later. If only a light flow of nectar was coming in at this time, the colonies were given two pounds of honey diluted with three pints of water every evening until the cells given them later were finished. These colonies were used as finishing colonies.

On the day of grafting, two days after raising the brood in the finishing colonies, three combs well filled with new honey, but not capped over, were placed in the swarm box, leaving space between the combs for cell carriers. At 10 a.m., three to four pounds of bees were shaken into this box from a strong colony. The queen of the colony was first found and placed to one side on a

comb of brood and the bees from the other combs were taken. The reason for taking the bees from the brood chamber is to get a large proportion of young nurse bees, which are the best for starting the new queen cells. As soon as the swarm box was filled, the queen was returned to the colony and the hive closed. The swarm box was placed in the bee cellar, which was dark and where the temperature was about 60° F. Six hours later (4 p.m.) sixty cells on three carriers were grafted with worker larvæ from the colony containing the breeding queen. The larvæ taken were two days old; older larvæ produced inferior queens. As soon as the cells were grafted they were given to the swarm box in the cellar. Care must be taken when grafting the cells that the young larvæ do not get chilled or become dried. The grafting should not be done at a temperature below 75° F., and must be done quickly and the cells placed in the swarm box at once.

The cells used were small wooden cups three-eighths of an inch in diameter, lined with beeswax. The lining of the cells was done by pouring hot wax into the cup and then pouring it out again at once. This left a thin film of wax lining the cup. Twenty of these cells were placed on each carrier and at the time of grafting were primed with a small drop of royal jelly from natural queen cells, which were found in colonies making preparations for swarming. The cells were then ready for the larvæ.

The cells were left in the swarm box for about eighteen hours. The box was then taken to the apiary and placed near the hive from which the bees were taken the previous day. The bees were carefully brushed from the three cell carriers, one of which was placed between the brood in each of the supers over the finishing colonies, that were prepared two days previously. The bees in the swarm box were returned to their hives. There was a great variation in the number of cells accepted in the swarm box, due to the bees used; some bees were better cell builders than others; those for the swarm box should be taken from a colony that persists in building natural queen cells or one that supplies its larvæ with plenty of food in the cells. The bees from a colony that does not keep the worker larvæ floating in jelly should not be used. Colonies that had been made queenless proved rather unsatisfactory, as a smaller percentage of the cells were accepted in them; but for small batches of cells, and where one does not have the time for making up a swarm box, it is quite satisfactory.

An attempt was made to get cells accepted by bees in a permanent swarm box but, owing to the poor honey flow, this method was not at all successful. The permanent swarm box consisted of a small hive containing three frames of Langstroth dimensions and was made up as follows: A few days before the first batch of queen cells were grafted, two frames of emerging brood and one of open brood and honey with adhering bees were taken from a strong colony and placed in the small hive; the comb containing the open brood was placed in the centre. The entrance was closed and the hive was placed in a cool, shady place for three days and on the fourth day the entrance was opened and the box placed on its permanent stand. Most of the capped brood had emerged by the fifth day, when the frame of young brood was taken from the box and the young bees shaken off. This comb was returned to its original colony and grafted cells placed in the swarm box. As soon as all the bees had emerged from one of the original combs given, it was replaced by another comb of sealed brood, when the second was emptied of brood it was replaced in the same way, so that the box was full of young bees all the time during the season. Owing to bad weather and light honey flow, the percentage of cells accepted was very small. This method of the permanent swarm box will be continued.

In using this type of box there is a danger of a stray virgin queen getting in and destroying the cells, or a few cells of open brood may be present on one of the combs and natural cells will be built. It is advisable to examine each comb thoroughly before giving fresh cells.

COMPARISON BETWEEN HIVES

The experiment with the various sizes of hives has narrowed down to the ten-frame Langstroth and the ten-frame Jumbo hives.

The investigations carried on show, however, that, after allowing for the fact that the outside combs are never entirely filled with brood and that a certain amount of space is lost due to the thick top bar now in general use and to certain stretchings of the cells that often take place in the upper two inches of the comb, the ten-frame Langstroth hive is not large enough to accommodate a prolific queen. The Jumbo hive appears to be large enough for a good queen and also makes for better wintering, besides giving stronger colonies. The smaller brood chamber, however, can be enlarged by placing another hive over it without a queen excluder between. Where colonies are examined every nine or ten days, there is the disadvantage of having a double number of combs to handle at every examination when the double brood chamber is used, except where the tipping of the shallow super is the only examination given. The comparison between these hives is being continued.

