

Survey of the Package Bee And Queen Industry

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THE commercial production of package bees, queens, and nuclei in the United States is largely confined to the five states bordering the Gulf of Mexico, plus Georgia, South Carolina, and California. A climate and flora favorable to the early development of colonies accounts for this concentration. The bees are marketed principally in the northern states and in Canada. This industry had an early evolutionary period beginning in 1912; by 1944 it had become an industry of 200 southern shippers providing 100 tons of bees and more than a million queens.

Within recent years, many northern beekeepers have found it profitable to move some of their colonies to these more southern states during the winter. Here they produce nuclei that are moved north in April and May. This movement is one phase of the commercial production of bees and queens for increase or replacement of colonies.

In the fall of 1966, we began a survey of the package bee and queen industry in the United States. A questionnaire was prepared and mailed to

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all known commercial producers. We received 18 completed returns from California (data bearing the 1966 season) which we could use for a study of that area. Also, 28 producers in the southern states supplied us with information which could be used for a study of that area; 20 of the 28 produced both package bees and queens—the other eight were queen producers only. Moreover, 21 questionnaires were returned by commercial honey producers who produced over 33,000 nuclei in the southern states and moved them to northern locations for their own use. Ten other returns came from such sources as bulk package bee producers and groups that produced queens only for their own operations; these are not included in the analysis.

We estimate that these 46 producers of package bees and queens on which we are reporting account for one-third to one-half of the total commercial production of the United States. Also, the 21 commercial nuclei producers probably account for about one-third of all nuclei produced and transported for commercial use.

The questionnaires revealed some major differences in the management methods and equipment used in California compared with the southern region. The 18 California producers

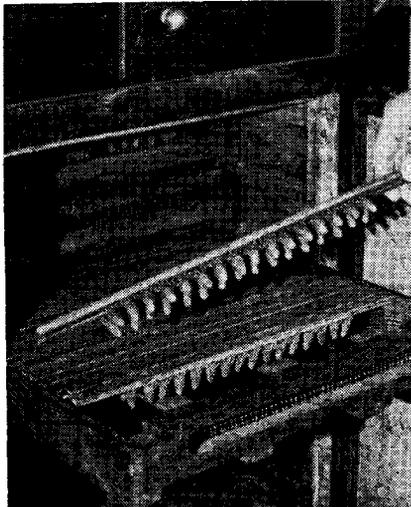
operated 52,000 colonies and 145,000 nuclei and shipped the equivalent of 176,000 two-pound packages of bees and 272,000 queens (These numbers have been rounded off to the nearest 1,000). The 28 producers in the southern states operated 50,000 colonies of bees and 90,000 nuclei and shipped the equivalent of 96,000 two-pound packages of bees and 335,000 queens. (The 20 southern producers of both package bees and queens operated 43,000 colonies and 80,000 nuclei and shipped 300,000 queens.)

Most package bees were shipped from the two regions between March 25 and May 10. However, the real shipping season is actually shorter because buyers generally take delivery during the 5 weeks from April 1 to May 5. Over 95 percent of all package bees from California but only about 50 percent of the package bees from the southern states were shipped by truck; the remainder were about equally divided between express and parcel post, and a few packages from both areas have recently been shipped by air. About 75 percent of the queens from California are shipped in the package bees; only about one-third of the queens from the southern states are sold with package bees.

California producers, with few exceptions, operate all colonies (except queen rearing colonies) in two 10-frame standard hive bodies. About two-thirds of these confine the queen to the lower hive body with queen excluders during the shaking season. The other one-third do not use excluders on outyard colonies. Southern producers use a variety of equipment: two-story 10-frame colonies without excluders are used for perhaps 50 percent of all colonies that produce package bees. However, one standard frame hive body supered with one, two, or three shal-



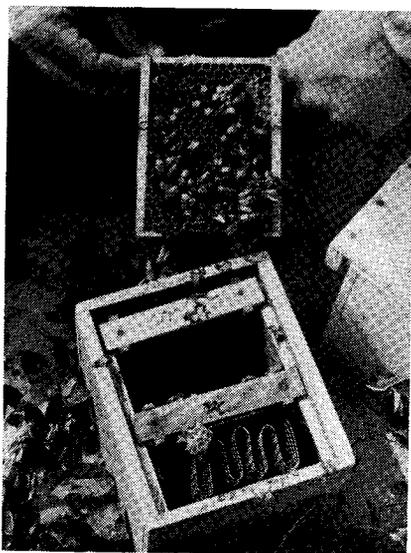
Grafting with automatic grafting needle.



Queen cells in incubator.



Queen-mating nuclei in a California yard.



Three-comb nuclei and "spam" can feeder containing folded hardware cloth "ladder" in feeder.

