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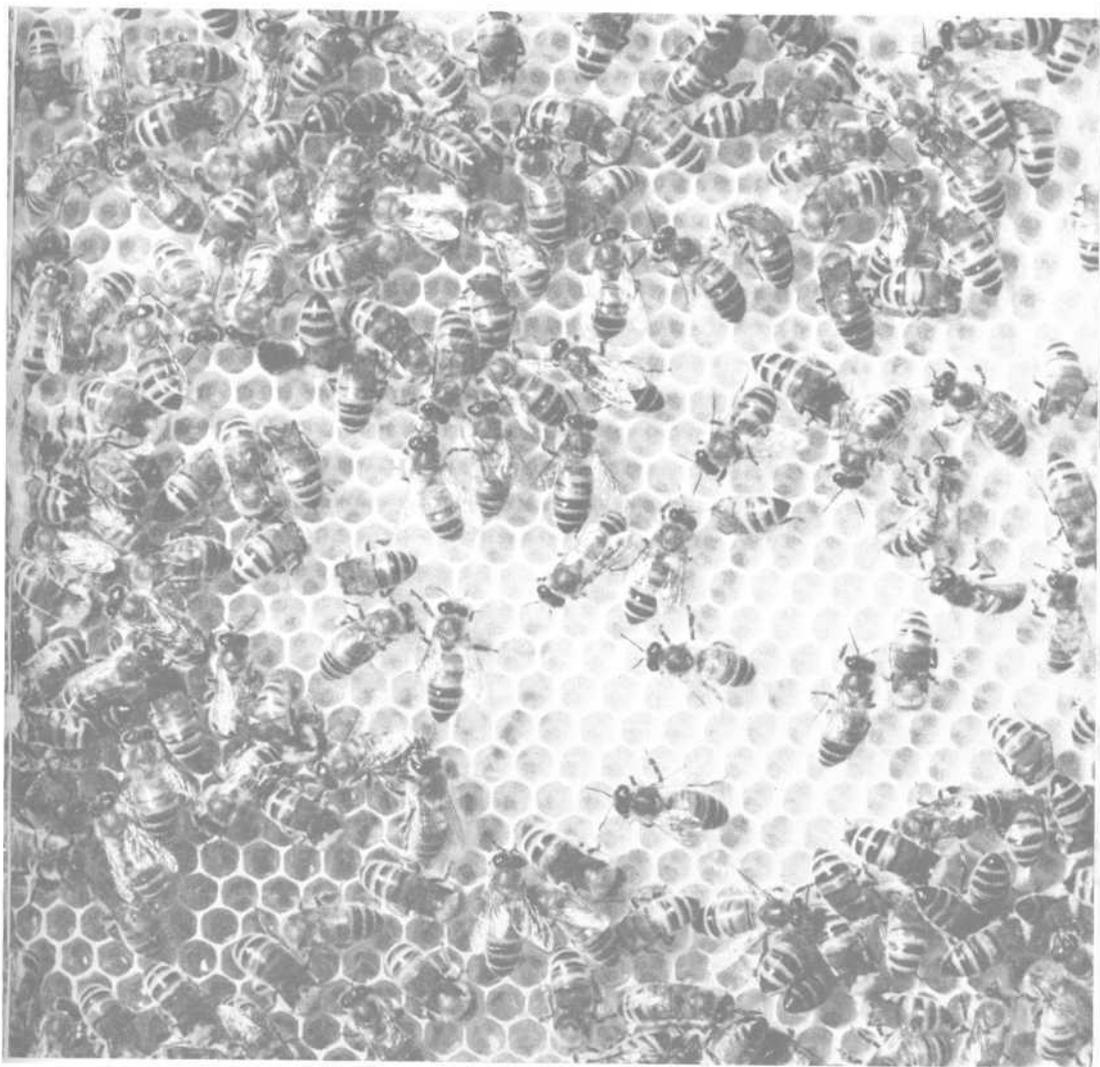
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Beekeeping

IN ARIZONA



● **CIRCULAR 238**

Agricultural Extension Service, University of Arizona, Tucson

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Beekeeping

IN ARIZONA

By J. N. Roney
Extension Entomologist
University of Arizona

Beekeeping in Arizona can be a fascinating hobby and a profitable business. Most people who keep bees do so because they love this type of work.

