

Using Bees with Vegetable Crops

In most vegetable plants, seed or fruit development depends on pollination and fertilization. In most cases, this involves the transfer of pollen from the male portion of the flower to the female portion. Pollen also is a source of protein for a wide spectrum of insects. It is especially important to bee species that specialize in collecting pollen. While collecting this valuable food source, these insects provide the pollen transportation link many plants need for reproduction. A single honeybee can carry up to five million pollen grains on its body, and a strong honeybee colony may bring in more than 50 pounds of pollen during a season.

There are several factors that influence the honeybee's role as the pollinating leader. First, only honeybees have developed a significant social system that allows them to overwinter as a colony. This makes it possible for humans to manage honeybees. Populations of naturally occurring bee species have been declining over the last few decades due to reduced natural habitats, parasitic mites, brood diseases, pesticides, and other factors.

At least 90 crops grown in the United States depend to some extent upon bees as pollinators, either for seed or fruit production. The exact number of hives needed to pollinate a crop depends on a number of factors, including the strength and condition of colonies, magnitude of the natural pollinator community, amount of wild flower material competing with the crop, attractiveness of the crop to bees, projected yield, and weather.

The following are guidelines for the number of hives to use when supplemental pollination is desired:

cucumber	(2 to 3 colonies per acre)
muskmelon	(2 to 3 colonies per acre)
pumpkin	(1 colony per acre)
squash	(1 colony per acre)
watermelon	(1 to 5 colonies per acre — the pollination requirements of seedless varieties are generally greater than seeded)

The following vegetables will set fruit without bees, but bee activity has been shown to increase yields:

eggplant	okra
lima bean	pepper

Honeybees do not assist in the pollination of the following crops, but will collect pollen and nectar from them:

pea	sweet corn
snap bean	tomato

Many growers currently purchase pollination services for their vegetable fields from beekeepers. To ensure the mutual satisfaction of growers and beekeepers, both should sign a pollination contract. The following points should be considered in the contract: rental price, number of colonies, strength of colonies, timing of placement in the fields and removal from fields, field location, responsibility for maintenance of the colonies, access for the beekeeper to the hives, liability for stings, and protection from pesticides.

Generally, a grower should require that any hive rented for pollination should have two deep supers (boxes), a good egg-laying queen, at least four to five frames of brood, produce more than 20 pounds of surplus honey, and be disease free. Hives should only be placed in fields after some of the crop's flowering has begun. If hives are placed before flowers are available, bees will forage in surrounding areas and may not return to pollinate the flowers of the intended field. Also, when planning where to place the hives, growers should remember that honeybees usually pollinate flowers most thoroughly within 100 yards of their colony, although if forced to, they will travel much farther. Thus, hives should be distributed in groups throughout the field rather than in a single location, with convenience to the beekeeper in mind as well as uniform pollination.

Certain pesticides and pesticide application practices pose serious hazards to honeybees. In general, nighttime applications pose the least hazard to bees, with early morning applications second best. Applying a single pesticide is usually less dangerous than applying combinations. Systemic insecticides are usually very safe to bees, as are granular formulations. Emulsifiable or water soluble formulations are safer than wettable powders of the same material. The list on page 23 classifies insecticides by the degree of toxicity to honeybees. A list of chemicals and methods of application that are mutually agreeable to growers and beekeepers may be added to pollination contracts.

Growers should work closely with beekeepers to develop a pesticide application scheduling and application program to protect their liability and the honeybees.

Highly Toxic Insecticides

Severe bee losses can be expected if the following materials are used when honeybees are present at treatment time or within a day thereafter:

Ambush[®], Ammo[®], Asana[®], Baythroid[®], Diazinon[®], Dibrom[®], Dimethoate[®], Furadan[®], Fury[®], Guthion[®], Imidan[®], Lannate[®], Lorsban[®], Malathion[®], Monitor[®], Mustang[®], Orthene[®], PennCap-M[®], Pounce[®], Scout X-Tra[®], Sevin[®], Warrior[®].

Moderately Toxic Insecticides

The materials below can be used in the vicinity of honeybees if the dosage, timing, and method of

application are correct; however, they should not be applied directly on honeybees in the field or at the hives:

Admire[®], Di-Syston[®], Metasystox R[®], Provado[®], Thiodan[®], Thimet[®], Vydate[®].

Relatively Nontoxic Insecticides and Acaricides

This group of materials can be used around honeybees with a minimum of injury:

Bacillus thuringiensis products (Agree[®], Biobit[®], Dipel[®], Javelin[®], Lepinox[®], M-Trak[®], MVP[®], etc.), Adios[®], Intrepid[®], Kelthane[®], Methoxychlor[®], Omite[®], Pyrethrum[®].

Re-entry Standards/Worker Protection

The EPA's Worker Protection Standard (WPS) is "designed to reduce the risk of illness or injury resulting from workers' and pesticide handlers' occupational exposures to pesticides used in the production of agricultural plants on agricultural establishments." It covers workers who come in contact with pesticides, workers who handle pesticides, or workers who are employed in the production of agricultural plants on four types of establishments: farms, forests, nurseries, and greenhouses. The WPS covers the following elements:

Pesticide Safety Training. Training instructions have to be provided on a five-year cycle. The pesticide safety training employers will provide their workers includes information on routes of entry, symptoms of poisoning, and emergency first aid. Those workers handling pesticides will need additional training on label interpretation, environmental impact from drift and runoff, wildlife hazards, and pesticide handling.

Pesticide Safety Information. Employers will establish a central location, accessible to all workers and handlers, for displaying pesticide information, including a pesticide safety poster, emergency medical care information, and basic pesticide safety concepts.

Application Notification. Workers will be notified of specific locations where pesticides have been applied, as well as any re-entry restrictions that may apply. Depending on the particular pesticide product,

notification may be oral or written and may require posting.

Entry Restrictions. Workers not involved in application will not be permitted to enter or remain in an area being treated. Under no circumstances may early-entry workers enter a treated area until at least four hours after a pesticide application is completed. Early-entry workers must be equipped with personal protective equipment as required by the pesticide label.

Personal Protective Equipment. Employers must provide pesticide handlers with whatever protective gear the pesticide label requires. Employers also must ensure that the equipment fits properly, is used correctly, and is clean, intact, and in good operating condition.

Decontamination Site. Water for routine washing and emergency eye flushing, soap, single-use towels, and a change of clothing will have to be provided at a clean site.

Emergency Assistance. If a worker or handler is poisoned or injured from a work-related pesticide exposure, the employer is responsible for making prompt transportation available to an emergency medical facility. Employers must provide product-specific information from labels (product name, EPA registration number, active ingredients, antidote, first aid) to medical personnel, and will need to know the circumstances relevant to the application and exposure.