Beekeeping development using value chain approach in Fogera district: Experiences from IPMS project interventions

Tilahun Gebey, Kahsay Berhe and Dirk Hoekstra

March 2010
Table of contents

Acknowledgements iii
Abstract iv

1. Introduction 1

2. Methods and approaches 1
   2.1. Baseline information 2
   2.2. Documenting change processes and results 2

3. Background to apiculture commodity development 3
   3.1. PLW Description 3
   3.2. History and diagnosis of apiculture development 5

4. The value chain development interventions 5
   4.1. Extension service interventions 5
   4.2. Input supply/service interventions 7
      4.2.1. Supply of hives 7
      4.2.2. Supply of accessories 8
      4.2.3. Bee colony supply 8
      4.2.4. Beeswax 8
   4.3. Production interventions 8
      4.3.1. Hive inspection 9
      4.3.2. Hive harvesting 9
      4.3.3. Bee forage development 9
   4.4. Output Marketing 11

5. Results and discussion 11
   5.1. Production/productivity/income 15
   5.2. Marketing and input supply 14
   5.3. Other indirect benefits 14
   5.4. Institutional/organizational arrangements 14

6. Challenges in the intervention process 15
   6.1. Environmental threats 15
   6.2. Bee forage 16
   6.3. Honey processing 16
   6.4. Marketing 17

7. Lessons learned 17
   7.1. Training 17
   7.2. Approach/Technologies 17

8. References 18
Acknowledgements

This paper documents interventions, results and lessons learned for apiculture commodity development in Fogera district, based on a participatory market oriented value chain approach. The approach was introduced by the Improving Productivity and Market Success (IPMS) project/staff, who not only facilitated the introduction of the approach (technically and financially), but also played an important role as partner in the development process.

Besides the authors, several people contributed to the realization of the report including Dr Moti Jaleta, Tesfaye Lemma and Lemlem Aregu which facilitated the first group discussion and prepared the document that could serve as a model to the first draft by the Fogera PLW. Rebeka Amha/Abraham Getachew also who provided summarized of beekeeping activities baseline data, Dr Moti Jaleta who provided household level cost/benefit impact data, Yasin Getahun who provided maps and Genevieve Renard who edited the final version of this document.

Ato Yirgalem Asegid, the former Fogera district Research and Development Officer, who has in-depth understanding of the entire IPMS project vision at early stage of the project life and prepared fertile ground to achieve the project objective. His final report, included in this document, is highly appreciated. My gratitude is also extended to Ato Dessalew Kassa, the district IPMS Field Assistant, who was involved in data collection.

Finally, my deep appreciation also goes to Fogera district OoARD staff Zewudu Almaw and Kindu Nigatu, beekeeping experts who provided information to validate the data collected from the beekeepers and Worku Mulat, the Head of OoARD, who played a supportive role to realize various beekeeping field activities including data collection for this report.
Abstract

Ethiopia is a leading honey producer in Africa and one of the ten largest honey producing countries in the world. Despite the favorable agro-ecology for honey production and the number of bee colonies the country is endowed with, the level of honey production and productivity in the country is still low. The annual average honey production per hive is as low as 6-7kg. One of the prominent factors for this low honey productivity is traditional hive and lack of improved beekeeping management techniques.

With the aim of enhancing the level of honey production both in quantity and quality, the Improving Productivity and Market Success (IPMS) project introduced a participatory market oriented value chain development approach in Fogera and with a group of stakeholders worked on improving production, input supply and marketing. The project partners trained beekeepers on colony splitting, hive making and seasonal bee colony management practices. In addition, the project facilitated the establishment of beekeeping input supply shop and advised beehive producers (carpenters) on the proper design of top-bar and frame-type hives. The adoption rate of the improved beekeeping has been improved substantially after the skill development trainings and production of appropriate beehives in the district. The number of improved beehives adopted in the district increased from 200 in 2006 to 882 in 2009, following the 2007 and 2009 beekeeping training through technical and financial support of IPMS project.

