

Productivity Management Options for Mountain Farmers

For mountain farmers, the most desired goal in crop farming is to get the maximum possible crop yields under constrained input conditions and ecological settings. For this purpose, farmers also try to improve the quality of the produce, particularly fruits and seeds produced for the market. It is particularly important to get a premium price for the produce when farmers are engaged in cash crop farming. In addition, using better quality seeds always helps to ensure a healthier crop harvest.

There are two well-known methods for improving crop productivity. The first method is the use of improved agronomic/culturable methods. The culturable/agronomic methods include plant husbandry techniques such as the use of good quality seeds and practices to improve yields, e.g., providing good irrigation, organic manure, and inorganic fertilizers and pesticides. The second crop productivity method includes the use of biotechnological techniques, e.g., manipulating the rate of photosynthesis and incorporating biological nitrogen-fixing techniques, genetic engineering, and so on. While these conventional techniques ensure a healthy growth of crop plants, these work only up to a limit. At some stage, crop productivity might even become stagnant or decline with additional inputs, since the known agronomic potentials of the crop will have been harnessed.

The third and less known method of increasing crop productivity is through managing pollination of crops using friendly insects, which, in the process of searching for food, perform a useful service to farmers. Pollination is an ecological process based on the principle of mutual interactions or relationships between crop plants and insect species.

The impact of cross-pollination on crop productivity definitely depends on the extent to which the crop can be pollinated. Therefore, if crop pollination is managed so that each flower is pollinated, a new dimension will be added to increase harvests and improve quality. This unique ecological option requires no inputs apart from the management of friendly insects, e.g., honeybees.

Traditionally, honeybees are used in various ways by mountain farmers; primarily for honey and other hive products that are used as foods and medicines, some of which bring in cash. Bees also play a role in maintaining the productivity of various agricultural and horticultural crops through crop pollination. The significance of this aspect of beekeeping to agricultural productivity has not been fully appreciated. With increasing emphasis on commercialisation of mountain agriculture, mostly through cross-pollinated crops, i.e., fruit or vegetable crops (Tables 1 and 2), crop pollination should become a priority area for R&D, if the productivity of mountain agriculture is to be maintained.

The Mountain Farming Systems' Programme at ICIMOD has been working on various aspects of honeybees and crop pollination in the HKH Region for the last

Table 1: Vegetable Production in the Hindu Kush-Himalayan Region

Country	Area ('000 ha)	Production ('000 tons)	Estimated Annual Seed Requirement (tons)
Indian Himalayas ¹	318.1	1354.4	1200
Nepal ²	140	741.6	500
Pakistan ³	282.9	1418.8	2312.5
Bhutan ⁴	1.8	-	10
China (Himalayan-Hengduan Region) ⁵	14.5	26.3	60

Source: ¹Singh 1993; ²Gurung 1993; ³Alam 1993; ⁴Wangchuk 1993; ⁵Du et al. 1993

Table 2: Fruit Production in the Hindu Kush-Himalayan Region

Country	Apples		Other Temperate Fruits	
	Area ('000 ha)	Production (000 tonnes)	Area (000 ha)	Production ('000 tonnes)
Indian Himalayas ¹	203	1052	530	1595
Nepal ²	5	50	46.2	293
Bhutan ³	1.5	87.7	.13	-
Pakistan (NWFP) ⁴	17.4	166	29.8	252
China (Himalayan-Hengduan Mountain Region) ⁵	-	24.2	1.4	21.5

Source: ¹Singh 1993; ²Gurung 1993; ³Wangchuk 1993; ⁴Alam 1993; ⁵Du et al. 1993

six years with the objective of improving the knowledge in and increasing institutional focus on these topics. This work has resulted in unique information about both Himalayan honeybees (*Apis cerana*) and crop pollination in mountain areas. The purpose of this discussion paper is to share this knowledge and create more awareness on this lesser known dimension in increasing crop productivity. It reviews the role of honeybees in increasing crop yields and improving the quality of various crops. This paper analyses the need for bee pollination in the light of the agricultural transformation that is taking place in the HKH Region and which is documented in the research carried out by the Mountain Farming Systems' Programme.

Furthermore, the paper discusses issues related to the comparative benefits of native and European bees, an outcome of the ICIMOD project on 'The Promotion and Development of Beekeeping through the Preservation of the Indigenous Asian Honeybee, *Apis cerana*'. The final section outlines challenges for promoting managed crop pollination. Promoting complementarity between the indigenous Asian honeybee species, *A. cerana*, and the European species, *Apis mellifera*, as pollinators is recommended for effective use of both species. While use of *A. cerana* could be promoted in the high hills, *A. mellifera*, which has already been introduced in the low hill areas, could be used for both crop pollination and honey production.