



The
Preparation
of BEES for
OUTDOOR
WINTERING



Farmers' Bulletin 1012
United States Department of Agriculture

ONE OF THE MOST VITAL parts of the beekeeper's work is the preparation of bees for outdoor wintering. No other phase of beekeeping has so direct an influence on the honey crop of the following season.

The apiary should be located in a protected place and the colonies should not be moved at the time of packing. Directions are given in this bulletin for the proper arrangement of the apiary to prevent confusion due to the shifting of hives.

The amount and character of the packing materials and the most economical type of packing cases are discussed.

A schedule of dates for packing and unpacking the hives is presented for all parts of the United States, and the amount and character of winter stores are indicated.

It is important that none of the factors of good wintering be omitted, and several tests are given so that the beekeeper may determine whether his bees are wintering properly.

Contribution from the Bureau of Entomology

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Issued September, 1918
Reprint, April, 1922

THE PREPARATION OF BEES FOR OUT-DOOR WINTERING.

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NO PROBLEM confronting the beekeeper in most parts of the United States is of more importance than the proper wintering of bees, yet it is one which is sadly neglected. It is urged that before attempting to make packing cases for the wintering of bees the beekeeper study Department Bulletin 93, Temperature of the Honeybee Cluster in Winter, and Farmers' Bulletin 695, Outdoor Wintering of Bees.

THE ESSENTIALS TO SUCCESS.

The essentials to success in caring for a normal colony of bees from the end of one season's honey-flow to the beginning of the next lie in providing three things in abundance: (1) Stores of good quality, (2) protection from wind and cold, and (3) room for the rearing of brood at appropriate times. These factors are all of the greatest importance, and an omission of any one of them may prevent completely the gathering of the honey crop of the following year, and if any of the factors are given in less degree the honey crop invariably is reduced. The importance of these essentials does not apply equally at all times from the end of one season to the beginning of the next, but at some time they are all vitally essential; and it is the purpose of this bulletin to show how all three may be given in the early fall, so that, without further handling, the colonies will come through the spring with the maximum population. If, for example, the room for breeding is not provided in the fall, it becomes necessary to handle the colony early in the spring, and this may be detrimental. Similarly, it is the practice of some beekeepers to add to the stores of the colony in the spring, rather than to leave enough

in the fall to last until new honey comes in. This is dangerous for two reasons: Too often the stores are not given on time or in adequate quantity, and frequently they can not be given without exposing the colony too greatly. It is therefore the best practice by far to provide all of these factors in the fall, and no other methods are so safe and certain of success. By practicing the methods here given the enormous annual loss of colonies in winter may be almost entirely eliminated, and, what is more important, much stronger colonies may be obtained for the early sources of honey.

NECESSITY FOR STRONG COLONIES IN THE FALL.

A common cause of loss is through attempting to winter colonies that are too small. It is somewhat difficult to set a standard for colony strength at this season, but in general it may be stated that it is unwise to attempt to winter colonies that are not strong enough to have brood sufficient to fill three to four Langstroth frames two months before the packing is applied. If the colonies in the apiary are not of the proper strength it is wise to unite until the proper strength is reached. Any uniting should be done at least two weeks before packing. There is a tendency in some localities for colonies to weaken rapidly in early fall, due to the nature of the honey-flow from fall flowers. To some degree this may be offset by putting on the packing earlier than otherwise would be necessary.

It is highly important that each colony have a vigorous queen in order that brood-rearing may continue in the fall and may proceed rapidly in the spring. With colonies such as are obtained by the methods here described it is not desirable to keep queens more than two years and it is preferable to requeen the entire apiary every season. To get the best results in requeening all young queens should be introduced so that they will begin laying two months before packing. It will be found that queens wear out more rapidly in the unusually strong colonies obtained by the methods of wintering here described, but every good beekeeper realizes that it is these enormous colonies which get the greatest crops.

ARRANGEMENT OF THE APIARY.

WIND PROTECTION.

It is of the greatest importance that the apiary be located where the wind in winter is virtually eliminated. A grove of trees or an adjacent hill usually offers the best protection, or it is possible to make an artificial windbreak such as a high fence. A natural windbreak usually is better, for it is more extensive in most cases. It has been found by the authors that if a wind of 20 miles an hour blows on the winter packing cases for a few hours the temperature

of the inside of the packed hive may be greatly reduced and may even fall as low as that of an unpacked hive. Too much reliance should not be placed in buildings as windbreaks, for they often serve simply to divert the wind slightly and may even make conditions worse. A fence made of close boards usually is unsatisfactory for it causes whirls that may destroy many colonies. A heavy blanket of snow serves to reduce the effect of the wind.

ARRANGEMENT OF THE HIVES.

In arranging the hives in an apiary it is necessary to take into account the method of wintering to be followed. If the bees are to be wintered in the four-colony cases to be described later the hives should be kept in groups of four all the season (fig. 1), for if colonies are moved more than a foot just before packing and then moved again as they are unpacked there is a considerable amount of "drifting"—that is, bees from some colonies join other colonies during

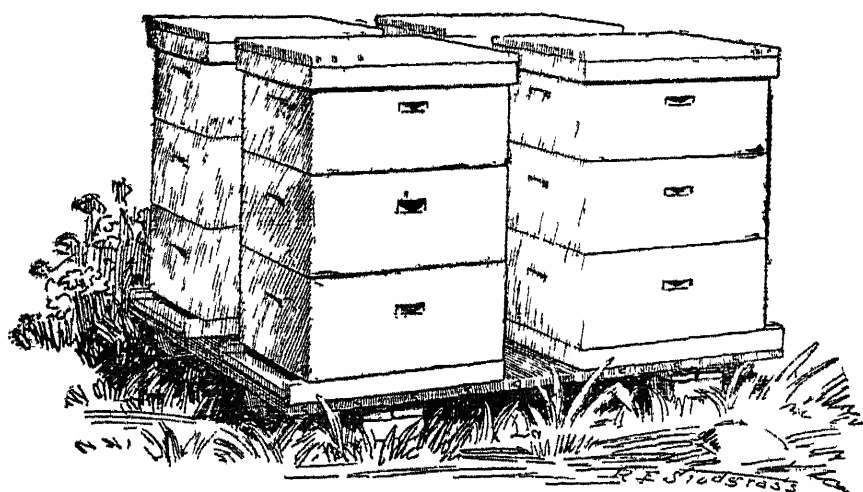


FIG 1—Colonies of bees in summer position in groups of four. This arrangement is advantageous whether or not the bees are wintered in four colony packing cases.

flight, and the result is an actual reduction of the number of colonies and of bees in the apiary. A failure to keep the colonies properly arranged for their winter stands during the entire summer is a common cause of failure in using the four-colony cases. Whatever type of case is used for outdoor wintering, the bees should occupy the same place during the entire year.