It is estimated that 600,000 persons keep about 5,000,000 colonies of bees in the United States. Honey production usually exceeds 200,000,000 pounds and beeswax produced amounts to about 4,000,000 pounds each year.

In Arizona approximately 480 people keep bees in about 70,000 hives. The greatest concentration of bees is in the Salt River valley and the Yuma area.

A colony of bees, with complete equipment, is worth about \$30.00. The value of honey bees, however, is not judged only by the honey produced, but also by their use in pollination of many cultivated and non-cultivated plants.

To give bees proper attention, one skilled beekeeper—having several years experience—can take care of not more than 500 colonies. And this is possible only where the apiaries are well concentrated. It requires an investment of about \$20,000 to operate an apiary of this size.

All honey bees belong to the species *Apis mellifera* but there are several races. In most cases, races of bees have been named after the country where they were first obtained. Bees were brought to the United States in the 17th Century.

German

Up until the late 1800's, the German race was the only race of bees. This race was inferior to later races, especially after the introduction of the Italian race.

German bees are black in color, very cross and run badly over the combs. They are very susceptible to foul brood and wax moth. Some German bees are still found in trees and a few small apiaries.

Italian

The Italian bee was established in 1860. The first three abdominal segments are yellow, although a strain of yellow Italians has been bred in the U.S. in which the entire abdomen is yellow.

The Italian bees are far superior to the German bees as they are quieter and gentler. They protect their hives against the wax moth

and they are more resistant to foul-brood. These are the most common honeybee in the U.S. today.

Caucasian

The Caucasian bee race was imported from the Caucasus region of Southern Russia. These bees are dark in color with greyish bands on the abdomen. They are the gentlest race of bees that man works with

Carniolan

The Carniolan race of bees was imported from the Carniolan region of Yugoslavia. They are rather large, silver-colored bees. They have a tendency to swarm more than other bees and have not been too popular in the United States

Hybrids

Hybrid bees occur when bees of two or more races are crossed. If hybrid bees do develop in your apiary, it is a good plan to re-queen with a pure race. Hybrid bees are often cross and inferior to a race of pure bees. Research work on hybrid bees is being conducted to find a resistance to American foul-brood disease and also for other desirable characteristics.

HOW TO KEEP BEES

First, decide where you wish to have your hives of bees. If you live in town, consider your neighbors—as some trouble might develop with those living near you. Also, con-

sider the honey plants available for the bees in your backyard.

If you wish to become a commercial beekeeper, select a location near or in the center of an area

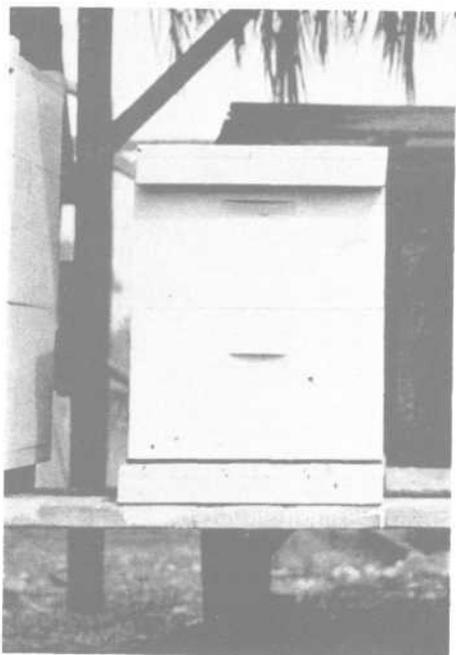


Trees provide excellent shade for bee hives.

If shade is not available it should be provided. →

where plenty of honey plants are available. Choose an area that is partly shaded, well drained, not far from water, and protected from large animals. Water should not be over $\frac{1}{2}$ mile from apiaries.

Because of Arizona's hot climate, shade is necessary. If hives are not shaded, or covered with an extra top, the comb cells are liable to melt, destroying their value. In some cooler areas of the state, beekeepers don't like shade and just use an extra top. Some think that shade keeps bees from working.



