

# Chapter 4

## Hive Bees As Crop Pollinators

### Which crops are pollinated by honeybees?

Honeybees are important for the pollination of many vegetable, fruit, oilseed, and fodder crops (Figure 4.1). Many of these crops, especially commercial varieties of cash crops, depend on cross-pollination by honeybees to produce fruit and seed. Others (self-pollinated crops) benefit from it for the production of good quality fruit and seed and higher yields (Table 1).

### Why are hive bees better than other bees for crop pollination?

The Hindu Kush-Himalayan region has many species of bees and all are useful as crop pollinators. However, some cannot be relied on as efficient pollinators. Wild honeybee species (*Apis dorsata*, *Apis florea*, and *Apis laboriosa*) are restricted in distribution and number and, being migratory, they are not available at any particular place throughout the year. Other bee species, such as solitary bees (including the carpenter bees), are truly seasonal in nature and may not be available when required for pollination. Hive bees (*Apis cerana* and *Apis mellifera*) are the most practical for crop pollination for the following reasons (Figure 4.2).

- Bees that are kept in hives can be managed unlike non-hive honeybees and wild bee species.
- Hive bees can be reared in sufficient numbers for effective pollination.
- When kept in movable-frame wooden hives, colonies can be transported to fields or orchards.

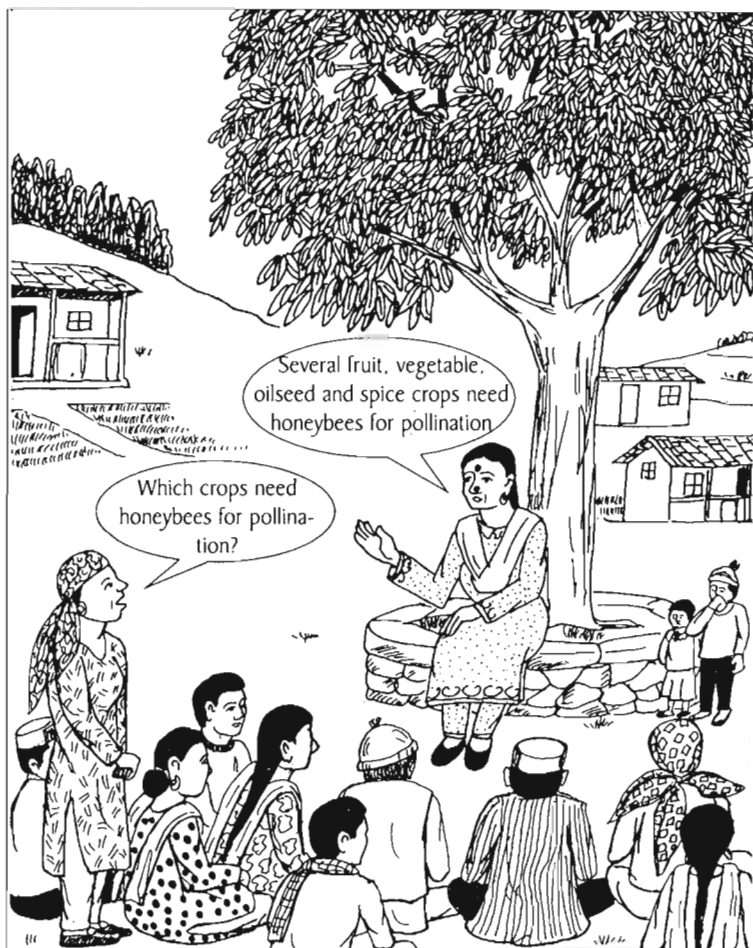


Figure 4.1: Awareness of farmers about the value of honeybees for pollination of their crops is important to promote managed crop pollination through beekeeping.

Hive bees are used for pollination of agricultural and horticultural crops in many countries. It has been found that the use of hive bees results in a manifold increase in yields and an improvement in the quality of produce. For example, experiments conducted in India show that compared to self-pollination, seed yield is increased in mustard by 131 per cent, in safflower by 511 per cent, in niger by 1,121 per cent, in sunflower by 675-3,600 per cent, in onion by 178 per cent, in carrot by 500 per cent, in radish by 700 per cent, in citrus by 35-900 per cent, and in guava by 200 per

**Table 1: Crops That Are Dependent on Or Benefit from Honeybee Pollination**

Crops dependent on bee pollination	Crops benefitting from bee pollination
<b>Fruit and nut crops</b> Almond Avocado Apple (all commercial varieties) Apricot (some varieties) Cherry (many varieties) Kiwi fruit Litchi Mango Plum (many varieties) Pear (many varieties)	Apricot (few varieties) Blackberry Citrus Peach Persimmon Strawberry
<b>Vegetable seed crops</b> Cabbage Carrot Cauliflower Cucumber Onion Pumpkin Radish Squash Turnip	Beans Capsicum Eggplant Okra Tomato
<b>Vegetable crops</b> Bitter gourd Bottle gourd Muskmelon Pumpkin Sponge gourd Squash Watermelon	
<b>Oilseed crops</b> Sunflower Niger	Mustard Rape Cotton
<b>Spice crops</b>	Greater cardamom Chillies Coriander

cent. It is calculated that the value of honeybees as crop pollinators is many times greater than their value as honey and beeswax producers.

