

Synergic impact of beekeeping

on crop production and income in Chambal region of Madhya Pradesh

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Bee keeping, a non-land based income generating agribusiness, is emerging as an important component for integrated rural development and off-farm employment. Observations revealed that the extraction of honey varied from 6 to 64 kg/ha from flowering period of crops, fruit and forest plants. The maximum honey extract came from mustard crop (64 kg/ha) followed by coriander (40 kg/ha) and least with sesame crop (6 kg/ha). The honey bees as pollinators increased the yield of crops by 3.3-31.2% compared to the yield without bee keeping fields. Among various crops, the additional income from honey was maximum (₹ 6,400/ha) with mustard and lowest (₹ 660/ha) with sesame. Like-wise, overall (yield of honey and crops) maximum additional income ₹ 21,900/ha was obtained from mustard and least with sesame (₹ 8,260/ha). Bee keeping is a low investment and high income generating business. Bee keeping also provides employment to rural people and arrest migration towards cities, besides enhancing income and employment for businessmen and manufacturers of bee keeping rearing equipments.

Key words: Bee keeping, Crops, Economic impact, Honey production, Pollinators

MORENA, Sheopur and Bhind district of Madhya Pradesh collectively belongs to Chambal division. The land of Chambal division is highly degraded as out of total geographical area of 16.054 lakh ha, the net sown area is 7.52 lakh ha and area under ravines is 3.11 lakh ha. Out of total geographical area, 1.826 lakh ha ravine land is in Chambal division. Unemployment of rural youth is very common in Chambal division. The region is enriched with abundant flora of sesame, green gram, black gram, pearl millet, mustard, short duration pigeon pea, ajwain, coriander, mustard + berseem in relay cropping during the month of August to April. Rest of the months, the flora of forest plant such as adusa (*Adhatoda vasca*), kher (*Acacia catechu*), sahanjan (*Moringa oleifera*), etc. in ravinous waste land flourishes. In summer, sunflower, cucurbits, maize and pearl millet are cultivated in adjoining

district (Table 1). Honey bee is the most important agent of cross pollination. Instead of making substantial use of chemical fertilizers, irrigation, etc., for yield enhancement to feed increasing population, a shift towards biologically based agriculture will become necessary to increase crop productivity. Bee keeping generates agri-based self employment in rural areas, high quality and

nutritious food and higher yield from crops, cucurbits, etc., increasing crop intensity and honey to improve the socioeconomic status of the farmers. The present article promotes beekeeping where the use of honeybee help in crop pollination and marketing of hive products like honey and other products to improve the economic status of farmers and farm women.

Table 1. Crops/trees of the region depend on bees for pollination

Categories	Name of crops
Vegetables	Cucumber, Bottle guard, Ridge gourd, Radish, Onion, Pumpkin, Brinjal, Tomato, Chilli etc.
Oilseed	Mustard, Toria, Sesame, Safflower, Linseed, Sunflower etc.
Pulse	Pigeon pea, Green gram, Field pea, Cluster bean etc.
Fruit etc.	<i>Psidium guajava</i> , <i>Punica granatum</i> , <i>Syzygium cumini</i> , <i>Citrus limon</i>
Forage legume	<i>Trifolium alexandrinum</i>
Forest plants	<i>Dalbergia sissoo</i> , <i>Acacia nilotica</i> , <i>Prosopis juliflora</i> , <i>Azadirachta indica</i> , <i>Eucalyptus globulus</i> , <i>Tectona grandis</i> , <i>Senegalia catechu</i> , <i>Moringa oleifera</i> , <i>Adhatoda vasca</i> etc.
Flowers	Marigold, Gaillardia, Calendula, Gladiolus, Rose etc.

Awareness building and promotion

Initially the centre had taken first step for motivating farmers for bee keeping programme during 2016 and selected 25 rural youth for intensive training on bee keeping and management for improving their economic status under FFP project. The response of the training was very much overwhelming and encouraging, the 5 group (each of 5 rural youth) started bee keeping with 10 bee colonies of each group in participatory mode under project. The frequent visit of the scientists to bee keepers and constant interaction encouraged the bee keepers and consequently the number of bee keepers in the adopted villages and also in adjoining areas increased very fast.