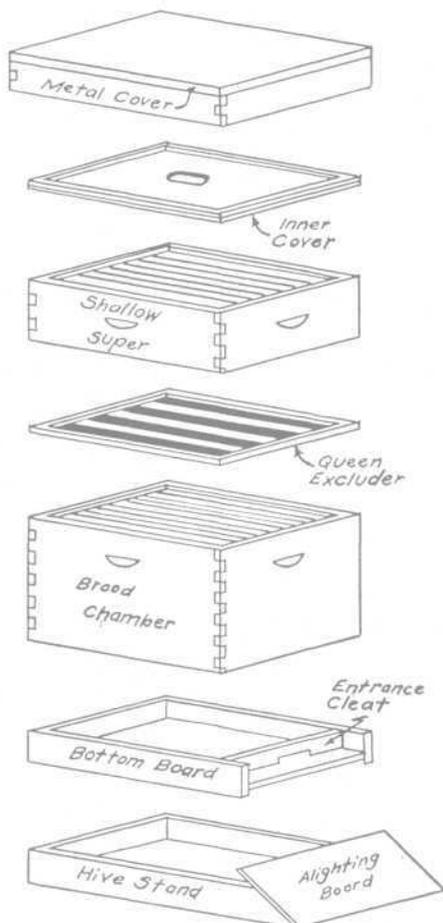


Beekeeping equipment includes a bee veil, a hive tool (in right hand), a pair of bee gloves, and a smoker.

Equipment you will need includes a bee veil, a hive tool, a pair of bee gloves, and a smoker. (Note picture). Wear light colored clothes with a smooth finish. Always wear a hat since bees are attracted to hair. A straw hat is best.

House the bees in a hive. The modern hive is a standard ten-frame unit consisting of a bottom board, hive body, cover, and frames. The drawing at right shows the parts of a modern hive.

Hives are built on the principle of bee space. A ten-frame hive should be $18\frac{3}{8}$ inches by $15\frac{5}{8}$ inches by $9\frac{1}{2}$ inches. Frames in



Standard Hive

Here are the parts of a standard hive.

these hives measure $9\frac{3}{8}$ inches by $17\frac{5}{8}$ inches. Each colony of bees needs two full-depth hive bodies for the brood and for storing of honey and pollen for the winter months.

To produce cut comb honey, you will need four to six shallow supers. You also will have to know how to use a queen excluder or you will have trouble with swarming. Use

unwired foundation in these shallow-supers since wire is not very desirable in cut comb honey.

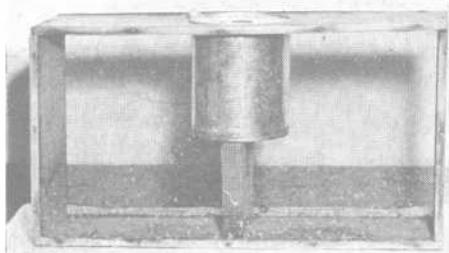
If you plan to extract your own honey, get two or three regular full-depth supers. For instructions on extracting, be sure to follow directions of the manufacturer.

Now you are ready for the bees to go to work for you. In Arizona, it is best to start in the late winter or very early spring in the lower elevations. In higher elevations, begin much later. In the Salt River Valley as well as in Yuma, citrus blooms are good, early honey plants.

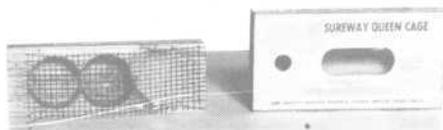
Securing Bees

There are several ways to secure bees. You may purchase a complete hive from a commercial beekeeper or friend. It is also possible to capture a swarm from a tree or some object where bees have settled around a queen.

In most cases, it is best to get a new or clean hive to avoid any possible disease. This is also true when buying full hives or package bees. In most cases, buy package bees or nuclei from reliable dealers.



A container for shipping a package of bees.



Types of queen cages for shipping.