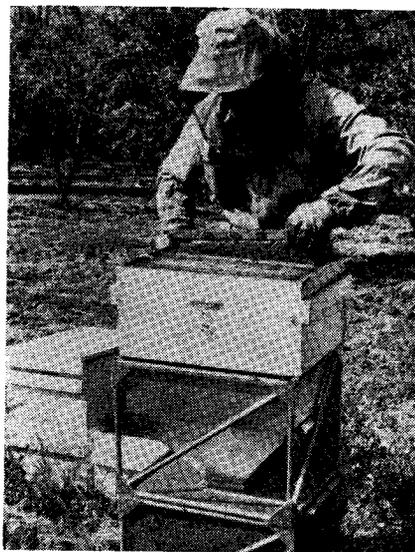
low supers is not uncommon, and some producers use eight-frame equipment. Less than 20 percent of those reporting used excluders on outyard colonies.

Bees in both regions are shaken from outyard colonies 2 to 4 times during April and May. About 85 percent of all colonies are shaken 2 or 3 times, with three shakings occurring more often than two. Per colony weight of bees from these shakings varies from 4 to 12 pounds. The average for all producers in both areas was slightly over 7 pounds per colony, but this figure does not include the bees shaken before April 1 for stocking the beekeepers' own nuclei or queen-rearing colonies (about 1 pound per colony).

Also, not all colonies are shaken. The figures show that the package bee and queen producers shake on the average about 8 pounds of bees from each colony.

Seventeen of the 18 California producers shook bees into a shakerbox, and only 50 percent of the producers in the southern states used a shakerbox, and when we omit Texas from the group of southern states, we found that less than one-third of the southeastern producers use the shakerbox. When the shakerbox is used, from 8 to 24 pounds (average 13.5 pounds) of bees are shaken from two or more colonies into the shakerbox before it is emptied into shipping cages. Some producers shake the bees from the super of combs above the excluder after smoking the bees up. Others shake all except three or four combs. If it is a good sunshiny day, some will shake everything except the bottom board.

Those producers who shake the bees from the upper hive body of the colony

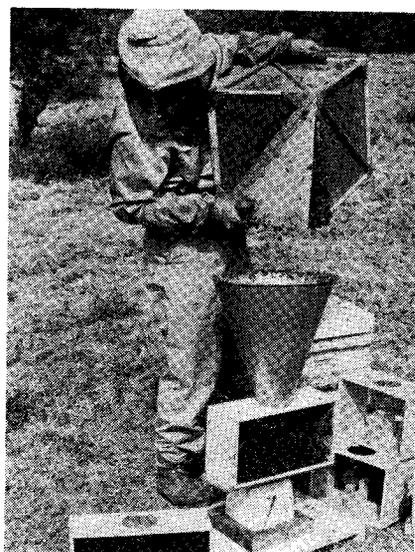


With queen and brood confined below excluder, bees are smoked up and shaken into shaker box. (California)

after smoking or drumming them up through the excluders on the colony do not use an excluder on the shakerbox or funnel; by this method the average production of the shaking crew (four men) is about 140 two-pound packages per man per day. Those producers who do not have queen excluders on their colonies shake the bees onto an excluder in the shakerbox; their production is about 110 two-pound packages per man per day. Ten southern producers who shake bees through a funnel into packages reported an average of about 75 packages per man per day; they usually shake bees after finding the queen in the colony and do not use excluders in the funnel.

Many shippers buy bees from other beekeepers, but the practice is more prevalent in California than in the South; it may account for some of the discrepancy in data between the two areas: as indicated by figures, California producers ship almost twice as many packages per colony operated as the southern states, but both areas report an average of 8 pounds of bees produced by each colony operated. Shippers buy bees during February and March and pay 80c to \$1.00 net per pound to the beekeeper. During April and May, the price varies from 50c to \$1.00. The average cost of bees in March is near \$1.00; during April and May, it is 75c. The buyer furnishes labor and equipment and does not find it profitable to shake colonies unless 4 or more pounds of bees are shaken from each colony at one time.

Commercial queen rearing begins in February and extends through October except in the extreme southern areas where it may continue for 11 months. Most queens are produced during



Filling package cages from shaker box. This is the way that it is done in California. Note scale under package.

March, April, and May. Fifteen of the 18 California producers discontinue queen rearing by mid-June; over 50 percent of the southern queen producers continue queen rearing into September, a difference that accounts for the increased production of about four queens for each nucleus operated in the South compared with two queens per nucleus produced in California.