With the constant encouragement to beekeepers and special efforts made by the scientist of the centre, the production of honey reached up to 60 kg/colony during the crop session. The awareness camps, sangosthi and trainings were organized regularly under FFP project of selected villages and 220 unemployed rural youth were trained from 2017 to 2019. In addition to trainings, World honey bee day was also organized. The exposure of all aspects of bee keeping covered during training in the apiary sites.

Impact on honey production and income

One group of bee keepers having 10 bee colonies earned annual income of ₹ 40,000 during 1st year. During second year, the number of bee colony were doubled and annual income rose approximately ₹ 1.0 lakh/year/group. The 25 rural youth are directly associated with bee

keeping under the project. About 3.0 tonnes of honey worth ₹ 2.5 lakh/year during 1st year and during 2nd year it was 6.4 tonne of honey worth ₹ 5.8 lakh/year was produced, respectively, under adopted village of FFP project.

Indirect impact of bee keeping on production

Among insects visiting on crop inflorescence, the honey bees (*Apis mellifera*) are the dominant. Honey bee visit flowers for collection of both nectar and pollen which in turn results in to florets getting cross pollinated. Bee keeping has also contributed to enhanced production and productivity of crops. Honey bees as pollinators increased the quality and yield of crops by 3.3 to 31.2% compared to without bee keeping. In addition to increase in yield and quality, 6 to 64 kg honey/ha from crops was also obtained from 1 to 4 cycles of honey extraction. Similarly, 10 kg honey/ha extract from *A. nilotica* from one cycle of

honey extraction.

Indirect impact of bee keeping on income

The role of honey bees in enhancement of income has been widely documented. The data on expenditure on bee keeping varied from ₹ 380 to 600/ha/crop and maximum investments were on bee keeping during off-season of flora (summer). The income from sale of honey varied from ₹ 660 to 6400/ha, whereas additional income from crops varied from ₹ 1400 to 19,000/ha (Table 3). The maximum income from pigeon pea (₹ 19,000/ha) followed by mustard (₹ 16,000/ha) and minimum with summer pearl millet (₹ 1,400/ha). It was also seen that the pearl millet crop gives only pollen. The net income from direct and indirect (production of honey and crop) varied from ₹ 8,600 to 22,400/ha. The maximum total net income was obtained from mustard (₹ 22,400/ha) followed by pigeon pea (₹ 20,800/ha), ajwain (₹ 14200/ha), coriander

Table 3. Direct and indirect impact of bee keeping and insect pollinators on economics (Information collected on the basis of survey of 25 beneficiaries)

Crop	Expenditure on bee keeping (₹/ha)	Income from honey (₹/ha)	Additional income from crop (₹/ha)	Total income (₹/ha)	Net income (₹/ha)
Mustard	480-500	6400	16000	22400	21900
Coriander	400-420	4100	8500	12600	12180
<i>A. nilotica</i>	400-420	1100	-	1100	700
Berseem	390-410	2100	10000	12100	11700
Summer crops*	580-600	-	1400	1400	800
Sesame	380-400	660	8000	8600	8260
Pigeon pea	400-420	1880	19000	20880	20460
Ajwain	400-420	2200	12000	14200	13800

*Summer pearl millet and vegetable crops. Local market rate of honey of mustard flora is ₹ 100/kg and other flora is ₹ 110/kg. Calculate income from mustard, pearl millet, pigeon pea at MSP, while sesame ₹ 80000/t, coriander ₹ 50000/t, berseem ₹ 100000/t and ajwain is ₹ 120000/t in local market.

Table 2. Direct and indirect round the year impact of bee keeping and insect pollinators on production

Crop	Month	Floral period (days)	Crop yield (t/ha)		Yield enhancement with bee keeping (%)	No. of bee boxes/ha	Honey extract cycle (no)	Honey production (kg/ha)
			Without bee keeping	With bee keeping				
Mustard	Dec.-Jan.	55-60	1.5	1.9	26.7	05	04	64
Coriander	Feb.	25-30	1.2	1.4	16.7	04	01-02	40
<i>A. nilotica</i>	March	20-30	-	-	-	04	01	10
Berseem	April	20-25	0.7	0.8	14.3	05	01-02	10
Summer Pearl millet	May to July	20-30	3.0	3.1	3.3	04	-	-
Summer vegetable	April to July	30-60	-	-	-	04	01	12
Sesame	Sept.	15-20	0.6	0.7	16.7	04	01	06
Pigeon pea	Oct.	15-20	1.6	2.1	31.2	04	01	08
Ajwain	Nov.	20-30	0.5	0.6	20.0	04	02-03	20

