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Agricultural Experiment Station

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*In cooperation with U. S. Department of Agriculture.
†Mr. Marshall also served from 1923 to 1929.
WINTERING BEES IN WYOMING

By C. H. Gilbert

Wintering bees presents a problem of major economic importance to Wyoming beekeepers. Winter losses are heavy because of the long winter season, wide temperature variations, and extremely variable weather conditions during the spring and fall. Normal winter loss for the entire state runs about 15 per cent with a much greater loss during unusually severe winters.

Honey production has become a highly specialized branch of agriculture and beekeepers are constantly confronted with the necessity of lowering production costs. This is particularly true in Wyoming where most of the crop is exported and transportation rates are high. A practical way to keep down costs in Wyoming is to reduce winter losses. Wintering of bees has been a major research project at the Wyoming Experiment Station for several years. The purpose of this bulletin is to describe methods of wintering tested and to outline and discuss briefly the results obtained.

The Wintering Problem: Wintering bees in Wyoming presents a complex problem because there are so many variable factors involved. The growing season is short, probably not exceeding five months in many sections of the state. The winter season, from the standpoint of the beekeeper, extends over a period of approximately seven months. Protracted cold spells may occur during December and January when the temperature drops below zero every day for a long period. Severe storms may strike suddenly in the spring and fall causing considerable damage to bees. The danger is particularly acute in the spring when the brood, so vital to the future of the colony and so costly from the standpoint of hive resources, may be killed by a short cold spell. Strong winds, a very important factor in wintering bees, are prevalent in many sections of the state.

Bees are confined to their hives for most of the winter where they remain in a cluster, eat honey stored the previous summer, and keep warm by generating their own heat. The amount of energy expended during the winter months determines to a large
extent the number of bees that survive. Brood is not reared for about four months of the winter and during that time there are no young bees for replacement. In order to take full advantage of the short summer season it is essential to have strong colonies in the spring. To carry a maximum number of bees through the winter it is important to conserve their energy. This can be accomplished by providing some sort of winter protection.

**Measure of Successful Wintering:** The generally accepted standard for judging the results of wintering is based upon the number of colonies that die outright. There are, however, other equally important results to be considered, some of which are listed below:

1. General condition of surviving colonies.
2. The size of the cluster in each hive.
3. The condition of each queen and number of queenless colonies.
4. The amount of brood in each hive in the spring, and the ability of the colony to build up for the honey flow.
5. The amount of honey consumed during the winter.
6. The amount of feed required in the spring.
7. The cost of packing material and labor required.
8. The amount of honey produced the following season. Production averages should be based on the number of colonies placed in winter quarters rather than upon the number of surviving colonies.

**METHODS OF WINTERING TESTED**

Fundamental studies were made early in the experiment with a few colonies as a foundation for future work. The number of colonies was increased as the experiments progressed and one year ninety-six colonies were under observation. All colonies were wintered in the same apiary and standard two-story, ten-frame hives were used throughout. Methods tested included: Colonies without protection, sawdust packing cases, tar paper packing, celotex packing cases, shed wintering, and cellar wintering.
DESCRIPTION OF METHODS TESTED

Unprotected colonies: Colonies in this group were given no protection other than that offered by the windbreak.

Sawdust packing: The type of sawdust packing case used on the experiment is shown in Figure 1. Approximately six inches of sawdust insulation was provided on the sides and top but none was placed under the hive.

Tar paper packing: The method of packing in tar paper is shown in Figures 2 and 5. The packing material consisted of low grade tar paper and building paper. The colonies to be packed were grouped with the bottom board sloping forward. The distance around the group was measured and tar paper cut long enough to reach completely around allowing two feet for lap. Two layers of building paper of the same length were placed on the tar paper and the three wrapped around the colonies. The lower part was nailed in place with the paper turned up to leave the entrances open and the top was folded over (Fig. 2). A layer of tar paper and building paper was placed over
Figure 2. Four steps in packing bees in tar paper.
the top and nailed down. The spaces between the hives in front were plugged with burlap and the back and sides were banked with dirt.

**Celotex Packing Case:** The type of celotex packing case used on the experiment is shown in Figure 3.

**Shed Wintering:** The shed used for wintering bees is shown in Figure 4. Unprotected colonies were placed in the shed on a support eight inches above the ground. Flights were controlled by adjusting doors in the front and top.

**Cellar wintering:** Two cellars of twenty colony capacity each were used on the experiment.

**COMPARISON OF RESULTS**

Comparative results for all the methods tested from 1930 to 1940 are shown in Table 1.

