Beekeeping in California

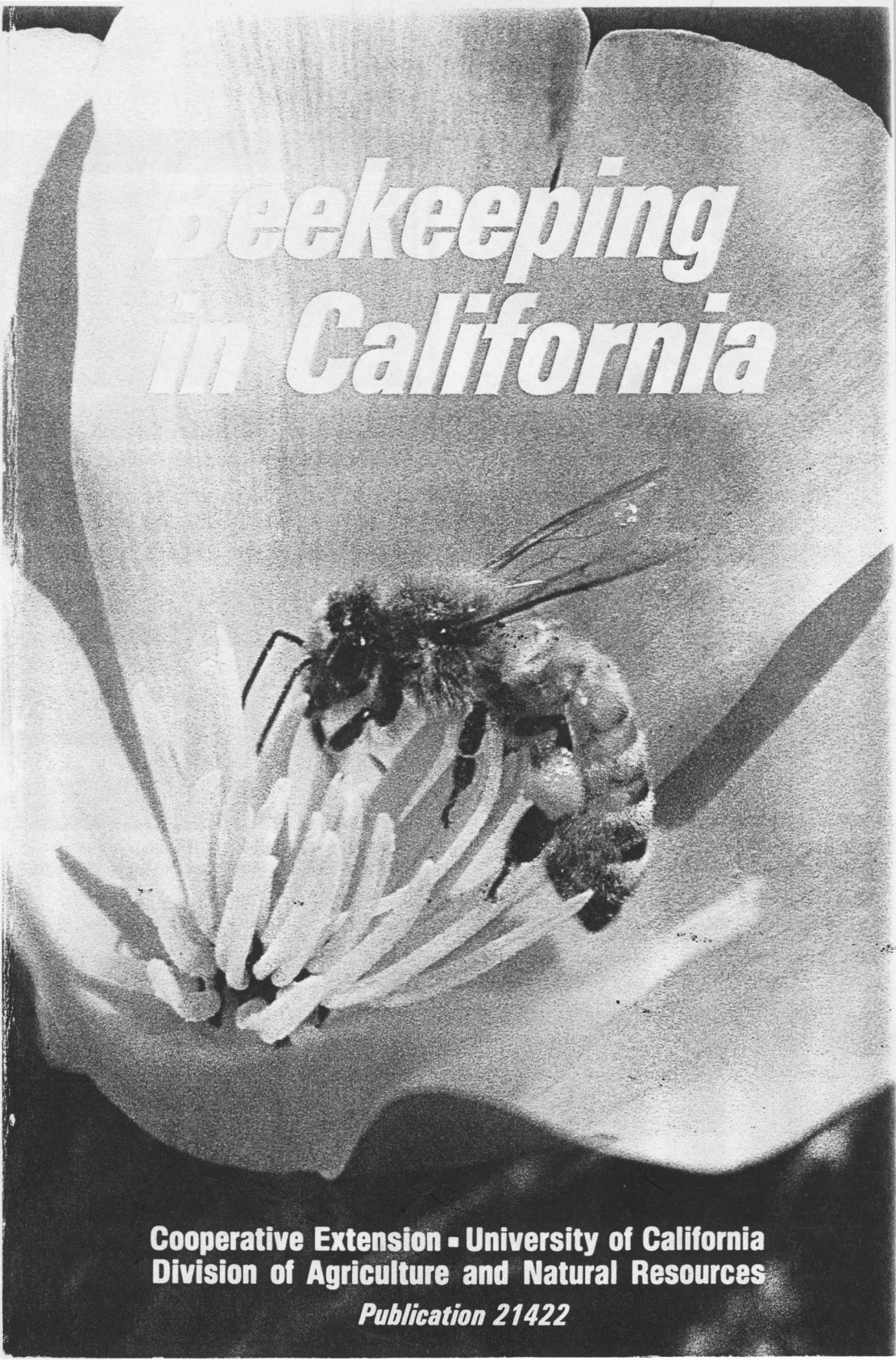

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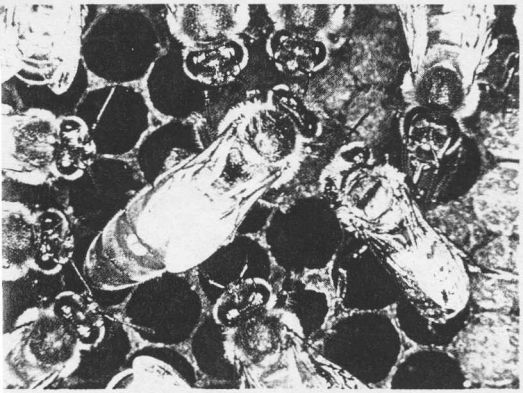
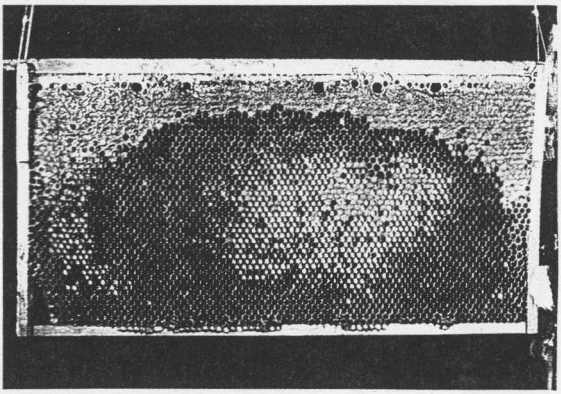
