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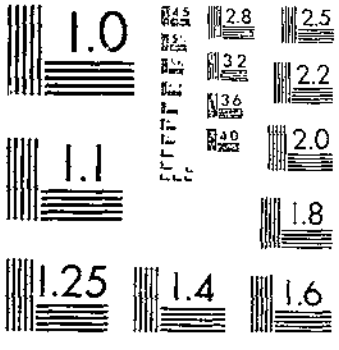

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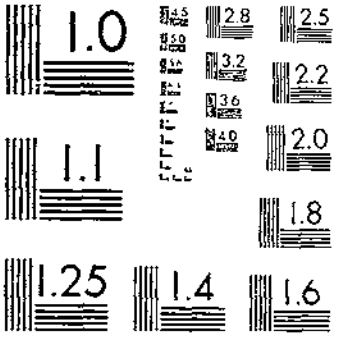

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TECHNICAL BULLETIN No. 481 July 1935

ORGANIZATION AND MANAGEMENT OF APIARIES PRODUCING EXTRACTED HONEY IN THE WHITE CLOVER REGION

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UNITED STATES DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

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By R. S. WASHBURN, *assistant agricultural economist, Division of Farm Management and Costs, Bureau of Agricultural Economics,* and G. E. MARVIN, formerly *assistant apiculturist, Division of Bee Culture, Bureau of Entomology and Plant Quarantine*

(The Bureau of Agricultural Economics and the Bureau of Entomology and Plant Quarantine in cooperation with the State College of Agriculture and the Agricultural Experiment Station at Cornell University, the College of Agriculture and the Agricultural Experiment Stations of the Universities of Wisconsin and Minnesota, the State Colleges of Agriculture of Michigan and Iowa, and Ohio State University)

CONTENTS

INTRODUCTION

The white clover region is the source of a large proportion of the honey produced in the United States and honey from this region ranks with the best on the market. Beekeeping there is conducted under a variety of different natural and economic conditions. Each situation has its effect on the practice employed in the care of bees and on the organization of the operating unit. Consequently, a rather wide variation occurs in apiary practice and business organization among beekeepers in this region.

During the 1930 and 1931 seasons records were kept by a selected group of commercial beekeepers producing extracted honey, of the daily labor expended on the beekeeping enterprise, the expenses incurred in the production of extracted honey, and the quantity of

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honey produced. In addition, inventories were taken of bees, buildings, and equipment. Periodic visits were made to check the records and general notes were recorded about each apiary. Both comb and extracted honey are produced and much of the product, particularly from the smaller apiaries, is sold locally in small lots through retail stores or direct to the consumer. But this detailed study does not include the records of comb-honey producers and no attempt was made to include data on the methods and costs of marketing retail honey or the influence of the different factors on income. In any given apiary the influence of a favorable factor, such as a low labor cost, may be entirely overshadowed by a low yield due to influences over which the beekeeper has little control, so that the influence on income of a favorable factor may be partially or wholly offset by unfavorable factors in the same apiary.

In the discussion that follows, the objective is to show the organization of the extracted honey business in a number of apiaries in the region and the cost of producing extracted honey, and to trace the variation from apiary to apiary of some of the factors relative to economy and efficiency in the production of extracted honey. In describing the organization and management of some of the apiaries represented, it is not intended necessarily to recommend the equipment in use and the practices employed. It is assumed that the reader is familiar with the usual beekeeping terms and the general phases of beekeeping.

The number of apiaries included in the various tables is dependent on the data to be shown. Certain apiaries have been omitted from some of the tables because incomplete data or other irregularities render them incomparable with others included in the study. The term "apiary" as used in this bulletin refers to the total number of colonies of bees under the management of each beekeeper. The term "outyard" refers to a site at a distance from the home yard where a given number of colonies of bees are located. The distribution of these beekeepers and the number of colonies of bees represented are shown in table 1.

TABLE 1.—*Number of beekeepers and colonies of bees represented, 1930–31*

State	Beekeepers		Colonies of bees		State	Beekeepers		Colonies of bees	
	1930	1931	1930	1931		1930	1931	1930	1931
	Number	*Number*	*Number*	*Number*		*Number*	*Number*	*Number*	*Number*
New York	7	2	2,093	844	Iowa	9	7	725	471
Michigan	6	5	2,360	2,230	Minnesota	8	8	1,903	2,495
Ohio	8	6	3,293	1,779					
Wisconsin	2		353		Total	40	28	11,662	7,825

PRINCIPAL HONEY PLANTS IN THE WHITE CLOVER REGION

White clover is widely distributed throughout the United States except in the arid regions. In the area comprising the northeastern portion of the United States, extending westward to Minnesota and south approximately to the Ohio River and the Mason and Dixon Line, white clover reaches its greatest importance as a nectar-producing plant. Where soil and climatic conditions are favorable, this plant produces large honey surpluses. But honey producers in this

region are not dependent entirely on white clover, for alsike clover in some localities is more important than white clover and the honey produced from it is equal in quality to that from white clover. Formerly these clovers were the main honey plants in the region, but during recent years sweetclover has become an important nectar-producing plant in many parts. Some of the beekeepers consider that more of their honey is now obtained from sweetclover than from white or alsike clover. This was particularly true in both 1930 and 1931 when, because of the prolonged drought, white and alsike clover were more severely damaged than was the more drought-resistant sweetclover. White and alsike clovers, however, are at the present time the most important honey plants in years of normal rainfall.

The honey flow from sweetclover in favorable seasons, especially in certain sections of Minnesota, extends over a period of nearly 2 months and comes on somewhat later than in the case of white or alsike clovers. This gives a long period in which to build up the colonies for the honey flow, enabling even divided colonies or package bees to be built up to sufficient strength during the white and alsike clover honey flow to gather a surplus from sweetclover. On the other hand, in an exclusively white clover area, a full crop of honey may be expected only from colonies and package bees that have reached the peak of population previous to the blooming period of white and alsike clover.

Although with most beekeepers the heaviest honey flow of the season comes from the clovers, other honey plants are important in local areas. Buckwheat is an important source of honey on soils that are derived from sandstone and shales in parts of Pennsylvania and New York; the honey flow from this plant usually occurs during August and early September. In parts of Michigan and Minnesota wild raspberry, milkweed, and fireweed produce a surplus crop in favorable seasons. Basswood, maples, dandelion, fruit bloom, goldenrod, asters, heartsease, and Spanish needle form important sources in many parts of the region.

Dates and duration of the honey flow vary according to the location and the nature of the available honey plants. The average blooming dates and the duration of the honey flow for the principal honey plants in the region are shown in figure 1.

APIARY ORGANIZATION

There are many large apiaries in the white clover region, but those of small-to-medium size predominate. The business organization of the small unit is relatively simple. The operator does most, if not all, the work himself. Few outyards are required and in many instances no special buildings are needed. On the other hand, the large apiary requires hired labor, more equipment, and a systematic arrangement of outyards to form an economically operated business unit.

SIZE OF APIARY AND CAPITALIZATION

The capital distribution of apiaries of different sizes based on inventory values as of 1930 is shown in table 2. Of the 40 beekeepers represented, 9 operated less than 100 colonies, 15 were handling from 100 to 299 colonies, and 16 had 300 or more colonies.

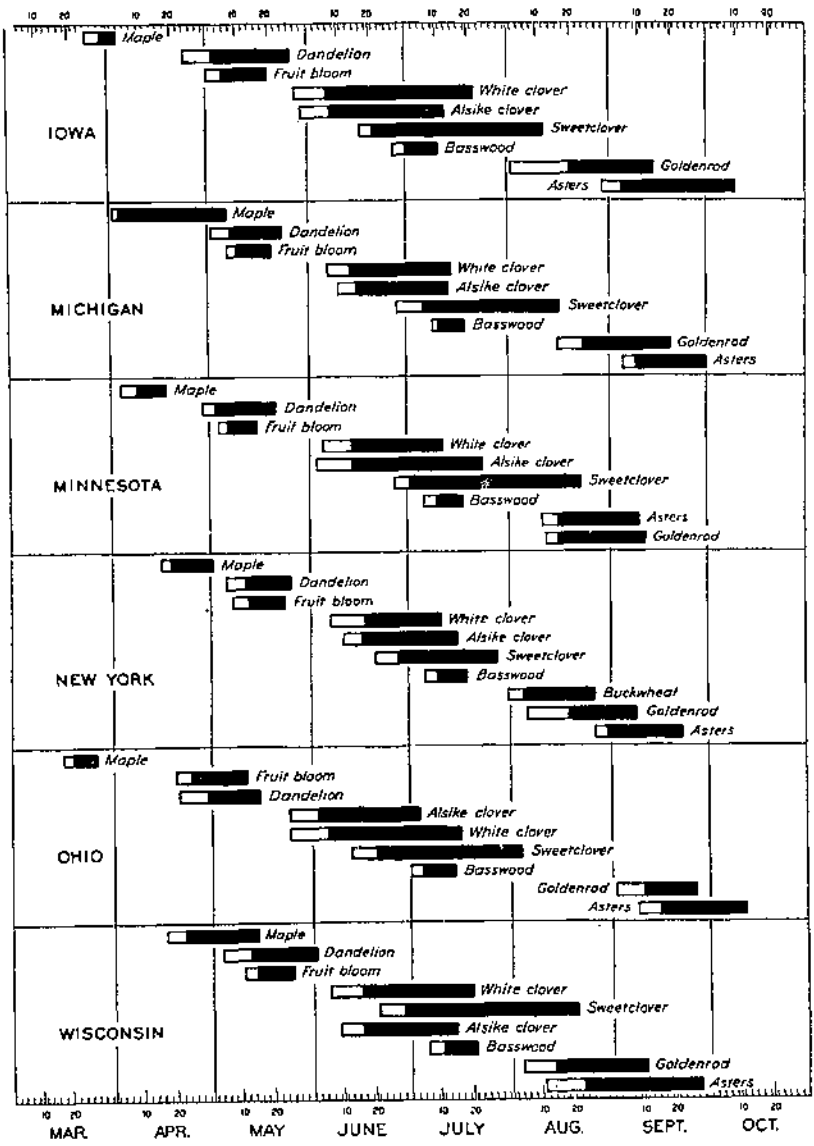

FIGURE 1.—BLOOMING DATES AND PERIOD OF NECTAR FLOW FOR THE PRINCIPAL HONEY PLANTS IN THE WHITE CLOVER REGION. (AVERAGES FOR YEARS 1926–32, INCLUSIVE.)

The clovers are the main honey plants in this region. The nectar secreted from this source is supplemented by that from maples, fruit bloom, and dandelion in the early spring and from asters and goldenrod after the main flow. Many other minor sources of nectar appear throughout the season. (The clear portion of each bar represents the period that the plant was in bloom before the nectar flow. The black portion represents the length of the honey flow for that plant.)

TABLE 2.—*Average capital distribution for apiaries of different sizes, Jan. 1, 1930* [1] [2]

Size of apiary (colonies)	Apiaries studied	Average colonies per apiary	Average capital per apiary					Average capital per colony
			Bees [3]	Buildings	Permanent equipment	Supplies	Total	
	Number	*Number*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Less than 100	9	49	383	198	608	4	1,191	24.31
100 to 299	15	178	1,433	545	1,435	14	3,427	19.25
300 to 499	8	366	3,301	849	3,405	16	7,571	18.12
500 to 699	4	595	5,739	1,675	3,517	128	11,087	18.63
Over 700	4	850	6,740	2,105	5,777	142	14,773	17.38
Total or average	40	302	2,533	796	2,288	36	5,653	18.74

[1] The total number of colonies cared for by each beekeeper is here considered as 1 apiary, even though kept in more than 1 bee yard.

[2] No value is shown for land occupied by bee yards since the area occupied by each yard is relatively small and many times on waste land, along fence rows or in an orchard. The number of colonies per apiary is the number prepared for wintering in the fall of 1929. Subsequent tables show the numbers of colonies for the honey flow.

[3] Includes a complete 1-story hive, including bees and brood combs for each colony.

The number of colonies per beekeeper ranged from 25 in an apiary operated at spare times to 870 colonies in an apiary divided into 16 outyards. The number of colonies of bees located at each outyard depends on the amount and quality of the available bee pasturage and for the 40 beekeepers here represented varied from 16 to 150 colonies per yard. In the group having less than 100 colonies only two beekeepers had outyards and these were located in close proximity to the home yard. In the group having from 100 to 299 colonies approximately two-thirds of the beekeepers maintained from 1 to 6 outyards which ranged in size from 16 to 125 colonies per yard. The distance of these outyards from the home yard was from 2 to 32 miles. In the group having from 300 to 499 colonies the number of outyards varied from 1 to 13 and the distance from the home yard was from 1½ to 18 miles. The beekeeper with 13 outyards had 464 colonies of bees. In the group with 500 and more colonies the number of outyards varied from 4 to 16 and the distance from the home yard was from 1½ to 25 miles.

When beekeeping is part of a farm business and the number of colonies of bees is not large, special buildings are not often required. The honey-handling facilities are set up in some existing building. But even with a building especially erected for a honey house the capital represented by buildings for the small beekeeper is not large. Of the beekeepers with less than 100 colonies, only 1 had buildings valued at over $275. The average for the others was $158 per apiary. On the other hand, a special honey house which contains an extracting room and storage room for honey and supplies is usually provided in the larger units, and in many cases represents an appreciable capitalization. For beekeepers with 100 or more colonies, the inventory value of buildings varied from $175 for a beekeeper with 104 colonies to $4,320 for a beekeeper with 660 colonies. The latter has a honey house which is thoroughly modern and conveniently arranged for the handling of honey but probably represents a rather larger building capitalization than is necessary.

Permanent equipment including hive bodies, supers, extractors, etc., represents the largest item of capital for most apiaries. The

range was from approximately $148 for a beekeeper with 36 colonies to $7,763 for an operator with 900 colonies. The majority of the beekeepers whose records are included in this study used queen excluders and inner covers and had two or more extracting supers per colony. In the group having less than 100 colonies, only 3 beekeepers used an automobile or truck and only one 45-frame radial extractor was represented. One 4-frame extractor was in use, and the remainder were 2-frame extractors. In the group with 100 or more colonies, an automobile or truck, or both, was in use by all except 2 beekeepers. Where the extracting was done at a central plant, which was the usual practice except in New York, the 45-frame radial extractor was the usual type. A number of these beekeepers also had smaller extractors, ranging in size from 2 to 8 frames. No doubt many of these smaller extractors were in use before the 45-frame radial extractor was installed. In New York, where the extracting was done at the outyard, the extractors ranged from 2 to 8 frames. Thirteen of the larger beekeepers use vertical steam boilers to furnish the steam supply. Where a considerable supply of steam is needed, as in a large central extracting plant such a boiler has many advantages. It supplies steam to heat the honey when necessary, to melt cappings, to heat the uncapping knife, to warm the honey house in cold weather and for other general uses. A number of the smaller beekeepers use either 2- or 5-gallon boilers to supply steam for an uncapping knife. Twenty-two of the larger extracting plants were equipped with electric motors and six used gasoline engines. Several of these plants were equipped with pulley shafts.