The following table shows the comparison in strength, brood production and honey crop of the Jumbo hives and the ten-frame Langstroth hives with a shallow super:—

THE JUMBO HIVE *vs.* LANGSTROTH WITH SUPER.

Size of Hive	Number of combs covered with bees at first examination	Amount of Capped Brood, in square inches				Average Honey Crop produced		Number of combs covered by bees at last examination
		1921						
		April 15	May 3	May 18	June 7	lbs.	oz.	
Ten-frame Jumbo	6·4	530	1,150	1,830	1,950	246	13	8
Ten-frame Langstroth with shallow super	6·6	400	890	1,740	1,590	191	7	8
		1922						
		May 15	June 1	June 10	June 20			
Ten-frame Jumbo	6·5	1,528	2,138	2,076	2,080	83	10	9·0
Ten-frame Langstroth with shallow super	6·5	1,298	2,024	1,929	2,016	72	7	8·75

In the above table it must be noted that the Jumbo hives are two inches deeper than the Langstroth hives; and although the same number of combs were covered with bees in both cases, the cluster would be deeper in the Jumbo; therefore these hives would contain a larger force of bees. It will also be noted that far more brood was produced in the Jumbo hives during May and early June than in the Langstroth hives with the shallow super, thus giving a larger working force for the clover flow, which is indicated in the larger average crop produced by the Jumbo hive. At the first and last examinations the Langstroth hives were without the shallow super. The super was put on as soon as the bees needed room and taken off when the queen returnd to the lower brood chamber.

WINTERING TWO QUEENS IN ONE HIVE

This experiment was continued during 1922 as a straight test between double and single colonies in ten-frame Langstroth and Jumbo hives, wintered both outside in packing cases and inside in the cellar, also as a method of carrying over a number of surplus queens for spring use. No colony was helped in any

way from other colonies. The results of this experiment are summarized in the following table:—

WINTERING TWO QUEENS IN ONE HIVE

Group consisting of	Average Yield of Honey	Percentage of Increase	Treatment for swarming
	lbs. oz.		
Double Jumbo (outside)	119 10	100	No attempt was made to swarm
" (inside)	62 4	100	" "
Double Langstroth (inside)	78 4	150	" "
Single Jumbo (outside)	83 10	100	" "
" (inside)	43 12	50	Dequeening and Requeening.
Single Langstroth (outside)	72 7	62½	" "
" (inside)	49 11	40	" "

The two following methods of getting the two queens into the double colonies, mentioned in the above table, were used:—

(1) The two queens were introduced into the hive at the time of treatment for swarming the previous year, between July 2 and August 3. Instead of giving one queen at the second destruction of queen cells, the brood was equally divided; a close-fitting division board was placed in the middle of the hive, and a queen introduced on each side. The hive entrance was closed in the centre, leaving a three-inch opening at opposite corners for each division. If no brood was found on one side at the time the white honey crop was removed, between July 6 and 26, another queen was introduced; or if no spare queens were on hand, the colony reverted to a single colony by removing the division board. The two parts of the colony were completely separated on the removal of the supers and queen excluder; in fact, there were two small colonies in one hive for the winter. In the spring, as soon as the bees in one side became strong enough to fill the compartment, they were transferred to a new hive placed alongside the orginal; each hive was then filled up with drawn combs. This was done on May 3 and 14, about one or two weeks before the flow from dandelion commenced. By this method early swarming was prevented, as the colonies were too weak to swarm.

(2) Instead of uniting moderately weak colonies in the fall as usual, five frames were taken out of each of the weak colonies and the bees adhering to these combs were shaken into the hives; they were thus made to cluster on the remaining five frames in one side of the hive. Two or three days later, a tight-fitting division board was placed in the middle of one of the hives with the five frames and bees on one side. The five frames covered with bees from another weak hive were placed on the opposite side of the division board. The entrance of the hive was closed in the centre to provide a double entrance.

The above shows that the wintering over of two queens in the ten-frame Langstroth hives did not produce a great deal more honey than colonies having only one queen; the greatest advantage is the increase made. On the other hand, those in the Jumbo hives greatly increased the honey crop, beside giving 100 per cent increase. The experiment indicates that a considerable advantage can be gained by wintering two queens in the larger hives. The bringing together of two weak colonies into one hive in the fall is also another great saving of queens and bees. In any case, the wintering over of a surplus number of young queens, for introduction to colonies that may have lost their queens during the winter or to replace weak and failing queens in the spring, is a decided advantage, as it is difficult to obtain queens from breeders at this time of the year. The smaller hive is satisfactory for this purpose only.