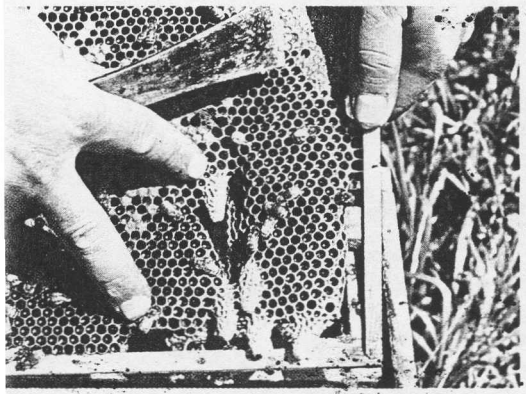
PLATE I Bees—from Queen to Crop



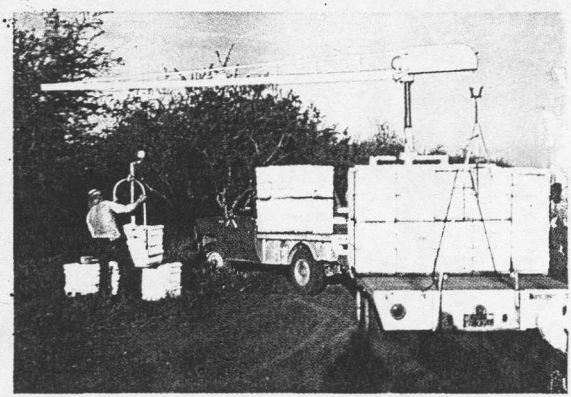
The queen bee lays hundreds of thousands of eggs each year to replace shortlived workers and drones.



