DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

BEE DIVISION

INTERIM REPORT OF THE DOMINION APIARIST

F. W. L. SLADEN

For the Year ending March 31, 1921

Photo by C. B. Gooderham, B.S.A.

View in the Apiary, Central Farm.

Printed by authority of the Hon. S. F. TOLMIE, Minister of Agriculture, Ottawa, 1921
27992—1

THE BEE DIVISION

REPORT OF THE DOMINION APIARIST, F. W. L. SLADEN

During the year apiaries have been maintained at sixteen of the Experimental Farms, as follows: Charlottetown, P.E.I.; Nappan, N.S.; Kentville, N.S.; Fredericton, N.B.; Ste. Anne de la Pocatière, Que.; Cap Rouge, Que.; Lennoxville, Que.; Kapuskasing, Ont.; Brandon, Man.; Lethbridge, Alta.; Lacombe, Alta.; Invermere, B.C.; Summerland, B.C.; Agassiz, B.C.; Sidney, B.C.; and the Central Experimental Farm, Ottawa.

In spite of unfavourable seasonal conditions in many places, a fair crop of honey was obtained, which indicated almost as strongly as a season of plenty the particularly favourable natural conditions that Canada offers for beekeeping. These, briefly summarized, are the abundant flowers of the principal honey plants, sufficient average rainfall, the cool nights and long warm and sunny days of summer favouring the secretion of nectar and its collection by the bees, and the steadily cold winters which are restful to the bees properly prepared to resist them.

In many parts of Ontario and Quebec the winter of 1919-20 began with severe cold without any snow until after Christmas and this, following a wet autumn, killed much alsike and white clover. It also caused a rather heavy loss of bees where outside wintering was followed without sufficient protection, especially in the province of Quebec, and it demonstrated the importance of packing not only at the sides of and above, but also underneath the hives. At Ottawa nearly all the clover was winter killed; the spring was too dry for rapid growth and during the season of honey-flow in July the weather was too cool and showery for much nectar secretion. In Manitoba the season became very dry after the commencement of the honey-flow. This resulted in a short honey crop and the storage of unwholesome honey in the brood chamber which caused a heavy winter loss, and demonstrated the necessity of feeding liberally with sugar syrup for winter where combs filled with clover honey or other honey known to be wholesome for wintering are not available. Feeding was checked by the high price of sugar. A great and sudden fall in the price of sugar took place suddenly in October after the best part of the feeding season had passed.

The rather high level to which honey prices had reached in 1919 was slightly lowered during the summer of 1920 and prices eased still more during the winter, but there was no great drop and the outlook at the time of writing is brighter than for many of the staple products of the farm. This is evidently due in the main to the fact that practically the whole of the Canadian honey crop, conservatively estimated to amount to between ten and fifteen million pounds a year, is normally absorbed by the domestic market. The future prospects of the Canadian honey industry are good because our northern honey is superior to honey of southern origin.

The work with bees at the Branch Farms has continued to be hampered by the difficulty of obtaining trained beekeepers to attend to the apiaries. This is principally due to the considerable profits made in private beekeeping by modern methods of management. Commercial beekeeping has become a highly specialized and skilled occupation requiring natural aptitude and at least two years' training. For our experimental work additional qualities are needed.

Highly encouraging returns from bees have been obtained in some regions where not much general agriculture is yet practised. An outstanding example is the Experimental Station at Invermere, situated in the high and dry Upper Columbia Valley, B.C. Bees have been kept here for seven years. The 1920 honey crop was 90 pounds to the colony. The average annual crop during the five years 1916-20 was

106½ pounds to the colony. The very dry conditions prevalent there are not favourable for clover and fireweed, the principal honey plants found in moister regions, but there is a special honey flora, the principal plant being wolfberry (*Symphoricarpos occidentalis*) which is also an important honey plant on the prairie, while in the spring the bees build up principally on bearberry. The copious and continuous secretion of nectar in this valley is apparently due to the very wide daily range of temperature during the summer months.