Since the outside of the winter case is quite different in appearance from the hives the bees often are somewhat confused. To prevent drifting from this cause it is a good plan to set a large stake between the two entrances on each end of the four-colony winter cases; this will serve to help the bees in orienting themselves during flights in winter and especially in spring. If it is possible to plant some shrubbery among the hives it is a good plan to have the plants arranged so that they will act as markers for the bees during these early flights (fig. 3). They will not be amiss during the summer, and, if properly

placed, they need not interfere with movement through the apiary during the summer's work, while they add to its attractiveness.

INSULATION OF THE HIVE.

AMOUNT OF PACKING NEEDED.

It is impossible to insulate bees too heavily during the winter. It is obvious, however, that the beekeeper will not want to put on more packing than is practically necessary. For a climate such as that of Washington, D. C., it is found desirable to provide 4 inches of packing underneath the hives, 6 inches on all sides, and 8 or more inches on top. In warmer climates less will be needed, but the beekeeper must not think that simply because he lives south of Washington he can be safe with less packing or none at all. There are many places farther south than Washington where more packing is needed, and there are, indeed, few places except along the Gulf or in southern California where less may be used if the best results are to be obtained.

For more northern localities more protection is needed. The amount indicated for Washington has been used with success in places as cold as northern Ohio and even in Canada, but in these places the insulation during the coldest seasons is usually augmented by heavy snows. These are not at hand every winter, or may be lacking during the coldest part of the winter, and it is, therefore, wise to provide more packing, especially on the sides and top. For a climate such as that of New York or Wisconsin, 8 inches of good packing on the sides and 1 foot on the top probably will be enough for good wintering every year. The amounts recommended for the different zones of the United States are given in Table I (p. 15).

A belief is current among many amateur beekeepers that good results may be obtained by using hives which have 2 inches of packing built in the sides and somewhat more on top. This amount is insufficient in winter in all parts of the country except the southern portions of the Gulf States. A common practice is to wrap some straw or corn fodder around the hives, but this may do more harm than good if the wind can blow directly through it. A covering of roofing paper with perhaps a little paper packing underneath is practically worthless in insulating value.

TYPES OF PACKING MATERIAL.

There is little difference in the insulating value of the various materials which may be obtained easily for the packing of hives in winter. Exaggerated claims have been made by some beekeepers for such materials as broken cork or certain commercial insulating materials, but it is safe to say that there is not 25 per cent difference between the poorest and the best of the available insulating mate-

rials, provided, of course, that obviously poor things such as corn fodder and straw be eliminated. Sawdust, fine planer shavings, forest leaves, chaff, broken cork, and such materials may be used, the choice depending chiefly on the availability of the materials. In general it may be stated that the smaller and the more numerous the dead air spaces confined in the packing, the greater will be its efficiency in insulation. If forest leaves are used they must be gathered the year before and stored, as the leaves fall some time after the bees should be packed. If sawdust is used it is best not to pack it down tight, but if forest leaves or planer shavings are employed it is essential that they be packed in closely and that the containers be completely filled. Broken cork, such as is used in the shipping of certain types of grapes, is good and has the advantage that it does not hold moisture as does sawdust. In all cases the packing should be placed in some sort of box which will be rain-proof and thus protect the insulation from rains and snow, for all insulating materials lose part of their efficiency when wet.

BOTTOM PACKING.

There has been considerable discussion among beekeepers as to the value of placing packing material below the bottom boards of the hives. This is usually provided by placing the hives on 2 by 4 inch supports or on racks of 4-inch material. Those who have opposed this have pointed out that "heat rises," overlooking the fact that while warm air attempts to rise, if this is impossible other avenues of escape of warm-air currents may be set up. Furthermore, and more important, they have overlooked the important fact that heat escapes from the hive not only by convection currents but by conduction and radiation as well. In an extensive series of experiments performed by the writers it was found that in hives packed at the top and sides most of the heat escapes through the bottom boards; in fact, this was so noticeable that the packing at the top and sides never served its full purpose so long as heat was escaping rapidly at the bottoms. It may be stated, therefore, that so long as the bottoms are unprotected there is little insulating value in materials piled on the top and sides beyond about 2 inches. This amount is insufficient for most parts of the United States, therefore bottom packing should be considered as absolutely essential wherever bees are packed.

To get the value of bottom packing it is absolutely essential that the entrance be reduced, but it need not be closed. In a long series of temperature readings on hives packed for several winters, the authors were able to keep a temperature of 50° F. on the bottom boards of packed hives directly behind the entrance openings. Those who have condemned bottom packing have labored under the mistaken notion that it is impossible to prevent currents of cold air

through the entrance. This is entirely possible if the entrances are adequately reduced. The conclusion to be drawn from the experiments performed is that unless the bottoms of hives are well packed, the beekeeper ought not to imagine that he has packed his hives at all well.

THE PACKING CASE.

There is no virtue in any special type of case, but in all types there are a few points which must be observed. There must be provision for abundant packing on the top, bottom, and sides, the entrances must be small, the case must be rain-proof, and the con-