ALUMINIUM COMBS

One colony of bees was placed on aluminium combs during the summer of 1920; the bees did not take to the combs satisfactorily and only worked on three of them during that season. In the fall this colony was considered too weak for successful wintering, so the bees were united to another colony. At the commencement of the clover flow in 1921, another colony was placed in a hive with the aluminium combs in the brood chamber and although the honey flow was very heavy, the bees practically refused to accept the metal comb even though three of them had been worked on the previous year. In the fall only four of the combs had been used so the bees were shaken onto wax combs which were immediately accepted and the colony built up rapidly. During the past summer the aluminium combs were again used with the same results; that is, very little new work was done on these combs even though feeding was resorted to.

DISEASES

Brood Diseases.—During the past season, 26 samples of diseased brood were received from various parts of the Dominion, for identification. Of these, 8 samples were affected with American foul brood, 7 with European foul brood, 1 with sac brood; the balance showed no disease. The sender of each sample was promptly notified which disease was present and was instructed as to methods of treatment required.

Adult Diseases.—Six samples of adult bees were received from colonies in which the bees were dying off rapidly. One of the samples in which poisoning was suspected was analyzed by the Division of Chemistry and found to contain far more arsenic than was required to kill the bees. This sample was received from the Annapolis Valley, Nova Scotia, and the poisoning was thought due to the bees gathering poisoned dust used in dusting the fruit trees. It is suspected that the dust was gathered from the dandelions and other flowers which were in bloom in the orchards at the time the trees were dusted and on which the dust had fallen, as the fruit bloom is not open at this time. The other samples were carefully dissected and examined but no symptoms of disease were found.

EDUCATIONAL

During the year, Bulletin No. 43 on "Wintering Bees in Canada" was revised and issued as Pamphlet No. 22 New Series. Press articles on various phases of beekeeping were also sent out from time to time. These articles were made as seasonable as possible. Addresses on beekeeping were given at the Annual Conventions of the Ontario and Quebec Beekeepers' Associations, also at county association and other meetings. Two lectures were also given to the regular students at the Kemptville School of Agriculture.

The various branch Farms in the western provinces, at which bees are kept, were visited during the summer for the purpose of supervising the bee work there. Those in the eastern provinces were visited in the spring and again in the fall for the same purpose.

The study of the honey-producing plants of Canada was also continued as far as possible.

WINTERING AT OTTAWA, 1921-22

Seventy-four colonies were prepared for the winter of 1921-22. Sixty-three of the colonies were fed an average of 24·8 pounds of sugar syrup to bring their stores up to sufficient weight for the winter. Six colonies were each given a shallow super containing combs of clover honey in addition to the stores

already in the regular brood chamber. No syrup was given to these colonies. The remaining five colonies had sufficient natural stores in the hive and were not fed. The sugar syrup was made in the usual manner and consisted of two parts best white granulated sugar to one part water. Miller feeders and ten-pound honey pail feeders were used. Feeding was commenced on October 6 and finished on October 25. Owing to the very cool weather during October, the bees were unable to take the syrup down very quickly and feeding was extended over a long period. All colonies were weighed immediately before and after feeding. The following shows the average loss in weight of the colonies on the different kinds of stores and the average strength of same colonies at the first examination.

LOSS OF WEIGHT ON VARIOUS STORES

Kind of stores	1921 Average Weight when placed in cellar		1922 Average Weight when removed from cellar		Average Loss in weight		Average number of Combs covered with bees
	lbs.	oz.	lbs.	oz.	lbs.	oz.	
Supers of clover honey	68	12	56	8	12	4	5·7
Sugar syrup	58	11	45	9	13	2	5·3
Natural stores left in hive	67	15	48	3	19	12	6·0

The following table compares the average weights of colonies before feeding, after feeding, and when removed from winter quarters, also the average loss of stores during the winter both for cellar and outdoor wintered colonies.