The work at Kapuskasing has also been encouraging. The locality consists of a clearing in the clay belt section of the spruce forest area of northern Ontario. It is situated only 150 miles from James bay on the north and lake Superior on the south, and, in consequence, is subject to occasional periods of cold and wet weather throughout the summer; light night frosts, and also periods of great heat and dryness. Alsike and white clover, protected by the continuous covering of snow in winter, spring into luxuriant growth as soon as the land is cleared and there is a plentiful sprinkling of fireweed which becomes abundant after fires. The stands of fireweed produced by fire remain in good condition for a larger number of years than they do further south. In the autumn *Aster macrophyllus,* a honey plant of minor importance, is common. The keeping of bees at Kapuskasing was started with two colonies in August, 1919. The colonies wintered well in the cellar and bred up very rapidly in the spring. When examined on June 12, the spring being favourable, the hives were found to be filled with brood and bees, drones had emerged and there were eggs in queen-cells, indicating preparations for swarming. Small quantities of nectar were being gathered from wild strawberry and Labrador tea *(Ledum groenlandicum),* and alsike clover was coming into bloom. The season proved rather too dry; 110 pounds of surplus honey were taken and there was an increase of one colony. A larger return would have been obtained if the colonies had not been divided in an attempt to make increase. The quality of the honey was excellent. Throughout the summer the hives were kept packed in cases and the apiary was sheltered from wind by a high board fence.

From these experiments and other information obtained it would appear that in the development of our northland, beekeeping should be encouraged to follow the lumber and pulp industry before the land is ready for cultivation.

We continue to get high returns from alfalfa at the Experimental Farm at Lethbridge. In 1920, 159 pounds to the colony were reported. The average annual returns since bees were started at this station in 1914 amount to 107·7 pounds per colony. These figures show that attractive returns may be expected from bees by ranchers who grow alfalfa extensively in southern Alberta. Wintering experiments at Lethbridge indicate that at least half of the winter stores should consist of sugar syrup, losses having resulted from the granulation of the alfalfa honey in the combs. Two empty combs should be placed in the centre of the hive for the reception of these stores. A promising method of wintering here is in a dugout, which owing to the very dry ground and great and rapid temperature changes should not be very freely ventilated. There is also a call here for outside feeding in spring with diluted sugar and some pollen such as pea flower to stimulate breeding on account of the scarcity of willows and other spring flowers, a practice not to be recommended in other parts of Canada where there is usually sufficient honey and pollen to be found to stimulate breeding, although on account of the heavy consumption of stores in the spring, it is important everywhere to retain a supply of combs filled with honey of the previous season which may be given to the colonies in the spring as needed.

The apiary at the Central Experimental Farm at Ottawa continues to lead in the annual average production per colony, with 116 pounds to the colony, spring count, for the eight years 1913-20, although the season of 1920 was a poor one, giving only 66 pounds to the colony. The lead at Ottawa is attributed to the fact that Eastern Ontario is one of the best sections of the clover honey region, also to the early start the bees get under the suburban conditions and favourable spring climate. The total production for the whole apiary was 2,564½ pounds of extracted honey, which realized $769.20. Twelve average colonies averaged 65 pounds 14 ounces; 1,321

pounds of sugar valued at $269.68 and 203½ pounds of honey valued at $60.69 were fed to the bees for the winter. The apiary was under the supervision of Mr. C. B. Gooderham, B.S.A.

The Experimental Farm at Nappan gave 81 pounds to the colony in 1920, Charlottetown 71 pounds, and Lacombe 67 pounds.

For the advancement of beekeeping in Canada the great need continues to be to educate beekeepers to replace, with modern methods of management, the old neglectful methods that continue to levy a heavy toll of loss, particularly (1) in winter, (2) from brood diseases, and (3) from old and failing, drone-breeding and lost queens. This work has been advanced by demonstration in our apiaries and by the distribution of our bulletins.