Any analysis of methods of queen rearing is difficult because of the many variations. Probably no two producers use identical methods throughout — from grafting to caging of laying queens. Queen cells are started by grafting worker larvae into artificial queen cell cups. A queenless cell starter colony with free flying bees is used most frequently in California, but 60 percent of southern queen breeders start cells in a closed swarmbox. About two-thirds of California producers start and finish queen cells in the same queenless colony; 85 percent of southern queen breeders use a queenright cell finisher. In both areas, cell building colonies are usually two-story units containing 10 to 12 pounds of bees and brood of all ages. California producers usually give each colony 45 queen cells every 3 days. In the South, cell finisher colonies are usually given 25 to 30 queen cells every 3 days. Most California producers add one to two frames of unsealed brood from other colonies every 3 to 6 days; southern producers usually raise two frames of unsealed brood weekly from below the excluder to the upper queen rearing area of a queenright colony.

All queen producers recognize the need for honey and pollen for queen rearing. Most add frames of pollen to cell-building colonies at the beginning

of the queen rearing season and feed sugar sirup continuously during queen rearing operations except during a honeyflow. Many attempt to keep adequate combs of pollen in cell building colonies at all times, but frequently during the busy season they do not have time to check all colonies on a regular basis.

For large scale queen production, cell starter, cell finisher, and feeder colonies are needed. The total production of queen cells per colony varies between six and 12 queen cells per day per colony used in queen rearing. Few producers average 10 queen cells per day per colony, and many fall below eight. From 50 to 200 nuclei are operated for each colony used in queen rearing; the average is near 100 nuclei. If each nucleus is given two queen cells per month, these figures suggest that each queen rearing colony is furnishing only about six or seven queen cells per day during the major portion of the queen rearing season.

For each 100 queen cells grafted, most producers report from 75 to 90 queen cells produced; the average is slightly less than 85. When these are placed in nuclei, they report that 40 to 80 percent result in mated queens; the average is nearly 60 percent. The figures appear high compared with the number of queens sold. During the 3-month period of major queen production, only about two and one-half queens are produced for each nucleus operated. There appears to be little if any difference in the productivity of queens per nucleus in the two areas studied.

We asked these producers what it cost to produce a queen cell and to get a virgin queen mated, laying, and ready for sale. California producers reported an average cost of 18c to produce a sealed queen cell, and 60c to get the queen mated and laying. Southern queen breeders reported 22c

to produce a sealed queen cell, and 53c to get the queen mated and laying. We do not intend that this be interpreted as an absolute cost accounting analysis. It is intended to show only the relative cost of these operations. In both areas, producers report that the cost of the nuclei operations are 2 to 3 times greater than the cost of producing the queen cells.

Several factors contribute to the relatively high cost of getting virgin queens mated and laying. Nuclei size, amount of bees, amount of feed, and loss on mating flights are the most important factors. The amount of comb space in nuclei varies from 30 to 300 square inches, but many successful operators use only 30 to 40 square inches of comb space, and this may be all in one 5- x 8-inch frame or in three small frames. Such small nuclei require only 1/6 to 1/4 pound of bees. Those nuclei with 300 or more square inches of comb space require 3/4 to 1 pound of bees. Food requirements are proportionate. Other factors increasing the cost of queens are time left in the nuclei and interval between successive queen cells. Most operators remove laying queens 12 to 14 days after the cells are given to the nuclei and give the next queen cell on the same or the following day. Nothing seems to be gained by leaving a queen in a nucleus more than 4 days after she begins to lay eggs. Similarly, leaving a nucleus without a queen cell more than 24 hours merely adds to the cost of queen production without increasing efficiency.

Many producers start queen rearing in February and have mated queens ready for shipment before the package shipments begin. These queens are often removed from the nuclei and stored in queen bank storage colonies. Queen storage colonies may be one, two, or three story, queenless or queen-right colonies with or without brood.

The number of queens stored in each colony is largely determined by the number of bees in the colony. Six pounds of bees are used for single-story queenless colonies containing 75 to 100 caged queens. Three-story colonies may contain 300 or more caged queens. The key to successful queen storage is a large population of bees in the colony. Few producers keep queens in storage over 1 month, and most prefer to remove them within 2 weeks.

The movement of colonies of bees to the south for increase has become more widespread with the development of better highways and truck transportation. Many far northern honey producers kill off 50 to 80 percent of their colonies after their crop is produced and move the remaining selected two-story colonies to southern locations in late fall. During the late winter and spring months, they produce queens and divide the colonies. In April or May, they move nuclei to their northern locations where they become productive colonies. Apparently, most of these producers return four or more three or four-frame nuclei with young queens to the north for each colony brought south in the fall, but those more experienced in this practice produce six nuclei per colony moved south. These experienced producers report that the nuclei build up faster than package bees and that they have less queen loss from nosema and other causes. Our survey of their methods of operation indicates that those who have recently started in this business will become more successful when they learn better and more efficient queen rearing methods.

