Enhancing Apple Productivity through Using Pollination Services of Honeybees: A Case Study from Himachal Pradesh, India

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Mountain Peoples' Livelihood Scenario

- Agriculture – the basis of livelihoods of over 80% of the rural population in the Himalayan region
- As many as 90% of the farmers are marginal or small - cultivating less than one ha of land each
- Agricultural land resources - marginal and quality deteriorating
- Many families facing food shortages - Necessary to explore ways to increase productivity and carrying capacity of these marginal farming systems
- Cannot be done by emphasizing the cultivation of cereal crops alone
- Agro-climatic conditions offer comparative advantage in cultivation of cash crops and other high value products

The Process of Agricultural Diversification

- Focus of agriculture shifting from traditional food crops to cash crops' farming
- Cultivation of fruit and vegetable crops increasing in several pocket areas
- Apple emerged as a lead cash crop
- The challenge now is to maintain or improve the productivity of these crops

Apple Farming in HKH Region

- Apple planted in 140 districts
- Apple orchards spread across 370,000 ha
- Annual production about 2.3 million tons
- Apple value about 500 million US$

Apple Farming in Himachal Pradesh, India

- A small province in northwestern Indian Himalayas
- Called as 'Fruit State' or 'Apple State' of India
- Out of 614,000 ha of total arable land about 196,000 ha (32%) is under fruit farming
- The State produces around 312,000 tonnes of fruit every year
- Apple accounts for 42% of total area under fruit
- Over 78,000 ha under apple farming
- More than 150,000 farmers engaged in apple farming producing about 227,000 tonnes of apple every year

Contribution of Apple in State Economy

- Apple playing a major role in State economy
- Its contribution to economy at present is estimated to be around rupees 7,000 crores (US$ 1.7 billion) per year (rupees 675-800 crores (US$ 150-170) direct contribution and rupees 6,500 crores (US$ 1.5 billion) indirect)
- Playing a major role in enhancing food security through creating employment and income generating opportunities for farmers/ orchardists and a number of other people associated with apple farming
- Provides employment to thousands of people in Himachal as well outside

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Apple Productivity Concerns of the Himachal Farmers

- Apple productivity low as compared to horticulturally advanced countries
- Farmers reported apple productivity started declining during late 1980s
- Farmers guess productivity declined by over 50 per cent by early 1990s
- Inadequate pollination one of the important reasons for this productivity decline

Factors of Inadequate Pollination in Apple Crop

- Lack of appropriate polliniser proportion - 7-10% (standard requirement about 33%)
- Lack of pollinators –pollinator population declining due to:
  - Excessive and indiscriminate use of pesticides
  - Increase in cultivated area by cultivating forest and grass lands resulting in loss of food and nesting sites of natural insect pollinators
  - Increase in cultivation of cross pollinated varieties
- Weather factors – unfavourable weather conditions (due to global climate change)
  - Rains during flowering wash away pollen grains
  - Hailstorm during flowering damages flowers
  - Low temperature during flowering affects the activities of pollinating insects
  - Occurrence of frost during flowering affects pollination and fruit set

Farmers Management Practices to Enhance Pollination: Increasing Polliniser Proportion

1. Planting pollinisers
   Farmers started planting polliniser to increase polliniser proportion in their orchards
2. Grafting polliniser
   Since newly planted polliniser trees take three to four years to produce flowers some farmers have grafted polliniser on commercial varieties
3. Using polliniser bouquets
   As a short term solution to manage polliniser farmers are practicing what is called as 'Bouquet Pollination'

Supplementing Insect Pollinators: Using honeybees for pollination

- Farmers are using honeybee colonies for apple pollination, because:
- Honeybees are known to enhance yield and quality in several crops and other plants through their pollination services
- Most efficient pollinators of agricultural/ horticultural crops
- Are manageable insects
- Can be managed in sufficient number and transported to fields where and when required
- Farmers are renting colonies of both Apis cerana and Apis mellifera from private beekeepers
- Some are keeping their own colonies for the purpose
- Fees for renting bee colonies is rupees 500 per colony for one apple flowering season that lasts for 10-15 days
- Managed pollination coming up as a new and more rewarding enterprise for beekeepers
- A number of pollination entrepreneurs are coming up in the area
- Beekeepers bring their colonies to the area in apple flowering season and earn a lot of money
- Farmers benefit from pollination services and get higher yield and better quality fruit as a result of honeybee pollination of their crop

Issues in using honeybees for pollination

- Demand for bee colonies for pollination is increasing with increase in awareness about the role of honeybees in pollination
- At present demand for colonies is much more than the number of colonies available for pollination
- Himachal requires over 200,000 bee colonies for pollination of only apples planted on over 78,000 hectares but the actual number of colonies available for pollination is a few thousand

Institutional Efforts in Promoting Beekeeping for Apple Pollination

1. University of Horticulture and Forestry

- Strong scientific expertise
- University field stations in apple areas
- On-farm field research and demonstration programmes on use of beekeeping for pollination
- Training on how to use honeybees for apple pollination

2. Role of Department of Horticulture

- Set up BKDO which maintains and rents bees for apple pollination
- Assesses demand for bee colonies and makes supply arrangement with private beekeepers
- Provides attractive financial support for starting bee enterprise
- Provides bee colonies at subsidized price to promote their use for pollination

3. Fruit Growers' Association

- Provides platform for discussing problems
- Acts as a strong pressure group to seek government intervention
- Raised apple pollination problem with University and Department of Horticulture
- Raised awareness about the problem and encouraged farmers to rear honeybees for pollination

Conclusion

- Horticulture is playing a very important role in enhancing food security through generating income and employment in mountain areas
- Maintaining yield and quality of horticultural crops is a challenge
- Pollination is a limiting factor of crop productivity and remains the missing dimension of apple productivity in many areas of the developing countries
- It is not only apple but there are other crops where pollination management is important, e.g. vegetable seed production
- Beekeeping plays a crucial role in enhancing yield and quality of fruit/ seed through pollination services of honeybees
- Best solution is to promote beekeeping for pollination. For this, there is need to change the focus of beekeeping from honey production to crop pollination