The most important experimental problems in Canadian beekeeping, in the opinion of the writer, are connected with the reduction of bee manipulation to enable a man to care for a larger number of colonies in a given time. In this country a great deal of time is spent in handling bees to prevent their swarming. The long, warm and sunny days and heavy honey flows develop a stronger tendency to swarm and the swarming season lasts longer than farther south. In most parts of Canada the swarming season continues far into the main honey flow, rendering manipulation work for the prevention of swarming particularly arduous because of the necessity of removing and afterwards replacing the supers containing honey in order to reach the brood chamber to carry out swarm control operations therein. What is needed is a reasonably certain method of preventing swarming that requires but little labour, the labour to be limited to certain days, making it possible for the beekeeper to do similar work in out-apiaries on the intervening days.

During the year, special attention has been devoted to the swarming problem and experiments started in previous years have been advanced. These experiments fall

Photo by C. B. Gooderham, B.S.A.

View in the Apiary at the Central Experimental Farm

under two heads: (1) management and (2) breeding. They have been carried out mainly at the apiary at the Central Farm, where fortunately the conditions are very well suited to the work, the impulse to swarm being very strongly developed here in average seasons.

Prevention of Swarming by Management

Investigations in previous years have indicated that the method of dequeening and requeening at the commencement of the main honey flow was the most promising one for experiment. No entirely successful manipulation, when the old queen was left in the hive, could be found. Besides, the greater productivity of the young queen makes the colony more profitable the following year. The young queen can be raised from selected stock and in this way the strain of bees can be gradually improved. The season of bee activity in most parts of Canada is so short and compressed that young queens should start laying before the end of the swarming season, so as to produce abundant young bees for winter.

The colonies were examined every seven, eight or nine days and those found to contain larvae in queen cells, a practically sure sign that the colony will swarm, were treated by removing or caging the queen and destroying the occupied queen cells. At the next examination, eight or nine days later, all the occupied queen cells were again destroyed in these colonies, the caged queen was removed and a cell of select parentage from a batch that was started as young larvae in one of the colonies at the previous visit, was given. Queen cells were occasionally built over drone larvae after the second destruction of the cells, indicating that a nine-day interval between the treatments would be better than an eight-day interval.

In the 1919 experiments it was found that the treatment caused some loafing, which was less during the period between the removal of the queen and the destruction of the queen cells eight or nine days later than during the period between the destruction of the queen cells and the commencement of laying of the young queen, a period that frequently lasts ten or fifteen days.

The 1920 experiments were therefore directed towards (1) simplifying the discovery of colonies that have larvae in queen cells, (2) shortening the period between the destruction of the cells and the commencement of the laying of the young queen.

The following plans for quickly and easily detecting the colonies that have larvae in queen cells without having to lift out and examine every comb in the brood chamber and for treating them without pulling all the supers apart, were tried:—

(1) The queen was allowed to breed in a shallow 5¾-inch super in addition to the regular 10-frame Langstroth brood chamber. It was thought that most of the queen cells would be built along the lower edges of the shallow combs, and that it would be only necessary to pry up the supers to detect any signs of swarming. This method proved very promising, as with 86·3 per cent of the colonies that had larvae in queen cells or capped queen cells these were found to be visible on the shallow combs when the super was pried up. In at least one of the cases where such cells were present only in the lower chamber, the evidence indicated supersedure without swarming. The examinations were made every eight or nine days, the queen's wings being clipped.

Out of thirty-seven colonies examined every eight or nine days, twenty-nine developed eggs or larvæ in queen cells. Seven of these had nothing more than eggs and twenty-two developed larvæ, uncapped and capped. In nineteen of these twenty-two colonies some of the queen cells containing larvæ could be seen between the bottom bars of the frames in the shallow super, when the latter was tipped up. Of the remaining three colonies one superseded its queen from a queen cell in the lower brood chamber without swarming; the second had two uncapped larvæ in the lower brood chamber and six days later had a capped larvæ visible on the under side of the super, without having swarmed in the interval, and the third had one uncapped larvae in the lower brood chamber, which was destroyed accidentally.