**Unprotected colonies:** Unprotected colonies were under observation continuously from 1925 to 1930. Because of the unsatisfactory results obtained, tests were discontinued following the fall of 1930 until 1936 when ten colonies were added to the experiment. Winter losses were greater in the unprotected group every year but 1929, when they wintered as well as protected.
colonies. Losses were especially heavy during the winter 1936-1937. Fifty per cent of the colonies died, and the surviving colonies were in poor condition. Consumption of winter stores was high, and they required feed through April and May. Results obtained by this method of wintering vary greatly from year to year depending upon weather conditions. Unprotected colonies may successfully withstand mild winters and cold spells of short duration but protracted cold weather or constant winds cause heavy losses. They may survive severe winters, but are frequently so weakened they spend most of the summer building up and are of little value for honey production. Protection is especially important in the spring when brood is being reared and the bee population is at low ebb. Insulation at this time of year aids materially in maintaining uniform hive temperatures, and the brood nest extends over a larger area than is possible when no protection is provided. Chilled brood was often found in unprotected colonies following storms in March and April. The loss of early brood is a severe shock from which the colonies are slow to recover. Comparisons early in the spring following a severe winter show that the protected colonies have more stores and considerably more brood than the unprotected colonies. Compared to other methods tested, unprotected colonies ranked low in honey production.

Sawdust packing: Colonies packed in sawdust wintered very well, but, considering the cost of packing material, labor, winter loss, and honey production, the method was not as efficient as some others tested. Winter loss was never very great and for three years there was no loss.

The sawdust packing case tested, shown in Figure 1, was made of native lumber which cost approximately three dollars for each case. Although the initial cost was high, the cases were used for twelve years, thus reducing the yearly packing charge. The cost of labor for sawdust packing is high. There is considerable handling of the sawdust in the spring and fall when the colonies are being packed or unpacked. Two or three bushels must be removed before spring inspections can be made. This is a disagreeable task, especially on a windy day. The sawdust
packs tightly about the hive during the winter, and it must be loosened and some of it removed before the hive can be taken from the case. When not in use, the sawdust must be stored in a dry place.

The sawdust protected the colony well, but in the spring tended to retard development. Moisture was absorbed during the winter and cakes of frozen sawdust were found in many of the cases late in the spring. The presence of moisture and frost in the sawdust kept the colony too cool and delayed brood rearing.

Honey production comparison shows that the colonies packed in sawdust rated next to the tar paper packed colonies. This method of wintering was not as efficient as other methods tested and was discontinued in the spring of 1936.

**Tar paper packing:** Packing in tar paper has proved to be a very efficient method of wintering bees. The loss never exceeded ten per cent and for five years all colonies survived; the
Figure 5. A group of colonies packed in tar paper opened for spring inspection.
colonies were in fine condition and rated high in honey production. A combination of tar paper and building paper offers ample protection in winter, does not retard early brood rearing and can be left on the hive until late in the spring. Despite the almost airtight pack provided by this method of wintering, sweating and condensation of moisture were negligible. Spring inspection was easily accomplished, as shown in Figure 5, by partial removal of the top layer of tar paper, which was replaced following inspection and the colonies remained packed until late in the spring. Costs of labor and material were low because, when properly handled and stored, the paper was used for several years.

The hives were grouped for packing and some confusion among the field bees resulted. This was especially noticeable when bees were wintered in the summer yards where they were moved only a short distance from their accustomed locations. Drifting of a serious nature was observed only once during the experiment when one colony became very strong at the expense of two adjoining ones.

**Celotex packing:** Celotex packing cases were first used on the experiment the fall of 1937. Four cases were used the first year, six cases the second and third years, and twenty-six the fourth year. The type of celotex case tested is shown in Figure 3. This method of wintering has given splendid results, but has been tested only four years. Celotex is a convenient material to use for the purpose but it is porous and may not withstand weathering. It will absorb moisture and may not be practical for that reason. Metal covers are essential as moisture is absorbed readily through the top. Materials for construction of each case consisted of approximately twenty square feet of celotex, four pieces 2 x 2 x 24 inch common lumber, and one piece light weight galvanized sheet metal, size 28 x 24 inches. The initial cost of approximately $1.30 for materials was high but would not be excessive if the case could be used for several years. The length of time the case can be used will be determined by the ability of celotex to withstand weathering, handling, etc. Cases used on the experiment were still in fair condition after four years of service.
The cases were made large enough to be placed over the hive with two inches of air space on the sides and top. No insulation was provided under the hives. Some of the cases were nailed together solidly while others were made so that they could be knocked down when not in use. Twenty cases, knocked down as shown in Figure 3, were stored in a space 24 x 28 x 72 inches. Assembled cases reduce labor of packing but require considerably more space for storage.

This method of packing bees has many distinct advantages. Labor is reduced to a minimum as the case is merely placed over the hive as shown in Figure 3 and the sides banked with dirt. Colony locations are not disturbed and there is no drifting or confusion among the field bees. The air space between the hive and the packing case protects the hive entrance from drifting snow and also reduces the damage caused by skunks. The cases are easily adjusted and permit rapid and convenient access to the hives for spring inspection. The insulation provides protection for spring brood rearing and tends to retard flights until the outside air temperature is safe. Considerable condensation of moisture was observed every year during the later part of March and April. Moisture collected on the inner covers and walls of the hives and in some instances pollen in the outside combs became mouldy. Condensation of moisture continued even when an extra auger hole was drilled in the top of the packing case. Celotex cases made of \( \frac{3}{4} \) and \( \frac{1}{2} \) inch material were used on the experiment the winter of 1939-1940. Ten colonies packed in cases made of \( \frac{3}{4} \) inch celotex consumed 3\( \frac{1}{2} \) pounds more honey per colony during the winter than an equal number packed in cases made of \( \frac{1}{2} \) inch material.

