

Importance of honey bees in pollination of horticultural crops

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Pollination means transfer of pollen from the male part of the flower, the *anthers*, to the receptive female part, the *stigma* for fertilisation and sexual reproduction. It is one of the most important feature in fruit production. Many types of commonly grown fruit require pollination in order to bear good marketable produces because fruit trees carry thousands of flowers, but unless there is adequate pollination, little or no fruit will be produced. For good, well shaped and higher fruit set, flower should get the right pollen to the right place at the right time. Pollination not only provides a good yield of fruits, berries or seeds, it may also give a better quality of produce which fits well in international markets and the efficient pollination of flowers may also serve to protect the crops against pests. For example, an apple will develop all the 10 seeds inside if it is pollinated by bees and fully fertilized apple with 10 seed will have good shape and appeals well for export. Similarly, strawberry needs about 21 visits of bees for complete development, a single strawberry can have 400-500 seeds sitting on the surface of one berry. The higher number of seeds developing fully, the bigger and more even shaped the berry will be.

Pollination happens in two ways *viz.*, abiotic and biotic. Abiotic pollination doesn't involve any living organisms, it happens by wind. Biotic pollination happens by the transfer of pollen by living organisms, it is the most common form of

pollination and 3/4th all flowering plants are pollinated by living organisms like birds and insects. Among birds and insects, > 95 % of the flowers is pollinated by insects especially honey bees.

Insect pollination is a symbiotic process, providing benefits for both insect and plant. Insects provide pollination service and plants provide food to insects, primarily nectar and pollen during foraging. Nectar is a solution of sugars mixed with mineral nutrients and fragrances and is usually located at the flower's base and pollen is rich in protein and a potential food source for many pollinators.

Why honey bees often are the most important crop pollinators?

The effectiveness of honey bees is due to their high number, their social life and their ability to pollinate a broad variety of different flowers. A colony can consist of 20-80 thousand bees, and they will normally be visiting flowers over a distance of two kilometres when they are collecting pollen and nectar. If they are not getting food, they can fly even seven kilometres. A normal *Apis mellifera* honey bee colony will make up to four million flights a year, where about 100 flowers are visited in each flight. The honey bee's pollination effectiveness also arises from the fidelity to flowers of one species. Scout bees communicate to other bees in the colony which species to visit,

and even give small tastes of nectar and scent from that flower.

What is the economic value of pollination?

The value of bee pollination in Western Europe is estimated to be 30-50 times the value of honey and wax harvests in this region. In Africa, bee pollination is sometimes estimated to be 100 times the value of the honey harvest, depending on the type of crop and in Western Europe pollination is estimated to be 30-50 times the value of honey and wax harvests in this region. The economic value of pollination worldwide may be as high as \$ 90 billion and the monetary value of pollination for the Indian crops is given below in the table 1.

How many colonies are preferred for good yield?

A most important things lies in farmers mind is when and how many colonies are necessary to ensure good pollination of their crops? But this is a quite subjective question to answer because pollination studies are poor and their ecosystem services are not established and also the other heterogeneous factors like bloom periods, bloom density, bloom attractiveness, blossom structure, competing bloom and weather determine how well honey bees will forage and pollinate a given crop which is quite difficult to measure quantitatively. The number of hives also depends on the quality and working strength of individual colonies.

Timing for using pollinators?

It is important that hives can be moved quickly to a crop that is ready for pollination. Move hives into the crop after 5 to 10 % flowering has already begun. If you move them in advance you give bees a

chance to forage on another non-target plant. As the bees shows high fidelity, once bees are trained/started visiting other flowers, they will not come back till the depletion of food and ignore the crop when it blooms. Growers can also spray chemical attractants contain synthetic queen pheromone or components of Nasonov pheromone, a chemical bees use to orient to nest sites, to increase the number of bees visiting their crops.

Conclusion: Globally bee are more and abundant compared to any other pollinators, it is estimated that one third of the food we eat each day depends on pollination by bees, most of the domestic and imported/exported commercial crops rely on pollination. Examples include almonds, avocados, blueberries, cucumber, citrus, soybeans, asparagus, broccoli, celery, Cherries, kiwi, peaches, squash, sunflowers and melons. So in order to get better bee ecosystem services, to increase food production and doubling the farmers income by pollination and commercial bee keeping for honey and other bee hive products, we need to make efforts to save them by providing friendly habitat and safe ecosystem along with creating awareness and campaign on their importance.

References:

Chaudhary O P, Chand R. 2017. Economic benefits of animal pollination to Indian agriculture. Indian Journal of Agricultural Sciences 87(9): 1117-1138.

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Table 1. Monetary value of pollination for the Indian crops

Sl. No.	Crops	Economic value (INR/Crore)	Economic value (%)
1	Rapeseed and mustard	19355	--
2	Oilseeds	43993	34
3.	Fruits	17095	14
4.	Vegetables	19498	11
5.	Fibers (mainly cotton)	17290	23
6.	Condiments and spices	10109	25

Source: Chaudhary and Chand, 2017

Table 2. The average numbers of hives employed per acre for pollination in some important crops are listed below.

Sl. No,	Crops	Hives per ha	Crops	Hives per ha
FRUIT CROPS			VEGETABLE CROPS	
1.	Apple	4	Bean (Lima)	3
2.	Almond	12	Cabbage	5
3.	Apricot	2	Brassica (canola, oilseed rape)	5
4.	Avocado	5	Carrot seed	8
5.	Blackberry	7	Cucumber	7
6.	Blueberry	8	Eggplant	3
7.	Citrus	2	Gourds	4
8.	Kiwifruit	8	Melon	7
9.	Mandarin	4	Onion seed	17
10	Mango	15	Pumpkin, squash, gourd	4
11	Watermelom	5		
12	Peach and nectarine	2		
13	Pear	4		
14	Strawberry	8		

* Number of colonies refers to colonies of *Apis mellifera* and number of recommended hives per ha depends on the attractiveness of the crop to bees, number of wild bees, number of competing weeds, strength and location of bee hives, weather and the grower's experience. Generally, anything that affects/hinder pollination efficiency invites more colonies per acre to compensate.