

POLLINATION BY HONEY BEES

Pollination is the transfer of pollen grains, the male sex cells of a flower, from the anther where they are produced to the receptive surface, or stigma, of the female organ of a flower. Since the honey bee is the most important insect that transfers pollen between flowers and between plants, the word "pollination" is often used to describe the service of providing bees to pollinate crop plants. This service is now more important than ever in the Midwest because the acreage of insect pollinated crops is large as compared with the number of all kinds of bees (honey bees, humble bees, and solitary bees) that are available to provide pollination. In many states the estimated number of colonies (hives) of bees has dropped drastically in recent years. For example, in Illinois the estimated number of hives dropped from 101,000 in 1964 to 46,000 in 1984. These two figures are probably much more accurate than some of the older, larger estimates that may have reflected state pride more than reality. Because of the reduction in numbers of bees, growers in any state can no longer assume that there are sufficient numbers of bees nearby to produce the best possible crop from insect pollinated plants.

Honey bees are good pollinators for many reasons. Their hairy bodies trap pollen and carry it between flowers. The bees require large quantities of nectar and pollen to rear their young, and they visit flowers regularly in large numbers to obtain these foods. In doing so, they concentrate on one species of plant at a time and serve as good pollinators for this reason. Their body size enables them to pollinate flowers of many different shapes and sizes. The pollination potential of the bees is increased because they can be managed to develop high populations. The number of colonies can also be increased as needed and the colonies can be moved to the most desirable location for pollination purposes.

Honey bees are most active at temperatures between 60 degrees F. (16 degrees C.) and 105 degrees F. (41 degrees C.). Winds above 15 miles per hour reduce their activity and stop it completely at about 25 miles per hour. When conditions for flight are not ideal, honey bees work close to their colonies. Although they may fly as far as 5 miles in search of food, they usually go no farther than 1 to 1-1/2 miles in good weather. In unfavorable weather, bees may visit only those plants nearest the hive. They also tend to work closer to the hive in areas where there are large numbers of attractive plants in bloom.

The following crops must be pollinated by bees to produce fruit or seed:

Alfalfa
Apple
Apricot
Blackberry
Blueberry
Cherry
Clovers
Sweetclovers, white and yellow
True clovers

Cucumber
Muskmelon, cantaloupe
Nectarine
Peach
Pear
Persimmon, native
Plum, prune
Pumpkin
Raspberry

Alsike
Ladino
Red
White Dutch
Cranberry

Squash
Sunflower
Trefoil
Watermelon

The following crops set fruit or seed without insect visits but yields and quality may be improved by honey bees:

Eggplant
Grape
Lespedeza
Lima bean

Okra
Pepper
Soybean
Strawberry

Honey bees visit several important crops but do not improve their yields of fruit or seed. These include the following:

Field bean
Pea

String or snap bean
Sweet corn

The provision of bees for pollination of crop plants is a specialized practice, not just a sideline of honey production. Beekeepers who supply bees for pollination must learn the skills of management that are necessary for success in this phase of beekeeping. Such skills include the development and selection of strong colonies that are able to provide the large force of field bees needed to do the job of transferring pollen. This task of the beekeeper is hardest to accomplish for fruit pollination early in the year. Each beekeeper or organization of beekeepers should set minimum standards for colony strength and size to use as a basis for establishing prices and for providing the best possible service. The number of bees, and not the number of hives, is the true unit of measure, and growers need to be told and shown what standards are being used to measure the honey bee colonies for pollination. For example, colonies for apple pollination should be housed in a two-story hive with a laying queen. There should be four or more frames with brood and sufficient bees to cover them. There should also be a reserve food supply of 10 pounds of honey or more. Colonies rented to pollinate crops that bloom later in the year should be proportionately stronger, with five or six frames with brood, approximately 600 to 800 square inches. In the field, the colonies must be supered and examined at intervals to keep them in suitable condition for pollination.

The number of standard colonies that are needed per acre of crop plants varies in relation to the attractiveness of the crop, the competition from surrounding sources of nectar and pollen, and the percentage of flowers that must produce fruit or seed to provide an economic return. Most crops are adequately pollinated by one strong hive of bees per acre. However, red clover grown for seed should have two or more colonies per acre moved to the field as soon as it begins to bloom (Fig. 76). Alfalfa requires three to five colonies per acre. Hybrid cucumbers grown at plant

populations of 40,000 to 70,000 or more plants per acre for machine harvest may require up to four hives per acre. The higher number of hives may be needed where other cultivated plants or weeds compete strongly for the attention of the bees.



Pollination of second-crop red clover for seed. Honey bees are effective pollinators of red clover in July and August when other clovers have ceased to bloom. Illinois produces large quantities of red clover seed, often as such as one-sixth of the total production in the United States. (Fig. 76)



Honey bee hives placed in groups in an apple orchard in southern Illinois. (Fig. 77)

Bees for pollination should be placed within or beside the crop to be pollinated. For apples, place groups of 5 to 15 hives at intervals of 200 to 300 yards (Fig. 77). They should be moved into the orchard at 10 to 25 percent bloom. For cucumbers and other cucurbits, bees should be moved to the field when the first female flowers appear, not before. Place the bees in a single group for small fields. For fields larger than 30 acres, place the bees in two or more groups at the edges of the field but leave no more than $\frac{1}{4}$ mile between groups. Bees seem to work better upwind from their hives than downwind, so it is probably worthwhile to locate more colonies on the downwind side of the field or orchard than on the side from which the wind blows.

Bees need a nearby source of water such as a farm pond or a stock tank with cork or wooden floats on which they can land. Water is important in the early spring for brood rearing and later for cooling the hives. In fruit pollination the bees benefit from full sun and shelter from the wind. Later in the year, some afternoon shade is helpful.

Contracts for honey bee pollination services should be a regular part of the business when more than a few hives are involved. Contracts prevent problems that may arise from misunderstanding, and they serve to emphasize the obligations and rights of both grower and beekeeper. Contracts

should include provisions relating to pesticide usage, colony standards and the rights of the grower to examine the colonies, rights of access by the beekeeper, pollination fees and time of payment, and a statement about the timing of movements of bees to and from the crop.

Colony rental fees vary in relation to the expenses involved and the length of time the colonies are needed. The potential or actual honey production of the rented colonies is also a factor in establishing prices for summer-blooming crops, with higher prices for less productive plant species. Additional moves and the movement of colonies by growers may increase or lower the price. *The Honey Market News* publishes typical prices being charged for pollination services.