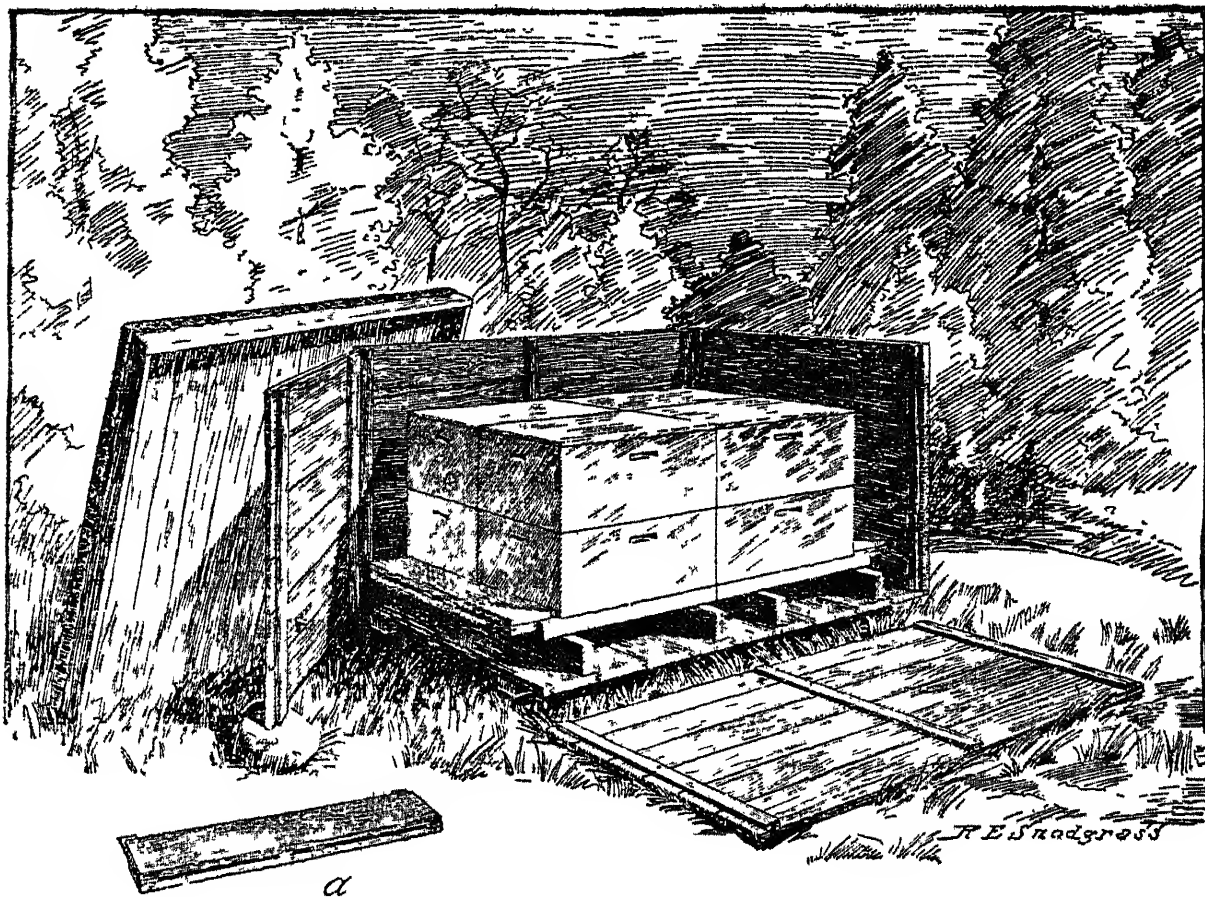


FIG. 2—The winter packing cases used in the Bureau of Entomology apiary. *a*, Detail of tunnel to hives. In the specifications given in this bulletin (p. 9) provision is made for room for a third hive body to be added in the spring.

struction of the case should be such that it may be taken apart and put together easily. The parts of various cases used in one series of apiaries should be interchangeable. The authors have refrained in the past from giving explicit directions for making a winter packing case for fear that some beekeepers might think that there may be peculiar virtue in the case used and recommended by the department (fig. 2). So many beekeepers, however, have written for exact dimensions for making the case used in the apiary of the Bureau of Entomology that it is considered best to give these in this bulletin.

In order that protection adequate for bees in a climate such as that of Washington may be provided, 4 inches of packing below the bottom board, 6 inches on all sides, and at least 8 inches on top are

desired. There is advantage in packing several colonies together, in order that they may warm each other and to reduce the cost of the case and the labor of putting it on. The bureau, therefore, has adopted the four-colony type of case which has been much used for years in all parts of the country. In this case, two colonies face east and two west. Provision is made for wintering all colonies in two full-depth hive bodies.

In the following dimensions it is assumed that $1\frac{3}{8}$ -inch tongued-and-grooved lumber is used, that the 10-frame Langstroth hive is in use, and that two hive bodies are employed for each colony, with adequate space above the hive so that, if needed, a third hive body may be put on before time for the removal of the packing. In this packing case the sides overlap the ends. For hives of other sizes the lumber must be cut so as to provide the packing specified in Table I (p. 15). For zones F and G (fig. 5) provision should be made for additional packing by increasing the length of all parts 4 inches, and for zone C a correspondingly smaller case may be made.

Bottom of case-----44 inches (exact) by 52 inches (exact).

Sides of case-----53 $\frac{1}{2}$ inches (exact) by 35 $\frac{3}{4}$ inches (minimum).

Ends of case-----44 inches (exact) by 35 $\frac{3}{4}$ (minimum).

Telescope cover of case--48 inches by 56 inches (minimum).

If 6-inch boards (laying 5 $\frac{1}{2}$ inches) are used, it is desirable to use 7 boards for the height of the case; if 8-inch boards (laying 7 $\frac{1}{2}$ inches) are used, 5 will be sufficient. In figure 2 only 6 boards, laying 5 $\frac{1}{2}$ inches, are shown, but in this case no allowance is made for a third hive body in the spring. For the telescoping part of the cover, 4-inch boards are used.

As was pointed out earlier, the hives should rest throughout the summer on the floor of the winter case (fig. 1). The plan of putting them in groups of four, two facing east and two west, has much to commend it during the entire year. The bottom therefore should be made strong enough to stand the weight of four colonies without getting out of shape. Since this weight may be over 1,000 pounds in a good year, it is advised that the cleats on the bottom of the case be of 2 by 4 inch material. The supports of the bottom and the position of the cleats should be arranged so that the weight will not rest too largely on the boards, and the stones or bricks used should be directly under the center of the hives when they are in their summer position. Obviously the hives will be moved to the outer corners of the bottom during the summer to facilitate handling.

The sides of the case should be so constructed that the cleats which hold the boards together will serve to support the overlapping sides on the bottom. This is clearly shown in figure 2. There should also be a central cleat on the sides to prevent warping, for the cases must be rain-proof. If cleats are properly placed as

shown in the illustration, they make the equivalent of a halved joint at the corners. The sides may be held in place and together by nails or by any sort of special hook. The entrances for the colonies during winter should be in the ends of the case, as shown. These will be discussed later.