The average total capital per colony was greatest for the group having less than 100 colonies. This high average of $24 per colony, however, was largely due to one beekeeper who was equipped to handle many more colonies than those kept during the 1930 season. This particular beekeeper had inventory values of $58 per colony whereas the other beekeepers in this group had an average capitalization of slightly less than $20 per colony. The range in capitalization per colony for the group with 100 or more colonies per apiary was from approximately $15 to $30 per colony. The average for all apiaries was $18.74 per colony. The total capital per colony tended to be smaller on large than on small apiaries. A complete one-story hive, including bees and brood combs for each colony, represented about 45 percent; buildings, about 14 percent; permanent equipment, about 40 percent; and supplies, about 1 percent of the total capitalization.

Since depreciation, repairs, and interest on honey houses and equipment constitute a sizable item of expense, it is essential to have, as far as possible, the proper balance between buildings and equipment for the number of colonies kept. In some instances the inventory value of buildings appeared greater than the number of colonies warranted, and a large extractor or other large equipment apparently was not always justified by the number of colonies of bees handled. On the other hand, some beekeepers had too little equipment for the work to be done.

SUGGESTED EQUIPMENT FOR APIARIES OF DIFFERENT SIZES

The type of beekeeping equipment is to a large extent a matter of personal choice. Some of the beekeepers had accumulated equipment that was not of standard size and not readily interchangeable

while others had equipment inventories that were too large for the number of colonies kept. Both of these conditions are contributing factors to the high cost of producing honey.

The equipment that appears to be adequate for the effective operation of apiaries of different sizes producing extracted honey is shown in table 3. These items are for a small, a medium-size, and a large apiary and are based largely on the equipment actually found in a number of well-organized apiaries.

TABLE 3.—*Principal items of equipment, based on 10-frame hives, suggested for apiaries of different sizes producing extracted honey*

Equipment	Equipment suggested for apiaries of indicated sizes		
	65 colonies	250 colonies	850 colonies
	Number	*Number*	*Number*
Brood chambers	130	500	1,700
Supers	195	750	2,550
Bottoms	65	250	850
Inner covers	65	250	850
Outer covers, metal	65	250	850
Queen excluders	65	250	850
Bee escape boards, wood or wire, 2- or 4-way escapes	15	60	200
Drawn combs:			
Brood	1,300	5,000	17,000
Surplus	1,755	6,750	22,950
Honey extractors:			
2-frame hand reversible	1		
4-frame or larger		1	
45- or 50-frame		[1] 1	1
Honey pumps		[1] 1	[1] 1
Uncapping knives:			
Steam-heated	1	1	2
Power		[1] 1	[1] 1
Uncapping tanks	1	1	1
Storage tanks:			
50-gallon	3		
200-gallon		3	
500-gallon			3
Steam boilers:			
2-gallon	1		
Vertical, 2 to 6 horsepower		[1] 1	
Vertical, 6 horsepower			1
Honey heaters	1	1	1
Bottling tanks:			
10-gallon	1		
20-gallon		1	
40-gallon			1
Electric motors:[2]			
1 horsepower		1	1
¾ horsepower		[1] 1	[1] 1
Scales, 1,000-pound platform	1	1	1
Motor trucks, 1½ tons		1	1

[1] Optional equipment.
[2] Where electricity is not available a 2-horsepower gasoline engine would provide the power for a 250- or an 850-colony apiary.

BROOD CHAMBERS AND SUPERS

As a matter of convenience the 10-frame Langstroth hive has been here chosen as a basis of comparison. It should be understood, however, that there are many other types and sizes of hives which, in the hands of capable beekeepers, can be used just as efficiently as the 10-frame Langstroth hive. Where a hive either larger or smaller than the 10-frame Langstroth is desired a proportionate reduction or increase in the number of hive bodies, frames, etc., will have to be figured. Provision is made for 2 brood chambers and 3 supers sufficient for the storage of approximately 135 pounds of honey per colony. Provision for 3 supers generally makes it possible to allow

the honey to remain in the hives until it is thoroughly ripened. This results in a better quality of honey and may save some labor in that all the extracting can be done at one time. If chunk honey is produced it is preferable to use shallow supers. Five shallow supers are the equivalent of three full-depth supers.

FRAMES, BOTTOMS, INNER COVERS, OUTER COVERS, QUEEN EXCLUDERS, AND BEE-ESCAPE BOARDS

The equipment for the 10-frame Langstroth hive includes frames, bottoms, inner and outer covers, queen excluders, and bee-escape boards. Bee-escape boards are provided for approximately one-fourth of the colonies. This number depends on the quantity of honey that can be handled in a day and on whether the operator finds it desirable to have a bee-escape board for each colony or to use bee escapes on only a few colonies and some other means of removing the honey from the remainder of the colonies. Ten frames of drawn combs are provided for the brood chamber but in the supers for the storage of honey only nine frames are needed.

HONEY EXTRACTORS, HONEY PUMPS, AND UNCAPPING KNIVES

Extractors of the 2-frame, hand, reversible type are suggested for the smaller apiary, a 4-frame power or larger extractor for the 250-colony apiary, and the large radial extractor for the 850-colony apiary. The steam hand uncapping knife is provided for all groups, with the power uncapping knife optional. The use of gravity for filling the storage tanks is considered the best arrangement but when it is not possible to arrange equipment so that gravity can be utilized the honey pump will take its place. It is well recognized, however, that if the honey pump is not properly used it results in lowering the quality of the honey.

UNCAPPING TANKS

A small uncapping tank equipped with a strainer is suitable for the small operator. A larger uncapping tank is essential for the large commercial producer. The uncapping tank may be equipped with a strainer in which the cappings will drain, previous to being dried in the radial extractor, or the cappings may fall into wire baskets made to fit the radial extractor.

STORAGE TANKS

Storage tanks are based on a capacity of approximately one-fourth of an anticipated yield. Three 50-gallon tanks are suggested for the small apiary with storage facilities in proportion for the larger apiaries. The storage capacity should be sufficient to allow the honey to remain in the settling tanks at least 3 days before being drawn off into containers. From the standpoint of quality of product this is the minimum time that honey should be allowed to settle. Each storage tank should be equipped with a honey strainer. Inadequate straining and settling facilities account for much of the unsightly honey found on the markets.

STEAM BOILERS, HONEY HEATERS, AND BOTTLING TANKS

A small 2-gallon boiler is suitable for a hand steam uncapping knife and a vertical stationary steam boiler is recommended where the

steam is used for a variety of purposes. It is necessary at times to heat honey to facilitate the removal of granulated honey from containers, to facilitate straining, to delay granulation, and to prevent fermentation. Owing to the lack of suitable honey-heating equipment on the market, most beekeepers have devised their own systems. It is only natural, therefore, to find that great quantities of honey are ruined through overheating. Ordinarily honey should not be heated over 160° F. and should then be cooled quickly after this temperature is attained. An agitator that does not incorporate air, in conjunction with the heating tank, enables the operator to heat honey uniformly and in the minimum length of time. For the small operation the most suitable heating system is to immerse cans of honey in hot water and allow them to remain until the proper temperature has been reached. If large quantities of honey are to be heated, correspondingly elaborate equipment must be installed. Bottling tanks are provided with the idea of preparing at least a portion of the production for disposal in pails or other small containers.

MOTORS AND ENGINES

If electricity is available an electric motor is to be preferred with a 1-horsepower motor for an apiary of either 250 or 850 colonies and a one-sixth horsepower motor if a power uncapping knife is used. If electricity is not available, a 2-horsepower gasoline engine is sufficient for either a 250- or an 850-colony apiary.

SCALES

Platform scales are included and, though not absolutely necessary, the best beekeepers usually maintain a colony on scales to observe the gain or loss in weight of colonies without examining the interior of the hive. The scales indicated in table 3 are mainly for use with scale colonies, but it would be possible for a beekeeper to use the platform scale in his bee yard until it is needed in the honey house.

MOTOR TRUCKS

A 1½-ton long-wheel-base truck equipped with an 8- by 12-foot rack is sufficient to handle all hauling for each of the two larger apiaries. This equipment is particularly necessary in the larger apiaries where there is much travel to and from outyards.

MISCELLANEOUS EQUIPMENT

A set of tools, bee brushes, smokers, and veils are essential in every apiary. In addition, a wiring board, frame-nailing device, wire embedder, workbench, and wheelbarrow are common to most apiaries. The investment in this equipment is small and to some extent a matter of personal convenience, and since the number of workers who use the articles are variable no attempt has been made to designate the number of specific articles of equipment for apiaries of different sizes. A wax press is needed if the beekeeper has a market for his beeswax in block form, but if the wax is exchanged for foundation or beekeeping equipment a wax press is not essential. Many operators of large apiaries are equipped to make most of their hives and other wood equipment, but no attempt has been made to list the

amount of wood-working equipment necessary to do this, since it is purely a carpentry operation. Some extractors are equipped to dry cappings, but no special equipment is needed for melting them. If it is desirable to melt cappings, appropriate apparatus for doing so is on the market or one can usually devise suitable apparatus for this purpose.

BEEKEEPING IN CONJUNCTION WITH OTHER OCCUPATIONS

The relation of honey production to other productive enterprises has considerable influence on the size and organization of a particular apiary business. Often the time available for the care of bees limits the number of colonies handled. Again, where the bee yard is located near at hand so that the work may be done at odd times, the number may be limited by the accessibility of honey plants. Many of the beekeepers in the white clover region do not devote their entire time to beekeeping. The units in many instances are too small to utilize the full time of the owner or to provide an adequate income. Fifteen of the 40 beekeepers represented in this study in 1930, mainly those with small-to-medium size apiaries, had other business interests. The bee business of these 15 men was not operated as a hobby, but rather for profit, and the organization of their apiaries was comparable with those of other beekeepers with the same number of colonies.

Beekeeping was conducted as a part of a farm business by several cooperators. The number of colonies per beekeeper ranged from 54, cared for when the other farm work was not urgent, to 500 colonies, demanding so much of the time of the operator that supervision only was given to the other farm operations. One cooperator was engaged in school work which gave summer vacations free for his bees. Two ministers, a locomotive engineer, a bee inspector, a postal clerk, a janitor, and a part-time store employee also operated a limited number of colonies. As a general rule among the larger operators beekeeping is not conducted in connection with a farm business.

Beekeeping should not be combined with an occupation that does not permit the operator to give attention to the bees when most needed. Figure 2 shows the labor distribution, classified by operations, for a small, a medium-sized, and a large bee business, and is an illustration of the amount of time spent on bee work at different periods of the year. The smallest apiary required comparatively little time even during the producing season, whereas the largest required the time of one or more men during the greater part of the year. In general it may be said that a supplementary business which does not exact too much time of the worker and which requires a limited amount of attention during the 6 weeks or more of the busiest season of the bee year, is well adapted to combine with beekeeping. In addition, a certain fundamental knowledge of bee behavior and a genuine liking for bees are requirements considered essential to success.

MAN LABOR USED ON APIARIES OF DIFFERENT SIZES

The amount of man labor required in the care of bees and in the production of honey depends mainly on the size of the apiary and to a lesser extent on the quantity of honey produced, the number and distance between outyards, and the beekeeping methods employed.

Table 4 gives the total man labor spent on apiaries of different sizes, divided among operator, family, and hired labor. For all size groups approximately 50 percent of the total time was represented by

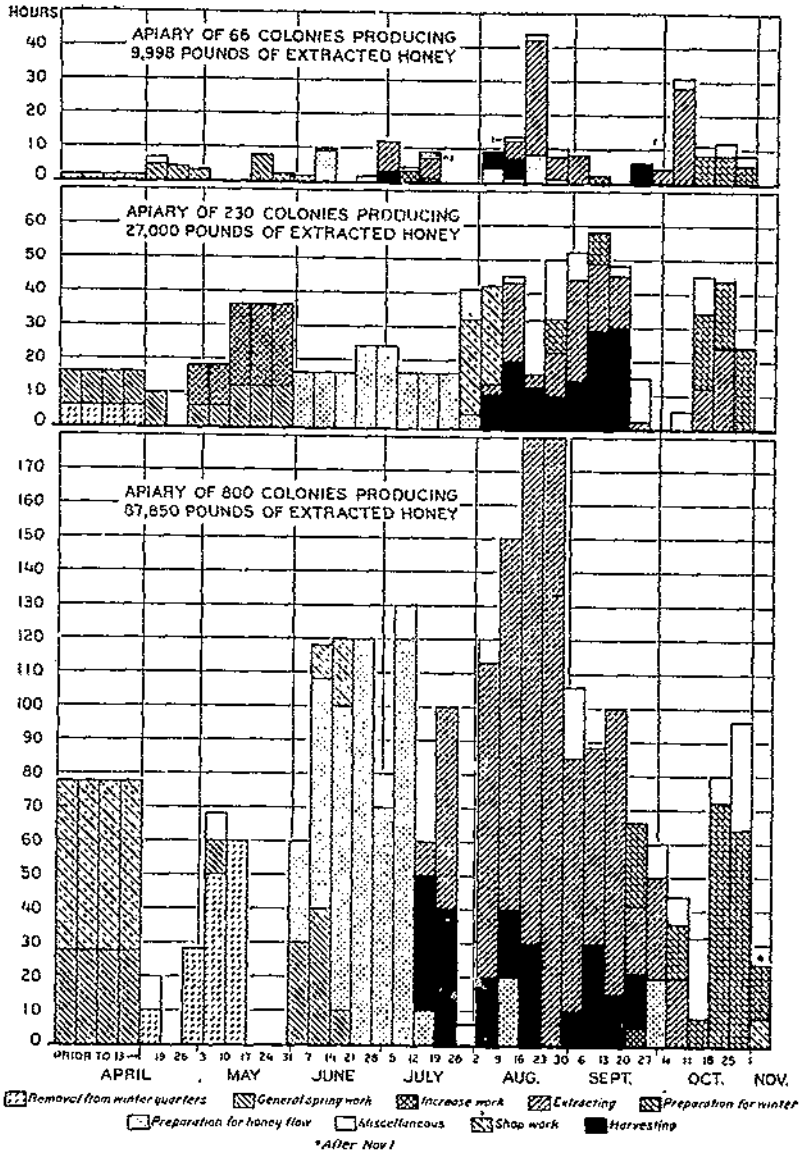

FIGURE 2.—SEASONAL DISTRIBUTION OF LABOR ON APIARIES OF DIFFERENT SIZES.