In these twenty-two colonies there were many more queen cells containing larvæ visible between the bottom bars of the supers than in the whole of the lower chambers.

(2) In the 10-frame Jumbo brood chamber a horizontal slit was made in one of

the combs in which it was hoped that the queen-cells would be built. This experiment could not be carried out satisfactorily. Although many empty queen cells were found in these slits only two of the six Jumbo colonies developed occupied queen-cells. One of these was constantly endeavouring to supersede its queen, which had been depilated at the time of its introduction to the colony the previous fall. All the cells in this colony were outside of the slit. The other colony had one queen cell containing a larva outside of the slit.

(3) Two hives were placed on elevated stands. The floor was hinged so that it could be lowered and a mirror could be placed beneath the combs so as to reflect the interior of the hives. This method did not prove very satisfactory because on some of the visits all the cells were so high up in the combs that they could not be seen.

(4) The writer has devised a wheelbarrow for lifting the supers off the hives and replacing them. It is hoped that this barrow will lighten and shorten the work of both examination and treatment. The barrow will also facilitate inserting the super clearer (bee escape) and the transportation of the honey crop from the hives to the honey house. The bottom super is left on the hive for examination. By the use of an inclined plane for the wheel the pile of supers can be raised and deposited again on the hive over an empty super that has been given.

The period of loafing between the destruction of the cells and the commencement of laying of the young queen was prevented by raising queens at the very start of the honey flow and placing them in nuclei. These queens soon after they commenced laying were introduced, instead of ripe queen-cells, to the later colonies requiring treatment.

An attempt was made to shorten the loafing period by introducing a queen-cell from which the queen was about to emerge at the time the old queen was removed. The cell was introduced in a specially constructed cage which permitted the bees to pass in and out but held the young queen. The queen was liberated from the cage at the time of the second destruction of the cells when the old queen was removed. In eight cases in the out-apiary where this was tried seven of the queens were found to be laying subsequently. An objection to this plan is that it is not easy to have a sufficient number of ripe cells on hand when the queens are removed.

Bee Breeding Experiments.—While the prevention of swarming has been the principal object in an attempt that has been carried on to overcome the difficulties in the line-breeding of bees, this work will, it is hoped, be of value for the development of other desirable qualities in bees. The uncertainty of mating queens with drones of select parentage on account of the fact that mating takes place in the air some distance from the hives has always made bee-breeding work difficult, and the Bee Division has been for some time conducting experiments in the isolated mating of queen bees.

In the summer of 1913 Italian queens and drones were brought to an isolated place on the Kazubazua plains, about forty miles north of Ottawa. Although no colonies could be discovered within three miles of this place, the colour of the workers produced was darker than that of pure Italians, showing that the queens had been mated by local black drones.

Another attempt was made in the same place in 1914. Fourteen queens of non-swarming parentage were mated there with Italians during the first week of October, after most of the local black drones had died off. Twelve of these queens were tested the following year, but a large proportion proved unprolific and the conclusion was reached that the queens had become impaired by being reared and mated so late in the season.

Attempts made at Ottawa in 1914 to get queens and drones to fly and mate later in the day than the regular hours showed that this plan, too, was impracticable.

In July, 1918, a number of queens were bred at Ottawa from non-swarming parentage and were taken in baby-nuclei with selected drones to Kapuskasing in Northern Ontario. It was believed that no other bees existed at or near this place.

Several matings were obtained, but a number of the nuclei swarmed out because of the small size of the boxes combined with the great and sudden changes in temperature of the north country.