Through the beekeeping technology transformation, the average annual honey productivity per hive has also increased from 7 to 13 kg by changing the hives from traditional to top-bar hives and frame hives. In addition to what has been achieved in enhancing the level of honey production, the technology transformation also improved honey quality substantially.

At present, productivity is at a level which leaves room for improvement. Challenges ahead will concern marketing of honey production as prices do not yet reflect the use of improved beehives. Accordingly, better linkages to appropriate markets, introduction to different markets for liquid honey, establish honeybee products marketing cooperatives still have to be investigated and/or developed.

From this intervention we have learned that the introduction of improved beekeeping technology and associated practices coupled with strengthening the involvement of other stakeholders along the value chain will enhance productivities of beekeeping business. Smallholders’ beekeepers household income maximized through honey and beeswax productivity increment per hive and input suppliers improved their income through selling of hives, top-bars, and other accessories as a result of the project intervention.

Key words: extension, honey, impact, smallholder, innovation systems
1. Introduction

The IPMS project, funded by the Canadian International Development Agency, was established to assist the Ministry of Agriculture and Rural Development in the transformation of smallholder farmers from a predominantly subsistence oriented agriculture to a more market (commercial) oriented agriculture.

The project adopted a ‘participatory market oriented commodity value chain development’ approach which is based on the concepts of innovation systems and value chains. Crucial elements in the approach are the focus on all the value chain components instead of only a production technology focus; the linking and capacitating of value chain partners and the assessment, and synthesis and sharing of knowledge among the partners.

The project introduced this approach in 10 Pilot Learning Woredas (PLW) in Ethiopia with the objective of testing/adopting the approach so that it can be promoted nationwide. An integral part of the approach is the identification of marketable commodities and the value chain constraints and interventions. This was accomplished through a participatory process in all PLWs.

This case study focuses on the development of apiculture in Fogera district with the objectives of documenting diagnostic results and value chain interventions, and providing evidence of concepts, challenges and lessons learned to be considered for scaling out.

Following the introductory section, the resulting sections are included. Section two deals with methods and approaches used in the study, while section three presents background information, including description of the PLW and the history and diagnosis of apiculture development. In section four value chain interventions - extension, production, input supply, marketing and credit issues are presented. Section five dwells on results and discussion on production/income, input supply/marketing, gender/environment/labour use, organizational and institutional aspects, while sections six and seven deal with challenges and lessons learned, respectively.

2. Methods and approaches

To start the development of a commodity, IPMS used a district level participatory market oriented value chain planning approach, aimed at identifying (i) main farming systems, (ii) potential marketable crop and livestock commodities at farming system level, (iii) constraints, potentials and interventions for each value chain component, and (iv) value chain stakeholder assessment with potential (new) roles and linkages. Different value chain stakeholders were involved and consulted in this planning exercise. Secondary biophysical and socio-economic data were collected, followed by open ended interviews with focus groups and key stakeholders. The results were presented in a stakeholder workshop in which priority marketable commodities were decided upon together with key intervention
areas and partners. This initial rapid assessment was followed by some more detailed studies on selected commodities. Such studies were conducted by partner institutions and/or students and or IPMS staff using formal surveys, interviews and observations.

To implement the program at Woreda, Peasant Association (PA) and community levels, the project facilitated different knowledge management and capacity development approaches and methods to stimulate the introduction of the value chain interventions by the actors concerned. The various value chain interventions are documented by the project staff in the six monthly progress reports and the annual Monitoring and Evaluation (M&E) reports.

To quantify the results from individual and/or combination of interventions, the project established a baseline and measured/documented changes. Several data sources were used to establish the baseline and to document changes and results.

2.1. Baseline information

To establish a baseline, data from a formal baseline study and data from some special diagnostic studies were used. The initial PRA study also contributed to the quantitative and qualitative baseline information.

Amongst others, the formal baseline study used PA level interviews and records to collect information on the number of beehives and the number of households involved in beekeeping. This information was used to compile district level information on apiculture development and households.