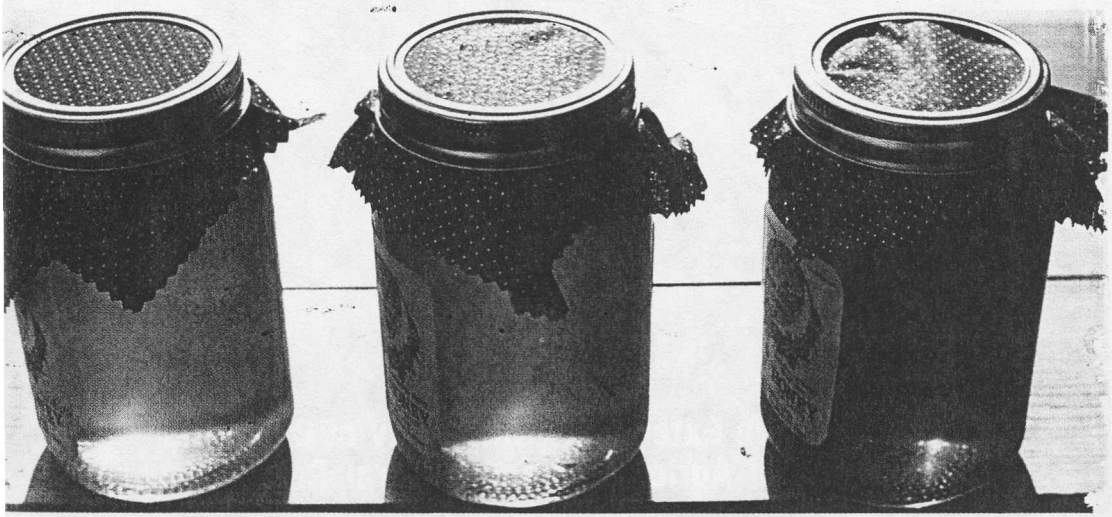
Various stages of immature bees (white larvae and tan capped brood) can occur on a comb surrounded by pollen (yellow) and capped honey at the edges.



Each spring a healthy colony produces queen cells or replacement queens when the old queen swarms.



California beekeeping is highly migratory and beekeepers have special equipment for moving bees.



Honey is available in many colors and flavors, depending upon the flowers that the bees visit for nectar.

Beekeeping in California

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Sources of Nectar and Pollen

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Beekeeping in California

Front and back cover photos by Paul Rosenfeld

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Foreword

California beekeeping operations range in size from commercial enterprises of 1,000 to 15,000 colonies owned by a single individual to just a couple of colonies in a beekeeper's backyard. Each of these colonies has the same basic needs that must be satisfied to ensure adequate strength and productivity. This publication describes the fundamentals of keeping bees in California and discusses the differences between commercial and noncommercial approaches. However, many procedures mentioned are not described fully, and inexperienced beekeepers are advised to read other references for details.

Beekeeping in California

The first known evidence that early man robbed honey from bees is a primitive drawing on a cave wall in eastern Spain dating from 7000 B.C. Throughout recorded history honey's importance as a food and as medicine has been realized. English settlers brought the honey bee (*Apis mellifera* L.) to North America in about 1622. Thomas Jefferson, in his *Notes on the State of Virginia*, observed that American Indians called the honey bee "the white man's fly." In California, honey bees were introduced in 1853 by Christopher A. Shelton, who established an apiary of 12 colonies just north of San Jose. Of the 12, only one survived, but it cast three swarms that summer and by 1858 there were at least 150 colonies directly descended from the Shelton hive.

California's first professional beekeeper, John S. Harbison, imported 57 colonies from Pennsylvania to Sacramento in December 1857; of these 50 survived. He increased them by artificial division to 136 hives and sold 130 for $100 each. Harbison then imported 114 colonies, lost 11, and in 1859 sold nearly $30,000 worth of bees, keeping 138 colonies for himself for the next season. Harbison's sensational success started a "bee rush" to California, and in 1859 and 1860 more than 8,000 colonies were imported from the East Coast via the Isthmus of Panama, the largest long-distance shipment of honey bees ever attempted. In 1869 Harbison moved his bees from Sacramento to the newly discovered sage and wild buckwheat ranges of San Diego County, and by 1873 San Diego County had produced more honey than any other county in California. By 1876, Harbison had 3,750 colonies of bees in 12 apiaries and was recognized as the largest honey producer in the world. Since that time, California has been one of the nation's principal honey-producing states.

Twentieth century beekeeping has its own unique problems, mostly the result of increased urbanization and the consequence that nectar sources are widely scattered. Fortunately, small numbers of colonies often can do well in or near cities because of the diversity of flowering plants within their flight range. The amateur beekeeper may often profit from this fact.