Experiments with the celotex packing case covered a period of 4 years and 42 colonies were wintered by the method. There was no winter loss and colonies were all in excellent condition. The group rated high in honey production, but the relatively small number of colonies tested does not permit a fair comparison with other methods. Production records of 16 colonies for a period of three years only were available for this report.
### Table I—Comparison of All Methods Tested Over a Period of 10 Years

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*Averages permit yearly comparison only. Time of weighing varied each year. Weights were taken when colonies were unpacked and do not represent the total amount of winter stores consumed.*
Shed Wintering: Colonies wintered in the shed suffered greater losses than those packed in celotex, tar paper, or sawdust. The inconvenience of adjusting the doors to control flights was a serious disadvantage. The method was not practical at this experiment station.

Cellar Wintering: Experiments on cellar wintering were conducted from 1930 to 1937. Results were published in Bulletin No. 234 of this experiment station. In order to show how cellar wintering compared with other methods tested some of the results are given in Table I. Two cellars were used and the figures given are average for both. From results obtained on these experiments, cellar wintering is not as efficient as tar paper, sawdust, or celotex packing.

**SUMMARY**

**ESSENTIALS FOR WINTERING BEES IN WYOMING**

Although conditions vary somewhat in different sections of the state, the following fundamental principles governing the successful wintering of bees can be applied to all localities.

1. Provide plenty of good quality stores. Each hive should contain sufficient honey to carry the colony from the cessation of honey flow in the fall well into the spring bloom. A large reserve supply of honey should be available in each hive during April and May to insure active brood rearing. The best way to insure strong colonies in the spring is to leave ample stores in each hive in the fall. Honey in the comb left in the hive where produced is the cheapest and most efficient feed for bees. This practice reduces the danger of spreading bee diseases, saves a great deal of labor and gives better results. Every colony should have a good supply of pollen when prepared for winter. Reserves should be especially heavy in locations where pollen is not available in the spring. Bees should be wintered near a source of good water. A large amount of water is required by each colony in the spring.

In order to provide sufficient space for honey, pollen and bees, it may be necessary to winter in more than one hive body.
Two ten-frame hive bodies were used entirely on these experiments.

2. Only strong colonies should be wintered. There should be a good-sized cluster, well-balanced in old and young bees. A well established young queen should head each colony. Late inspections may prevent wintering queenless colonies. Colonies having disease should not be placed in winter quarters.

3. Provide adequate protection. Each colony should have some type of winter protection and a good windbreak. All yards should be fenced to prevent damage from livestock.

4. The results of this series of experiments show (a) that wintering in yards with protected hives gives better results than wintering in cellars; (b) that excellent low cost protection is given by tar paper packing and (c) that individual celotox cases, though more expensive, are very convenient and gave the best results during the four years of tests.
The following publications of the Wyoming Experiment Station may be had upon request: (Revised list, May, 1940).

ANNUAL REPORTS—
19th to 49th, inclusive (1908-9 to 1938-39, except 21st and 22nd.)

INDEX BULLETINS—
E, G, and H.

No. STATE FARMS BULLETINS—

No. CIRCULARS—

No. BULLETINS—
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116. Winter Grains.
163. Results with Tree Planting at the Sheridan Field Station.
180. Vegetable Cookery at High Altitudes.
185. Barley Tests at the Sheridan Field Station.
205. Economic Studies of Irrigated Farms in Big Horn County.
209. Forty Years of Weather Records.
210. Crossbreeding with Western Ewes.
212. Steer Feeding in Southeastern Wyoming.
216. Sugar Beet By-Products for Fattening Lambs.
221. Occurrence of Selenium and Seleniferous Vegetation in Wyoming.
222. Potato Seed-Treatment Studies in Wyoming.
223. Corn Production on the Campbell County Experiment Farm.
225. Variation in the Shrinkage of Wyoming Wools. I. Differences Between Duplicate Samples.
227. Sugar Beet Tops, Cottonseed Cake and Mono-Calcium Phosphate in Rations for Steers.
228. Type of Farming and Ranching Areas in Wyoming.
229. Vegetative Composition, Density, Carrying Capacity and Grazing Values in the Red Desert Area.
231. Poisonous Plants and Livestock Poisoning.
232. Breastbones of Turkeys in Relation to Roosting.
234. The Cellar Wintering of Bees.
236. Hybrid Corn Adaptation Trials in Wyoming in 1939.
237. Roughage Feeding of Dairy Cattle.