

Pollination as a Factor Controlling Crop Productivity

The Natural Ecological Process

Pollination of crops is essential for crop productivity and without it crop yields can be difficult to maintain. The process involves proper floral pollination of crops leading to fertilization to form future fruits and seeds. Pollination ensures the transfer of pollen grains from the anther to the stigma of (i) same flower (self-pollination) or (ii) another flower of the same plant species (cross-pollination). Pollination is a prerequisite for fertilization which is the union of the male nucleus of pollen grain with the female nucleus of the ovule. Fertilization is essential for seed and fruit development. Pollination is, therefore, the most crucial factor and process in the production of seeds and fruits; if there is no pollination, no seeds and fruits will be produced by the crops.

The process is vital for completing the life cycle of plants and ensuring better crop yields; whether for grain crops, seeds, or fruits. It is based on the ecological principle of species' interrelationship and interaction, known as 'protocooperation', between natural pollinating agents, largely insect species, and the crop plants.

Most crops are actually self-sterile and require cross-pollination to produce seeds (Free 1993; McGregor 1976). Moreover, it is not only self-sterile varieties that benefit from cross-pollination, but self-fertile varieties also produce more and better quality seeds if they are cross-pollinated (Free 1993). While other agronomic practices, such as use of manure, fertilizers, pesticides, and irrigation are important, without cross-pollination of the flowers by natural insect pollinators, such as different species of wild bees, flies, beetles and moths, and so on, crops remain underexploited.

The Need for Managed Crop Pollination

Inherent problems and limitations in the natural pollination system are more evident in mountain areas. The first problem is that, although the natural pollinating agents, largely insect species, play an important role in the pollination of various summer crops grown in the mountain and hill climates, these pollinating agents cannot be useful to mountain farmers for pollinating the crops that

flower during winter and spring; for instance, vegetables such as cauliflowers, cabbages, radishes, broad-leaved mustard, and fruit crops such as apples, peaches, plums, and pears. This is because these pollinating agents are absent during this period and also, since these insects cannot be domesticated, it is not possible to use them in managing crop pollination.

The second problem is the declining population of natural insect pollinators; and among the reasons for this could be the decline in habitat, with the accompanying decrease in food supplies, and negative impacts of modern agricultural interventions, e.g., use of chemical fertilizers and pesticides which are toxic for many species (Deodikar and Suryanarayana 1977; Verma 1990; Verma and Partap 1993). One indicator of the decline in natural insect pollinators is decreasing crop yields, despite necessary farm inputs. For example, in the North West Frontier Province (NWFP), despite agronomic inputs, there has been a decline in fruit yields over the last few years (personal communication, AKRSP). Declining trends in apple production in Himachal Pradesh are now recognised to be due to lack of pollinating agents.

The third problem is related to the increase in crop areas requiring pollination by a limited population of natural pollinators. So far, natural pollinating agents have been sufficient for local subsistence farming systems and also for limited areas under introduced crop species. However, with an increase in cash crop farming and larger areas of crops that require cross-pollination, a shortage of pollinators will ensue. The adverse impacts of these changed cropping systems on productivity can well be imagined.

Any one of the above three reasons has the potential to hinder pollination. The threat also emphasises the need for more research and development into crop pollination. Unfortunately, there are few institutions, especially in mountain areas, devoted to research on crop pollination and productivity. Policy-makers, planners, researchers, and extension workers should be made aware of the importance of promoting management of crop pollination in strategies for maintaining agricultural production.