Package bees usually come in 2 or 3 pound sizes according to the weight of the bees. This package of bees is made up of a queen and about 2,500 to 3,000 worker bees. Order bees ahead of the blooming season and ask that shipment be made so they will reach you by a certain date. Package bees are shipped by express. Be on the lookout to get them at the station or express office as soon as they arrive.

Installing Bees

Before installing package bees, find out something about life in a beehive. A beehive is made up of many thousands of bees. These include one queen, and many drones and workers.

Bees cannot stand severe cold or severe heat without protection. They die very rapidly at temperatures of about 40 degrees F. or below. A colony may survive cold weather by clustering. In extremely hot weather, the combs melt and run together, destroying the hive. This is why shade is so important in Arizona.

The honey bee does not like for the temperature of the hive to ever go below 57 degrees F. When the temperature does drop below that figure, the bees gather together and generate heat. Bees also maintain a uniform temperature in the hive by circulating the air by fanning their wings. Bees maintain a brood



nest temperature of about 94 degrees F. as this seems to give best production.

Queen is Large

The queen is the largest of the inhabitants of the hive and is shown in the drawings above. The queen can usually be distinguished from the worker bees by her large size, and from drones or males by her pointed or tapering abdomen (See drawings).

The important job of the queen is to lay eggs. A queen is developed from fertilized eggs and is fed "royal jelly" all of the time she is in the larval stage. She is equipped with a stinger, but rarely uses it.

A queen may live five or six years, but for the most practicable purpose, she is only useful to a hive for about two years. Older queens tend to produce too many drones.

The queen usually mates only once during her life. When about a week old, she makes her so-called "nuptial flight" high into the air. While on this flight she may be pursued by several drones. However, it is believed that only one drone mates with the queen. Some research workers think that queens may mate on successive days, but all agree that they never mate after they start laying eggs. A good queen may lay more than 2,500 eggs a day during the height of the brood rearing season.

The queen has the ability to lay either fertilized or unfertilized eggs. All the eggs are viable, however, and will hatch normally. An unfertilized egg is laid in a large drone cell (4 to the inch) and will hatch a drone. Fertilized eggs hatch into queens or workers.

The shape of the cell tells you whether a worker or queen will hatch. Queen eggs are laid in worker cells (5 to an inch) and normally there are a few empty cells called "skips." It's important to know what a queen cell looks like, as you can prevent swarming by breaking down queen cells, thus producing more honey.

In order to keep the queen out of the supers where you are producing honey, use a queen excluder (shown in drawing, page 6).

Workers are Smaller

Worker bees are the smallest individuals that hatch in the beehive from cells other than queen cells. Actually, they are undeveloped females since they come from the same type of egg as a queen. The chief difference between a queen and a worker is that the queen receives royal jelly throughout its larval stage, while the worker only receives royal jelly for the first two days of its larval stage.

Worker bees do the real work in a hive. They feed the larvae, gather

nectar and store pollen, clean out cells, feed drones, and cap the cells of brood and completed honey. Workers also defend the hive from robbers.

There are from 15,000 to 20,000 worker bees in a hive in the winter, and as many as 60,000 or more during the summer. Records show that during peak honey production, there is a new hatch of worker bees every 21 days.

Too Many Drones

Drones, or males, are recognized by their size and blunt posterior end. The queen regulates the number of drone cells in a comb. The drone's only function is to mate with the queen, and he dies immediately after mating.

There always is a large surplus of drones, and workers feeding them reduces honey production. So examine brood combs often. If you find a great number of drone cells, replace the frame above a queen excluder. When this brood hatches, remove or melt the comb for wax. Drone cells are longer and wider than worker cells.

When bees are ordered, they arrive in a screen wire cage with a queen. There are several ways of transferring them from the screened package to the hive. If bees arrive in the afternoon—too late to transfer that day—place them in a dark place where the temperature stays about 60 degrees F. Leave them there until the next morning.

To receive bees, close your hive entrance completely. Then remove three or four frames from the middle of the hive. Spray a sugar syrup over the screened package of bees and shake the bees on a hard object. This forces the bees to the bottom of the cage.

Take out the feeding can of syrup and the queen cage. Remove the piece of cardboard or tin from the candied end of the queen cage, and punch a hole in the candy with a large nail to speed the release of the queen. Hang the queen cage between two frames of your hive with the open end facing away from the hive entrance.