For each apiary the peak labor load usually occurs in August or September during the harvesting and extracting season.

operator's labor, 15 percent by family labor, and 35 percent by hired labor. For beekeepers with less than 100 colonies, hired labor was negligible. For the groups with over 300 colonies, hired labor amounted to from 33 to 64 percent of the total.

TABLE 4.—*Operator, family, and hired labor on apiaries of different sizes, 1930–31* [1]

Size of apiary (colonies)	Average colonies per apiary		Man labor							
			Operator		Family		Hired		Total	
	1930	1931	1930	1931	1930	1931	1930	1931	1930	1931
	Number	*Number*	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*
Less than 100	47	59	168.0	135.5	13.6	6.4	23.8	3.7	205.4	145.6
100 to 200	177	175	546.1	476.0	76.2	150.5	53.7	23.7	676.0	650.2
300 to 499	397	428	921.9	855.4	294.6	325.9	598.5	709.6	1,816.0	1,920.9
500 to 699	597	569	941.0	720.3	4.0	.....	1,670.4	1,245.7	2,615.4	1,966.0
Over 700	757	805	1,446.4	835.7	999.6	815.8	1,006.5	2,119.1	3,362.5	3,770.6
Average	292	279	665.0	515.9	181.0	177.2	414.2	421.6	1,261.1	1,114.7

[1] All labor performed on the bee enterprise, including work on new equipment, is included in this table.

The division of labor as between work and travel shows that for apiaries of less than 100 colonies the travel hours were small, whereas for larger units they amounted to from 7 to 15 percent of the total (table 5). An automobile or truck is used largely to travel to and from outyards and the number of, and distance between, these have a direct bearing on the travel hours per apiary and per colony. In the group with less than 100 colonies, two beekeepers maintained outyards. The average travel hours in 1931 for this group were 0.2 hour per colony as against 0.6 hour per colony for the group with over 700 colonies. The number of outyards in the latter group varied from 8 to 15 per beekeeper. The most distant outyard was 25 miles from the home yard. The average hours spent on work of different kinds including the accompanying hours of travel are shown in table 6. Approximately 25 to 30 percent of the time is spent in harvesting and extracting and the remainder in other work with the bees.

TABLE 5.—*Work and travel hours on apiaries of different sizes, 1930–31* [1]

Size of apiary (colonies)	Average colonies per apiary		Labor per apiary						Labor per colony					
			Work		Travel		Total		Work		Travel		Total	
	1930	1931	1930	1931	1930	1931	1930	1931	1930	1931	1930	1931	1930	1931
	No.	*No.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hr.*	*Hr.*	*Hrs.*	*Hrs.*
Less than 100	47	59	202.5	134.4	5.0	11.2	208.4	145.6	4.3	2.3	0.1	0.2	4.4	2.5
100 to 200	177	175	619.8	601.3	56.2	45.9	676.0	650.2	3.5	3.5	.3	.3	3.8	3.8
300 to 499	397	428	1,705.6	1,762.9	110.4	158.0	1,816.0	1,920.9	4.3	4.1	.3	.4	4.6	4.5
500 to 699	597	569	2,347.6	1,721.7	267.8	244.3	2,615.4	1,966.0	3.9	3.0	.5	.4	4.4	3.4
Over 700	757	805	3,030.0	3,248.4	323.5	522.2	3,362.5	3,770.6	4.0	4.0	.4	.6	4.4	4.6
Average	292	279	1,157.8	1,092.3	103.6	112.4	1,261.4	1,114.7	4.0	3.6	.4	.4	4.4	4.0

[1] All labor performed on the bee enterprise, including work on new equipment, is included in this table.

TABLE 6.—*Labor distribution by operations on apiaries of different sizes, 1930 and and 1931* [1]

Item	Labor on apiaries with—									
	Less than 100 colonies		100 to 299 colonies		300 to 499 colonies		500 to 699 colonies		700 colonies and over	
	1930	1931	1930	1931	1930	1931	1930	1931	1930	1931
Apiaries	*Number* 9	*Number* 7	*Number* 15	*Number* 11	*Number* 8	*Number* 5	*Number* 4	*Number* 3	*Number* 4	*Number* 2
Average colonies per apiary	47	59	177	176	397	428	597	569	757	805
Average yield of extracted honey per colony	*Lb.* 109	*Lb.* 15	*Lb.* 67	*Lb.* 88	*Lb.* 66	*Lb.* 99	*Lb.* 142	*Lb.* 49	*Lb.* 73	*Lb.* 57
Remove from winter quarters	*Man-hours* 13.7	*Man-hours* 10.9	*Man-hours* 23.4	*Man-hours* 21.5	*Man-hours* 67.8	*Man-hours* 65.2	*Man-hours* 75.8	*Man-hours* 60.0	*Man-hours* 160.8	*Man-hours* 163.8
General spring work	25.0	14.4	71.5	94.3	224.3	194.4	210.8	150.8	293.4	622.6
Prepare for honey flow	21.4	19.4	112.9	78.6	225.9	317.4	404.1	336.4	510.0	790.1
Increase	7.0	2.5	26.4	31.1	37.2	107.4	134.2	66.5	128.0	332.4
Harvesting	24.3	6.9	78.9	73.3	121.6	158.6	222.4	173.6	249.7	473.5
Extracting	59.3	11.8	90.0	108.1	345.0	359.2	850.5	334.7	640.3	419.0
Disease control	7.6	8.8	21.4	16.0	52.5	53.8	13.1	25.8	40.2	139.7
Shop work, repairs	8.4	14.3	32.5	55.7	84.8	129.5	24.7	52.8	343.2	108.1
Prepare for winter	22.7	10.9	62.5	58.8	191.9	223.6	236.2	225.6	306.8	333.1
Miscellaneous	9.4	13.3	51.8	52.5	124.5	109.7	115.5	179.7	206.8	246.2
Total, per apiary	190.7	122.2	580.3	589.9	1,475.5	1,718.8	2,287.3	1,595.9	2,879.8	3,634.5
Total, per colony	4.25	2.97	3.28	3.37	3.72	4.01	3.83	2.80	3.80	4.51

[1] Labor not ordinarily required in the care of bees and in the production of honey, such as the making of new equipment, has been omitted from this table. For this reason the hours per apiary and per colony are somewhat less than those shown in tables 4 and 5.

The total time spent by individual beekeepers in 1930 ranged from 2 to 14.6 hours per colony. In 1931 the range was from 1.2 to 9.1 hours per colony. This wide range suggests that the methods followed by some beekeepers are more economical in the use of labor than those followed by others. In discussing the practices employed in the production of honey, some of these differences will be analyzed and some of the factors that illustrate economy and efficiency in the management of apiaries will be pointed out.

PRACTICES IN THE PRODUCTION OF HONEY

GENERAL SPRING WORK

Under "general spring work" are included all manipulations from the time of removal of the colonies from winter quarters to management for the honey flow, including early inspection for diseased and queenless colonies, uniting, feeding, evaluating and clipping of queens, removal of burr comb, cutting out queen cells, and the giving of room for brood rearing.

Twenty-nine of the 40 beekeepers clip the queens' wings either during an early spring inspection or at the time of supering. Seven beekeepers do not clip the queens' wings, and four plan to do so but because of the pressure of other work sometimes neglect to do it.

Those that "winter" in two brood chambers sometimes clear the top one of honey or reverse them. Feeding of sugar sirup or giving of full combs of honey saved from the previous season are the common

methods of feeding when colonies are low in stores. Boiled amber honey was fed by three beekeepers.

Some of the cooperators who winter their bees in one brood chamber add a second one at the time of removal from winter quarters regardless of whether the bees are crowded. Some wait until the bees are actually crowded before a second brood chamber is added. Several provide about 15 pounds of honey in the second one when it is added.

The hours of man-labor for general spring work in 1930 ranged from 0.08 to 2.34 per colony, with an average of 0.44 hour per colony. In 1931 the range was from 0.06 to 1.8 hours per colony, with an average of 0.49 hour per colony.

This variation in labor is caused by a number of factors but much of the excessive time is due to the fact that (1) the beekeeper was the operator of a comparatively small number of colonies, had no other work to occupy his time, and for that reason spent more time with his bees than would otherwise be the case; and (2) the bees were not provided with adequate stores in the fall, so they came through the winter in poor condition, making it necessary to feed sugar sirup and otherwise nurse the colonies along in an effort to build them up to proper strength for the honey flow.

The average hours of general spring work for the group having less than 100 colonies in 1930 was 25.9 hours, or 0.55 hour per colony (table 6). The range was from 0.13 hour per colony for a beekeeper with 46 colonies to 2.34 hours per colony for a beekeeper with 58 colonies. The beekeeper who had the minimum of spring work had strong overwintered colonies that required no spring feeding, early spring inspection being the only labor. The beekeeper having the maximum of labor fed a considerable quantity of sugar sirup, had no other work to occupy his time, and gave much more labor to his bees than appeared necessary.

In the group with 100 to 299 colonies the average amount of general spring work in 1930 was 71.5 hours, or 0.4 hour per colony. The beekeeper with the maximum of man labor spent 2.8 hours per colony in 1930 and 1.8 hours per colony in 1931. This beekeeper had no other business interests and so spent nearly every favorable day in inspecting his bees. A total of 0.38 hour per colony was spent in feeding sugar sirup. The beekeeper with the minimum of labor in 1930 spent 0.08 hour per colony. His bees were wintered outdoors in quadruple cases and in the fall each colony was provided with at least six full frames of honey. Early spring inspection, with the adding of a brood chamber, was the only labor performed on the bees until the preparation for the honey flow. The beekeeper having the minimum of labor in 1931 spent 0.2 hour per colony. This beekeeper cellar-winters in single brood chambers. In the fall, if the bees do not weigh up to 70 pounds, full combs of honey are provided. About May 1, when the brood chamber is crowded, a second one containing some stores is added.

An examination of the range in labor among beekeepers with sufficient colonies to occupy their full time shows a variation in time requirements but not so marked as in the groups with a small number of colonies. In the group of over 700 colonies in 1930 the average amount of general spring work was 293.4 hours per apiary, or 0.39 hour per colony (table 6). The range was from 0.23 to 0.66 hour per

colony. The beekeeper having the minimum of labor winters his bees in single full-depth brood chambers in quadruple cases. In the fall each colony is given 6 or 7 frames of honey. The colonies are unpacked about April 1 and are given another brood chamber containing 15 pounds of honey. The beekeeper having the maximum hours of labor winters his bees in two shallow brood chambers in the cellar. In the spring a third shallow is added. The use of this type of equipment where individual frames are examined entails a considerably longer time for spring inspection in comparison with the time required when standard full-depth brood chambers are used.

From an analysis of the labor and other items of feeding costs, it would seem to be good economy to save full combs of honey for winter and early spring stores rather than to feed sugar. A record was not kept of the quantity of honey consumed, but assuming that the leaving of full combs of honey valued at 3 cents per pound[1] was at the same rate as that of sugar, etc. (12 pounds per colony in 1930, and 9 pounds in 1931), the cost of the former method is much less than that of the latter. In 1930, 16 beekeepers having 5,886 colonies of bees fed a total of 70,895 pounds of sugar valued at $3,598.96. This feeding operation required 1,452 hours of man-labor and 3,032 miles of travel at an estimated cost of $910.16, making a total cost of $4,509.12, or $0.77 per colony. On the other hand, the 14 beekeepers having 4,083 colonies of bees who provided full combs of honey had a cost for honey of $1,469.88. Three hundred sixty-nine hours of man-labor and 357 miles of travel represent an additional charge of $206.32, making a total of $1,676.20, or $0.41 per colony. The cost per colony of feeding sugar was 36 cents more in 1930 than that of providing full combs of honey.

A similar comparison for 1931 showed that the cost of feeding sugar was 26 cents per colony greater than that of providing full combs of honey. On a colony basis the value alone of the sugar fed was approximately two-thirds greater than that of honey in the comb. In addition, the labor and power cost of providing full combs of honey was materially less than that of feeding sugar.

Among most beekeepers it is the p[illegible]ce to leave sufficient stores to carry the bees through the winter and start brood rearing in the spring, but when the type of honey is not suitable, or when there is not enough honey for wintering it is necessary to augment stores by the feeding of sugar sirup at the close of brood rearing, even though this practice is considered an expensive operation.

SWARM CONTROL AND PREPARATION FOR HONEY FLOW

In addition to swarm-control measures, the handling of queens, the supering, and the use of queen excluders are included here. Increasing the number of colonies and the control of disease, operations performed during this period, are discussed under separate headings.

Most of the beekeepers represented in this study used a modification of the well-known Demaree system of swarm control and supering while a few allowed the queen free range. By the former system of swarm control and supering the queen is separated from part of the brood.

[1] This value is based on honey in the comb, before extracting and placing in containers.

The methods of swarm control and preparations for the honey flow as practiced by the cooperators are as follows:

(1) Twenty beekeepers allow their colonies to build up in two brood chambers. At the beginning of the honey flow the queen is put in the lower chamber either with the hatching brood or on empty combs. A queen excluder is put on, supers are put above in which frames of brood have been placed, and the chamber with the rest of the brood is put on top.

(2) Four cooperators put on supers whenever the colony appears crowded. These beekeepers do not use queen excluders.

(3) Two cooperators equalize their colonies during the spring building-up period. Five frames of brood and about 10 pounds of honey are provided in each 8-frame hive, and 6 frames of brood and the same amount of honey in each 10-frame hive. Colonies with less than the prescribed quantity of honey are supplied from those having a surplus. At the beginning of the honey flow the queen is confined on the emerging brood in the lower chamber by an excluder and supers are added, with the hive body containing the unsealed brood placed on top.