In 1919, sixteen queens and five hundred drones were taken in nuclei on regular Langstroth frames to Duck island, near the eastern end of lake Ontario. This island is eight miles from the nearest islands and eleven miles from the mainland. Twelve of the queens began to lay soon, but six of these produced drones only and the other six varying proportions of drones and workers. The cause of the imperfect mating was not ascertained, but it may have been that the drones were too young or too few. The experiment, however, gave much useful information. It gave evidence that the bees sent to Duck island were isolated and that the proportion of queens lost in mating under the conditions on the island was not greater than on the mainland.

The Duck island experiment was repeated in 1920 on a larger scale. Sixteen nuclei containing fifteen virgin Italian queens of non-swarming parentage (two of them emerged on July 19 and thirteen on July 25 and 26), with 2,128 drones that had emerged between July 20 and 24, were brought to Duck island on July 28, just as the basswood flowers were beginning to open. Eleven of the queens, including the two emerged July 19, mated quickly and perfectly, producing large patches of worker brood. The four remaining queens were lost.

Nine more queens that had emerged August 1 and 2 were taken without more drones to the island on August 3. Seven of these were mated perfectly and two lost.

Twelve more queens that had emerged August 7 to 11 brought August 12 without drones, resulted in nine perfect matings, two matings producing partly drones and partly workers, and one queen lost.

The workers produced from twenty-six out of twenty-seven perfect matings were examined; they were lightly coloured enough to show that the queens were mated with Italians. This helped to support the evidence that they were mated with the drones brought, because the colonies on the nearest mainland, Point Traverse, Ont., were found to be mostly black bees.

After the removal of most of the queens on August 30 and 31 queens and drones were raised fortuitously in some of the nuclei, and when the latter were removed from the island on September 23, it was found that a honey flow from aster was proceeding and that several of these queens had begun to lay.

Six of the successfully mated queens were mailed to the Branch Farms; the remainder were introduced to the colonies at the Central Experimental Farm.

It is planned to test the island-mated queens for non-swarming and honey gathering in 1921, and from the best of them to rear queens and drones for mating on Duck island again.

It is also planned to commence the distribution of virgin queens, and, if possible, a few fertile queens, raised from the best Duck island stock. It is anticipated that it will be possible for a beekeeper to raise a sufficient number of drones from a few of these queens the following year to mate a proportion of any further virgins he may obtain.

Sizes of Hives

In our experiments with bees we have found that a large brood chamber is advantageous and also that the brood chamber, which becomes the wintering chamber in winter, makes for better wintering if it is deepened. The eight-frame hive containing eight Langstroth frames 8½ inches deep was replaced in the Central Farm during the year 1913 by a ten-frame hive containing frames of the same size. More recently it has been found that a prolific Italian queen will more than fill the combs of a ten-frame Langstroth hive with brood, allowing for the fact that the outside combs are never entirely filled and that there is a certain loss of space due to the thick top bar now in general use and to the stretching of cells that often takes place in the upper two inches of the combs. Comparison was therefore started last year between the

ten-frame Langstroth hive and two larger sizes, the twelve-frame Langstroth and the ten-frame Jumbo, the Jumbo frames being 2 inches deeper than the Langstroth frames. This experiment was continued through 1920 with the result that the twelve-frame Langstroth hive has been found to be too wide to handle easily and has the additional disadvantage that its use would render valueless the covers and floors of ten-frame hives in many apiaries where the ten-frame width has been adopted. The comparison between the ten-frame Langstroth and the ten-frame Jumbo is being continued.

However, a small brood chamber can be enlarged by placing another over it and this has certain advantages. More serious disadvantages of the eight-frame chamber are that in a good season for honey production the supers are tiered so high that it is not possible to handle the top ones without a step ladder and that if it contains Langstroth frames it is not strong enough to hold a strong colony for winter.

Wintering two Queens in a Hive

It is now three years since experiments with a system of wintering two queens in one hive was started at the Experimental Farm at Ottawa. The idea was suggested by the remarkably quick warming up and the long, warm and sunny days of spring in this locality, which it was noticed, caused strong colonies to begin swarming in average years during the honey flow from dandelion nearly a month before the honey flow from clover begins. This led to the expectation that a larger number of bees could be raised in time for the clover flow if two queens instead of one were wintered in a hive and substantial increase could be made as well. Experiments proved that this belief was correct.