2.2. Documenting change processes and results

Several sources were used for regular documentation of change processes and results, including six monthly progress reports, annual M&E reports, MSc thesis research, records kept by the OoARD, personal observations and diaries.

In 2009, the project also developed a set of guidelines for the PLW staff to systematically collect relevant information for the case studies including history, changes in extension services, value chain interventions (production, input supply, marketing and credit), results, challenges and lessons learned. Part of the information was obtained from the previously mentioned baseline and other sources and specially arranged (i) key informant interviews, (ii) a commodity stakeholder workshop, and (iii) a household level survey (111 households, based on stratified random sampling).

The stakeholder meeting was organized to establish the evolution of the roles and linkages of the value chain actors.

The formal household survey conducted in 2009 obtained data from selected sample households in 11 PAs (Hagera Selam, Wojj, Alembir Zuria, Zeng, Woreta Zuria, Kedest Hanna, Kuhar Michael, Tihua Abua, Shena, Nabega,
Abua Kokit). The survey data consists of relevant production and marketing information on apiculture including number of hives, production costs and inputs use, level of production, and marketed surplus. In selecting the sample households, with the aim of getting some idea about the effect of the different interventions, a distinction was made between households who had adopted/benefited from the various interventions and households who did not. Adopters are farmers who own modern or transitional hives; and non-adopters own only traditional hives. In both sample groups, both wealth and gender criteria were considered to get a representative distribution of sample households.

Following the collection of all relevant information, a write-shop was organized to present information in a systematic manner. Drafts of the PLW specific commodity case studies were then reviewed by experts at the IPMS Head Quarter.

3. Background to apiculture commodity development

3.1. PLW Description

Fogera Woreda is one of the 106 Woredas of the Amhara Regional State found in South Gondar Zone (Figure 1). It is situated at 11058 latitude and 37041 longitude. Woreta is the capital of the Woreda and is found 625 Km from Addis Ababa and 55 Km from the Regional capital, Bahir Dar. Woreta and Alem Ber are two major towns in the Woreda. The Woreda is divided into 25 rural Peasant Associations (PAs) and 5 urban Kebeles.

The total land area of the Woreda is 117,405 ha. Flat land accounts for 76%, mountain and hills 11% and valley bottom 13%. Average land holding is about 1.4 ha with a minimum and maximum of 0.5 and 3.0 hectares respectively. The total human population of the Woreda is 233,529. The rural population is estimated at 206,717. The proportion of male and female population is almost similar in both rural and urban areas. The number of agricultural households is 42,746.

Fogera Woreda is endowed with diverse natural resource and can grow diverse annual and perennial crops. The Woreda is one of the eight Woredas bordering Lake Tana and has an estimated water body of 23,354 ha. The Woreda is classified as one of the surplus productive Woredas in the Region. Altitude ranges from 1774 to 2410 masl (meter above sea level) and is predominantly classified as Woina-Dega agroecology. Based on the existing digital data, mean annual rainfall is 1216.3 mm ranging from 1103 to 1336 mm. Belg (small rains) and Kremt (long rainy season) are the two cropping seasons. Farmers depend on Kremt season for crop production.

According to the Woreda Office of Agriculture, the dominant soil type in the Fogera plains is black clay soil (ferric vertisols), while the medium and high altitude areas are orthic Luvisols. There are two major rivers that are of great economic importance to the Woreda. These rivers are mainly used for
irrigating horticultural crops, mainly vegetables, during the dry season. Gumara River: passes through Fuafuat Gajera, Kinti Merewa, Abagunde Sendega, Aba Kiros, Bebek, Quahr Michiel, Shena Kidist Hanna, Wagatera and Guramba PAS. While, Reb River passes through Wetemb, Addis Betekerstian, Reb Gebriel, Debasie Fatra, Abana Kokit, Shaga, Naber and Shina PAS and ends into Lake Tana.