Shake some bees over the queen cage and the surrounding frames. Place the entire package of bees in the space where you took out the frames. The bees will then go into the frames.

Place an inner cover over the hive body, and give the bees sugar syrup in a five-pound can of honey which has small inverted holes in the lid. Next, invert the can so the holes in the lid are over the hole in the inner cover. Place an empty super on top of the hive body to protect the can. Reduce the entrance to one inch to prevent robbing.

Keep the hive closed for at least seven days except to refill the can of syrup. After seven days, examine the hive to see if the queen has been accepted by the bees and if she is laying eggs. Remove the empty package.

If there is no honey flow, feed the bees until it starts. Sometimes you must furnish the hive with a pollen supplement. When honey flow starts, remove the syrup and place a full super above the brood.

Proper Management

Proper handling or management of bees is essential if you intend to produce good honey or good bees.

The successful beekeeper does a good job of management in the fall and winter, especially in the lower



Note how the bee veil protects the beekeeper.

elevations of Arizona. Strong, vigorous colonies in the early spring provide a good start on next year's honey crop. These strong, over-wintered colonies raise plenty of young bees in the early spring.

If bees go into the winter with very little food, you may have to feed them. Every colony going into the winter should have a strong queen, bees covering 20 frames, and 75 pounds of honey and enough pollen for winter and early-spring brood rearing. Usually a full super is enough.

If colonies become weak and need feeding, make up a heavy sugar syrup and place a 5-pound pail of this material over the top of the frames of the inner cover. Check the hive food supply frequently. If poor queens are found—evidenced by very little brood in the hive—re-queen the hive.

In doing this, use the same methods described for transferring package bees into a hive. But, before putting a new queen into a

hive, make sure the old queen has been destroyed. Remember, it is always best to replace a queen after two years.

Always keep hives off of the ground, as rodents, ants, and floods can cause trouble.

Swarming

Swarming is a natural part of bee life. It is a method of reproduction by colonies. Without this instinct, honey bees would have perished from the earth long ago. By swarming, bees increase the number of colonies already existing and replace those which perished from adverse living conditions.

Swarming is not profitable to the beekeeper. The swarm usually contains bees that would have stored surplus honey. It pays to try to reduce swarming as much as possible.

A number of factors influence swarming. Some beekeepers feel that swarming can be prevented by rearing queens from colonies that show little inclination to swarm.

The most important cause for swarming is lack of room to raise a brood and store honey. A super may be filled very quickly when honey flow is extra good. It always is wise to have plenty of room for both the brood and for storing honey.

Colonies headed by young vigorous queens are less likely to swarm than those with poor queens. One good sign of swarming is to see a cluster of bees just outside a hive and many workers in the process of "fanning" at the entrance. This means the hive is getting too hot, or is too full of honey. It will cause swarming if the hive

isn't given some ventilation. This is another reason for shade in Arizona apiaries.

To reduce chances of swarming, examine the brood weekly and destroy all queen cells. Replacing queen bees often also helps to prevent swarming.

When a swarm leaves a hive, the bees usually cluster nearby before going to a new home. If the settling place is on a low limb or object, you may move a hive or other container to the location. Smoke the bees and gently shake them into the hive containing two frames of brood. Be sure to get the queen in the hive.

If the swarm settles high in a tree, shake the bees into a bushel basket or similar container. The basket of bees may then be emptied in front of a hive and induced to enter by pushing some to the entrance.

Honey Production

You have kept the bees all winter and now they are working for you by filling up supers which you added at the beginning of the honey flow. If you didn't add the supers, you may have had some swarming. Where foundation supers are used, don't put them on too long before the honey flow starts as they may get travel stained. It is best to place supers of extracted honey on the hive about a week or ten days before the honey flow.

How to Open a Hive

Never stand in front of a hive when working bees. Stand to one side when working at the entrance to the hive. (See photo above).



Stand to one side of the hive when working at the entrance to the hive.

When opening a hive, always blow a gentle puff or two of smoke into the entrance to disarm the guards. The smoke is usually produced by pieces of burlap or mesquite bark.