In 1919 when the honey flow began on June 15, a week earlier than usual, in a six-hive experiment, the capped brood produced by the two queens covered an average of 1,330 square inches compared with 840 square inches produced by one queen in regular colonies. The honey taken from the two-queen hives averaged 189 pounds each and there was an increase in number of colonies of 100 per cent, compared with 178 pounds each, with no increase, from the regular colonies.

In 1920 the honey taken from a group of eight hives of which fifty per cent contained two queens averaged 77 pounds each with an increase of 50 per cent, against 68 pounds each with no increase, from six regular colonies.

All these experiments were in ten-frame Langstroth hives. An experiment in 1920 with two ten-frame Jumbo hives containing two queens each, gave the much greater return of 147 pounds each, with an increase of 100 per cent, more than double the production in honey alone from the regular colonies in ten-frame Langstroth hives.

The method of manipulation of the two-queened hives was as follows: The two queens were usually got into the hive at the time of treatment for the prevention of swarming. Instead of giving or leaving one queen-cell at the second time the queen cells were destroyed, two queen-cells were left or given, one on each side of the division board then inserted. A special portico was fitted into the front of the hive to separate the entrances for the mating of the queens. In colonies treated later in the season young fertile queens were given instead of queen-cells. If no brood was found on one side when the white honey crop was removed the division board was removed and the colony reverted to a one-queen colony. The two parts of the colony were completely separated on removal of the supers and the queen excluder in the fall so that actually two small colonies were wintered in each hive. A week after the first young bees emerged the outside comb was placed next the division board to permit continued expansion of the brood nest. The stronger of the colonies was placed in a separate hive two or three weeks later when the dandelion was starting to yield. By this means early swarming was prevented. In the 50 per cent group the double colonies were strengthened with a frame of brood from the single-queen colonies of the same group about the end of the dandelion flow. This meant removing two combs of brood from each single colony, which appeared to weaken it too much, consequently an

experiment with 33⅓ per cent double colonies, which will draw only one frame of brood from each single colony, will be tried instead next year.

To test the two-queen system in an out-apiary, four hives containing two double colonies and two singles were taken from the Central Experimental Farm apiary to a farmers' garden at Billing's Bridge on May 8. They were visited once every eighth or ninth day and were treated in the same manner as the groups containing fifty per cent double colonies in the home apiary. No swarms issued from these colonies, the average yield of honey was 158 pounds 10 ounces per hive spring count and there was an increase of two hives of bees. The value of total production of honey and bees from the four hives was $204.35. 128 pounds of sugar, valued at $24.19 was fed to these colonies for the winter.

For the success of the system it would appear to be necessary to have a spring climate almost as favourable as that of Ottawa and also expert management. It is, therefore, not to be recommended for general adoption throughout the country, although the high returns from it with Jumbo hives justify the continuance and expansion of the experiments with these. The experiments show, however, that there is no difficulty in wintering two queens in one hive when the bees accompanying each queen cover four or five combs. Not one of the double colonies was lost, including four in ten-frame Langstroth hives wintered outside in a four-colony case. The great value of a few spare young queens in spring for introducing into colonies that have lost their queen and the difficulty in procuring them then and in good condition and in introducing them safely makes it very desirable that moderately weak colonies containing young queens, instead of being united in the fall, should be placed in hives in pairs, separated by a close fitting division board, so that both queens may be saved.

In 1920, I spent a good part of the spring and summer personally conducting and directing the swarm control and two-queen experiments at Ottawa and also the breeding experiments here and at Duck island.

The investigation of the honey producing plants of Canada that has been in progress for several years has been continued. This includes a study of climatic and soil conditions as they affect nectar secretion.

The experiment to determine the actual value of bees in apple production has been continued on the Branch Farm at Kentville.