An interesting characteristic of Fogera district is the seasonal (rainy season) flooding of the PAs bordering Lake Tana as a result of the overflow of Lake Tana and the above mentioned rivers. These flooded areas are used for rice production during the rainy season.

Figure 1. Location of Fogera district and PAs
3.2. History and diagnosis of apiculture development

Ethiopia is a leading honey producer in Africa and one of the ten largest honey producing countries in the world. The current annual honey production of the country is estimated to be about 28,000 tons. Annual production of honey in the Amhara National Regional State is estimated to be 6,975 tons (CAAC 2003). This accounts for nearly 25 percent of the total honey production of the country. In Fogera district alone, the number of bee colonies in the traditional, Frame type and Top-bar hives are 20,413, 882 and 559 respectively and annual honey yield from the total hive is around 144 tons (OoARD, 2008).

Unlike other agricultural products, which have shorter shelf-life, honey and beeswax can be kept for longer period of time without quality deterioration until the price improves, thus making it less vulnerable to seasonal imbalances in supply and demand. Moreover, beekeeping as compared to other agricultural practices requires less energy, time and capital and does not need large and fertile land.

While a significant number of traditional hives were present in the Woreda in 2005, and despite the excessive push to diffuse the zander hive technology, only few farmers had attempted to adopt it in the PLW. Most failed, because of absence of queen excluders and wax and because of lack of consideration for available bees resources (Yirgalem Assigid, 2006).

Using the participatory value chain approach, introduced by IPMS, the project stakeholders identified lack of adequate skills on operating the modern hive and seasonal beekeeping management, shortage of input supply (hives, colonies) and deterioration of the number of bee colonies as important bottlenecks for the development of apiculture.

4. The value chain development interventions

Through technical and financial support of the project, different types of interventions were initiated. These are: skill training on bee colony multiplication through colony splitting, hive making and seasonal bee colony management techniques in modern and top-bar hive to beekeepers, beekeeping experts and Development agents (DAs). In addition, the project facilitated the establishment of beekeeping input supply shop and advised beehive producers (carpenters) on the proper design of top-bar and frame type hives.

4.1. Extension service interventions

Taking into consideration the failure of the initial introduction of the top-bar hives, a more inclusive approach with appropriate knowledge and skills development was taken. Farmers were targeted based on the availability of natural forests (for bee foraging) and water, their track record of innovative management, and number of traditional hives they have (to help as models).
Accordingly three farmers at Alem Ber PA, two farmers from Quhar Michael and Woreta zuria (one farmer each) were targeted by the Development Agents of the Woreda. And it was learnt that farmers were interested to try the action research if they got sufficient time (minimum of two years) to observe the advantages and disadvantages of the modern hives comparing against the traditional hives (Yirgalem Assiged, 2006).

To avoid the high input technology which requires sophisticated skill, the project started top-bar hive intervention for the first time through delivering training in 2006 to 45 beekeepers. Training focused on construction of the hives from locally available materials and preparing proper placement of the bee hives. The four who ranked first on proper apiary arrangement were rewarded with wooden made Kenyan top-bar. Based on the response of the trainees and discussion with OoARD, the following two training sessions were designed to be conducted during the subsequent years of the project life.

There was one session on bee colonies splitting (bee colonies multiplication) and another on improved beekeeping technologies transformations. Seventy five percent of these trainings were practical. They were supported by video show using mobile audio-video tools. Field days were also organized in farming training centers (FTC) apiary, to share and scale out knowledge and skills.

Training on bee colonies splitting was conducted for three days (Sept. 18-20, 2007) with farmers, development agents and experts who came from Fogera, Bure and Metema districts, totaling 58 participants (Table 1). The training was conducted in collaboration with Andassa Livestock Research Center. Based on the training, participatory action plans were formulated by the trainees. Following this practical training, a number of beekeepers split their colonies. The split colonies also transferred to production hives (large hive). See economic benefits under results section.