The top of the case may be made to telescope over the sides, as shown in figure 2, or it may be made in any other way desired so that it is adequate to keep the packing absolutely dry throughout the winter. The telescope cover has much to commend it, especially in the ease with which the covers may be stored in summer. The top of the wooden cover should be covered with a roofing paper of first quality in order that the protection will last for years. If the tele-

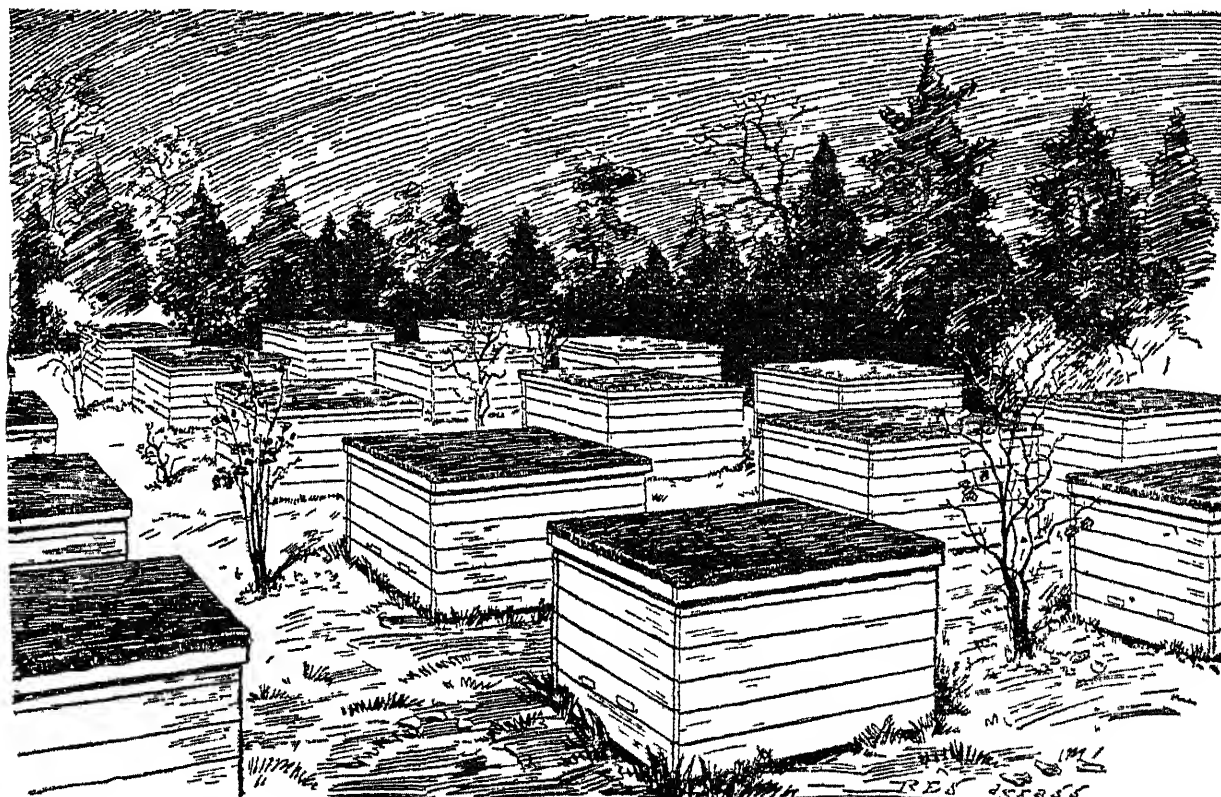


FIG. 3.—An apiary packed for winter in four-colony cases such as are used in the Bureau of Entomology apiary.

scope type of cover is used, no cleats other than the sides and ends of the telescoping portion will be needed.

A tunnel (fig. 2, *a*) is also needed through which the bees may pass on warm days and to permit ventilation. This is best made of two boards, one the width of the packing (e. g., 6 inches) and the other this width less the extension of the bottom board. In most cases this extension is 2 inches, so the lower board will be 4 inches wide. These are held apart by strips three-eighths of an inch thick. This is the height of the usual hive entrance in winter, and the passage between the boards is therefore the same height as the hive entrance. In order that the tunnel may not get out of alignment, these strips are continued back, as shown in the figure, and these projections extend into the hive entrances at the corners. The arrangement

for keeping alignment at the outer edge is discussed under "The entrance" (p. 13).

SINGLE OR DOUBLE CASES.

For those having only a few colonies, it is not always convenient to build cases for colonies in groups of four. It is not necessary to give dimensions in detail for those having a few colonies, however, for they will usually wish to use whatever they have at hand. It is often possible to arrange a heavy wooden box, such as those used for shipping dry goods (fig. 4), so as to make a winter case for one colony which will answer every purpose. It is, of course, necessary that the salient feature of a good winter case be preserved. If the arrangement of the apiary makes it inconvenient to have the colonies in

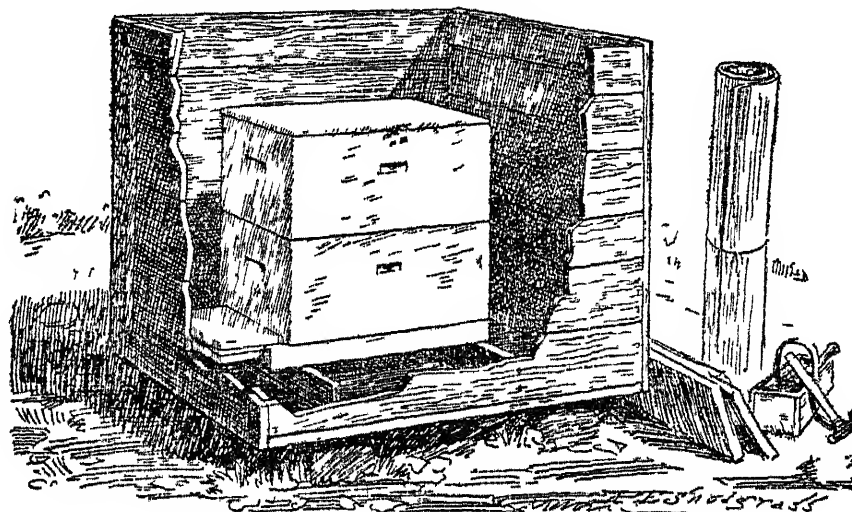


FIG 4—An improvised winter case for one colony.

groups of four throughout the year, it is quite possible to make good cases for two colonies. Anything other than the four-colony case, however, will probably cost more per colony, or if too many colonies are put into larger cases there may be trouble from other causes, as from drifting.