(4) The colony is allowed to build up in two brood chambers. The queen is placed in the lower brood chamber with 3 or 4 empty combs when the honey flow begins. The rest of the brood is put above the excluder with plenty of supers on top. Whenever the brood chamber is filled 3 or 4 of the combs are removed and put in the super directly above the excluder. Empty combs are put in the place of those removed. Among some cooperators who use the large hive, combs of honey on either side are removed and the same number of empty drawn combs are put in the center. The full frames are either set aside for fall feeding or given to other colonies.

(5) One cooperator used two brood chambers all the year. Sometimes the upper brood chamber is cleared of honey, or it may be reversed if the bees begin to rear brood in the lower one. If much honey is above, it is put below and precautions are taken to have the top chamber full of brood when supers are given. The cooperator who followed this meth had much pollen in the combs and excessive swarming during certain seasons.

(6) When all the colonies are removed from the quadruple cases an extra chamber containing some honey is given to each. At the beginning of the fruit and dandelion bloom an excluder is put on the second chamber and a super is added. At the beginning of the main flow the queen is found and the frame she is on, with eight empty drawn combs, is put in a chamber on the bottom board. An excluder is put on, followed by supers, with the brood on top. Queen cells are removed from the brood put above. One cooperator practiced this method of swarm control.

(7) One cooperator who does not use queen excluders during the early period of the honey flow puts on supers as the colony becomes crowded. About 25 days before the honey is removed the colonies are examined and the queen is confined by an excluder to the lower chamber.

(8) One cooperator winters his bees in two shallow brood chambers. In the spring a third "shallow" is put on and, as a rule, at the beginning of the honey flow, the queen occupies the two top ones. The top brood nest, which is filled with brood, is raised by placing supers in

between. As the brood emerges the top body becomes filled with honey to be used as stores in the fall. In the fall the lower chamber is removed and the colony is wintered in the top and second chamber.

(9) After the bees are out of winter quarters and have had a flight, one cooperator inspects from the bottom by lifting up the brood chamber from the bottom board. If anything seems to be abnormal an inspection is made from the top. During this examination the colony is given a clean bottom board and a shallow food chamber is placed underneath the brood chamber. Later a second full-depth brood chamber is placed between the two chambers. At the beginning of the honey flow, the colony is handled as follows: The original brood chamber is put on the bottom board, then a super containing empty combs, the excluder, the shallow food chamber, and finally the brood which was in the second brood chamber are placed.

(10) The colony is wintered in a single large brood chamber containing 11 frames. A hive body is added soon after unpacking and the queen is kept below with an excluder. Two weeks before the beginning of the honey flow the excluder is removed to allow the queen to go above. When the queen becomes well established in the second hive body, she is put below the excluder in the original brood chamber with supers in between, and the rest of the brood is placed on top. The cooperator who uses this system has observed that the brood chamber is used more fully for brood and the surplus honey is carried above; thus the queen is not crowded by the storage of honey in the brood chamber.

(11) One cooperator winters the bees in 1-story, or 1½-story hives. A brood chamber, either full depth or shallow, is added at the time of unpacking. The colony builds up in the 2 full-depth brood chambers or in the full-depth and 2 half-depth brood chambers. Later the queen is confined by an excluder to the lower full-depth brood chamber, and at the beginning of the honey flow this brood chamber is put above the supers after the queen is taken out and again put below the excluder in a hive body of selected empty combs.

(12) The colony is allowed to build up in two brood chambers. At the beginning of the honey flow the queen is put in the lower one with the sealed brood. An excluder is put on, two supers are added, and on top of these supers another excluder is placed. Then the brood chamber containing the unsealed brood is put on the top. An auger hole in this chamber allows the young queen, which is raised there, to go out and mate. In this way additional young queens are raised. This method of swarm control was practiced by one cooperator.

The yield of honey and character of the honey flow have a decided influence on the labor required during the period of preparation of bees for the honey flow. The manipulations during this period are principally associated with swarm-control measures which involve the addition of supers not only to give room to the bees but also to provide space for the storage of honey. Where the honey flow is intense it is more difficult to control swarming and more labor is required than in cases where the honey flow is slower and more uniform. Again, in seasons of a large honey flow more supers must be added, which in turn entails additional labor.

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The hours of man-labor spent in preparing colonies for the honey flow in 1930 ranged from 0.11 to 2.35 per colony with an average of 0.64 hour per colony. In 1931 the range was from 0.08 to 1.5, with an average of 0.67 hour per colony.

The beekeepers with the minimum hours of labor in 1930 and 1931 wintered their colonies in two standard brood chambers in which the bees build up during the spring period. At the beginning of the honey-flow the previously clipped queens were confined by excluders to the lower brood chambers with the emerging brood. Either 1 or 2 supers were put on above the excluders, depending on the strength of the colony, and the rest of the brood was put at the top. Queen cells built from brood placed above the excluder were not removed. The beekeeper with 0.11 hour of work per colony had a yield of 87 pounds per colony, whereas the one with 0.08 hour per colony had a near failure.

The beekeeper with the maximum hours of work per colony in 1930 wintered his bees in the cellar in one brood chamber. In the spring the colonies were equalized in number of frames of brood and stores, and as soon as this brood chamber was fairly well filled another brood chamber was added. When the queen was laying well in this second brood chamber, a bottom board was placed under it. A board extending from the ground at an angle to the entrance of the second brood chamber causes the young bees in the lower brood nest to go into the second one. A queen excluder was put above the second chamber and additional supers were added as needed. After 3 weeks the brood chambers were reversed and the extra bottom board was removed. During the period of preparation for the honey-flow a total of 2.35 hours of work was spent per colony, of which 1.9 hours represented swarm-control measures and 0.46 hour was used in moving bees. The yield was 88 pounds per colony and much swarming was reported. This is a complicated and not very effective method of swarm control and involves much more work than should be required during this period.

The beekeeper with the maximum number of hours per colony, in preparation for the honey-flow in 1931, wintered the colonies in the cellar in a full-depth brood chamber and a shallow food chamber. At the first spring examination the chambers were reversed. The colony built up in this way until the first super was added by lifting up the full-depth brood chamber and placing the super between the shallow and the brood chamber. Later the brood chamber was put on the bottom board, then an empty super on which the excluder was placed, then the shallow food chamber, and the brood which was in the second brood chamber below. Empty supers were always put under the excluder until partly filled and later put above the excluder when the next super was added.

This method of swarm control seems to work well in the case of this beekeeper, although it is rather complicated. The total time in preparation for the honey-flow was 1.5 hours per colony, of which 0.7 hour was in swarm control and 0.8 hour in moving bees to distant bee pasturage when it was apparent that the honey-flow in the immediate neighborhood would be practically a failure. As a result of moving the colonies to favorable pasturage, a yield of 121 pounds per colony was obtained, which more than justified the extra time spent in moving.

INCREASE IN COLONIES

Comparatively few of the cooperators were attempting to increase materially the numbers of their colonies; the majority were striving only to maintain a fixed number. Where winter and spring losses were heavy as well as losses from foulbrood, as was the case with many beekeepers, several new colonies were needed to make up for these losses.

The several ways of making increase were:

(1) Through natural swarming.

(2) Through the purchase of package bees with queens. As a rule 3-pound packages are used where white clover is the principal nectar-producing plant, while in sections where sweetclover is common and the colonies have a longer period in which to build up to full strength, particularly in Minnesota, 2-pound packages are commonly used.

(3) Through the dividing of the brood and supplying the queenless part with purchased or home-reared queens.

(4) Through the rearing of queens from brood placed in a hive body above a screen or excluder and containing an auger hole from which the queens can fly out to mate. After these queens are laying this brood chamber is set off on its own bottom board.

(5) Through division of strong colonies. Several beekeepers, in sections where sweetclover is the principal honey plant, divide their strong colonies early in the season. Such divided colonies usually build up during the dandelion and early white clover flow to colonies of full size by July 15, and during favorable seasons both divisions usually store a good crop of honey.

(6) Through the purchase of full colonies of bees.

(7) Through other means. One cooperator who does not use bee escapes in removing the honey makes increase in the following manner: As many bees as possible are smoked down from the filled supers. The supers with some adhering bees are then taken to the honey house and left uncovered. The bees fly to the window where they collect in a hive which contains brood and a queen. In this way an increase of around 20 colonies is made each year.

The inventory at the beginning of 1930 showed a total of 12,098 colonies of bees for 40 cooperators. At the beginning of the honey-flow a total of 11,662 colonies was reported or a net loss of 436 colonies. Eleven reported an increase, 24 a decrease, and 5 had the same number as at the beginning of the season. The number of colonies reported at the end of the year was 12,246 or a net increase of 1.2 percent for the year. Twenty-three reported a gain, 15 a decrease, and 2 had the same number as at the beginning of the year. The hours of labor in making increase amounted to 779½ or 1.37 hours per colony for the 23 beekeepers who reported an increase of 569 colonies.

The total increase in numbers of colonies in 1931 was 182 or a percentage increase of 2.3. Of the 28 cooperators represented in that year, 12 reported a total increase of 452 colonies, 14 reported a total decrease of 270 colonies, while 2 had the same number of colonies at the end as at the beginning of the year. The labor used by 12 beekeepers, who reported an increase of 452 colonies, amounted to 693 hours or 1.53 hours per colony.

CONTROL MEASURES FOR AMERICAN FOULBROOD

American foulbrood is widespread in sections of the white-clover region in which this study was made but, because the statistics are inadequate, it is impossible to estimate accurately the damage done. Foulbrood not only takes a serious toll in the destruction of colonies but distracts the beekeeper's attention from work having directly to do with honey production. The disease attacks all races of bees, and strong colonies are as susceptible as weak ones. It is impossible to manipulate or manage colonies so that they will not contract this disease, although precautions may be taken to prevent its spread in an apiary. Much worry and financial loss may be avoided by dealing promptly and effectively with the disease upon its appearance.

Of the 28 beekeepers represented in 1931, 18 operators, or 64 percent, reported American foulbrood. Two hundred and eleven, or 2.7 percent of the total colonies represented, were infected. Of the 18 reporting foulbrood, 5 destroyed the bees and combs; 5 saved the bees and destroyed the combs; 4 saved the bees and treated the combs, and 4 destroyed the bees and treated the combs. A majority of those who saved their bees shook them on to new foundation. A variety of methods were employed in treating combs, from soaking them in alcohol-formalin solution to treatment with water-formalin.

Although a decidedly greater immediate loss is incurred when the bees and infected brood combs are burned, this method has been adopted in a majority of the States. By following this practice the danger of infecting healthy colonies is materially lessened. No specific method of management absolutely prevents the introduction of American foulbrood, although there are precautions that every beekeeper should observe, such as not buying bees or old equipment unless they are known to be free of disease, not locating an outyard where foulbrood is prevalent, and in preventing robbing insofar as is possible.

The data gathered are not detailed enough to show the costs of the different methods employed, but it is certain that American foulbrood in an apiary, irrespective of how it is handled, is expensive. Of 18 apiaries representing 211 affected colonies, 74 colonies valued at $296 and 2,910 combs valued at $291 were destroyed. Fifty-six gallons of alcohol-formalin solution valued at $84 was used in treating 2,820 combs. Seven hundred fifty-one hours of man-labor and 73 miles of travel involved an additional cost of $304.81. The total cost amounted to $975.81, or $54.21 per apiary and $4.62 per colony.

HARVESTING

Harvesting includes the operations involved in the putting on of bee escapes, the brushing of bees from the combs, and the removal of supers of honey from the bee yard to the honey house. Of 40 beekeepers in 1930, 30 used bee escapes and 10 brushed and smoked the bees out of the supers.

The labor requirements for a group of beekeepers who use bee escapes, show some saving in man-labor through the use of the escape. The users of escapes, represented by 8,205 colonies producing 674,229 pounds of honey, harvested 270 pounds of honey per hour of labor compared with 194 pounds of honey per hour of labor for

a group of beekeepers operating 2,919 colonies and producing 237,461 pounds of honey who did not use bee escapes.

In addition to some saving in labor through the use of bee escapes an additional advantage is claimed in that the bees are gentler and that there is less robbing during seasons of a light honey crop.

EXTRACTING

The labor required to uncap and extract honey depends on several factors such as the type of uncapping knife, the type and size of extractor, and the manner in which the honey is conveyed from the extractor to the storage tank. The plain uncapping knife, the steam-heated hand knife and the steam-heated power knife are all in general use. The extractors in use varied from the 2-frame hand to the 45-frame radial power extractor.

The quantity of honey extracted per hour of man-labor varied from an average of 76 pounds with a 2-frame hand extractor and a plain hand knife to 133 pounds with a 45-frame power extractor and a power knife (table 7). Seventeen of the twenty-eight apiaries represented, averaging 523 colonies each, were equipped with 45-frame radial extractors and either steam hand or power knives. The smaller apiaries used extractors which varied in size from the 2-frame hand to the 4-frame power, with a cold hand or steam hand knife. The steam hand knife was the one most generally used among small as well as large operators. If a beekeeper has a business of sufficient size, or if he has only a few colonies and contemplates fairly rapid expansion, he will usually find it advantageous to install the larger radial extractor.

TABLE 7.—*Quantity of honey extracted per hour of man-labor with specified equipment, 1930* [1]

Type and size of extractor	Type of uncapping knife	Apiaries	Colonies per apiary	Honey extracted per hour of labor
		Number	*Number*	*Pounds*
2-frame hand	Plain, hand	3	65	76
Do	Steam, hand	5	60	85
4-frame power	do	3	115	90
45-frame power	do	4	371	114
Do	do	[2] 7	684	127
Do	Power	[2] 6	437	133

[1] Certain apiaries are omitted from this table because, for a given unit, the size and type of equipment was not the same.

[2] Honey pumps were in use in these groups of apiaries.

Where the extracting plant is not so arranged that the honey flows from the extractor to storage tanks by gravity, it appears that some saving in man-labor can be made through the use of a honey pump. Seven beekeepers, operating 45-frame extractors with honey-pump attachments, and using steam hand uncapping knives, extracted an average of 127 pounds of honey per hour of labor as against an average run of 114 pounds per hour for extractors of the same size but where the honey pump was not used. Beekeepers represented in the latter group lifted the honey to the storage tanks by hand. Where honey is pumped to storage tanks it is preferable to allow it to run first from the extractor to a small tank or sump to which the honey pump is

attached. With this arrangement there is less danger of air bubbles forming in the honey, since the fall of the honey level in the sump may be more readily seen and the pump stopped before air is pumped into the honey.