Table 1. Apiculture capacity building and knowledge management events at Fogera

<table>
<thead>
<tr>
<th>Date</th>
<th>Type of event</th>
<th>Public</th>
<th>Farmers/Private</th>
<th>Total Male</th>
<th>Total Female</th>
<th>Total partic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept. 2006</td>
<td>Training</td>
<td>5</td>
<td>45</td>
<td>50</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>Sept. 18-20, 2007</td>
<td>Training</td>
<td>10</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>58</td>
</tr>
<tr>
<td>Aug-31, 08</td>
<td>Field days</td>
<td>2</td>
<td>43</td>
<td>53</td>
<td>3</td>
<td>52</td>
</tr>
<tr>
<td>Nov. 26-Dec. 3, 08</td>
<td>Training</td>
<td>15</td>
<td>7</td>
<td>59</td>
<td>66</td>
<td>152</td>
</tr>
<tr>
<td>Sept. 19-23, 2009</td>
<td>Training</td>
<td>8</td>
<td>3</td>
<td>81</td>
<td>3</td>
<td>92</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>40</strong></td>
<td><strong>13</strong></td>
<td><strong>287</strong></td>
<td><strong>77</strong></td>
<td><strong>404</strong></td>
</tr>
</tbody>
</table>

Source:IPMS progress report.
Training on improved beekeeping technologies was facilitated for beekeepers (couples), DAs and beekeeping experts in collaboration with OoARD. Unlike the conventional types of training, this type of training improved the level of skills for husband and wife, leading to joint decision making in the household on beekeeping technologies adoption and acquiring box hives through credit. The main topics of the training were top-bar hive making from locally available material, bee colonies transfer from traditional to improved beehives, seasonal bee colony management, bee colonies splitting, honey harvesting and post harvest management, swarm control, bee colony management during dearth period and prerequisites concerning pesticide application in bees foraging territory to minimize massive field bees death. These trainings were conducted at five FTCs totaling 244 participants. At the end of each training session, a participatory action plan was formulated regarding the new skills acquired during the training (see details for the number of training programs).

4.2. Input supply/service interventions

4.2.1. Beehive and other beekeeping equipments

- Modern (or frame hives) and transitional hives (or top-bar) have been introduced extensively in the district for the last three years.

The modern moveable-frame hive maximizes honey production. It is a beekeeping system that allows for the interchanging of combs both within and between colonies whereas top-bar or transitional hives have a series of bars across the top which allow for attachment of the comb. These bars are spaced to give the bees sufficient room to build a comb centered on each bar and to leave a bee space between combs. Such hives can be constructed of many materials, including straw, bamboo, mud-plastered baskets, metal, or wood. (C. Gentry, 1982).

Modern hives are distributed through credit and/or cash whereas top-bar hives are constructed by beekeepers themselves who received the training provided by the project technical support. Though the regional government was subsidizing the beekeeping equipment in general, beekeepers were still complaining about the modern hive high prices. Recently though, the government subsidy has been completely canceled.

- Four local carpenters are also making top-bars for transitional hives and box hives. These carpenters are assisting the beekeepers in supply of top-bars and box hives. Top-bars transactions are made directly with the beekeepers, but for frame-type hives so far the arrangement was made through the WOARD.

- The cost of hive has been increased from 590 to 650 birr/hive for modern hive and 18 to 90 birr for top-bars from 2005 to 2009. One well manufactured frame hive can serve a minimum of 20 years whereas one top-bar hive (bars made by carpenters and body of the hive made by the beekeepers from locally available material) can serve up to 10 years.
4.2.2. Supply of accessories

- Along with the introduction of the modern hive, other beekeeping accessories like honey extractor and casting mould are distributed free of charge by the OoARD for demonstration purposes and usually kept in FTCs under the DAs custody.
- Two seasonal beekeeping equipment supply shops in the Woreta town were established by private individuals through awareness creation by the project. These suppliers are usually functioning from August to December. The main beekeeping equipment supplied by the shop are smokers, protective clothing, and water sprayers on cash basis.
- The source of money to purchase some beekeeping equipment like smoker, veils and top-bars are obtained from selling sheep and goats, vegetables and eucalyptus trees or other sources of animal products.