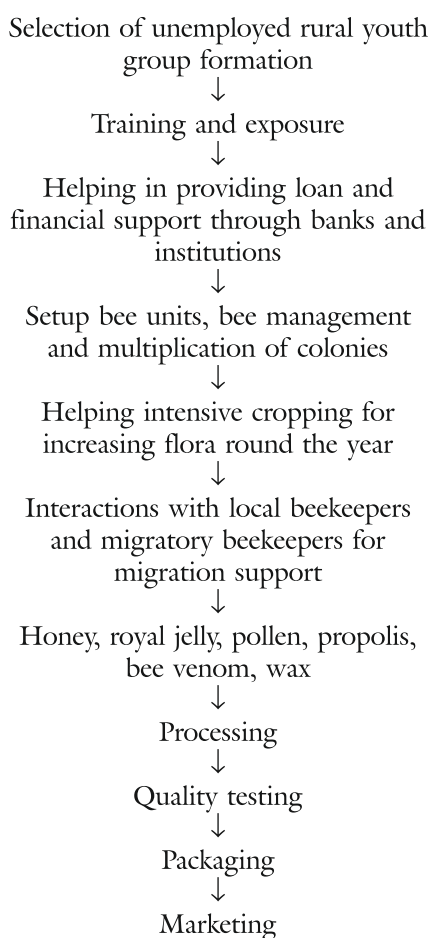
(₹ 12,600/ha) and minimum with sesame (₹ 8,600/ha) crop.

Marketing of honey

The marketing of honey was facilitated by developing one marketing group of rural youth with the name Raj Vijay and linkage with University and Mahatma Gandhi Seva Ashram, Morena. Presently one group of rural youth is working for processing, packaging and marketing with technical support of FFP project staff.

Steps for promotion of bee keeping

The promoting bee keeping for higher income and employment the following steps are as given below.



Environmental benefits

The FFP staff also promote for use of organic insect or pesticides by bee keepers and farmers'. The cropping intensity also increased due requirement of round the year availability of flora helping carbon sequestration. The bees are



Bee keeping on mustard field

environmentally friendly and generates income without destroying habitat. The beekeeping also encourages the maintenance of biodiversity.

Economic and social impact

Among the insect visiting on crop inflorescence, the honey bees (*Apis mellifera*) are the dominant visitors than any other insects. Honey bee visit flowers for collection of both nectar and pollen which, in turn results increase in pollination. The information on the role of honey bees in pollination, which leads to increase in the quality and yield of crops, has been widely documented. The self or cross pollinated crops honey bees are very attractive insect. The beekeeping also played significant role for enhancing the productivity of crops through better pollination. Farmers received higher yield with extra benefit through production of honey and related products (royal jelly, pollen, propolis, bee venom, wax), and bee hives marketing. For enlargement of floral period, the introduction of short duration variety of pigeon pea and berseem crop for fodder and seed production under FFP project, therefore floral availability for honey bee have increased from September to April. Increase in pigeon pea production in the areas where beekeeping practice was adopted was observed. Beekeeping is a simple business which requires less investment and

technical skill and provides good income due to increasing demand of good quality honey in domestic and international market. Beekeepers of FFP project are an example and role model for unemployed rural youth for our Country. To cope up with increasing demand of pulses and oil seeds, pollination has to be increased for receiving higher yield. Hence there is a bright future of beekeeping by increasing spread of insect pollination in India.

SUMMARY

The bee keeping practices can promote sustainable development of farmers by production of honey and related products as well as increasing crop productivity due to increasing pollination by honey bees. The honey bees are important and efficient pollinators of crops. Beekeeping is a simple business which requires less investment and technical skill and provides good income due to increasing demand of good quality honey in domestic and international market. Bee keeping requires fewer investments and provides good income. Therefore beekeeping has lot of chances to reduce poverty and arrest migration from rural areas by adoption of beekeeping alone or along with agriculture.

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