Comparatively little difference in output of honey per hour of man-labor was found as between the use of the power uncapping knife and the steam hand knife. As shown in table 7, the honey extracted per hour of labor with a 45-frame extractor and power knife was 6 pounds more than with a 45-frame extractor and a steam hand knife.

Cappings were (1) dried in a radial extractor, the dried cappings being melted up at the convenience of the beekeeper, and (2) dried in a simple draining box or tank into which the cappings fall as they come from the uncapper; and were melted up after they had been drained as free as practicable of honey.

Where the cappings are dried in a radial extractor, an uncapping box, tub, or can serves as a receptacle for the cappings. Where the power uncapper is used, a tub is placed on a platform similar to those used under supers but larger and is usually handled with a truck lift. Where a 5-gallon can is used to catch the cappings a hopper is arranged to direct the falling cappings into the can. Two men usually lift the tub and dump the honey and cappings into the radial extractor, while 1 man performs this operation when a 5-gallon can is used. With a steam hand knife it is customary to allow all cappings to drain in an uncapping tank before they are dried in the radial extractor.

When cappings are dried in a draining box they should be left in the box for several days. For fairly large operations, when cappings are dried in a radial extractor the capping tank should be of sufficient size to hold the cappings from a day's run, as it is convenient to handle cappings at the close of each day or at the beginning of the following day.

The honey that remains after the cappings are melted is sold for baking or manufacturing purposes, as it is usually spoiled for table use.

The following is a description of the interior arrangement of the honey house and the extracting methods of an extensive operator. The house is 60 by 30 feet, 2 stories in height, and has a basement which serves as a storage room for supers. The first-floor arrangement is such that a truck can be driven into one end of the building opposite an unloading platform which is adjacent to the extracting room. The unloading platform and floor of the extracting room are slightly lower than the level of the floor of the truck, which makes it possible to load and unload with the minimum of labor (fig. 3). The tank room and storage room occupy the remainder of the first-floor space to the rear of the extracting room. The cellar has a summer temperature of approximately 60° F., which serves to keep moth injury at a minimum. Supers are stored in the basement until cold weather, when they are moved to the top floor, where they are cleaned, sorted, and stored for the winter.

A 45-frame radial extractor, a revolving comb rack, a steam hand knife, and a plain draining box are in use (fig. 4). The uncapping box is of galvanized iron 2 feet wide by 2 feet deep and 3 feet long with a bar across the middle, thus making it possible to suspend a few combs in the box. The box rests on a frame made of 1-inch angle iron. At the side of the uncapping box there is a device to catch the drip from the knives. Two drain pipes from the knives empty into this device.

FIGURE 3.—Unloading filled supers of honey from the truck to truck racks. To the left is shown a loaded lift truck which is used to move the filled supers to the extracting room.

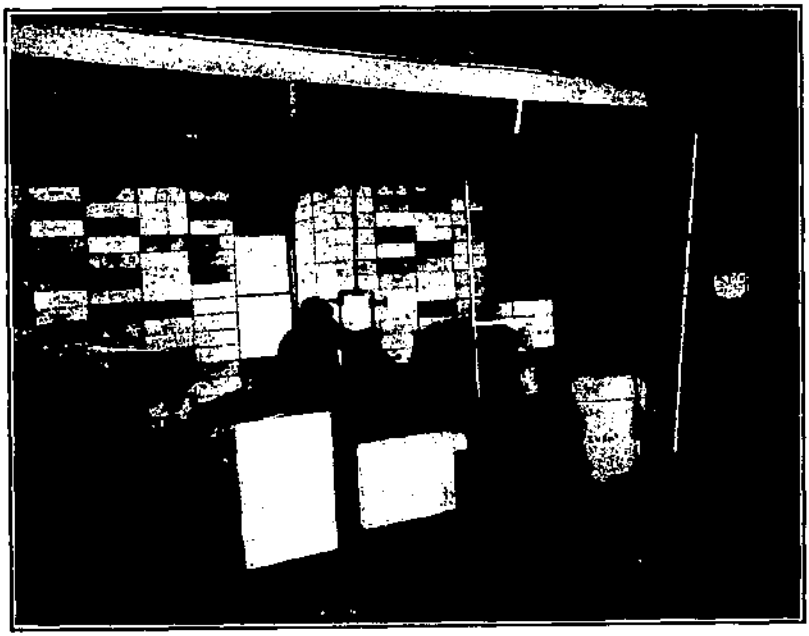

FIGURE 4.—Interior of the extracting room showing the arrangement of the extractor, revolving comb rack and uncapping tank. It requires about 2½ minutes for 2 men to empty and refill the extractor.

The inlets from the steam pipes to the knives are directly over the uncapping box so that the rubber hose from the knives hangs vertically in the box to catch the drip. The steam outlet is 2 feet 6 inches above the box and there are 2 valves to regulate the steam supply to the 2 knives. The edge of the revolving comb rack extends over the uncapping box 3 inches, which serves to prevent the drip of honey to the floor. The steam pipe to which the knives are attached and all cross bars on the uncapping box swing out of the way to facilitate transfer of the cappings to the extractor.

The pump is equipped with an 8-inch pulley and a 1½-inch pipe for the vertical rise and a 3-inch galvanized pipe for the horizontal run. A piece of rubber hose 6 or 8 inches long connects the pump and the riser. This piece of rubber hose pulsates with each turn of the pump and evens the flow of honey in the pipe. The pipe from the pump

FIGURE 5.—The interior of the tank room showing a convenient arrangement for filling containers.

empties into a strainer box which is held on the bottom of the storage tank by a prop to the ceiling. The strainer box has ⅞-inch vertical strips at the four corners and is bound half way up by screen wire cloth placed at the outside of the corner strips. A cheesecloth bag suspended inside of the strainer box is held in place by a ⅞-inch square frame attached to the top of the box. Before honey is drawn off the tank any foreign matter in the bag is removed, permitting the strainer to be used several times without washing.

There is a honey outlet from the uncapping box into the extractor through a pipe and short hose connection. From the extractor to the pump and from the pump to the pipe line there are similar connections. The extractor is equipped with a steam coil in the bottom which can be used to melt any honey that might granulate.

The storage tanks, which are in a separate room, are placed about 35 inches above the floor level (fig. 5).

The supers, 10 to a load, 2 long and 5 high, are brought in from the unloading platform on a light lift truck. Two men, one at each end of the uncapping tank, uncap on a frame rest and place the combs in the revolving comb rack until a sufficient number are ready. The extractor is filled by placing the combs one at a time. The combs are taken from the extractor 4 or 8 at a time, being first pushed slightly forward to free them from the periphery of the extractor, thus giving room to grasp them. Using 8 combs in a super, 8 in each section of the revolving comb rack, and 8 in each of the 5 sections of the extractor, makes it easy to keep each set of combs separate, as a division is always evident between the lots. The combs from the extractor are placed in supers on a truck rack, 20 empty supers constituting a load.

The cappings are shoveled out of the draining box into galvanized-iron bushel baskets and are dumped into the extractor for drying. The dried cappings are transferred through a chute to the basement, where they are allowed to remain until a convenient time for melting.

WINTERING

That winter losses may be held at a minimum, every effort should be made to prepare the colonies properly for the winter. The prime requisites are strong colonies of young bees, young vigorous queens, and sufficient stores of good quality to carry the colonies through the winter and well into the spring, together with adequate protection against the cold.

Three general types of wintering are practiced in the white-clover region—wintering in bee cellars, wrapping in tar paper, and wintering in packing cases.

CELLAR WINTERING

Until comparatively recent times cellar wintering, particularly in the northern border of the white clover region, was largely practiced. Although this method is still common it is being displaced by other methods. The reported winter loss for 1930 was 7.2 percent for the cellar method of wintering. This relatively high winter loss was attributed largely to poor ventilation, which in turn resulted in a lack of uniformity in temperature and in an excessive amount of moisture.

Of the 40 beekeepers reporting in 1930, 10 wintered all and 6 wintered a portion of their bees in cellars and wrapped the remainder in tar paper. Of the 10 beekeepers who wintered all their bees in cellars, 7 used the 1-story hive; 1 used a 1½-story, and 2 used a 2-story hive.

Two of the cooperators wintered their bees in a cellar 60 by 20 by 10 feet, which has a concrete floor and side walls, a shingled roof, and 1 foot of flax straw under the ceiling. Another beekeeper has a 16 by 16 foot cellar under the barn.

Four have cellars of the type illustrated in figure 6. The sides are built of logs which are extended across the top to form a ceiling over which straw and dirt serve as insulation. Most of these cellars are provided with ventilating shafts. In a cellar of this type, but which lacked ventilating facilities, 150 colonies of bees were placed in the fall of 1930 with a loss of 56 colonies during the winter. On examination in the spring of 1931 it was found that moisture had collected in

the hives and most of the combs were moldy. This perhaps is an extreme case, but is illustrative of what may take place in greater or less degree in poorly constructed and operated bee cellars. Bee cellars of the type shown in figure 6, in which the ceiling is lined with straw and ventilating shafts are installed, give a fair degree of success.

The following is a description of a cooperator's modern bee cellar in which winter loss of bees has been small. It is about 7 feet 6 inches in depth and the top of the wall is at the ground level. The construction is of hollow tile with a concrete floor. The roof of the building, of galvanized iron, is gabled and supported by iron posts. The ceiling is lined with a 2-foot layer of clover chaff held in place by heavy woven wire. The entrance is at one end. An air shaft extends up through the ceiling and at its lower end has a blanket cover that can be unfolded to control ventilation. An electric fan used to draw out the stale air is housed in a separate building and is connected with a 16-inch galvanized-iron pipe which extends into the bee cellar.

FIGURE 6.—Bee cellar of the dug-out type. This cellar has a dirt floor and plank ventilating shafts. The side walls and top are constructed of logs. More permanent cellars of this type have concrete floors and side walls.

This iron pipe is separated at two places and reconnected with tape, to lessen vibration. The noise of the motor that operates the fan does not disturb the bees. A long underground air-intake pipe of 22-inch tile branches into two 16-inch pipes inside the cellar and extends to each end. Both outlets of the pipe in the cellar may be closed by shutters that operate through the ceiling. A thermometer which can be drawn up through the ceiling is used to note the temperature without entering the cellar. An electric fan with thermostat automatically controls the temperature within a variation of a few degrees.

WINTERING IN TAR-PAPER CASES

The tar-paper case is becoming increasingly popular for wintering bees. The winter loss for this method of wintering was 3.5 percent. Of the 40 cooperators, 8 used tar paper exclusively and 6 wrapped a

portion of the colonies in tar paper and wintered the remainder in cellars. Six of those who wintered in tar paper exclusively used 2-story and 2 used 1½-story hives.

Three cooperators pack their bees for winter with slater's felt and chaff packing; one uses a shallow packing tray under two colonies and the other two winter on summer stands in one and one-half story hives with no packing below. Another cooperator uses 2 layers of corrugated paper around the sides of the hive and 1 layer of waterproof paper which extends 1 foot above the top. This paper is tacked and cleated around the bottom. About 6 inches of shavings are placed on top of the hive. The paper is folded in and the top is put on and tied down with cord. Waterproof paper is used on the outside at the rate of 1 roll for 20 colonies. No bottom packing is used. Another cooperator uses a mixture of clover-chaff, shavings, and cut straw and 4 inches of bottom packing. Telescope outer covers and inner covers are used. When the packing is removed in the spring it is sorted, placed in piles, and covered with tar paper.

FIGURE 7.—Two 2-story colonies of bees wrapped in slater's felt. The hives are set in a packing tray and the insulating material is a mixture of planer shavings and sawdust. Note the windbreak in the rear. Where a natural windbreak is not available, it is desirable to provide a fence for wind protection, particularly on the north and west of the yard.

Two-story colonies of bees wrapped in slater's felt are shown in figure 7. The materials required for such a package are: (1) Regular entrance blocks to contract entrances down to about 3 by ⅜ inches; (2) two 32-inch laths and two 16-inch laths; (3) one tunnel strip, 2 by 32 inches; (4) twelve six-penny box nails; (5) about 40 feet of binder twine; (6) one sheet of slater's felt 11 feet 4 inches long for the packing case, one sheet 3½ feet long for cover and four six-penny box nails for pinning the case.

Packing trays are used under the hives. These trays are 2 feet 2½ inches wide, 3 feet 2½ inches long, and about 3¾ inches deep. The rim of the tray and the band to hold the rear end of the hives are 1- by 4-inch strips and are placed 4 inches from the outside of one of the long sides of the tray.

The procedure in packing is as follows: The hives are removed from the summer stands to make room for the bottom packing trays. Then the tray, filled with packing material, is placed on the stand. The hive is then placed on the tray and the tunnel strip is placed in position and secured by a nail through each end into the bottom board. The slater's felt in the form of a cylinder about 6 to 8 inches in diameter is unrolled around the tray and the ends are lapped a few inches and pinned with a nail. The lower edge of the felt is brought up against and even with the bottom of the tray and one of the 32-inch laths is placed against the tunnel strip so that its lower edge is even with the lower side of the tunnel strip. Then a 32-inch

lath is placed in position at the rear and 16-inch laths are placed at either end. Three nails are used in each of the front and rear laths and 2 in each of the end laths. Now the ends of the felt are pinned with 2 or 3 additional nails. The nails used to fasten the strips are allowed to protrude about one-quarter of an inch, to facilitate ease of removal and so that twine can be fastened to them.

Planer shavings and sawdust are dumped in at each end of the case and packed down, especially at the corners, sufficiently to give shape to the case. Then more packing is added and the upper part of the felt is folded in so that the cover can be put in place and tied down. The twine is allowed to remain in a continuous length and the cover is tied down in the way shown in figure 7. After the case is packed and tied an opening about 2 inches by ¾ inch is cut through the felt

FIGURE 8.—Packing material sufficient for approximately 80 colonies of bees with a tar-paper covering and securely tied down with string. The material consists of planer shavings, sawdust, laths, tunnel strips, and tar paper. The material from each yard is packed in that yard where it is handy for the next season's use.

into the tunnel just under the front lath, directly in front of the inner entrance.