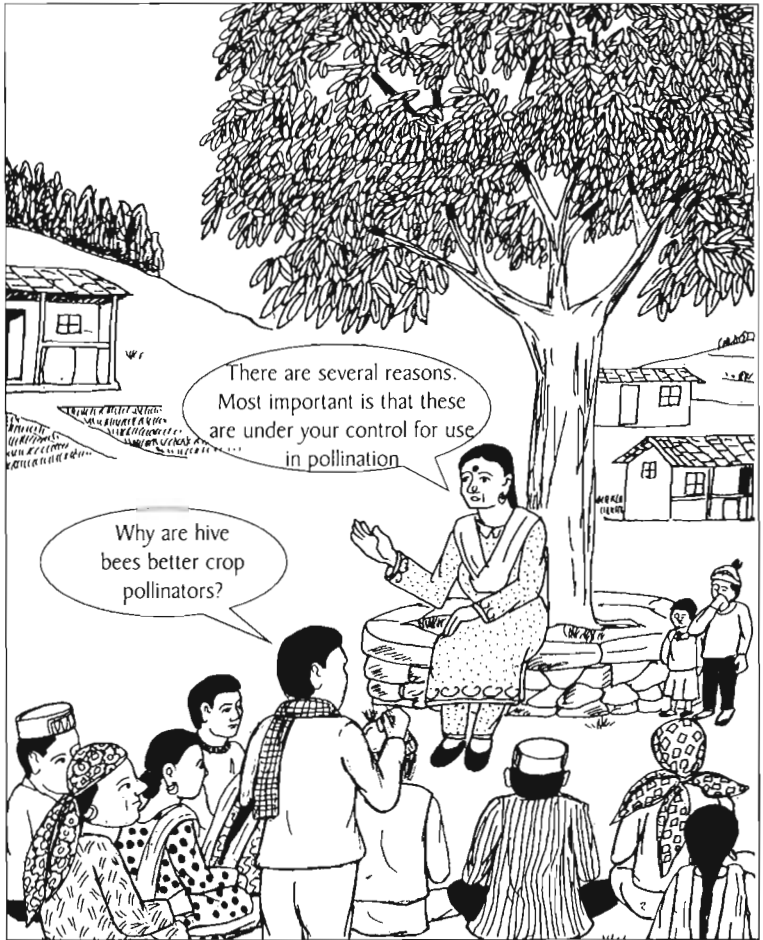


Figure 4.2: It is important to know why honeybees are better crop pollinators than other insects.

**Why do we need to manage hive bees for crop pollination?**

There are limitations in the natural pollination system, resulting in a need to manage honeybees (Figure 4.3).

- Natural insect pollinators play an important role in the pollination of summer crops cultivated in hilly and mountain areas. However, most are absent during the winter and early spring and are not available for pollination of early-blooming mountain crops such as