ARRANGEMENT WITHIN THE HIVE.

CAPACITY OF THE WINTER HIVE.

As has been pointed out, bees need room for breeding in the fall and again in the spring. During the winter season there is no brood-rearing in normal colonies which are adequately protected, and room for breeding therefore is not essential during the winter. If the bees are to have room for the proper development of colony strength, however, they should have two hive bodies each of 10-frame Langstroth size by about the beginning of April in most parts of the country, and earlier in the South. In order that it may be unnecessary to open colonies during a period of such unsettled weather as obtains at this season, it is advised that the room for breeding be provided in the fall and left with the bees all winter. To make this a

safe procedure, it is necessary to provide more packing than would be necessary if the colony were provided with only enough room for the cluster and winter stores during the winter. It has been found desirable also to leave more stores with the bees than have been left by many beekeepers, and this is additional reason for the giving of more room during the winter.

It is recommended, therefore, that in all parts of the United States colonies of full strength be wintered in two hive-bodies of 10-frame Langstroth size. They should, of course, be provided with abundant protection and the entrances should be reduced

SPACE ABOVE THE FRAMES.

Formerly it was commonly recommended that corn cobs, or other objects designed for the purpose, be placed above the top bars of the frames, and then that quilts be placed over these. The purpose of these objects was to lift the quilts so that the bees could pass over the tops of the frames. In former years it was advised that holes be bored through the combs to permit passage from one space to the other. Of late years these things have been abandoned, to a large degree, for it is known now that if bees are packed as they should be they may pass easily at all times to any part of the hive as need arises. It is often stated that bees die of starvation in the hives when there is abundant honey not many inches away from the cluster. This, of course, never happens in colonies that are well packed. In colonies that are adequately protected there is no better plan than simply to leave the regular wooden cover in place and sealed down by the bees. Quilts directly over the frames are a nuisance at any time, and during the winter they are of no value for upward ventilation in well packed colonies and should be used only as a poor makeshift for good packing.

UPWARD VENTILATION.

A common practice has been to remove the hive cover when the bees are packed for winter and to cover the frames with burlap or some such porous material, the object being to allow the escape of any moisture which may be generated within the hive during the winter. Moisture is being generated constantly as the bees consume the honey stores, but if the bees are adequately packed the amount of moisture will be reduced to the minimum. The chief danger, of course, is from moisture which condenses, and in an adequately packed hive there is no condensation. The temperature never goes low enough for water vapor to condense. Therefore it is obvious that upward ventilation for the escape of moisture is never needed in hives that are packed as they should be. Any beekeeper who has had trouble in the past with condensed moisture in the hives, or with wet

packing over the porous tops, may be sure that he has not provided enough packing material.

Another thing is to be considered in connection with the subject of upward ventilation. The entrances to the hives must be greatly reduced in order that there may not be excessive loss of heat at that point. If upward ventilation is provided, there is opportunity for the wind to blow through even the small entrance, through the hive and out through the porous cover. This current of air will be slight but nevertheless it exists, and serves as an avenue for the escape of considerable heat.

If insufficient packing is provided, upward ventilation becomes almost necessary, unless a large entrance is left. The beekeeper must see to it that he is providing adequate packing material before he gives up the upward ventilation, but he should not count his bees well packed for winter so long as he must provide for the escape of condensed moisture.

THE ENTRANCE.

As has been pointed out, the entrances of hives must be greatly reduced during the winter in order that the efficacy of the bottom packing may be preserved. It is desirable, however, that provision be made for larger entrances during the early fall and again in the spring. To provide conditions suitable at all times while the packing cases are on, the Bureau of Entomology has adopted a type of entrance which to some extent has been used previously in the North. Five $\frac{3}{8}$ -inch auger holes are bored in the ends of the packing case at a height that will allow for the thickness of the case floor, the bottom packing, and the thickness of the bottom of the hive. This usually is a little over 6 inches from the lower edge of the case ends. No alighting board should be placed at the outer entrance holes, as it is not needed and serves only to collect snow and ice.

To prevent the tunnels from getting out of alignment at the outer edge, a peg of the diameter of the holes is inserted through the outer hole for each hive and into the tunnel (see fig. 2). This peg is usually about $2\frac{1}{2}$ inches long. This leaves four auger holes, each three-eighths of an inch in diameter, for the bees to use as an entrance during the fall and spring, and during the colder weather a piece of section material or a small board is tacked over three of the holes. (See fig. 3.) This gives in winter a single hole for an entrance, three-eighths of an inch in diameter. This provides a place for the bees to remove their dead, a place for flight on moderately warm days, and also provides adequate ventilation for the hive while the bees are confined without an opportunity for flight. However, the size of entrance should not be discussed without warning beekeepers that unless adequate packing is provided, such a small entrance may result in the death of the

colony. Furthermore, a poorly packed colony will not be able to carry out the bees as they die, and the death rate will be higher; and these things combined may result in an accumulation of dead bees at the entrance, which will serve to suffocate the remaining bees. A colony that is well packed, however, is able to remove all dead bees as fast as they die, and there will never be an accumulation on the floor of the hive. Furthermore, a well-packed colony does not need so large an entrance for ventilation as does one that is not packed or which has not enough packing. If snow drifts over the small entrance here described, the beekeeper need have no anxiety, for the bees can still receive adequate ventilation. If a crust of ice closes the entrance it will be well to break it, but usually the escaping heat will melt this ice before any damage is done.

WINTER SCHEDULE.