The packing material from the cases is stored in the way shown in figure 8. To hold this material together and keep it dry, a circular bin is formed from a piece of woven-wire fence about 32 feet long, the ends being lapped to form a bin the right size to hold the packing material to be accommodated. Three of the long pieces of slater's felt are used to line the inside of the wire bin, and additional paper is added as packing progresses. All laths and tunnel strips are placed on top, followed by all-paper covers and long sheets of packing-case paper, the top layer radiating from the center and so placed that it will shed water. A knot is tied in the middle of about 20 strings used to tie the cases, leaving each string about 20 feet from the knot to the end. This knot forms the hub, which is placed at the center of the top of the pile, and the string is made to radiate like the spokes

of a wheel and is tied down firmly to the wire. In this way the packing material is kept dry and at hand, where it is convenient for use the following fall.

WINTERING IN PACKING CASES

Seven beekeepers reported wintering all their colonies in packing cases with a winter loss of 4.5 percent. Of this number, 5 used a 1-story and 2 used a 2-story hive. Two wintered a portion of their colonies in packing cases and the remainder in double-walled hives.

The type of packing case showed considerable variation, but the quadruple case (fig. 9) is most generally used. Six cooperators used this type of case. One of them winters in a single brood chamber, using sawdust for packing material. In the spring at the time the bees are removed the packing material is stored in the cases for use

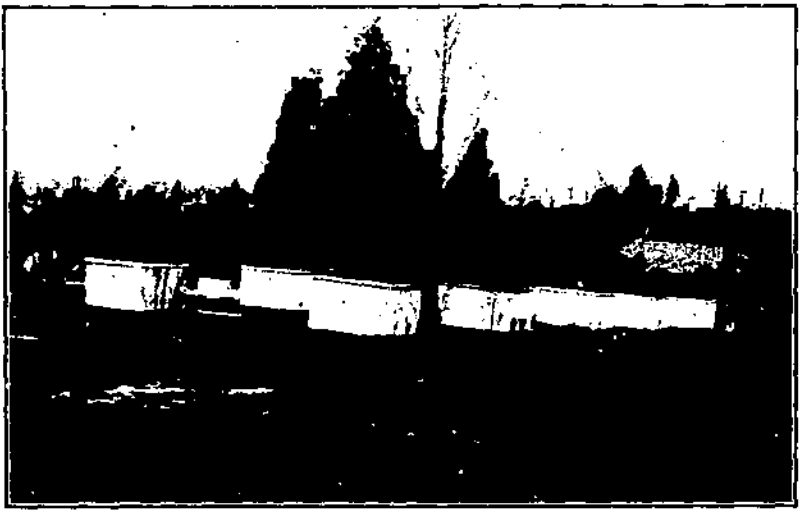

FIGURE 9.—Colonies of bees in two brood chambers packed in quadruple cases with sawdust as the insulating material.

the following year. Another uses a single brood chamber which is left permanently packed.

One beekeeper uses 2- to 4-colony wooden cases in which the bees are allowed to remain throughout the year. These cases have drop backs and lift tops and the brood chamber is left permanently packed.

Two beekeepers winter their bees in single cases. One uses wooden cases and 1-story hives. The other has cases of galvanized iron with an inner casing of cypress lath to hold the packing material of shavings, which are put in from the top. These cases fit down over a 2-story colony and are set on an extension of the bottom board. The top is covered with a tray held in place by rivets. The winter entrance is through a slot, cut in the iron, into a ⅞-inch portico and a ⅜-inch contracted inner entrance. The packing material is allowed to remain in the cases, which are stored at one end of the yard when not in use.

COMPARATIVE COST OF WINTERING BEES BY DIFFERENT METHODS

The cost of outdoor packing of colonies is somewhat greater than cellar wintering, but the tendency seems to be toward the former.

Of the two general methods employed in outdoor wintering the tar-paper package is the cheaper. In 1930 the comparative cost was 25 cents per colony for cellar wintering, 31 cents for tar paper, and 39 cents per colony for packing in permanent quadruple winter cases. Packing in tar-paper cases involves the largest amount of man-labor. Travel with automobile or truck was least where the cellar method of wintering was employed (table 8).

TABLE 8.—*Cost of wintering bees by different methods, white-clover region 1930*[1]

Item	Outdoor wintering				Cellar wintering (10 apiaries having 2,655 colonies)	
	Tar-paper cases (8 apiaries having 1,634 colonies)		Quadruple packing cases (7 apiaries having 2,907 colonies)			
	Quantity	Cost	Quantity	Cost	Quantity	Cost
Fall expense:		*Dollars*		*Dollars*		*Dollars*
Man-labor, hours	539¾	269.87	812½	406.25	431	215.50
Truck or automobile, miles	369	10.10	1,019	57.05	495	30.34
Tar paper, twine, etc., dollars		73.69				
Interest, depreciation, and repairs, dollars				425.45		228.00
Spring expense:						
Man-labor, hours	245	98.00	571½	228.60	409	163.60
Truck or automobile, miles	336	17.10	843½	45.04	528	31.54
Total cost, dollars		477.85		1,162.99		669.88
Cost per colony, do		.31		.39		.25
Man-labor per colony, minutes	31		28		19	
Truck or automobile travel per colony, miles	.46		.63		.39	

[1] Includes only those apiaries in which all the colonies were wintered in the same way.

CASH EXPENSES FOR APIARIES OF DIFFERENT SIZES

The cash outlay for apiaries of different sizes is shown in table 9. Of these items a large part of the use of automobile and truck is represented by travel to and from outyards, and the greater number of outyards and the consequent greater number of miles traveled largely account for the greater cost for use of automobile and truck with the larger apiaries. Beekeepers with less than 100 colonies, as a rule, conducted their business at the home bee yard, whereas those in the larger-size groups, in some instances, had a dozen or more outyards. In the group having less than 100 colonies, only 3 beekeepers used an automobile or truck in the conduct of their business, with the result that the average cash cost for use of automobile and truck was only $5.36 per apiary in 1930 and $13.05 in 1931. In the groups with 100 or more colonies the miles of travel ranged from slightly less than 100 to over 5,000 miles per apiary, with a corresponding cash cost for automobile and truck in the first instance of slightly more than $3 and in the latter case of nearly $500 per apiary. The latter case involved a beekeeper whose prospects for a honey crop were poor in his immediate neighborhood, so he hauled his bees to distant bee pasturage and obtained a fair crop of honey, whereas had his colonies remained at home his crop of honey would have been a near failure.

TABLE 9.—*Cash expenses for apiaries of different sizes, 1930–31* [1]

Item	Less than 100 colonies		100 to 299 colonies		300 to 499 colonies	
	1930	1931	1930	1931	1930	1931
	Number	*Number*	*Number*	*Number*	*Number*	*Number*
Beekeepers	9	7	15	11	8	5
Average colonies	47	59	177	175	397	428
Cash outlay per apiary:	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Auto and truck	5.36	13.05	40.55	41.27	71.78	106.35
Hired labor	11.52	2.10	17.75	13.62	213.39	261.39
Supplies	24.76	15.95	60.11	36.63	89.96	160.73
Bees and queens	8.28	14.08	75.82	65.99	174.48	221.73
Permanent equipment and repairs	27.85	08.49	107.75	112.90	309.73	115.75
Apiary rental	3.02	2.43	17.75	18.11	36.25	24.66
Containers	34.25	6.69	89.64	109.11	190.82	257.23
Other items	3.24	2.72	23.49	14.26	61.80	42.70
Total per apiary	116.88	126.47	491.83	402.89	1,148.21	1,190.54
Total per colony	2.49	2.14	2.78	2.30	2.89	2.78

Item	500 to 699 colonies		700 colonies and over		All apiaries	
	1930	1931	1930	1931	1930	1931
	Number	*Number*	*Number*	*Number*	*Number*	*Number*
Beekeepers	4	3	4	1	40	27
Average colonies	597	509	757	776	202	258
Cash outlay per apiary:	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Auto and truck	160.79	265.77	193.86	143.30	69.61	73.62
Hired labor	656.90	392.57	307.74	300.00	154.39	160.25
Supplies	361.31	135.35	450.88	728.34	124.47	90.84
Bees and queens	130.59	147.00	59.38	24.00	83.34	80.05
Permanent equipment and repairs	280.38	319.10	360.80	88.00	196.14	123.91
Apiary rental	58.00	67.25	100.80	123.00	30.60	24.60
Containers	614.64	158.27	397.20	293.60	180.68	118.61
Other items	63.34	57.69	88.00	57.00	37.03	22.04
Total per apiary	2,321.95	1,533.00	2,030.72	1,757.24	576.24	652.82
Total per colony	3.89	2.69	2.60	2.26	3.00	2.53

[1] Based on extracted honey sold in cases of two 60-pound cans and in 105-pound kegs. Marketing charges are not included.

The expense for hired labor was small on apiaries of less than 300 colonies because most of the labor was performed by the owner and his family, whereas on the larger apiaries the charge for hired labor was one of the major items of cash expense. All beekeepers with 300 or more colonies hired some labor. The range in cost of hired labor for this group was from $5 for an operator with 355 colonies to $1,267 for an operator with 670 colonies. The former had an abundance of family labor and only a fair yield of honey, while the latter had no family labor and a very good yield.

The charge for supplies includes such items as sugar bought for feed and packing materials used in the winter packing of colonies. The cash expense to those beekeepers who buy sugar for feeding could be materially reduced by providing full combs of honey, rather than feeding sugar sirup. If sugar had not been fed the average cash costs would have been reduced by about 10 percent in both 1930 and 1931.

The purchase of bees and queens represents an appreciable cash outlay for some size groups. As a rule these purchases were to maintain the number of colonies in the apiary, but in some instances the

expense was incurred to increase the number of colonies, and then the expense for this item was partially offset by the increase in inventory at the end of the year. The purchase of bees and queens was particularly heavy in 1931 in the group with 300 to 499 colonies, amounting to an average of approximately $222 per apiary mainly due to the purchase by 2 beekeepers of a large number of package bees and queens to replace winter and spring loss of colonies. Cash expenses to many beekeepers who wish to make increase could be reduced by the division of strong colonies early in the season and the introduction of home-produced queens rather than by the purchase of package bees. In 1930, 11 beekeepers bought a total of 558 packages of bees at a cost of $1,791, or $3.21 per package, while in 1931, 12 reported the purchase of a total of 626 packages at a cost of $1,947, or $3.11 per package. If increase had been made by division rather than by the purchase of package bees, the average cash costs would have been further reduced by about 5.5 percent in 1930 and by 12 percent in 1931.

The cash outlay for repairs and permanent equipment is a substantial item of expense for some size groups. In some instances the expense incurred for permanent equipment is partially offset by the increase in inventory at the end of the year. In addition, some immediate saving might be made by holding to the minimum the purchase of permanent equipment.

Apiary rental represents the amount paid in cash or in honey for the use of land occupied by bee yards. When honey was exchanged for the use of bee-yard site it was charged at the market price and the value was credited to honey sales. If the yard was located on land owned by the beekeeper no charge was made for use of land, since the area occupied by each yard is relatively small and is often waste land, along a fence row, or in an orchard. The charge for apiary rental was in proportion to the number of bee yards required and amounted to a substantial sum for the larger apiaries.

The cash outlay for containers is confined to the purchase of 60-pound cans and 165-pound kegs, and for a given size group this charge varies directly with the yield obtained. For instance, in the group of less than 100 colonies per apiary in 1930, with a yield of over 100 pounds per colony, the charge for containers amounted to 73 cents per colony, whereas in 1931, with a yield of approximately 15 pounds per colony, this charge was only 11 cents per colony.

RETURNS FOR APIARIES OF DIFFERENT SIZES

The receipts per apiary during 1930 and 1931 were from 36 to 256 percent greater than the cash outlay for all groups, except in 1931, for the group of less than 100 colonies, which averaged $50 less than the cash outlay mainly because of the low yield of 15 pounds of extracted honey per colony (table 10).

TABLE 10.—*Returns for apiaries of different sizes, 1930 and 1931* [1]

Item		Beekeepers with—					
		Less than 100 colonies		100 to 299 colonies		300 to 499 colonies	
		1930	1931	1930	1931	1930	1931
Beekeepers	number	9	7	15	11	8	5
Average colonies	do	47	59	177	175	397	428
Yield of extracted honey	pounds	5,081	856	11,805	15,467	26,076	42,531
Yield of comb honey	sections	127	.....	673	503	1,920	2,158
Yield of wax	pounds	80	12	170	224	426	555
Receipts per apiary:							
Extracted honey	dollars	352.15	59.87	762.31	931.64	1,668.52	2,518.86
Comb honey	do	17.78	11.97	86.70	114.76	275.14	257.90
Wax	do	21.12	2.40	50.36	43.29	113.46	97.70
Inventory net increase [2]	do	41.54	.....	79.06	9.35	316.69	.....
Other	do	.31	2.77	15.53	18.73	4.13	.....
Total	do	415.90	77.01	994.10	1,117.77	2,377.94	2,874.46
Cash costs	do	116.88	126.47	491.83	402.89	1,148.21	1,190.51
Other costs:							
Unpaid family labor	do	5.46	1.91	30.46	45.14	117.85	97.77
Operator's labor	do	83.03	54.23	273.03	190.42	460.91	354.14
Inventory net decrease [2]	do	.....	38.31	.....	.....	.....	34.56
Total	do	88.49	94.45	303.49	235.56	578.79	486.47
Total cost exclusive of interest	do	205.37	220.92	795.32	638.45	1,727.00	1,677.01
Interest at 5 percent	do	50.54	55.13	171.37	163.65	378.55	361.27
Total cost per apiary	do	251.91	276.05	966.69	802.10	2,105.55	2,038.28
Total cost per colony	do	5.04	4.68	5.46	4.58	5.30	4.76
Receipts, less cash costs: [3]							
Per apiary	do	299.02	−49.46	502.27	714.88	1,229.73	1,683.92
Per colony	do	6.36	−.84	2.83	4.08	3.10	3.93
Receipts, less total costs: [3]							
Per apiary	do	159.09	−198.01	27.41	316.67	272.39	836.18
Per colony	do	3.21	−3.38	.15	1.80	.69	1.95
Quantity of extracted honey per colony required to pay costs [4]	pounds	87	78	81	79	82	79