Now go to the rear of the hive, raise the top cover, then crack the sticky seal with your hive tool holding the inner top. Blow in a few more puffs of smoke. Then, loosen the outside frame and remove it from the hive with the hive tool. (See photo on next page).

After you have examined the comb, stand the frame on end at the front of the hive. A little more smoke may be needed at intervals to quiet bees in the hive as other frames are examined.

Lift frames by holding both ends of the top bar. Keep the frames in a horizontal position during examination as the queen is apt to fall to the ground from a frame turned on its side. Remove and examine the second frame, then put it back nearest the side of the hive. Remove the remaining frames and replace them in the hive using the same method.

Before replacing the first frame, push the other frames in the hive over to the far side to make enough room for it. Push all of the frames over at once to avoid killing bees and to save time. Take care not to crush any bees when removing supers in the top story of a two-story hive.

Don't open hives except on warm, sunny days when very little wind is blowing. On cold, damp and windy days, bees can be especially mean to work with. Always wear a bee veil, gloves, and either boots with pants inside or rubber bands or string around the bottom of your trousers.

Some people are stung by bees more quickly than others. When stung by a bee, always remove the



Loosen the outside frame and remove it from the hive with the hive tool.

stinger. Be sure to scrape the stinger out—don't mash it.

DISEASES OF BEES

There are several bee diseases. Those which attack the brood are the most serious.

European foulbrood — a brood disease—is not too serious in Arizona. Where it is present, it is the most damaging disease that beekeepers have to deal with. It is caused by a bacterium, *Bacillus pluton*. The bee larvae die when quite small and remain curled up on the bottom of the cell. Affected

larvae lose their plumpness and soon become grayish-yellow in color, giving off a very sour odor.

The larvae and scales formed from foulbrood may be easily removed. The disease sometimes spreads very rapidly and often an entire apiary will be stricken within a few weeks.

The American foulbrood is caused by a germ known as *Bacillus larvae*. It is the most serious

disease American beekeepers have to fight. It attacks the honey bee larvae with great losses at times. The dead larvae, or pupae, turn chocolate brown and lie lengthwise along the lower cell wall. The capping of the cells is discolored and sunken. Quite often you will find many already punctured. The punctured or open cell may show a shrunken pupa. If a small piece of wood—like a match—is inserted into an open cell and then removed, the cell contents string out like a rope.

Dead pupae give off a characteristic odor which smells like burned glue. People familiar with this disease can detect it at once. If you are suspicious, call in a bee inspector as the disease can easily put you out of business if controls are not started.

Most states have laws regulating the attempted eradication of the disease. In Arizona, the Agricultural and Horticultural Commission, under W. T. Mendenhall,

State Entomologist, appoints a state bee inspector. It is his job to inspect your bees at least once a year, and to kill, burn, and destroy all infected hives and contents. For complete information on this law, write to W. T. Mendenhall, State Entomologist, Capitol Annex, Phoenix, Arizona.

Always buy good equipment to start with. Be sure the bees you purchase are from reputable beekeepers. If you have to re-queen or get more bees, be certain you secure disease-free bees.

Never feed honey to your bees unless you know it is from bees that were free of diseases. Inspect your bee hives regularly and, if disease appears or you suspect its presence, call for an inspector at once.

There are some other diseases of bees and their brood that may occur. If something strange is present in your colonies, call your County Agricultural Agent or State Bee Inspector.

ENEMIES OF BEES

Wax Moths

There are several species of moths that can injure colonies and stored combs. Wax moths seldom attack strong colonies. They do the greatest damage to very weak colonies. The Indian meal moth is often very injurious to stored combs.

If comb and colonies become infested with moths, fumigate hives and all equipment with a good fumigant, like cyanide, methyl bro-

mide, or some other recommended material. Always follow directions carefully when using any of the materials.

Other Pests

Sometimes skunks become serious pests of apiaries. Best control of these animals is secured with baits or traps. Rodents like mice and rats may also be a problem, but they, too, can be controlled with baits or traps.