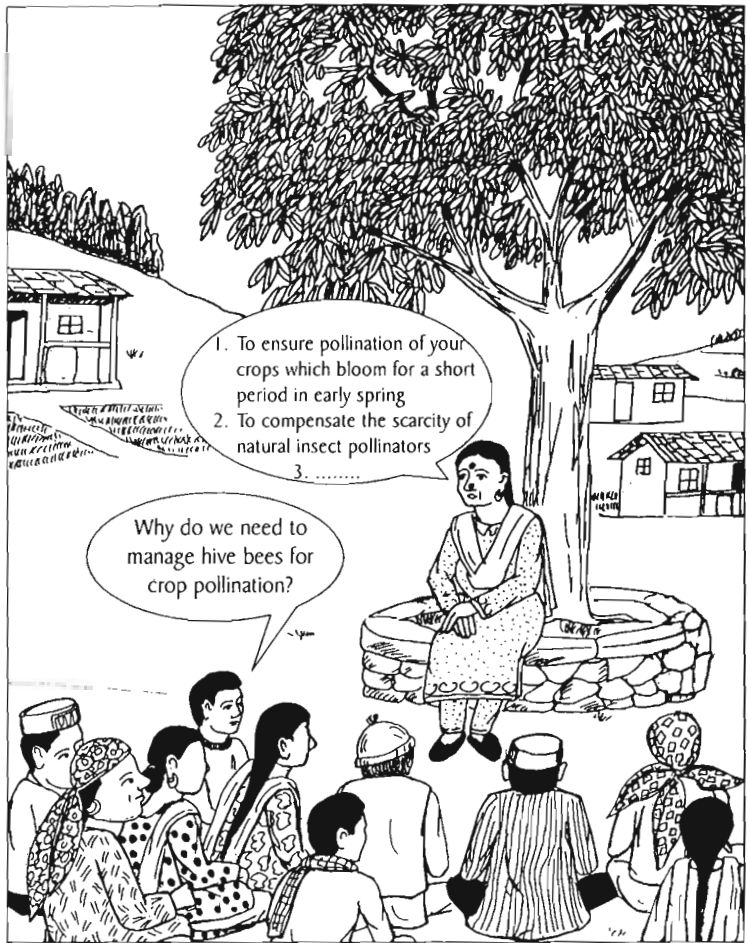


Figure 4.3: An understanding of the limitations with natural pollinators can encourage farmers to manage pollination of their crops.

cabbage, cauliflower, radish, broadleaved mustard, winter rape, apple, peach, pear, plum, etc. Moreover, natural insects cannot be managed for pollination.

- Some crops—especially temperate fruit crops such as almond, apple, plum and pear—bloom for only a short period early in the bees' active season when numbers of natural pollinators are low.
- Populations of natural insect pollinators are declining, meaning that there are not sufficient numbers for adequate pollination. There are two main reasons for the decline: a reduction in nesting habitats and food

sources and use of pesticides. Clearing of forests and grasslands for agriculture and horticulture has reduced the habitat necessary for hibernation and nesting of natural insect pollinators. Moreover, cultivation of large areas of the same crop (monoculture) has reduced the diversity of plants that provide nectar and pollen. Commercialisation of agriculture has increased the use of pesticides that kill, in addition to target pests, many natural insect pollinators - including species of wild bees.

- As a result of cash-crop farming, large areas are under crops that require cross-pollination. With the decline of natural pollinator populations, the lack of insects results in low productivity and inferior quality fruit and seed.
- Management of hive bees is also important for the pollination of crops grown in greenhouses. One such cash crop becoming popular in the Hindu Kush-Himalayan region is the strawberry.

### **How should we use hive bees for crop pollination?**

Farmer-friendly techniques have been developed for using honeybees for pollination. Both *Apis cerana* and *Apis mellifera* are used. However, for early flowering mountain crops, the native honeybee, *Apis cerana*, is more efficient. The race of *Apis mellifera* that has been introduced into the Hindu Kush-Himalayan region is more suitable to the low hill and plains' areas. A simple method of crop pollination is to place honeybee colonies in a field when the crop starts flowering. However, for effective pollination, a farmer should remember the following (Figure 4.4).

- Large, strong colonies are better pollinators than small colonies because larger colonies have more forager bees. Also, good honey-yielding colonies are more efficient pollinators.

Research has shown that a bee colony with 60,000 worker bees produces one-and-a-half times more honey than four colonies with 15,000 workers each. The same is

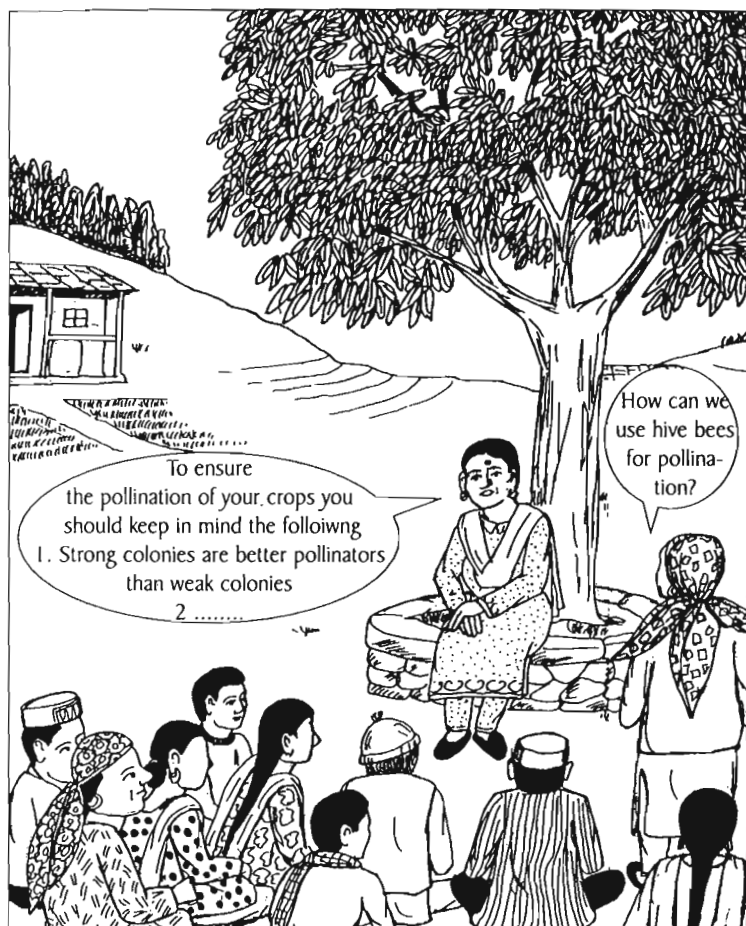


Figure 4.4: Making farmers aware of how to use hive bees for pollination of their crops is essential for managed crop pollination.