Great confusion has existed among beekeepers as to the right time to pack the bees for winter, and especially as to the right time to remove the packing in the spring. It is quite possible to give definite directions for both procedures and to place the recommendations on a firm foundation by basing them on weather phenomena. The maps (figs. 5 and 6), showing the time of the first average killing frost in the fall, serve as a basis for the recommendations for each

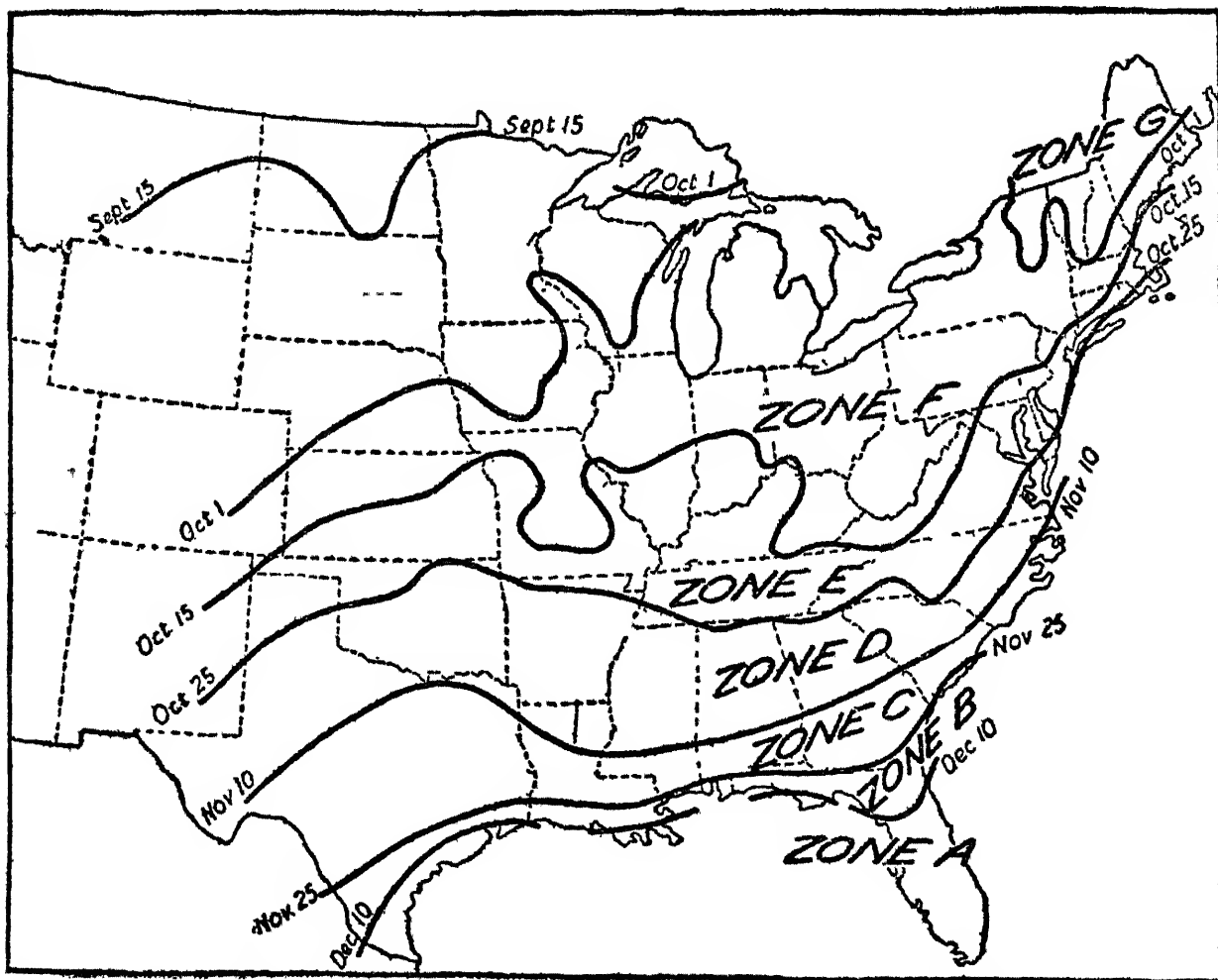


FIG. 5.—Map of the eastern United States indicating average date of first killing frost in autumn. On this the zones for winter packing are based. No packing is recommended in zones A and B.

of the zones into which the map of the eastern United States is divided. Perhaps it will be a matter of surprise to beekeepers in parts of the South to see that, so far as the wintering of the bees is concerned, they are as far north as beekeepers who live many miles farther toward the pole.

The lines on figure 5 indicate the average dates of the first killing frost in the fall, and these dates, given at the ends of the heavy lines, are of direct value to the beekeeper as giving the proper time for putting on the winter cases. The average dates of the last killing frost in the spring do not show exactly the same lines on the maps, but the differences are not sufficiently great to justify the use of a separate map for this purpose. The authors have chosen therefore to divide the country into the zones indicated, and the recommendations given below apply to each of the zones shown.

On account of the variations in elevation, it is impossible to carry these lines into the Rocky Mountain region, but as packing is just as necessary in the West as in the East, figure 6 is inserted to indicate roughly the time for the putting on of the packing in the fall. The dates in this map are the average dates of the first killing frost. By consulting Table I the beekeeper of the West may learn the time advised for the removal of the packing, by placing his locality in its proper zone, on the basis of the first killing frost.

TABLE I.—*Dates for the packing and unpacking of bees in the various parts of the United States, based on data furnished by the Weather Bureau for the average dates of the first and last killing frosts. The amount of packing recommended for each zone is included.*

Zone.	Date for packing.	Date for unpacking.	Packing recommended. ¹	Remarks.
A.....	None needed.
B.....	Do.
C.....	November 25.....	March 15.....	2-4-6	
D.....	November 10.....	April 10.....	4-6-8	
E.....	October 25.....	May 1.....	4-6-8	
F.....	October 1.....	May 20.....	4-8-12	
G.....	September 15.....	June 1.....	4-8-12	Cellar wintering much safer.

¹ In this column the first figure represents in inches the amount of packing needed below the bottom boards, the second the amount of side packing, and the last the amount needed on top.

TIME FOR PUTTING ON THE WINTER PACKING.

Frequently great loss of colony strength is due to delay in putting on the packing. Perhaps this is the most common source of loss in outdoor wintering aside from that due to a failure to pack the bees at all. Packing should not be deferred after the flowers furnishing the last honey are killed by frost. In case the late fall flowers furnish honey that is to be removed, then it is necessary to wait until nectar is no longer coming in before applying the packing, but it is indeed rare that the last honey should be taken away, and it is good beekeeping to apply the packing even before there is any frost at all. The determining factor is the necessity for handling the bees.