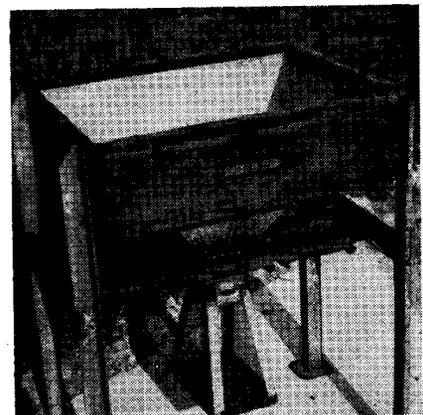
The commercial package bee industry has changed greatly since its beginning in 1912. Additional changes are likely to occur in the near future. The number of pounds of bees shaken from each colony is less than that of a generation ago largely because the



Packages are crated before filling and weighed individually when filled from the shaker box. (Texas)



A more recent method is to blow the bees from the combs into the shaker box like this. (Texas)



A funnel and collecting box are used (in Alabama) for measuring bees instead of weighing them.



A single-story, queen-storage colony in Texas. From 50 to 60 queens may be stored in this colony for a short time before shipment.



Fibrous adhesive tape holding indented metal stripping to crate package bee without nailed strips. Uncrating is done by cutting the tapes. (Alabama)

shipping season is shorter. Increased labor costs have forced producers to shake more bees from each colony in a single shaking and to shake each colony fewer times in this reduced season, but heavily shaken colonies cannot continue brood production at the high level allowed by lighter shaking.

Most cages used for the shipment of package bees are little changed from those designed a generation ago. Since bees can be shipped on dry sugar or candy, such packages have no need for the H-bar needed when a can of liquid sirup is used. Disposable paper or plastic packages of lighter weight appear to be possible in the near future. If the packages can be kept in a relatively dark cool area, less screen can be used, and the danger of overheating can be reduced. More use of refrigeration in storage and in transit will also result in less bee loss.

Methods of shaking bees will be improved when better repellents are pro-

duced for driving bees upward through excluders on colonies. Also, shaking efficiency will be increased when self-filling packages are developed to reduce attrition of bees by funnels and shakerboxes.

The use of DRIVERT sugar or a similar food plus a pollen substitute or supplement offers the possibility of increasing brood rearing, because it will greatly reduce the hazards of pollen deficiencies during unfavorable weather in late winter and early spring. Such products will greatly reduce travel costs and time losses in getting to remote bee yards. A thousand colonies could be kept during the shaking season in an area now occupied by less than 100 colonies.

Improvements in the efficiency of queen rearing can be made, but no great savings is expected in the cost of producing queen cells in the near future. The greatest gain should occur when the cost of getting queens mated

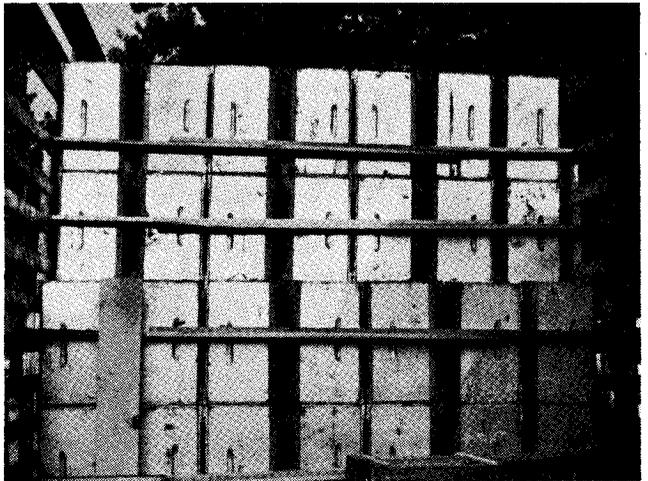
is reduced. Since unfavorable weather often causes great losses of queens on mating flights, the use of artificial insemination and the elimination of nuclei is the most hopeful method of increasing efficiency in queen rearing in the foreseeable future. ●

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Loading nuclei in Texas for trucking to North Dakota. Each box contains two four-frame nuclei. Some are deep and others shallow combs. Note special wood crating between. This truck will carry 800 nuclei. Larger trucks will carry 500 standard bodies containing 1,000 four-frame nuclei.



Loading nuclei on truck in Louisiana for shipment to Minnesota. NOTE stacking nuclei boxes on end instead of bottom. These are 10-frame bodies containing three-frame nuclei. The screened bottoms have 2-inch blocks on each corner that serve as hive stands and separators when loaded on the truck.