Value of the industry

From an economic standpoint, honey bees make their greatest contribution to California agriculture as pollinators of commercial crops. The following crops, realizing more then $1 billion annually, require bee pollination: alfalfa seed, almonds, most apples, avocados, Bartlett pears, bushberries, cherries, cucumbers, flaxseed, kiwi, Ladino clover seed,

melons, plums, prunes, pumpkins, rape seed, safflower seed, squash, sunflower seed, tangelos, tangerines, 22 vegetable seeds, and flower seeds. Many of these crops, as well as ornamental plants, are grown in home or community gardens where bee pollination is equally as essential for producing seeds, fruits, or vegetables. Bees also pollinate weeds, which provide food for wild birds and mammals and prevent erosion of watersheds and wilderness areas. Bee pollination has an enormous impact on our diets and on the stability of our environment.

Some California beekeepers specialize in producing queens and packaged bees for sale for starting new colonies or requeening functioning units. More than 450,000 packages (each with a queen) are shipped annually to northern honey producers to restock hives that are emptied in winter. Another 150,000 queens are sold for installation in overwintered hives or to quick start recently divided colonies. The demand for queens and packages produced by reputable bee breeders is great, because commercially produced stocks are most likely to be mild-tempered, good producers.

Commercial honey production in California varies from good to poor, depending upon weather conditions. Most beekeepers equipped to move bees take at least a portion of their bees to potential honey-producing areas each year. When the nectar flow is heavy in certain areas, thousands of hives may be moved in. The California honey crop averages about 20 million pounds per year, not enough to meet the state's consumer demand. Honey packing and importing are important segments of the California beekeeping industry.

Hobby beekeepers often keep their bees in one location. Honey crops can be quite good in coastal, urban, or suburban areas where weeds, trees, flowers, and shrubs are apt to bloom most of the year. However, where lack of rainfall creates long nectar and pollen dearths during summer, colonies must be examined often and frequently must be fed to avoid malnutrition or starvation.

Keeping bees for fun and profit

Interest in keeping bees increased during the 1970s, largely because of the conviction that natural foods are preferable to processed foods. Thus, honey appeared to be an ideal substitute for sugar. The aesthetic values of beekeeping are also often important. Observing bee behavior at the hive (regulation of population size and use of space within the hive) or outside the hive (foraging for water, nectar, pollen, and propolis, plus pollination ecology) is a leisurely way to relax and enjoy life. The rewards for successful colony management and the consequences of unsuccessful management are apparent.

Every beekeeper can realize a profit, if that is a goal. Locally produced honey usually sells quickly at, or slightly above, supermarket prices when hobby beekeepers advertise its availability. Beekeepers who wish to augment their incomes substantially must operate between 50 and 500 colonies. Most commercial beekeepers operate between 1,000 and 2,000 colonies, often with one or more permanent helpers and part-time employees for extracting honey or shaking bees. Most commercial beekeepers in California engage in crop pollination during the year, from which they earn a significant portion of their annual income.

Becoming a Beekeeper

Persons considering keeping bees can learn through self education and experience. Classes and short courses in beekeeping are also helpful, and many good books and other literature are available (see *References*). However, no amount of reading can substitute for actual experience with colonies. Local beekeeping clubs often willingly share information, and many will show beginners how to manage a colony and what to expect through the year. Those seeking financial profit should apprentice themselves to a commercial beekeeper for a year or two to learn the ropes. Names of beekeepers often are available from county agricultural commissioners, county farm advisors, local police and fire departments, and animal control units.

If you decide to start keeping bees:

(1) Check state and local laws for possible restrictions on keeping bees (see below).

(2) Determine your sensitivity to bee stings—your doctor can test this.

(3) Purchase, assemble, and paint standard-size equipment well in advance of the anticipated arrival of the bees.

(4) Locate your apiary close to home, away from pedestrians and auto traffic, and where the bees will not disturb people or livestock.

(5) Provide a permanent, functional watering device if a natural source of water is not readily available.

(6) Avoid placing hives in areas where pests (ants, skunks, bears) or poisonous plants (California buckeye, locoweed, corn lily, or death camas) may damage the colony.

(7) Protect your bees from strong winds and hot summer sunshine.

Beekeeping organizations

Groups of California beekeepers have been meeting for nearly a century. At the state level, the California State Beekeepers' Association represents the interests of the commercial beekeepers, although a number of noncommercial beekeepers attend their annual meeting in November.