true for pollination. Thus, as far as possible, farmers should use strong colonies. The colonies should be well settled, disease free, and have young, laying queens. The strength of a honeybee colony depends above all on the season. In the Hindu Kush-Himalayan region, colony strength is poor during winter because of low temperatures and a dearth of bee flora. Thus, when required in early spring for pollination of temperate fruit crops, these colonies do not have enough strength to act effectively. To help colonies maintain their strength, mountain farmers and commercial beekeepers should move colonies to low hill/plains' areas during winter,

because it is warmer and floral sources are available, and return them to the hills in spring when temperate fruit and vegetable crops are blooming. Such a migration of bee colonies is the practice in Himachal Pradesh in India, the North-West Frontier Province (NWFP) and Punjab in Pakistan, and northern parts of China.

- The number of colonies required for pollination varies for different crops.

This depends on the total number of plants; the total number of flowers per plant; attractiveness of flowers to bees; duration of flowering; amount of nectar and pollen; bee species used; strength of colonies; number of pollen foragers; and amount of unsealed brood in the colonies. In general, three strong colonies of *Apis mellifera* per hectare of crop are recommended for adequate pollination. Colonies of *Apis cerana* are smaller: a 10-frame full-strength colony of *Apis mellifera* is three times larger than a 10-frame full-strength colony of *Apis cerana*. However, the foraging rate of *Apis cerana* is 1.5 times greater than *Apis mellifera*. Therefore, 4-5 strong colonies of *Apis cerana* per hectare of crops are required. The number of colonies required also varies from crop to crop and from season to season for the same crop. This is discussed in detail in Chapter 5.

- The time of placement of bee colonies is important for high yields and good-quality produce.

It is important to synchronise flower opening and foraging activities of bees. Freshly migrated colonies are more likely to visit a crop than those in place for a long time. Colonies should be brought to the field when 5-10 per cent of the crop is in bloom. If colonies are placed early, bees will forage on flowers of wild plants nearby, becoming conditioned to these and ignoring the target crop when it blooms. If bees are moved late, they will only pollinate late and less vigorous flowers, resulting in poor yields and low-quality produce. For effective



pollination of crops that flower for a short period, such as plums, bees should be moved when plants just start blooming because 50 per cent flowering is achieved within 3-4 days.

- Cool weather and wind affect foraging activities of bees.

Place colonies in sunny, sheltered locations giving protection from wind to encourage maximum flights in spring (Figure 4.5). Where no natural windbreak is available, provide a temporary wind shelter. Placement of honeybee colonies in the field is important.

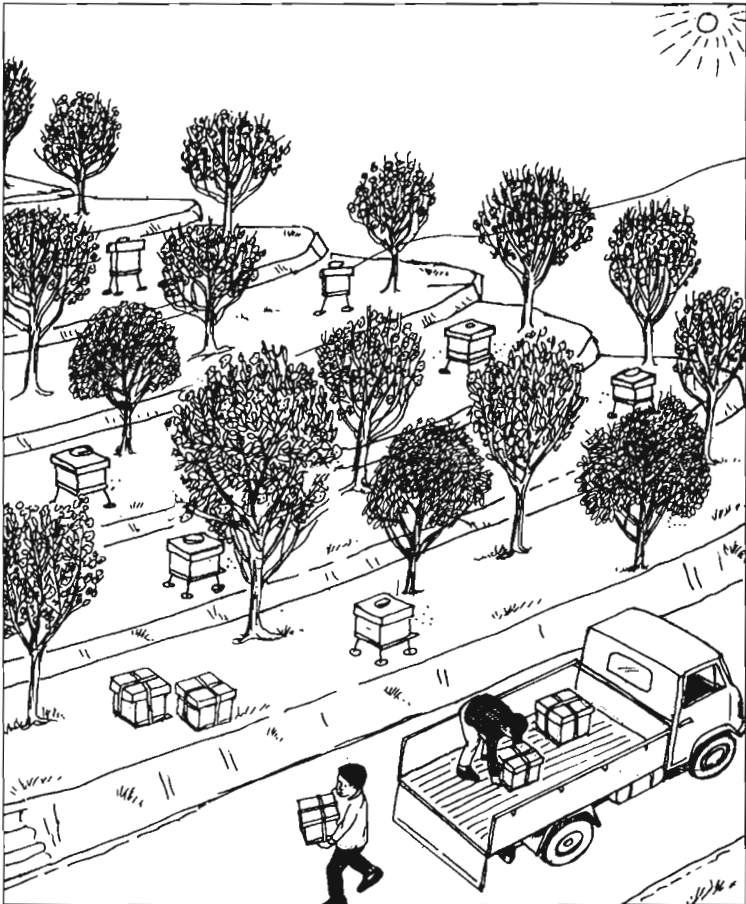


Figure 4.5: To ensure better pollination of all trees, beehives should be placed evenly in the sunny locations in the orchard and protected from the direct wind.