If more stores must be given them or if some of the late honey is to be removed in order that it may be replaced by better honey or by sugar sirup, then handling of the bees after frost may be needed, but after the last essential handling it is much the best plan to pack the bees. In parts of the country where bees are wintered outdoors it is quite customary to delay packing until Thanksgiving Day, but this is too late by far except in the extreme South (zone C).

It is safe, therefore, for the beekeeper to use the dates shown in figures 5 and 6 and the data given in Table I as a guide to the time of packing. He may be assured that if he delays packing later than the dates shown therein the bees will suffer by a loss of colony strength and vitality at a season of the year when they can ill afford to be weakened by neglect. Under no circumstances should packing be delayed more than two weeks after the date given for each zone. Further, if packing is delayed until after cold weather begins, the disturbance of the colony may induce the beginning of brood-rearing, and this in turn may result in the death of the colony. If by chance a colony has been left unpacked until after the bees have been confined by cold weather for three or four weeks, the packing may do more harm than good.

TIME FOR THE REMOVAL OF PACKING.

If bees are given the right amount of room, stores, and protection early in the fall, nothing that the beekeeper can do will benefit them until it is necessary to handle them because of preparations for swarming or because of the incoming nectar. Of course if bees are well packed they get so strong in the spring that if crowded they begin preparations for swarming earlier than do colonies which have been neglected during the winter. By following the methods here described the season for swarm control is advanced, so that usually it is entirely passed before the honey-flow begins.

In the region of Washington it has been found best not to remove the packing until at least May 1. Farther south or in warmer regions it may be well to remove the packing earlier, but in localities such as New York or Wisconsin (zone F) the packing should be left in place until at least May 20, and usually until June 1. Obviously this will be impossible unless two hive bodies are left on the bees all winter, or unless more room is given in the early spring, before unpacking. It has been found that if the bees are allowed to remain in the cases until the dates named they may then be taken out ready for whatever nectar may come. By that time they should have 12 frames of brood—far more than is found in the average colony throughout the country even in the midst of the honey-flow. Such colonies are so strong that if cooler weather comes after they are unpacked, as it sometimes does, they are not injured by it. Of course the bees would be as well or even better off if the packing

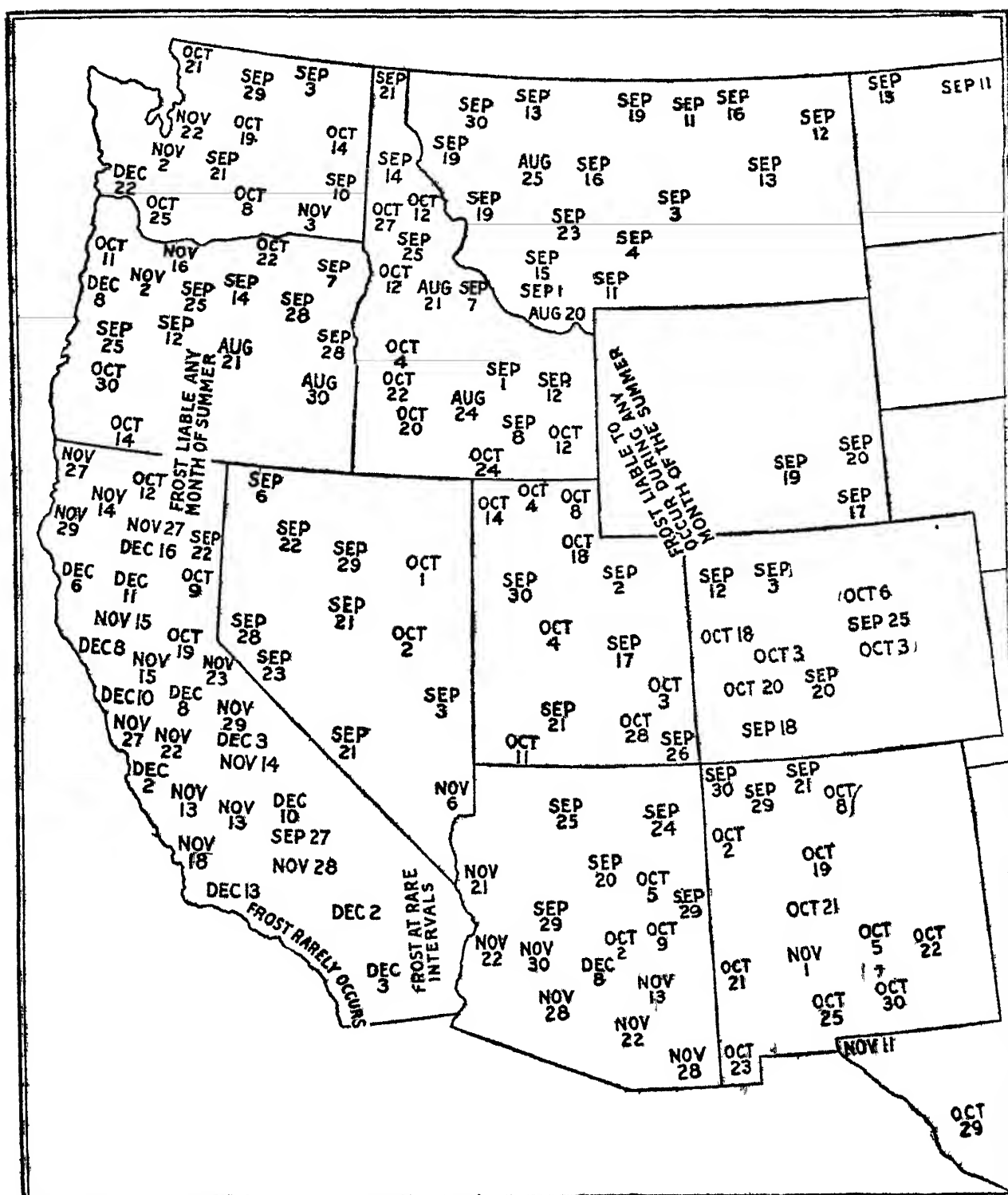


FIG 6—Map of the western United States, showing variation in average date of first killing frost. For each locality the recommendations for packing and unpacking are the same as in corresponding zones in figure 5. The dryer atmosphere of most of the West does not diminish the need of packing. For localities where the first frost occurs after November 25 no packing is recommended.

could be left on throughout the year, but as yet no practicable way has been devised for giving the bees enough packing during the winter and then leaving it on throughout the summer. The commercial double-walled hives which have been devised for this purpose are all too scant in packing material for good results, and none of them can be recommended.