By direction of the Deputy Minister of Agriculture, a circular was issued inviting beekeepers to enter a colonial honey competition at the Grocers' Exhibition and Market, London, England. Mr. C. Vaillancourt of Levis, Que., was successful in winning the highest award in this competition.

The writer acted as judge at a large and excellent exhibition of honey and other apiary products made under the auspices of the L'Islet County Beekeepers' Association at St. Jean Port Joli, Que., September 27 to 30. The most important class was six one-pound jars of light honey which contained about eighty excellent exhibits, eighteen of which secured prizes. Our apiary at Ste. Anne de la Pocatière has shown that the light honey of this region is of superlative quality, and it is suggested that the beekeepers of this region increase production with a view to the development of an export trade with discriminating purchasers across the ocean.

Co-operative experiments with private beekeepers in localities having other conditions than those found on the Branch Farms have been continued and valuable data collected.

During the year Bulletin No. 43, second series, on "Wintering Bees in Canada," by F. W. L. Sladen, has been published. The circulars entitled "Beekeeping in Canada" and "Facts about Honey" have been revised. Other bulletins and circulars are in the course of preparation. A number of different press articles on the different phases of beekeeping have been published from time to time. The writer gave an address on our bee breeding work at the Annual Convention of the Ontario Beekeepers' Association at Guelph, Ontario, early in December. He also gave an address on the prevention of swarming at the Annual Convention of the Manitoba Beekeepers'

Association at Winnipeg in January. Other addresses were given at Toronto, Ottawa and elsewhere. In March a tour of the Western Provinces commencing at the Experimental Farm, Sidney, B.C., was begun.

Wintering at Ottawa, 1919-20

Forty-seven colonies were prepared for the winter of 1919-20; twenty-eight of these contained one queen and nineteen contained two queens. All colonies were fed sugar syrup to bring their stores up to sufficient weight for the winter. The average amount of sugar given to each colony was 26.1 pounds. Feeding was commenced on October 1 and finished by October 15, when the hives were weighed and averaged 65½ pounds for the ten-frame Langstroth hives and 84 pounds 11 ounces for the ten-frame Jumbo hives and 90 pounds 2 ounces for the thirteen-frame Langstroth hive, exclusive of cover.

Wintering Outside.—Sixteen of the colonies were placed in four 4-hive packing cases on October 6 and 7 and fed afterwards. In three of the cases the protection consisted of 3 inches of planer shavings underneath and on the sides and 8 inches on top. In the fourth case it consisted of 6 inches of packing used on the sides and bottom and 12 inches on top. The entrances during the winter were reduced to 1¼ high by three-eighths inch wide.

On October 22 one colony was placed in a one-hive packing case with 2½ inches of planer shavings on all four sides, bottom and top. On the same date another colony was placed by itself in a large case with 11 inches of shavings all around. The entrances in these cases consisted of three small holes three-eighths inch in diameter.

The yard was protected from the wind on all sides by a board fence 8 feet high.

The early part of the winter was very cold and the ground was practically bare of snow until the latter part of December, from then on there was a good depth of snow until early in March. The snow disappeared by March 27. The first good flight was on March 23. All the colonies were quiet throughout the winter with the exception of the one in the extra thick packing. This colony showed signs of uneasiness after it was packed and the bees clustered outside of the entrance and fanned vigorously until the cold weather set in.

The colonies wintered outside were examined on April 20 and were covering, at that time, an average of 6.3 combs. The single colony in the thick packing showed signs of dysentery in the spring and when unpacked it was found to be considerably weaker than the colony in the thin packing. The colonies were found to have a considerable amount more brood than those wintered in the cellar. No difference in wintering could be discerned between the colonies packed in six inches of shavings and those in only three inches. The double colonies, of which there were eight, came through equally as well as the single.

Cellar Wintering.—On November 15 eight hives with two queens and fifteen with one, were placed in the cellar, four days after the last good cleansing flight.