Honeybees prefer to visit sources of nectar and pollen that are near to their colonies (200-300m). At over 500m pollination activity diminishes greatly. For effective pollination, colonies should be placed singly instead of in groups and distributed evenly in the field (Figure 4.5).

- Bees that forage for pollen (pollen collectors) are known to be better pollinators than nectar collectors.

Colonies being used for pollination should have large amounts of unsealed brood. This will increase the pollen requirement and the colony will recruit more pollen foragers. The amount of unsealed brood in a colony can be increased by adding frames of unsealed brood from another colony that is not being used for pollination (Figure 4.6). Pollen collection can also be increased by taking out frames in which the bees have stored pollen.

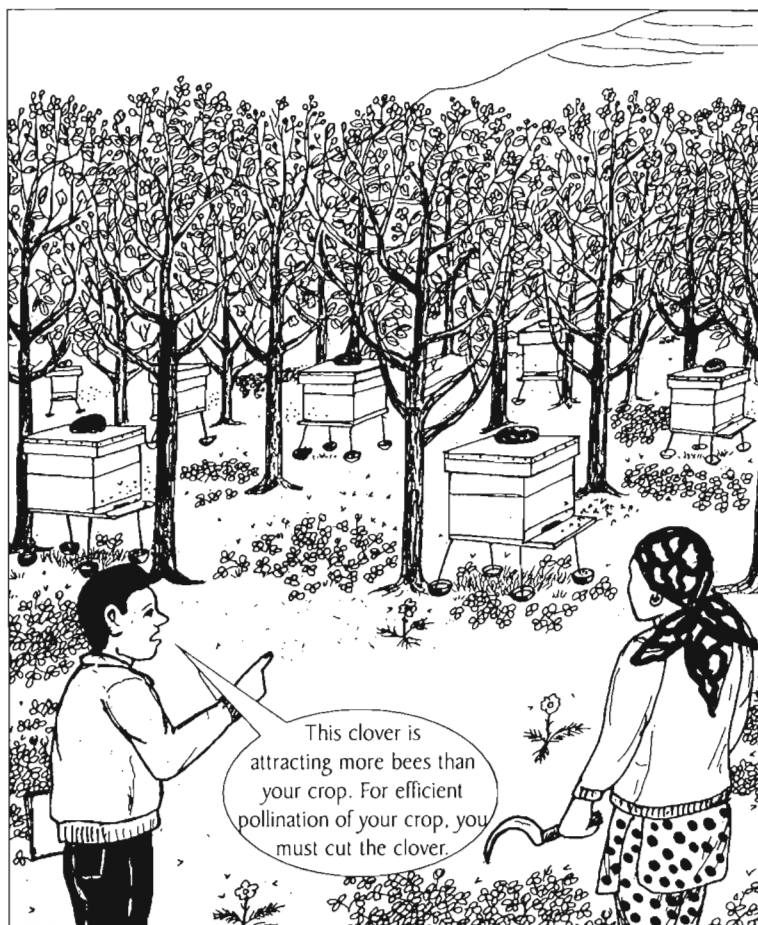


Figure 4.6: Putting frames of unsealed brood increases the number of pollen collectors and enhances pollination.

- For crops that are poor nectar producers and relatively unattractive to honeybees, e.g., kiwi fruit, bees should be fed sugar syrup in which a few fresh flowers and pollen from the crop have been soaked for some hours (Figure 4.7). Feeds should be given at night or early morning before bees go foraging. This increases pollen collection and thus pollination.
- Sometimes the crop to be pollinated is ignored. Bees may forage on other more attractive plants, e.g., weeds nearby. In such cases, remove the weeds to avoid competition in attracting bees (Figure 4.8), and use good