Item		Beekeepers with—				All apiaries	
		500 to 699 colonies		700 colonies and over			
		1930	1931	1930	1931	1930	1931
Beekeepers	number	4	3	4	1	40	27
Average colonies	do	597	569	757	776	292	258
Yield of extracted honey	pounds	85,000	27,746	55,462	44,000	21,832	19,112
Yield of comb honey	sections	.....	1,500	960	.....	761	771
Yield of wax	pounds	1,316	383	935	650	397	260
Receipts per apiary:							
Extracted honey	dollars	5,420.00	1,387.71	3,698.62	2,640.00	1,696.10	1,135.73
Comb honey	do	.....	319.73	213.75	.....	142.92	133.14
Wax	do	403.88	74.67	220.50	130.00	114.52	40.46
Inventory net increase [2]	do	.....	100.71	72.75	.....	185.86	.....
Other	do	.....	.....	212.50	.....	27.97	8.35
Total	do	5,823.88	2,082.82	4,468.12	2,770.00	1,067.43	1,326.68
Cash costs	do	2,321.95	1,531.00	2,030.72	1,257.21	870.23	652.82
Other costs:							
Unpaid family labor	do	1.60	.....	363.85	75.00	72.76	39.76
Operator's labor	do	470.50	288.10	726.90	367.20	332.61	202.83
Inventory net decrease [2]	do	37.22	.....	.....	263.36	.....	25.09
Total	do	509.32	288.10	1,090.75	1,105.56	405.37	268.48
Total cost exclusive of interest	do	2,831.27	1,821.10	3,127.47	2,862.80	1,281.61	921.31
Interest at 5 percent	do	554.31	459.92	738.65	826.47	282.67	229.58
Total cost per apiary	do	3,385.61	2,281.02	3,805.12	3,689.27	1,561.28	1,150.89
Total cost per colony	do	5.67	4.01	5.11	4.75	5.36	4.46
Receipts less cash costs: [3]							
Per apiary	do	3,501.93	549.82	2,431.40	1,012.70	1,031.19	673.86
Per colony	do	5.87	.97	3.21	1.31	3.73	2.61
Receipts less total costs: [3]							
Per apiary	do	2,438.27	−198.20	662.00	−919.27	−363.15	175.79
Per colony	do	4.08	−.35	.90	−1.18	1.38	.68
Quantity of extracted honey per colony required to pay costs [4]	pounds	87	67	78	79	82	74

[1] Based on extracted honey sold in cases of two 60-pound cans, and in 165-pound kegs at wholesale prices. Wholesale prices were approximately 6½ cents per pound in 1930 and 6 cents per pound in 1931. Marketing charges are not included. In 1930, unpaid family labor was charged at 40 cents per hour and operator's labor at 50 cents per hour. In 1931, unpaid family labor was charged at 30 cents per hour and operator's labor at 40 cents.

[2] Difference in inventory values of bees, buildings, equipment, and supplies.

[3] Minus denotes loss.

[4] With honey selling at 6½ cents per pound in 1930 and at 6 cents per pound in 1931.

The receipts exceeded the cash outlay plus value of unpaid family and operator's labor and interest on the apiary capitalization at 5 percent for all 5 size groups in 1930 and for 2 in 1931. The difference between receipts and expenses including interest for all size groups averaged $1.38 per colony in 1930 and $0.68 per colony in 1931. One beekeeper, having 795 colonies and a yield of 111 pounds of extracted honey per colony, had a balance of $3,805 after paying all expenses, including interest. Another, with 425 colonies and a yield of 40 pounds per colony, had receipts that were insufficient by $1,089 to pay all charges, including interest. In 1930 there were 24 beekeepers whose receipts exceeded their expenses including interest as against 16 whose expenses were greater than their receipts. The average yield for the former group was 111 pounds of extracted honey per colony as against an average of 50 pounds for the latter group. A similar comparison for 1931 showed 13 beekeepers whose receipts exceeded their expenses, including interest, and 14 whose expenses were greater than their receipts. The average yield of extracted honey for the former was 97 pounds per colony as against 46 pounds for the latter.

The comparatively lower returns as between 1930 and 1931 for apiaries in the same size group are largely explained by the yields obtained. The yields required to pay costs, with extracted honey selling at the wholesale price of 6½ cents per pound in 1930 and at 6 cents per pound in 1931, are shown in table 10. The average yields of extracted honey obtained in 1930 and in 1931 (table 11) were insufficient to pay total costs in 3 of 5 size groups in both 1930 and 1931. Because of inventory net increase, however, and receipts from sales of wax, comb honey, and some miscellaneous items, all groups in 1930 and 2 of 5 size groups in 1931 had receipts which exceeded total expenses. To realize a substantial income, a beekeeper must operate on a relatively large scale and he must obtain good honey yields.

TABLE 11.—*Production of honey by apiaries of different sizes, 1930 and 1931*

Year and size of apiary (colonies)	Apiaries studied	Colonies per apiary				Average production per apiary			Average production per colony [1]	
		First inventory	Second inventory	Average	Honey flow	Comb honey	Extracted honey	Wax	Comb honey	Extracted honey
1930	*Number*	*Number*	*Number*	*Number*	*Number*	*Sections*	*Pounds*	*Pounds*	*Sections*	*Pounds*
Less than 100	9	49	54	51	47	127	5,081	89	3	108
100 to 299	15	178	183	181	177	673	11,805	179	4	67
300 to 499	8	396	414	405	397	1,920	20,076	426	5	66
500 to 699	4	595	605	600	597	.....	85,000	1,346	.....	142
Over 700	4	850	810	831	757	960	55,462	935	1	73
Average		302	306	304	292	761	24,832	397	3	85
1931										
Less than 100	7	52	53	53	50	.....	855	12	.....	15
100 to 299	11	177	185	181	175	503	15,467	224	3	88
300 to 499	5	407	421	414	428	2,158	42,531	535	5	99
500 to 699	3	574	644	608	559	1,500	27,740	353	3	49
Over 700	1	705	766	780	770	.....	44,000	650	.....	57
Average		257	267	262	258	771	10,112	266	3	74

[1] Based on number of colonies for the honey flow.

EFFECT OF YIELD ON COST OF PRODUCING EXTRACTED HONEY

The yield of honey in a given region is influenced by a number of factors. The honey flow may be reduced by a scarcity of honey-producing plants or by unfavorable weather conditions. There is little the beekeeper can do to combat unfavorable natural conditions, although if bloom is scarce in one locality some advantage may be gained by moving the bees to better pasturage. Some advantage of expected natural conditions may be taken by bringing the colonies up to full strength at the time heavy bloom is expected. This timely development of the strength of the colonies explains in part the difference in yield obtained under similar conditions by different beekeepers.

The yield of honey obtained in 1930 and 1931 is shown in table 11. In 1930 the range in yield of extracted honey for individual beekeepers was from 8 to 190 pounds and the average yield was 85 pounds per colony. In 1931 four beekeepers did not harvest any honey; the remainder had yields of extracted honey ranging from 6 to 148 pounds per colony. The average yield was 74 pounds per colony. In addition a small quantity of comb honey was produced in both years. Yields in 1931 in some sections were much lower than usual because of the prolonged drought which destroyed much of the bloom.

Yield per colony is the factor exerting the greatest influence on the cost per pound of producing honey and is an important factor in determining the profits from honey production. The influence of yield on the cost per pound of producing extracted honey in 30 apiaries for 1930 is shown in the following tabulation. In general as the yield per colony increased the cost per pound decreased. The average cost per pound for 14 beekeepers producing less than 80 pounds of extracted honey per colony was nearly three times as high as the average cost per pound for 14 beekeepers producing 100 pounds or more per colony.

Average yield of colony (pounds)	Cost per pound (cents)
190	3.1
183	2.6
155	2.6
151	1.8
136	4.9
134	4.0
130	2.5
120	3.6
118	4.2
111	2.7
104	5.6
102	4.6
102	2.6
100	4.7
88	6.4
87	5.5

Average yield of colony (pounds)—Continued.	Cost per pound (cents)
76	6.6
71	7.2
70	4.2
67	6.8
66	8.9
64	4.8
61	6.3
55	9.0
50	8.4
40	12.6
36	12.8
34	19.0
30	14.1
14	20.8

THE INDIVIDUAL APIARY

In order that a particular beekeeper may compare his business with that of other successful beekeepers, four representative apiaries have been selected and their organization and management are here discussed in considerable detail. Such a comparison is likely to suggest ways in which the organization and management of any indi-

vidual apiary can be improved. The selected apiaries are operated by men who have been keeping bees for a number of years, and although doubtless some details of their business could be improved, these men are recognized as successful beekeepers. Table 12 gives a summary of their business.

TABLE 12.—*Summary of apiary business of four typical beekeepers, 1930–31*

Item	No. 1		No. 2		No. 3		No. 4	
	1930	1931	1930	1931	1930	1931	1930	1931
Colonies of bees	*Number* 66	*Number* 65	*Number* 295	*Number* 253	*Number* 505	*Number* 500	*Number* 660	*Number* 770
Yield of extracted honey	*Pounds* 9,008	*Pounds* 0	*Pounds* 9,000	*Pounds* 37,200	*Pounds* 66,000	*Pounds* 75,000	*Pounds* 50,000	*Pounds* 41,000
Yield of wax	115	0	110	680	1,000	1,150	740	650
Apiary capital:	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Bees	462	469	2,086	1,891	4,545	3,960	6,940	7,659
Buildings	25	21	300	200	1,100	1,040	4,320	4,220
Permanent equipment	372	343	2,705	2,651	3,874	3,703	3,338	4,223
Supplies	20	23	11	42	15		800	136
Total	879	859	5,102	4,880	9,534	8,703	14,098	16,529
Receipts:								
Extracted honey	599.88	0	624.00	2,232.00	6,240.00	4,500.00	3,125.00	2,640.00
Wax	31.50	0	30.00	136.00	570.00	207.00	222.00	130.00
Inventory increase [1]							1,561.07	
Total	631.38	0	654.00	2,368.00	6,810.00	4,707.00	4,908.07	2,770.00
Cash costs:								
Auto and truck	3.75		81.78	82.43	186.21	211.14	170.05	143.30
Hired labor			10.80	1.00	607.80	505.15	455.00	300.00
Supplies	4.29	3.25	35.00	10.80	308.20	202.75	1,077.10	728.31
Bees and queens	1.80		40.00	20.00	198.90	886.90	225.00	21.00
Permanent equipment and repairs	8.61	2.80	25.71	8.95	52.20	291.78	810.80	88.00
Apiary rental			41.00	41.00	28.00	27.00	116.20	123.00
Containers			79.50	211.80	720.00	500.00	325.36	293.60
Other items	30.53		33.53	39.63	31.00	51.75	57.00	57.00
Total	46.98	6.05	350.29	451.03	2,130.31	2,827.07	3,281.31	1,757.21
Other costs:								
Unpaid family labor	26.60	4.80	15.80	48.00			494.20	75.00
Operator's labor	74.62	24.46	303.60	237.20	721.25	474.70	665.00	367.20
Inventory decrease [1]	8.74	45.11	271.27	214.08	259.55	5.80		663.36
Total	107.96	74.51	590.67	500.78	980.80	480.50	1,059.20	1,105.56
Total cost exclusive of interest	154.94	80.56	940.96	951.81	3,111.14	3,307.65	4,340.51	2,862.80
Interest at 5 percent	43.95	42.95	258.10	244.50	476.70	439.65	748.10	826.45
Total cost:								
Per apiary	198.89	123.51	1,198.46	1,196.31	3,587.84	3,747.31	5,088.61	3,689.25
Per colony	3.01	1.90	4.52	4.70	7.10	6.69	7.72	4.75
Receipts less total costs: [2]								
Per apiary	435.19	−123.51	−544.46	1,168.69	3,222.16	959.69	−180.54	−919.25
Per colony	6.60	−1.90	−2.05	1.61	6.38	1.71	−.29	−1.18

[1] Difference in inventory values of bees, buildings, equipment, and supplies.
[2] Minus denotes loss.

Beekeeper no. 1 operates a 66-colony apiary in connection with a general farm in east-central Iowa. White clover, sweetclover, and basswood are the main honey plants. The colonies are located in the home yard in close proximity to the farm buildings.

The honey house is a small 1-story building. Honey and supplies are stored in other farm buildings. The total inventory values as of 1930, of buildings, bees, equipment, and supplies amounted to less than $900 or approximately $13.50 per colony, which was far

less than the average capital for other apiaries of a comparable size. About four shallow supers are provided for each colony. A 2-frame hand extractor, a steam uncapping knife, an uncapping tub, an 85-gallon storage tank, and six barrels comprise the bulk of the remainder of the equipment. This cooperator has only the minimum of equipment. Many of the hives have been in use for 30 years and are seldom painted. He buys nothing except what is essential and thereby keeps his inventory at the minimum.

About the middle of April the colonies are unpacked and if any are light in stores they are given full combs of honey saved from the previous season. During the spring period the bees build up in two brood chambers. They are inspected from time to time for disease, quantity of stores, and rate of building up. Queenless colonies are either given a frame of brood from another colony or united with a queenright one.

Clipping of the queen's wings is not practiced nor are queen excluders used. One super is added at a time. Bee-escape boards are used in removing the honey, the honey is extracted, and the supers are put back on the colony.

Extracting is with a two-frame hand machine. The cappings, removed with a steam-heated hand knife, fall into a draining tub. The honey from the extractor is drained into a pail and carried to an 85-gallon storage tank equipped with a strainer. Later it is drawn off into 50-gallon barrels and sold wholesale in this type of container.

The colonies are wintered in two brood chambers on their original hive stands. Approximately 60 to 70 pounds of stores are left in the hive, making the feeding of sugar sirup unnecessary. About six layers of newspaper are placed on the inner cover and the same quantity is wrapped around the hive and folded under the metal roof cover. Tar paper is then wrapped over the newspaper up to the metal cover and tied with twine. The operator says he has been particularly successful with this type of wintering.

This beekeeper realized a good return in 1930 but because of a crop failure there were no returns in 1931. The apiary was operated with approximately 3¼ hours of man labor per colony in 1930 and with slightly more than 1 hour per colony in 1931. In both years cash as well as other costs were at the minimum.