AVERAGE WEIGHTS BEFORE AND AFTER FEEDING

Groups of colonies	Average Weight of colonies before feeding		Date of weighing	Average Weight of colonies after feeding		Date of weighing	Average Weight of colonies when remov'd from winter quarters		Average Loss	
	lbs.	oz.		lbs.	oz.		lbs.	oz.		
Ten-frame Langstroth hives wintered in cellar	45	14	Oct. 6-18	62	7	April 10-12	44	14	17	9
Ten-frame Langstroth hives wintered outside	48	15	"	67	5	May 15-16	54	4	13	1
Ten-frame Jumbo hives wintered outside	53	11	"	72	6	May 3	48	8	23	14

WINTERING OUTSIDE, 1921

Twenty-one colonies containing one queen, and two colonies containing two queens were weighed and placed in packing cases between October 4 and 8, before feeding. After feeding they were again weighed and finally packed on October 17 to 21. The two colonies containing two queens each and fourteen colonies having one queen each were placed in four quadruple packing cases. In three of these cases the packing consisted of three inches of planer shavings underneath and about the sides and eight inches on top. In the fourth case the packing was six inches thick on sides and bottom and ten inches on top. The entrances of the cases were reduced to one inch high and three-eighths inch wide.

Four colonies were placed in double packing cases and packed in the same manner, that is, with three inches of planer shavings underneath and about sides and eight inches on top.

One colony was placed in a single Kootenay case and permanently packed with three inches of planer shavings underneath and all four sides, and six inches on top.

Another colony was placed in a Krouse case and the sides packed with four inches of shavings and eight inches on top. This case does not allow for underneath packing.

The last colony was transferred to a double walled hive having three inches of permanent packing on the bottom and all four sides and allowing for six inches on top.

The winter yard is protected from the wind on all four sides by a board fence eight feet high.

The weather during the early part of the winter was fairly mild until about December 21, when it turned cold. Very little snow fell and the cases were not entirely covered with snow at any time during the winter.

The Jumbo colonies were removed from the winter cases on May 3, as the double colonies were then strong enough to divide, but the Langstroth hives were not removed until May 15-16. All colonies were examined on April 24, before they were removed from the cases. The following table shows the average number of combs covered with bees and the amount of brood contained in each colony at this examination.

RESULTS OF SPRING EXAMINATION

Wintering cases used	Date of first examination	Kind of Hives	Number of combs covered with bees	Amount of brood
4 colony case	April 24	Double Jumbo hives	5·5	5·0 combs
4 " "	" 24	Single Jumbo hives	6·5	4·0 "
4 " "	" 24	Single Langstroth hives	6·7	5·1 "
2 " "	" 24	" "	6·2	5·5 "

All the colonies wintered outside were short of stores owing to heavy brood production. Those that wintered in quadruple cases were in the best of condition, no colonies or queens being lost. No advantage was gained by the extra thick packing used in one of the cases.

The colonies in the double cases did not winter so well, as two colonies were very weak, one of them having a drone-producing queen; this colony was united to another. The average number of combs covered by the bees was 6·2. The colonies had lots of brood but were short of stores and had to be fed.

The colony in the Kootenay case was very weak, covering only one and a half combs. Plenty of stores were present in the hive and small patches of brood.

The bees in the Krouse case were also very weak, covering only two frames. This colony had a drone-producing queen which was destroyed and the colony united to two other weak, queenless colonies and a laying queen from a double colony was introduced.

The colony in the double-walled hive was very strong, covering seven combs and having plenty of stores and brood.

CELLAR WINTERING, 1921

On November 9, thirteen hives containing two queens and thirty-eight containing only one queen were placed in the bee cellar, nine days after the last

good cleansing flight. The average weight of the colonies when placed in the cellar was 61 pounds. Three colonies were kept on scales constantly during the winter and the weights recorded each week. The average loss per colony, per week, was $8\frac{3}{8}$ ounces.

The bee cellar, which is under the bee building, is fairly dry, well ventilated and kept dark at all times. The temperature was maintained between 45 degrees F. and 47 degrees F. throughout the winter. The bees were quiet from the time they were brought in until they were taken out in the spring. They were not disturbed at all during the winter and the cellar was visited only once each week to record temperature, humidity and weights.

On April 10 the bees wintered outside were bringing in the first pollen of the season, from alders.

The cellar-wintered bees were taken out on April 10 and 12, during dull weather to prevent flying and drifting. One colony was found dead from starvation and the bees from another had migrated to the adjacent hive. On April 13 these bees had their first good cleansing flight and started to gather pollen and nectar the same day.

On April 22 and 24 all colonies were examined for stores and brood. Of the 36 single colonies taken from the cellar, one colony contained a drone-producing queen; this queen was destroyed and the colony requeened with a mated queen from one of the double colonies. Another colony was queenless and was united. The remaining 34 colonies were in good condition, having plenty of stores and the bees covering an average of 5·2 combs. Of the 13 doubles put away in the fall, 8 were in good condition and still contained two queens; one was queenless on one side, and the other side contained a drone producer. The division board was removed from this hive and a queen from another double colony was introduced. In the remaining 4 hives, the bees from one side had migrated to the other side so the division board was removed from the hive and the colonies reverted to singles.