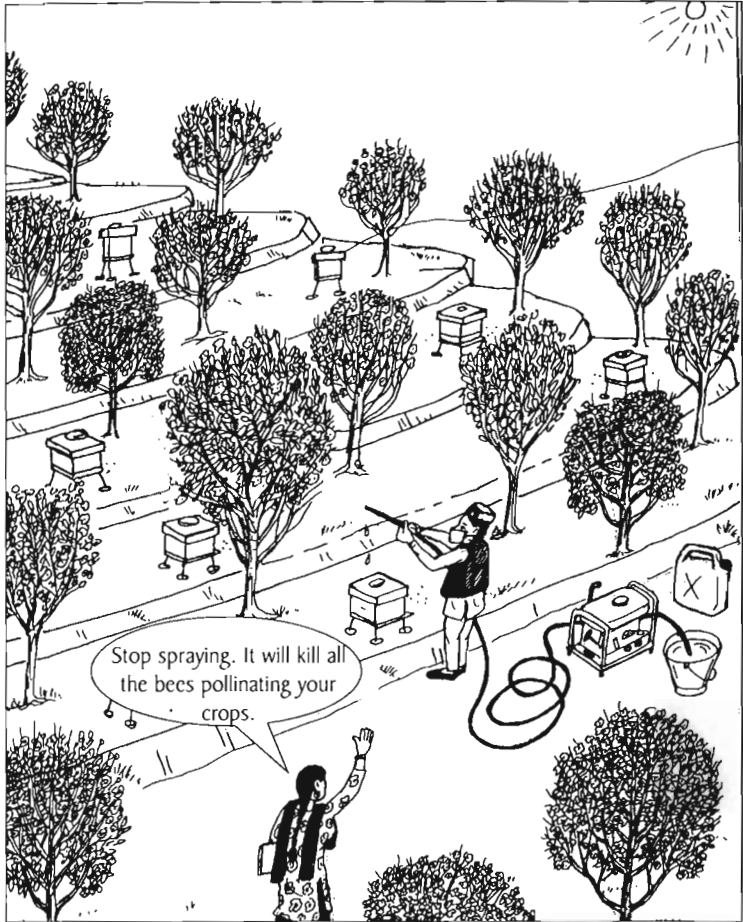
Figure 4.7: To enhance pollination, feed the bees with sugar syrup flavoured with the flowers of the crop to be pollinated.



*Figure 4.8: For efficient pollination of the target crops by bees, it is important to remove non-target plants (weeds etc.) that may be more attractive to bees.*

agronomic practices for a healthy crop such as proper manuring, irrigation, and pesticide application. Usually, however, weeds are useful as they provide additional nectar and pollen sources.

- Some crops are not attractive to bees. In such crops, flowers can be sprayed with honey or sugar solution to attract more foragers.
- Do not spray pesticides while the crop is flowering and bees are visiting it (Figure 4.9). Remove colonies immediately after petal fall and before pesticides are applied.

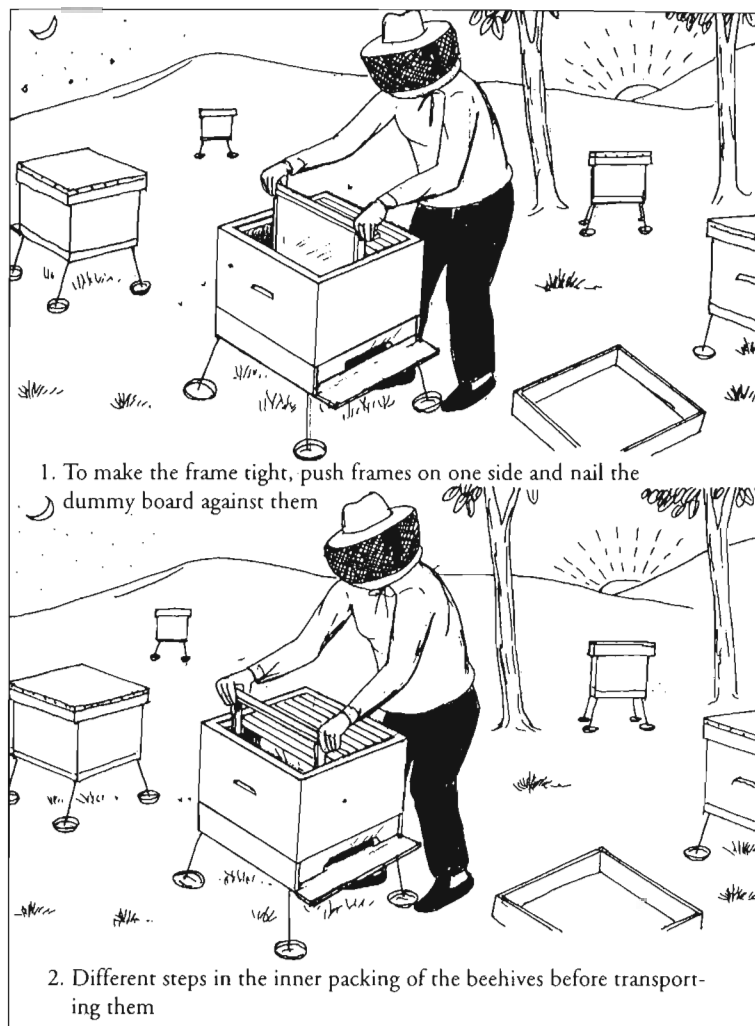


*Figure 4.9: To save bees and other insect pollinators from pesticides, these should be not sprayed during the flowering period when the bees and other insect pollinators are visiting the crop.*

### **How should honeybee colonies be transported?**

Before moving the hives, close them and ensure that they are properly ventilated. Hives should be closed during the night because most foragers return in the late evening.