4.2.3. Bee colony supply

- Currently, through the project support, beekeepers started bee colonies multiplication techniques through splitting.
- There is a fluctuation in flowering between seasons and years, which affects hive occupancy by colonies. At the time of more flowering years, the bee colony gets more populated, produces swarm and increases the number of bee colonies in the apiaries. When resources in pollen and nectar are low (dearth period), brood-rearing decreases, and the colony population decreases. Hence knowledgeable beekeepers unite the colonies so that the number of bee colonies in the apiary will be reduced.

4.2.4. Beeswax

- To tackle the lack of wax (for frame hives), the OoARD/IPMS approached local alcohol brewers of TEJJ (local honey brew). This did not work out because of existing relationship between local brewers with candle makers who supply churches.
- The project then facilitated local processing of wax with two honey presses (as demo material) by farmers in Alembel, Hagere Selam, Woj-Arba amba, Quhar Michael, and Woreta Zuria (Yirgalem Assegid, 2006).
- Later on, the project also demonstrated beeswax rendering techniques to “Teji” Honey wine brewers and honey traders. During the training, beekeepers also discussed how to get beeswax from dried combs from absconded colonies hives.

4.3. Production interventions

With the introduction of improved hives, farmers have to use new production technologies to maximize benefits. A summary of the various new production technology options can be seen in Table 2 and some key production interventions are highlighted below:
4.3.1. Hive inspection

• Unlike traditional hives, both improved hives have moveable combs so that the beekeepers can open the hives and inspect them to follow the progress of the bee colonies and/or identify diseases and other bee colony problems, in order to solve the problems accordingly and contribute to honey production improvement.

4.3.2. Hive harvesting

• Harvesting several times is possible in one season since unripe and brood combs are not destroyed and bees are not killed upon harvesting (See the comparison table below).

4.3.3. Bee forage development

• Natural pasture improvement was introduced during the last three years for the improvement of dairy and fattening commodities. Grazing in communal grazing areas has been restricted and has resulted in natural pasture growth which includes production of bee flora. Around five indigenous *Trifolium* spp. well known for nectar source, four different types of leguminous and 8-12 flowering grass spices were flourishing as sources of bee forage to enhance honey production.
Table 2. Comparison of the three beekeeping technologies in 12 years experience