The bees wintered in the cellar were not in as good a condition as those wintered outside, having a smaller number of combs covered with bees and less brood. More stores, however, were present in the hives.

WINTERING IN OTTAWA, 1922-23

One hundred colonies were prepared for the winter of 1922-23; of these, 83 contained only one queen and 17 contained two queens. All colonies were up to good strength by October 1. Feeding commenced on September 28 and finished on October 9. Thirty-four of the colonies were given shallow supers containing clover honey. Nine colonies were given a mixture of 80 per cent extracted honey and 20 per cent water. Thirty-five colonies were given straight sugar syrup made up of two parts granulated sugar to one part water. Twenty-two colonies were given a syrup consisting of 50 per cent each of the last two mixtures. Miller feeders and ten pound honey pails were used. As in other years, the latter feeders proved the better, being easier to handle; and the bees appear to be able to take the syrup down much better, as they do not have to leave the brood nest to do so.

WINTERING OUTSIDE, 1922

Thirty-two colonies are being wintered outside. Of these, twenty-eight contain only one queen and four contain two queens; the latter are in Jumbo hives. Four of the single colonies are also in Jumbo hives. The colonies were first weighed and then placed in packing cases with four inches of bottom packing; they were then fed as rapidly as possible and again weighed; after which they

were packed on all four sides and the top. Twenty-four of the colonies are in six quadruple cases with four inches of packing underneath, three inches on the sides and from six to eight inches on top. The entrances into five of the cases are reduced to one by $\frac{3}{8}$ inches but, in the other case, the entrances are eight by one inch. Four of the colonies are in double cases with four inches of packing on the bottom and all four sides and six inches on top. Two colonies are in single permanent Kootenay cases with three inches of packing on bottom and all four sides and six inches on top. One colony is in a single Krouse case which allows 4 inches of packing on sides but none on the bottom and one is in a double-walled hive. The following table gives a summary of the weights of colonies before and after feeding:—

WEIGHTS OF COLONIES—BEFORE AND AFTER FEEDING

Group of Colonies	Nature of Stores	Average Weight before feeding	Average Amount fed	Average Weight after feeding	Remarks
		lbs. oz.	lbs. oz.	lbs. oz.	
Single Langstroth.....	Shallow super of honey	38 11	33 2	67 14	
" "	Honey syrup.....	38 8	57 0	72 0	80% honey; 20% water:
" "	Sugar syrup.....	44 13	45 0	71 5	2-1.
Double Jumbo.....	Sugar syrup.....	51 6	38 4	70 14	"
Single Langstroth.....	Sugar and honey.....	46 1	44 14	73 5	(Mixture containing
Single Jumbo.....	Sugar and honey.....	46 14	43 15	73 8	50% of each of the above mixtures.)

CELLAR WINTERING, 1922

Sixty-eight colonies were placed in the cellar on November 21, eighteen days after the last good cleansing flight. The average weight of the colonies when placed in the cellar was 61·9 pounds. Five colonies are kept on scales and the weight of each recorded every week. So far the average weekly loss has been 7·94 ounces. The following table summarizes the weights of colonies before and after feeding and again when they were brought into the cellar.

CELLAR WINTERING, 1922

Group of Colonies	Nature of stores	Average weight before feeding	Average Amount fed	Average Weight after feeding	Remarks
		lbs. oz.	lbs. oz.	lbs. oz.	
Single Langstroth.....	Shallow super of honey	36 2	34 0	68 6	
" "	Honey syrup.....	41 7	28 8	59 7	(80% honey, 20% water.
Double Jumbos.....	"	43 0	28 8	68 0	
Double Langstroth...	Sugar syrup.....	47 6	29 4	60 9	2-1
Single Langstroth.....	"	44 5	33 4	60 10	
Double Jumbos.....	"	57 1	12 0	64 5	
Single Jumbos.....	"	52 0	18 0	64 0	
Single Langstroth.....	Sugar and honey.....	40 10	37 0	64 0	(Mixture containing 50% of each of the above mixtures.)
Double Langstroth....	"	42 8	37 0	66 4	

The outside temperature during the early part of the winter was very variable and caused considerable restlessness in the colonies; many bees were tempted to fly out and were lost on the snow. In the cellar there has been some difficulty in maintaining an even temperature and the slightest variation had a disturbing influence on the bees.

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