- Pack the inside of the hive to keep frames tight. This is important to avoid combs detaching from frames, particularly if all the frames in the brood chamber are not covered with bees. Push full frames to one side and nail a dummy board against them (Figure 4.10 ). Place



*Figure 4.10: Different steps in the inner packing of the beehives before transporting them.*

empty frames on the other side of the dummy board to transport them safely (optional). If a super is being used, do the same for the frames covered with bees in the super. If all the frames in the brood chamber and the super are covered with bees, there is no need for a dummy board.

- Close the hive entrance with a material that allows proper ventilation and does not allow bees to fly out, e.g., 3-

4mm wire mesh or loosely woven cloth (Figure 4.11). If a super is being used, nail the super to a brood chamber. Nail the inner cover in place.

- Secure hive with belts (Figure 4.11).
- Load hives on to a vehicle and transport them (preferably at night) to crop to be pollinated (Figure 4.12).

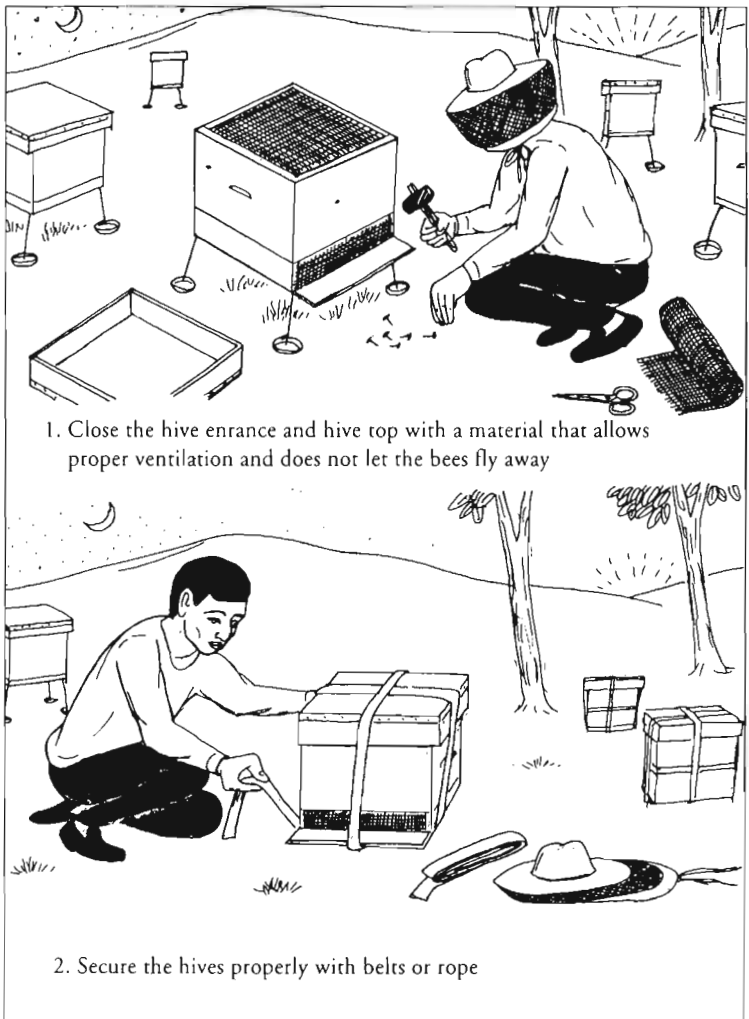
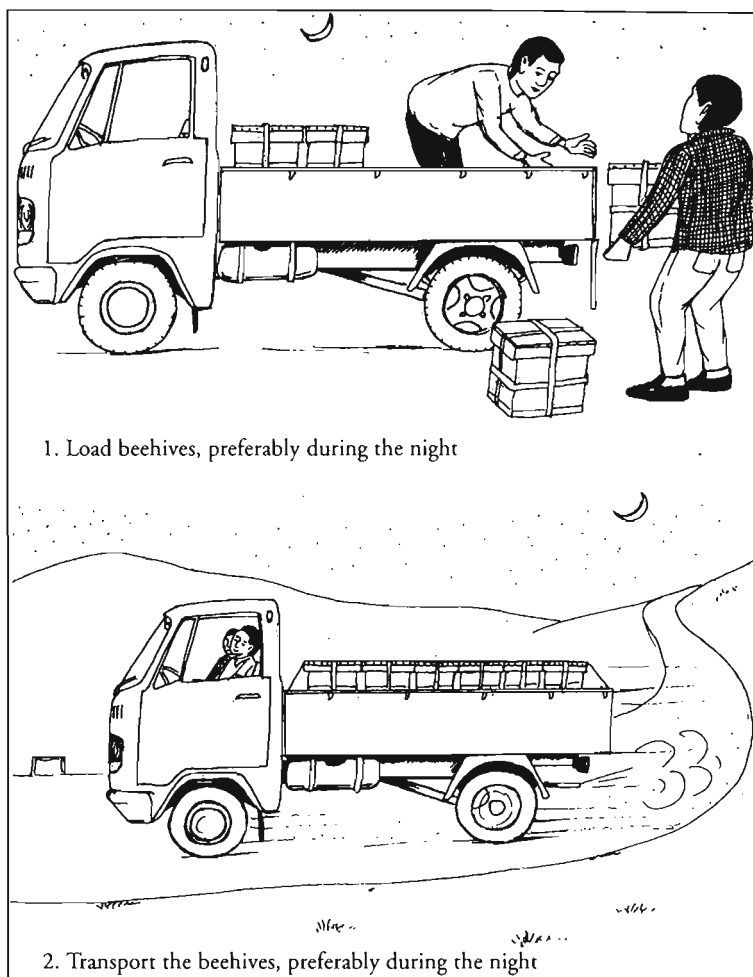