All colonies except two were removed from the cellar on April 16 and weighed. The first examination was given on April 19. The average number of combs covered per colony at this time was 5.9. Most of the colonies had begun brood rearing and all had a fair amount of stores.

Not one of the colonies that were wintered in the cellar or regular wintering cases died and all the doubles came through equally as well as the singles.

The average loss of weight from all colonies, from the time feeding was finished to the first weighing in spring, was as follows:—

				Average Loss
		From	To	lb. oz.
10-frame Langstroth,	wintered	in the cellar, Oct.	16-April 16.	19.4
" " "	outside	"	14-May 17.	27.15
13-frame "	"	"	14 " 17.	35.9
10-frame Jumbo "	"	"	14 " 8.	34.9
" Langstroth,	wintered under straw	"	16-March 22.	19.8

The two colonies left in the cellar till May 6 lost an average of 35 pounds 16 ounces.

Outhouse Wintering.—On November 14 six colonies were placed in an outhouse and packed in straw. Air was allowed to circulate through the building by means of two small screened windows one on either side and about four feet from the floor. These colonies were removed from the house on March 22 and found to be in bad condition. Brood rearing had evidently commenced very early as brood was present in most of the colonies but these were very weak in bees. In one colony only about fifty bees were alive. After uniting, only three colonies remained. Further dwindling occurred till finally only two weak colonies were left. The loss was evidently due to insufficient ventilation as the combs contained a considerable amount of water which should have passed off as vapour, especially in the lower tier of hives. A chimney in the straw would have been advantageous.

Wintering at Ottawa, 1920-21

Fifty colonies were prepared for the winter of 1920-21. All feeding was done between October 2 and 19. Forty-six colonies were fed an average of 44 pounds 6 ounces of syrup each. The syrup, as usual, consisted of two parts sugar to one of water by measure. A ten pound honey pail was found to contain nine pounds of this syrup, of which six pounds was sugar and three pounds water. It was found by weighing colonies before and after feeding that the average gain for every nine pounds of syrup given was 5 pounds 4 ounces. Three colonies weighed one week after feeding showed an average gain of 5 pounds 13 ounces. This figure would indicate that in estimating the weight of sugar required for fall feeding one should allow about one pound for every pound of gain in weight desired.

Sixteen colonies were packed in quadruple wintering cases on October 12 and 13. Planer shavings were used as packing material. In three of the cases, three inches of packing was used on the bottom and all four sides and eight inches on top. In the fourth case six inches of packing was used on sides and bottom with twelve inches on top.

On November 13 twenty-five single and nine double colonies were placed in the bee cellar shortly after the last good cleansing flight. The temperature of the cellar varied between 46° F. and 49° F. during the greater part of the winter. No signs of uneasiness occurred and very few bees died while in the cellar.

The bees were removed from the cellar on April 12 and were examined on April 18. One colony was found queenless and another to contain a drone producing queen, all other colonies were in good condition and with plenty of stores and young brood. The bees covered an average of 5·7 combs.

The bees that wintered outside were examined on April 19 and found to be in good condition with plenty of stores, brood and emerging bees. An average of 5·6 combs were covered with bees and more brood was present in these hives than in the cellar wintered colonies. Again no advantage was offered from the extra thick packing.

The average loss of weight for single colonies in the cellar from the time they were fed until they were taken from the cellar was 14 pounds 10½ ounces. For the double colonies the loss was 17 pounds 3½ ounces. The colonies that wintered outside were not weighed until May 10. The average loss of the single Langstroth colonies from the time they were fed until taken from the cases was 21 pounds, for the Jumbo the average loss was 22 pounds 8 ounces, for the thirteen frame Langstroth hive the loss was 23 pounds 4 ounces. The cellar wintered colonies were again weighed on May 10 and were found to have lost from the time of feeding 19 pounds 12½ ounces or 1 pound 9 ounces less than the outside wintered colonies during the same length of time.

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