Beekeeper no. 2 is in western Ohio in a locality in which sweetclover is an important honey plant. Alsike and white clovers are also grown but honey from these plants is not abundant except in favorable years. This beekeeper gives his full time to beekeeping during the bee year and operates approximately 250 colonies located in 6 outyards. The honey house is a 1-story structure with an estimated value of $300. A storage house is rented at a cost of $15 per year. The inventory value of buildings, bees, equipment, and supplies amounted to approximately $5,000, or $20 per colony. Approximately four extra full-depth supers are provided for each colony. Quadruple winter cases are used for wintering, and queen excluders and bee escapes are ample for the number of bees. An 8-frame extractor is driven by a gas engine. Three storage tanks with a combined capacity of 2,700 pounds are provided. The outyards vary in distance from the home yard of from 3½ to 12 miles. The miles of travel per apiary amounted to 5.45. The number of colonies for the honey flow was 265 in 1930 and 252 in 1931. This apiary was operated with a

total of 664 hours of man labor or 2.5 hours per colony in 1930, and in 1931 with 719 hours or 2.86 hours per colony. Much of the increased labor in 1931 was due to the additional time required to harvest and extract the larger yield of honey obtained in 1931.

The colonies wintered in quadruple cases are unpacked about April 1, provided the weather is favorable. Those that are light in stores are given full combs of honey saved from the previous year's crop. The feeding of sugar sirup has no place in the management. When all the colonies are unpacked a second full-depth hive body is added.

When fruit trees and dandelion come into bloom, an excluder is put on the second brood chamber and a super is added. It has been observed that the incoming honey is not stored in the brood chamber, which would congest it, but is carried above the excluder.

At the beginning of the honey flow (June 5 in 1931) the colonies are examined, the queen is found, and her wings are clipped. Every queen that is found to be already clipped is replaced at this time. The queen, with the frame she is on, is put in a hive body on the bottom board with 8 empty drawn combs. Only 9 combs are used in the brood chamber. Because of more clustering space thus provided, brood appears on the outside of the last frames. A queen excluder is put directly above the brood chamber, then empty supers containing 9 combs and finally the brood is placed at the top. The put-up brood is later examined for queen cells which are removed.

Increase is made at the time of supering for the honey flow. Four to five frames of brood with adhering bees are placed in a separate body with drawn combs and are given a laying queen.

Bee-escape boards are used in removing the honey. The combs are uncapped with a steam hand knife, the cappings falling into a draining box. After draining, a capping melter is used. The honey is pumped from the extractor into storage tanks. The honey is strained through a fine-mesh wire screen into a hoop of coarse wire which supports a cheesecloth strainer inside. The honey is allowed to settle 48 hours before it is drawn off into 60-pound cans.

On sorting the combs those containing much pollen are soaked in a tub of water to which yeast has been added. The yeast loosens the pollen in the cells, after which the combs are run in the extractor which removes most of the pollen. That remaining dries up and falls out or is removed by the bees.

The colony is wintered in a single brood chamber on nine combs in quadruple cases. Straw and leaves are used for packing material. In the fall, six frames of honey from the last super are put in the brood chamber.

The receipts were about $545 less than the total cost in 1930 mainly because of the very poor yield of 36 pounds per colony, while in 1931 with a yield of 148 pounds of honey per colony, the receipts were approximately $1,170 greater than the total costs. The apiary capital is about the same as the average of the other cooperators who handle approximately the same number of colonies. The hours of man labor per colony, 2.5 in 1930 and 2.86 in 1931, were considerably lower than the average.

Beekeeper no. 3 is located in west-central Minnesota where, in most years, sweetclover is an important source of nectar. The bees build up on the dandelion flow. In favorable years white clover is

plentiful. During 1930 and 1931, however, little honey was secured from white clover and during the dandelion bloom conditions were not very favorable. This apiary is operated by two brothers who have been particularly successful beekeepers. Starting in 1919 with 14 colonies, the business has been increased to 505 colonies for the honey flow in 1930 and to 560 in 1931. During the period 1925 to 1931, inclusive, the yield ranged from 135 pounds to 270 pounds per colony and in 3 of the 7 years it exceeded 200 pounds per colony. This apiary is operated in connection with a dairy farm, but during the bee year the owners merely supervise the work of the dairy. The colonies are located in 7 outyards which vary, in distance from the home yard, from 5½ to 11 miles.

The honey house is a one-story building, valued at approximately $1,000, and is provided with an extracting room and storage room. A bee cellar valued at $100 has a dirt floor and concrete side walls with a roof of poles over which straw had been placed and banked over with dirt. Two 12-inch tile intake pipes and an 18-inch tile outlet comprise the ventilating system. The total investment in buildings, bees, and equipment amounts to approximately $9,500 or $19 per colony (table 12).

Approximately four extra full-depth supers are provided for each colony. Queen excluders and bee escapes are ample for the number of bees. A 45-frame radial extractor driven by electric power, an old-style slow-running pump, a steam boiler, a capping melter, a power uncapping knife, a storage tank of 5,000 pounds capacity and 2 of 1,500 pounds capacity each, comprise the bulk of the remaining equipment.

Between April 1 and 15 the colonies are removed from the cellar and taken to the outyards where the hives are arranged in groups of six. Bricks or pieces of timber are used for hive stands. Used corrugated paper is placed in front of the entrances to keep the grass down.

The first inspection is made soon after removal of bees from the cellar to see that the colony is queen-right and has sufficient stores. The bottom boards are stapled to the first hive body which makes it necessary to lift out frames instead of reversing whole bodies without paying any attention to the condition of the lower brood nest. The removal of combs makes it possible to determine the condition of the brood chamber and make it clear for a good queen. At the second inspection a second brood chamber is given, the queen's wing is clipped, and the colony is again inspected for disease. When opening hives the inner cover is removed and the bees are shaken onto the ground in front of the entrance. The hive body is set off behind the colony on an empty body carried along for that purpose. When the excluder is removed it is placed in front of the hive, upside down. In replacing hive bodies very few bees are crushed.

At the beginning of the honey flow the queen is confined by an excluder to the lower brood chamber which is arranged to have a frame of honey next to each outside wall, two frames of hatching brood in the center, and the dark empty combs for the remainder. If the 2 brood chambers are fairly full of brood, 2 supers are added, otherwise only 1. Nine combs are put in each super. Supers of foundation (nine frames to a body, carefully spaced) are put directly above the excluder. The rest of the brood is put above. As the flow from sweetclover extends over a comparatively long period, more brood

has to be put above the excluder at a later time. No attempt is made to cut queen cells built from brood put above the queen excluder because it has been observed that these queens disappear without the colony swarming.

In harvesting honey, bee escapes are used. The attachments between the supers are broken by twisting each one aside slightly so that the bees will largely clean up broken burr combs between them. The burr comb is not removed but is left until uncapping time.

A power uncapping knife is used. The combs are uncapped into a draining box and the cappings are dried in the extractor and then put into boxes; when convenient they are melted in a capping melter.

Extracting is with a 45-frame radial extractor. The honey is pumped to a heater by means of an old-style slow-running pump, where it is warmed to 100° F. before being strained in a centrifugal strainer.

Formerly all colonies were wintered in the cellar in 1-story hives but recently a portion of them have been packed in tar-paper cases holding two bodies. In the fall considerable uniting of colonies takes place. Two to six frames of honey are taken out of the last super and put down into the brood chamber for winter feed.

This apiary was operated with a total of 5.82 hours of man-labor per colony in 1930 and with 4.64 hours in 1931. The miles of travel per colony were 4.66 in 1930 and 6.28 in 1931. Much of the larger number of hours and miles of travel in 1931 compared with 1930 was due to the longer time in preparing for the honey flow and in harvesting and extracting the larger yield in 1931.

Because of excellent yields this apiary showed a good return in both 1930 and 1931. The capital investment is moderate and there appears to be a good balance between the different items of the capital set-up. The outyards appear to be well arranged.

The hours of labor and miles of travel per colony are somewhat higher than with some other apiaries of a comparable size. One item that tends to increase these requirements is the time and travel used in packing bees in tar-paper cases. The man-labor for this operation amounted to 0.9 hour per colony as against an average of 0.5 hour per colony for all colonies packed in tar-paper cases. The miles of travel for this operation were 1.4 per colony as against an average of 0.46 mile for all colonies. The rather large amount of time and travel is perhaps due in part to the fact that until recently the colonies have not been packed in tar paper and the operators are not particularly expert in this method of preparing bees for winter.

In 1930 the expense for sugar for spring feeding was $279 and in 1931 it amounted to $248. This expense could have been reduced somewhat had full combs of honey been provided instead of feeding sugar sirup. Then in 1931 approximately $886 was spent for bees and queens. The cash expense for this item could have been materially reduced had increase been made by division of strong colonies.

Beekeeper no. 4 is located in central Michigan, in an area where white and alsike clovers formerly predominated but where sweetclover is becoming increasingly important. At times basswood adds to the surplus. In the fall the bees build up on buckwheat, goldenrod, and aster and in the spring on willow, fruit bloom, and dandelion. The full time of this beekeeper is given to beekeeping with the ex-

ception of a little time spent in insurance adjusting and some shop work for others.

The honey house is two stories in height and has a basement. A truck can be driven into one end of the building opposite an unloading platform. This platform is slightly lower than the level of the floor of the truck which makes it possible to load and unload with the minimum of labor. The tank room and storage room occupy the remainder of the first-floor space. The top floor is utilized for storage purposes. The total capitalization per colony, including bees, buildings, equipment, and supplies amounted to slightly more than $20. This beekeeper has approximately 750 colonies of bees. There are 11 outyards and the distance from the outyards to the home yard ranges from 3 to 13 miles. Approximately 2 extra full-depth and 2 shallow supers are provided for each colony. Queen excluders are provided for all colonies and bee escapes are used on a portion of the colonies. One 45-frame radial extractor, 2 steam hand uncapping knives, 1 honey pump, 1 comb rack, 3 storage tanks of a total capacity of 12,000 pounds, 1 steam boiler, and 2 electric motors comprise the bulk of the remaining equipment.

Early in April the first inspection of outyards is made. None of the packing cases are opened, the colonies being judged by outside appearance only. If weather conditions are favorable the packing is removed about May 15. The colonies are then inspected for queenlessness, disease, and quantity of stores. Queens' wings are sometimes clipped at this time. Shallow division board feeders are used on colonies that are light in stores.

Just prior to the honey flow all colonies are examined, and the queen is put into the full-depth brood chamber with a queen excluder below the shallow one. At the beginning of the honey flow the queen and bees are shaken onto empty combs below the excluder, supers are put on, and the brood is put above. Later the colonies are again examined and queen cells found on the put-up brood are removed.

In harvesting, bee escapes are used on a portion of the colonies; the remainder of the honey is removed by smoking the bees from the supers. The honey is hauled to the honey house. Any bees left in the supers fly to a nearby window where a nucleus is kept to collect them.

The honey is uncapped by means of steam uncapping knives and is extracted in a 45-frame radial extractor. There is a revolving comb rack between the uncapping box and the extractor. The cappings are dried in the extractor. An old-style pump elevates the honey to storage tanks (three with a total capacity of 12,000 pounds) where it is strained through a cheesecloth sack in a square wire box extending to the bottom of the tank. A boiler furnishes steam for various uses including heat for the radiators in the honey house in cold weather. Two electric motors furnish the power.

The majority of the colonies in one full-depth brood chamber and a shallow food chamber are wintered in tar-paper packing cases. Two colonies are placed together on a shallow packing tray. Slater's felt, shavings, laths, and twine are the packing materials. As a rule the food chamber is fairly well filled with honey and late in the fall the colonies are fed sugar sirup until they attain a weight of approximately 115 pounds for those in 1½-hive and 75 pounds for those in

single-hive bodies. In 1930, 700 colonies were wintered in 1½-hive and 90 in single-hive bodies.

The expenses including interest exceeded the receipts in both 1930 and 1931. A comparatively low yield in 1931 materially reduced the receipts for that year. The capitalization is relatively high, particularly that represented by buildings which resulted in a rather high interest charge. In both 1930 and 1931 large quantities of sugar were fed. Much of this cash expense could have been reduced had full combs of honey been provided. In 1930 a rather large cash expense was incurred in the purchase of permanent equipment and in the increase in numbers of colonies. Some of this expense is reflected in the increase in inventory values at the end of the year.

SUMMARY

White clover is widely distributed throughout the United States except in the arid regions. In the area comprising the northeastern portion of the United States and extending westward to the Dakotas and south approximately to the Ohio River and the Mason and Dixon Line, white clover reaches its greatest importance as a nectar-producing plant. Alsike clover is also grown in the region and during recent years sweetclover has become an important nectar-producing plant in many parts of the white clover region.

There are many large apiaries in the white clover region, but those of small-to-medium size predominate. The relation of honey production to other productive enterprises has considerable influence on the size and organization of a particular apiary business. Fifteen of the 40 beekeepers represented in this study in 1930, mainly those with small-to-medium size apiaries, had other business interests. In general, it may be said that a supplementary business which is not too exacting in time and that requires limited attention during the 6 weeks or more of the busiest season of the bee year is well adapted to combine with beekeeping.

Man labor is one of the principal items of expense in the production of extracted honey. The time spent in 1930 ranged from 2 to 14.6 hours per colony. In 1931 the range was from 1.2 to 9.1 hours per colony. The average was 4.4 hours per colony in 1930 and 4 hours per colony in 1931. For beekeepers with less than 100 colonies, hired labor was negligible. For the groups with over 300 colonies hired labor amounted to from 38 to 64 percent of the total. Approximately 25 to 30 percent of the time is spent in harvesting and extracting and the remainder in other work with the bees. The quantity of honey extracted per hour of labor varied from an average of 76 pounds with a 2-frame hand extractor and a cold knife to 133 pounds with a 45-frame power extractor and a power knife.

The cost of out-door packing of colonies is somewhat greater than cellar wintering, but the tendency seems to be toward the former, and of the two general methods employed in out-door wintering—wrapping in tar paper and wintering in packing cases—the tar-paper package is the cheaper. In 1930 the winter loss for cellar wintering was 7.2 percent; for the tar-paper case, 3.5 percent; and for packing cases, 4.5 percent.

The receipts per apiary were from 36 to 256 percent greater than the cash outlay for all groups except, in 1931, for those of less than 100 colonies. The receipts for this group in 1931 averaged $50 less than the cash outlay mainly because of the low yield of 15 pounds of extracted honey per colony. The receipts exceeded the total costs including interest on the apiary capitalization at 5 percent for all 5 size groups in 1930 and for 2 in 1931. The comparatively lower returns as between 1930 and 1931 for apiaries in the same size group is largely explained by the yields obtained. The average yield in 1930 was 85 pounds of extracted honey per colony as against 74 pounds per colony in 1931.

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