Figure 4.11: Different steps in the outer packing of the beehives.



*Figure 4.12: Loading and transporting beehives*

Prevent overheating of hives during transportation. This can happen while transporting colonies from warmer areas and may cause many bees, or sometimes the whole colony, to die. To prevent overheating, unload hives and open the lid above the ventilation screen (Figure 4.13) and then continue the journey. Do not close the hives for more than 24 hours.

### **How are bee colonies obtained for pollination?**

Crop growers can obtain bee colonies for pollination of their crops from either local beekeepers or the governmental



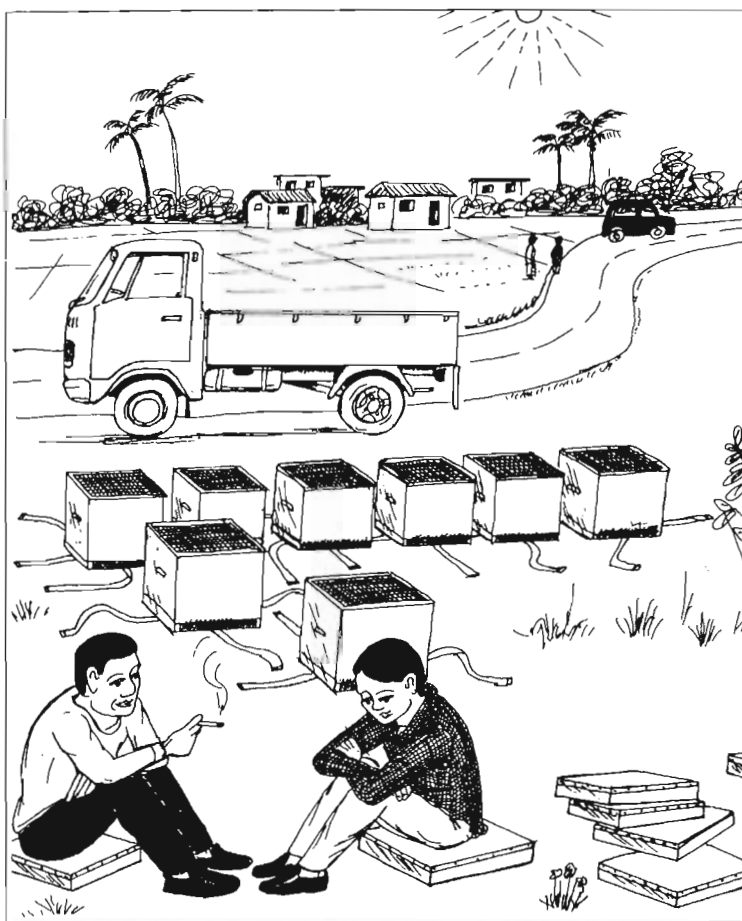


Figure 4.13: Overheating of bee colonies (while transporting in warmer areas) can be prevented by unloading the colonies and opening the ventilation screens.

Beekeeping Departments. In some states of India and China, the government has created the institutional infrastructure to rear and manage large numbers of bee colonies and rent these to farmers. For example, in Himachal Pradesh in India, the Department of Horticulture rents bee colonies to farmers for apple pollination. In China, the government promotes beekeeping for crop pollination by encouraging farmers to rent bee colonies for the pollination of their crops and by educating them to protect bees from pesticide poisoning. It is important to rent only strong and healthy bee colonies, because weak and diseased colonies are of little value for

crop pollination, especially of crops that bloom during early spring when cold weather is often encountered in mountain areas.