HONEY PLANTS

According to Frank E. Todd, USDA Apiculturist of the Southwestern Bee Laboratory at the University of Arizona, the following honey plants grow in Arizona. Although about sixty Arizona plants have been recorded as honey plants, surplus honey crops come from only six sources. Other honey plants provide the necessary pollen and nectar to support brood rearing and maintain colonies.

Surplus honey sources in Arizona are shown in the list at right. Note the season available.

Plants	Season Available
Citrus Fruits (<i>Citrus spp.</i>)	April
Mesquite (<i>Prosopis juliflora DC</i>)	April, May, June
Catclaw (<i>Acacia greggii Gray</i>)	April and May
Alfalfa (<i>Medicago sativa L.</i>)	May, June, July
Cotton (<i>Gossypium hirsutum</i>)	July, August, September
Athel (<i>Tamarix aphylla</i>)	July and August

POLLINATION

According to Mr. Todd, bees are important as pollinators for many cultivated crops grown in Arizona. Growers of some crops find that it pays to increase the local supply of pollinators by renting bees from the beekeeper during crop blossoming time. This pollination practice is common in the production of fruit crops, cucumbers, melons, vegetable seeds, alfalfa, clover, and vetch.

When using honey bees for pollination, both the crop grower and the beekeeper should understand certain general principles. For example, a colony of bees is not a standard unit because the size of the bee force and the quantity of brood vary with the time of year and other conditions. However, one strong colony will give better pollination service than will two weak colonies.

Research shows more effective service is given when colonies are placed in, or as near as possible to, the field or orchard to be pollinated. And, scattered groups of five to ten colonies in a field or orchard to be pollinated are likely to give better pollination than placing hives singly or putting them all in one group. Always set out colonies in a location easily reached by road so you can care for them properly.

In Arizona's irrigated valleys, colonies must be shaded. See that a source of water is available within one-quarter to half a mile of the apiary.

Since bees are susceptible to insecticide poisoning, work out an agreement with the grower about the use of insecticides when you rent bees for pollination service.

Growers are sometimes disappointed in results obtained from

the use of bees for pollination mainly because they expect too much. Bees are only one of many factors in producing a crop, so their use cannot overcome faulty cultural practices, poor stands, bad weather, or failure to control harmful insects on the crop.

Fruit

In fruit pollination, the recommended practice is to provide at least one strong colony per acre. The colonies are scattered in the orchard in groups of five to ten hives, and should be in place before flowering begins.

Cantaloup

For cantaloup pollination, a minimum of one strong colony per acre should be provided. Place colonies on field borders. And, depending on field size, set them out in groups or all in one setting. For fields of fifty acres or more, scatter groups of colonies in the field. To obtain a crown set, colonies should be in place at the beginning of flowering.

Alfalfa

There are two reasons for providing plenty of bees for pollinating alfalfa seed crops.

More seed may be produced by increasing the supply of pollinators, and the quality of the seed produced may be superior. It is well known that when alfalfa is self-pollinated, plants produced by the seed lack vigor. In fact, tests show about 40 percent reduction in forage produced by plants from self-pollinated seed.

When bees trip alfalfa flowers, cross-pollinated seed is insured. Not only more seed, but also seed of better quality may be produced with an adequate supply of pollinators.

For Arizona, use four or more colonies of bees per acre of alfalfa. Locate five to ten groups of colonies in the field as this usually gives more effective tripping than when colonies are all in one group. Move colonies into the field about a week after the first flowers appear.

CAUTION!

Bees are susceptible to insecticide poisoning, so precaution in their use is necessary when bees are in the field. Parathion, malathion, DDT, dieldrin, aldrin, BHC, and chlordane are likely to cause considerable damage to bees when applied to flowering alfalfa.

Systox, toxaphene (at low dosages—2 lbs. or under), sulphur, and

methoxychlor may be used with relative safety when applied during the hours bees are not active in a field. That is between 7 p.m. and 7 a.m. Insecticides drifting over colonies are likely to kill many bees, so keep this from happening.

Note: Systox may be used only on condition that the owner will burn and destroy the alfalfa chaff and hulls. It cannot be used on hay.

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County Agricultural Agent or
Home Demonstration Agent
for other farm and
home information.