Many local clubs have formed on a county basis. These clubs tend to represent commercial, hobby, or mixed interests depending upon the makeup of the group. Club members know best how to keep bees in their

local areas, and they are willing to share that information.

Names and addresses of contact persons for these organizations tend to change over time. However, the Cooperative Extension apiculturist, county agricultural commissioners, or Cooperative Extension farm advisors should be able to steer you to a local group.

STATE LAWS RELATING TO BEEKEEPING

California laws regulating beekeeping are enforced by county agricultural commissioners and provide the basis for an effective apiary inspection program that helps beekeepers protect honey bee colonies from disease, pesticide damage, and theft.

Excerpts from the California Agricultural Code relating to bees and apiary inspection can be purchased from: Office Services, California Department of Agriculture, 1220 N Street, Sacramento, CA 95814; (916) 445-8164. Beekeeping in some localities is also governed by city or county ordinances. Beekeepers should consult local authorities about this.

Apiary registration. All apiaries must be registered each January with the agricultural commissioner of the county in which the colonies are located. Registration fee is $10 and involves listing the location of each apiary and the number of colonies at each location. Newly acquired apiaries and apiaries brought from out of state must be registered within 30 days of establishment.

Apiary movements and identification. Details of laws pertaining to movement and identification of apiaries can be obtained from county agricultural commissioners or Supervisor of Apiary Projects, California Department of Agriculture, 1220 N Street, Sacramento, CA 95814.

Apiary assessment. Resident and nonresident beekeepers operating 40 or more colonies in California are required to pay an annual assessment fee on their colonies. The rate has varied for several years, so the Supervisor of Apiary Projects (address above) should be contacted for current rates.

The Colony

A colony of bees consists of a queen, worker bees, drones, and various stages of brood (immature bees) living together as a social unit. There are between 10,000 and 50,000 bees in a colony. The brood nest is spherical in shape, increasingly filling more cells in each comb and covering more combs as it expands in size. Partially digested pollen, called bee bread, is stored adjacent to cells containing brood. Honey or nectar is stored around the outer edges of, and above, the brood nest.

A honey bee egg looks like a tiny grain of white rice standing on end, centered at the base of a cell. To facilitate seeing eggs and other larval stages, shake or gently brush the bees off the comb (use a bee brush) and stand with your back to the sun. Tilt the comb so that the light shines directly into the cells. With a little experience it is not difficult to recognize larval bees or to distinguish capped brood (pupae) from capped honey (ripened honey covered by a thin layer of wax). See Plate I.

The queen bee

Each colony normally has only one queen (Plate I), which is the only bee in the colony capable of fertilizing the eggs she lays. The queen bee develops from a fertilized egg that hatches 3 days after being laid. Nurse bees, a class of worker bee, feed developing queen larvae a special diet consisting mostly of the royal jelly that they secrete from their glands. This special diet shortens the time spent to reach maturity to 16 days, compared with 21 days for the worker bee and 24 for the drone. The result is a bee larger than any others, with fully developed ovaries and a very large abdomen. The queen lacks the specialized body parts of worker bees that help them accomplish their tasks. The queen's task is to produce bees and the constant diet of royal jelly fed to an adult queen supplies the nutrients necessary for development of the large ovaries that swell the abdomen.

The queen is reared in a large cell resembling a peanut shell that hangs vertically from the comb (Plate I), and about 10 days after emerging she becomes sexually mature. The virgin queen takes one or more brief mating flights during which she mates with 10 to 20 drones to ensure complete filling of the spermatheca. Large amounts of sperm are necessary, since the queen will be laying more than 1,000 eggs a day for many

months and will never mate again. The queen begins laying eggs shortly after mating.

Even though the queen has a larger thorax, longer abdomen, and less hair than the workers, she can be very difficult to find in a populous colony. Clipping and marking the queen is worth much more than the few cents it costs when she has to be located in the colony. To ensure the potential for having a populous and productive colony, beekeepers should requeen their colonies annually with young vigorous queens (see *Maintaining Genetic Stock*).