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter</th>
<th>Traditional Beehive</th>
<th>Low cost Top-bar Beehive (non-timber)</th>
<th>Frame Type Beehive</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cost of the hive</td>
<td>Very cheap, material for the hive is locally available. Up to 45 birr</td>
<td>Cheap, probably people who cannot manufacture precision top bar may need to purchase. Up to 90 birr only for 30 top bars.</td>
<td>Very expensive: 590 birr</td>
</tr>
<tr>
<td>2.</td>
<td>Service life of the hive</td>
<td>Up to 10 years</td>
<td>6-7 years</td>
<td>15-20 years</td>
</tr>
<tr>
<td>3.</td>
<td>Accessories</td>
<td>No need of sophisticated equipment. Even beekeepers open the hive with minimum sting without using protective clothing.</td>
<td>Top-bar hive management needs protective clothing since it is opened more than the traditional hive. Honey extractor and casting mould are not necessary.</td>
<td>Highly dependent on very expensive accessory equipment.: honey extractor; casting moulds; protective clothing, etc.</td>
</tr>
<tr>
<td>4.</td>
<td>Combin condition</td>
<td>Fixed comb – difficult to inspect, and during harvesting many bees and the brood are killed.</td>
<td>Moveable comb – easy to inspect and harvesting doesn’t kill bees and damage brood.</td>
<td>Moveable comb – easy to inspect and harvesting doesn’t kill bees.</td>
</tr>
<tr>
<td>5.</td>
<td>Swarming</td>
<td>Swarming is not under the control of the beekeepers</td>
<td>Possible to control through internal inspection.</td>
<td>Possible to control through internal inspection.</td>
</tr>
<tr>
<td>6.</td>
<td>Honey harvesting</td>
<td>Difficult to harvest as the comb is fixed type.</td>
<td>Easy as the comb is moveable and doesn’t need further extractor unless it is needed.</td>
<td>Easy to select and remove the frame but needs expensive equipment for honey extractions.</td>
</tr>
</tbody>
</table>
| 7.  | Honey Quantity             | Low 5-7 kg honey on average and possibility to harvest once per season.             | - 18 kg on average and up to 30 kg harvest obtained in one season through three times harvest.
- Honey harvest will remain consistent, as the contents of the hive are not damaged during harvesting. | - 22 kg on average and more harvest is possible
- Honey harvest will remain consistent, as the contents of the hive are not damaged during harvesting. |
| 8.  | Honey Quality              | Inferior quality as the honey is mixed with the brood, died bees and unripe honey. | Good quality as it is possible to separate the ripe honey from the remaining hive content.     | The honey harvested from this type of hive is always pure honey                     |
| 9.  | Beeswax                    | Up to one kilogram harvest per year                                                 | More than one kilogram per year                                                                  | Very minimum, in fact wax is an input into frame hives, although bees will add to it. |
| 10. | Colony reproduction        | Impossible                                                                         | Colonies can be easily reproduced by simple colony splitting techniques. From small trials queen rearing is also possible through grafting techniques. | Queen rearing techniques is possible and highly developed and commercialised.      |
| 11. | Harvesting of other bee products | Brood is sometimes consumed within the household (although this has a negative effect on honey production.) | - Propolis can be harvested from this hive through modification of top bars.
- There is also a potential to harvest royal jelly. | Propolis and royal jelly can be successfully harvested.                                       |
| 12. | Rate of adoption           | Skill transferred from generation to generation through the family                  | High, due to low cost and easy access to hive construction and other equipment                  | Low, due to cost of hive, high precisions needs, and expensive accessories.         |

Source: own assessment
4.4. Output Marketing

Two types of honey have been marketed in the district. The first and the largest proportion is crude honey harvested from traditional hive and the second is comb honey and liquid honey harvested from top-bar and box hives respectively.

The crude honey is collected by rural assemblers and later on sold to main traders at Woreta and Alembur and transported to Addis Ababa market, whereas the comb honey and liquid honey are sold locally in niche market (Teachers, DAs, OoARD experts and other civil servants) at Woreta town.

The project introduced and demonstrated honey press to extract liquid honey from traditional and top-bar hive honey in two FTCs. However, beekeepers were not interested because it is time consuming, and results in wastages. Although the quality of honey has improved and market demand is increasing, the price increase of honey as compared to other stable foods like teff, rice, etc. has been limited, mostly due to marketing and linkages to be developed.

Beekeepers sold most of their honey at their farm gate. Beekeepers themselves have already up-to-date market information from Woreta town weekly open market. Development agents are also playing in providing market information.

5. Results and discussion

5.1. Production/productivity/income

The impact of the various value chain interventions can be measured at household and district levels.

Household level data

The household survey conducted in 2009 provided the following information on the hive ownership (see table 3), household production and hive productivity for adopters (top-bar and frame hive owners) and non-adopters (traditional hives).

Table 3. Average number of hives per household in Fogera

<table>
<thead>
<tr>
<th>Farmer type</th>
<th>Number of hives owned per household</th>
<th>Occupation rate</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adopters</td>
<td>20</td>
<td>1.1</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>17.3**</td>
</tr>
<tr>
<td>Non-adopters</td>
<td>37</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9.2</td>
</tr>
</tbody>
</table>

Source: IPMS Household survey 2009

Note: * Number of sample households engaged in beekeeping.
** significantly higher than the other mean at 5% significance level
Table 4. Household level average honey production and value of production in Fogera

<table>
<thead>
<tr>
<th>Farmer type</th>
<th>Traditional</th>
<th>Transitional</th>
<th>Modern</th>
<th>Total</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adopters</td>
<td>Obs</td>
<td>18</td>
<td>9</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>Non adopters</td>
<td>29</td>
<td>32.4</td>
<td>0</td>
<td>0</td>
<td>29</td>
</tr>
</tbody>
</table>

Note: * Average production value is calculated by multiplying the individual honey production from each hive type by the hive specific average honey prices for each group (adopters and non-adopters) in each PLW. HHs with hives but zero level of production are dropped out in calculating the average productions and values.