The dates given for the removal of packing in the spring follow approximately the average dates of the last killing frost in the spring for each locality. In case local conditions make the removal

of the packing unnecessary as early as the dates indicated, it is entirely safe to leave the packing on until some manipulation makes it desirable to handle the combs, as this can not well be done while the hives are heavily packed.

WINTER STORES.

In packing bees for winter two things require attention so far as stores are concerned, and one is as important as the other: (1) There must be plenty of honey in the hive to last until the spring honey-flow, and (2) the stores which will be used by the bees during the period of confinement in winter must be of the best quality and well ripened.

It is, of course, possible to give the bees more honey or sugar sirup after spring opens, but this means that the colonies will need to be handled during this period, and this is not the best plan. It is commonly said among the best beekeepers that "the best time to do spring feeding is the fall before." The safest plan by all means is to allow each colony to have at least 45 pounds of honey at the time the bees are packed. They should then be allowed to keep any honey which may come in later, and it will be adequately ripened if the colony is well packed. This will be small in extent if they are packed at the right time, and the bees will also have their stores replenished by small amounts of honey which come in during the early spring before they are unpacked. This amount of stores for winter will seem large to many beekeepers who have been in the habit of leaving less, but the object of the plans herein set forth is to have much stronger colonies than are found in the average apiary in the spring, and the amount of stores mentioned may be needed. The only places where beekeepers might have some reason to reduce the amount of stores are locations where the honey granulates quickly, in which event it can not be extracted later. Such honey, however, usually is as good for winter stores as if it were not granulated, and it may then be saved for stores the following winter. Forty-five pounds of honey on the hive is a better investment for the beekeeper than money in the bank, and more beekeepers make mistakes in this regard than anywhere else in the work of the year.

Honey that is high in gums, as many of the honeys which come from various trees, is not good for winter stores. Honeydew honey is still less desirable. When either is present it is best to remove it and either to give frames of good honey to take its place or to feed about 10 pounds of good honey or sirup made of granulated sugar after all brood-rearing has ceased. Honey or sugar sirup which is fed late is stored in the place where the last brood emerged; it is therefore the first of the stores that the bees use. As long as they are having good honey or sugar stores for winter use the condition known as dysentery will be warded off. Then, later, when they have used up

the good stores, the weather will permit frequent flights, and then the less satisfactory stores will do no harm. Honeydew honeys usually may be detected by their bad taste, accompanied ordinarily by a dark, muddy appearance. In case of doubt as to the stores it is always safe to give good honey or sugar sirup. Unfortunately it is true that many of the fall honeys are not of the best quality for winter use, and this, in part, accounts for the heavy losses of bees occurring regularly in some parts of the country.

ALL THE FACTORS OF GOOD WINTERING ARE NEEDED.

One frequently encounters beekeepers who condemn winter packing, stating that they have tried it without success. The writers have met many such beekeepers, and many of them are good beekeepers in other respects. On careful inquiry it is learned that in all cases they have omitted some vitally important factor. The most common fault in winter packing is to leave the entrances of the hives wide open. This, of course, nullifies the benefit of the packing to a large degree, and one need not be surprised that these men do not find virtue in packing heavily. Another common fault in packing is to omit the packing from the bottom. Snow acts as an excellent insulation, but one can not be sure that there will be snow at just the right times, and it is therefore necessary, to insure good wintering, that good packing be placed on the bottoms.

It is also common to face the hives to the south and then leave the fronts without packing, under the erroneous impression that since the heat from the sun will enter more readily, the colonies will be benefited more than they would be if they were heavily packed in front. To combat this view it should be necessary only to point out that the sun shines only a small fraction of the hours during winter. Furthermore, any place through which heat may enter easily serves also as a place through which heat escapes. In certain well-known cases the other factors of good wintering, strong colonies and good stores, are so well provided that the loss from this lack of protection is not detected, yet it is certain that in any such method of wintering there is a great loss of bee vitality, and the bees are compelled to do more work in heat generation than would be the case were they well packed.

It can not be stated too strongly that the right way to winter bees is to provide *all* the factors needed, and not to omit any of them simply because in most years the bees can get through without all dying when less help is given. The three things necessary for successful caring for bees from the time they are packed until they are unpacked in the late spring are (1) plenty of protection, (2) plenty of stores of good quality, and (3) plenty of room for the building

up of the colony strength in the spring. None of these may be omitted without reducing the colony strength in the spring, and, as every good beekeeper knows, it is the strong colonies which get the maximum crop.

MEASURES OF SUCCESS IN WINTERING.

It is often difficult for a beekeeper to know whether he is wintering his bees as well as he should, for he may not have been able to learn from reading or visiting other apiaries how well colonies may be brought through the winter. The writers therefore have attempted to give here a few measures which the beekeeper may apply to his apiary, that he may be able to decide whether his methods of wintering should be improved.

1. When bees are adequately packed and protected from the wind, they are able to push out the dead bees as they die in winter. There should never be an accumulation of dead bees on the bottom board.

2. A colony of full strength will have 12 Langstroth frames filled with brood by the time that the bees should be unpacked. The bees should not be taken from their cases until it is necessary to handle them, and if two hive bodies have been given each colony, unpacking may be deferred until time for the control of swarming or until the new honey is coming in freely. Sometimes it even happens that colonies need a third hive as a swarm prevention measure before it is time to remove the packing, in which case it can be given and the packing replaced, at least around the sides of the third hive body. Space for this is indicated in the dimensions given on page 9.

3. A colony is not of proper strength for winter unless it has between three and four frames of brood two months before the time for putting on packing. Usually this will be six weeks before brood rearing ceases. If there is less brood at that time it indicates either that the queen is not good or that the colony has been weakened from some other cause. If taken in time this condition may be remedied by adding brood or honey or by uniting. It is extravagant to attempt to winter weak colonies.

4. If a thermometer is inserted into the hive through the auger hole entrance at the time of the coldest weather in winter it should show a temperature above the freezing point. At no time should the temperature of any part of the hive go below freezing, and the point just within the entrance is the most convenient one at which to take the temperature readings. The lowest temperature obviously will be at this point.