The drone bee

At their peak population (early summer), drones rarely exceed 600 per colony. Their sole function, as male bees, is to mate with the queen. When virgin queens are no longer being produced (in the fall), the drones are forced out of the colony to die of starvation, and no drones are reared until the following spring.

Drones develop from unfertilized eggs that hatch 3 days after they are laid. Nurse bees feed the developing larvae royal jelly, honey, and pollen over a 7-day period; the cells are then covered with air-permeable wax (capped). A drone pupa is longer than a worker pupa; thus, its capping is raised above the surface of the comb. This is especially apparent if the drone is reared in a worker cell, where the capping rises way above the capped worker brood and sometimes is referred to as a "bullet." The drone emerges 24 days after the egg is laid and spends the next 10 days maturing sexually and learning to fly. A drone must be fed by worker bees from the time he emerges until the day he dies of old age (about 5 weeks after emerging) or immediately after mating with a virgin queen.

The drone can be distinguished from the workers by its large size, blocky shape, and very large eyes which cover most of his head. He makes more noise when flying than does the worker, but he is harmless because he has no sting.

The worker bee

All the rest of the bees in the colony are workers. The worker bee develops from a fertilized egg that hatches 3 days after it is laid. Nurse bees feed the developing larva royal jelly, honey, and pollen during the next 5 to 6 days, then cap the cell. Each larva spins a cocoon and changes to a prepupa, then a pupa. The pupa is not physically active, but undergoes extensive chemical and structural changes that convert it into a functioning adult. (Adult workers are always female.) On the 21st day after the egg has been laid, the adult chews through her wax cap and emerges from the cell to groom herself and to start eating honey and pollen. Her exoskeleton hardens and she is ready to begin her many chores.

The workers, endowed with specialized body parts to accomplish their tasks, supply all the labor of the colony. Young worker bees clean cells, feed larvae (through food glands in the workers' heads), remove debris from the hive, evaporate water from nectar to produce honey, secrete wax (through wax glands in their abdomens), build the comb, guard the colony (by means of their inbuilt chemical alarm system), and ventilate the hive. When they are about 3 weeks old, worker bees

begin to forage for water and nectar, carrying their finds in a honey sac. Worker bees live only 6 weeks or so during periods of active brood rearing and foraging, but they can survive for several months over winter.

Annual colony cycle

The yearly cycle of the colony begins in January when the queen starts to lay eggs in response to an increasingly longer day. The population of the brood nest continues to increase as long as there is an adequate supply of honey and pollen stored in the hive. Fresh pollen collected by foraging workers from early spring flowers signals the beginning of a great increase in brood rearing. Newly emerged workers, well suited for producing royal jelly and wax, accelerate the population explosion.

Rapidly becoming filled with bees, brood, and food, the hive may become congested. Congestion often leads to swarming, especially when an old queen is in residence (see *Managing Bees*). Worker bees in colonies manipulated to discourage swarming collect nectar and pollen in surplus of their immediate needs. This surplus is stored for use when food is not available in the field (dearth). Honey bees store more honey than they need for a year, if nectar is abundant. This excess is the beekeeper's reward for proper colony management.

Nectar and pollen become scarce at the end of summer. Brood rearing decreases markedly. Drones are evicted and the worker population begins to decline. Foraging bees collect extra propolis to close up hive entrances for the winter. The bees become much less active as cool weather sets in. In areas where temperatures fall below 57°F, the bees cluster or form a large ball. Bees in the center of the cluster eat honey and produce heat; bees on the outside of it act as insulation, keeping the heat in the cluster. The rest of the hive and combs not in contact with the cluster are nearly as cold as the outside air. The cluster, moving over the combs and consuming stored honey and pollen, slowly approaches the cover of the hive. In January, the bees increase the temperature in the center of the cluster to around 95°F, the temperature required to rear brood. The necessity of having an abundant supply of stored honey and pollen is readily apparent. Bees wintering in central and southern California frequently are not confined by cold weather and tend to fly much of the year, thereby requiring a great deal of stored honey if nectar is not available to foragers.