As seen from Table 3 and 4, there is a difference between adopters and non adopters’ average honey production from traditional beehives. Adopter farmers own more numbers of traditional beehives per household.

Table 5. Average honey productivity per hive type and farmer type in Fogera

<table>
<thead>
<tr>
<th>Farmer type</th>
<th>Traditional</th>
<th>Transitional</th>
<th>Modern</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Obs</td>
<td>Mean</td>
<td>Min</td>
</tr>
<tr>
<td>Adopters</td>
<td>18</td>
<td>7.6</td>
<td>2</td>
</tr>
<tr>
<td>Non adopters</td>
<td>29</td>
<td>6.6</td>
<td>2</td>
</tr>
</tbody>
</table>

Source: IPMS household survey 2009

Note: Farmer type: Adopters = Own modern or traditional hives; Non-adopters = Own only traditional hives
Eighteen (18) out of 22 beekeepers who received colony splitting training in 2008 were able to reproduce the colonies and increase the number. According to many of the beekeepers, the level of awareness and adoption of improved beekeeping practices are getting better due to practical learning and more support given to beekeepers at all level. Nowadays the beekeepers look forward to using improved beekeeping technologies and are interested to transfer their traditional hives colonies to modern and top-bar hives.

**District level**

The baseline survey conducted in 2005 showed that there were approximately 24,000 traditional hives in the Woreda which were managed by around 3,500 households (Table 6). The total estimated production was about 148,102 kg with an estimated value of 1.2 million Birr. A few frame hives and top-bar hives were noted but they were insignificant and had been introduced only by a few private individuals. (Yirgalem Assegid, IPMS final report, 2006).

The various interventions resulted in a significant change and improvement in the number of improved beekeeping technologies like top-bar and frame type hive uptake in the district. Following the various extension efforts, in 2009 the number of frame hive has increased from 200 in 2006 to 882 hives, whereas the top-bar hive uptake went from none to 259.

**Table 6. Fogera baseline data on apiculture in 2005**

<table>
<thead>
<tr>
<th>Local beehive</th>
<th>No of hh/pa</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average yield per harvest/hive (kg)</td>
<td>20HH</td>
<td>6.19</td>
</tr>
<tr>
<td>Number of hives producing honey/hh</td>
<td>36HH</td>
<td>6.83</td>
</tr>
<tr>
<td>Total yield per household (kg)</td>
<td>computed</td>
<td>42.3</td>
</tr>
<tr>
<td>Number of hives in the Woreda</td>
<td>25PA</td>
<td>23,926</td>
</tr>
<tr>
<td>Estimated number of households</td>
<td>computed</td>
<td>3503</td>
</tr>
<tr>
<td>Estimated production in the woreda (kg)</td>
<td>computed</td>
<td>148,102</td>
</tr>
<tr>
<td>Average price per kg (birr)</td>
<td>36HH</td>
<td>8.1</td>
</tr>
<tr>
<td>Total value per hive/year (birr)</td>
<td>computed</td>
<td>50.1</td>
</tr>
<tr>
<td>Total value per household (birr)</td>
<td>computed</td>
<td>342.6</td>
</tr>
<tr>
<td>Estimated value in the woreda (birr)</td>
<td>computed</td>
<td>1,199,626</td>
</tr>
</tbody>
</table>

Source IPMS baseline survey 2005
5.2. Marketing and input supply

The household commercialization survey conducted in 2009 showed some differences in prices for honey from traditional, transitional and modern hives in 2008 (i.e respectively birr 13.76, 14.57 and 17.05 per kg.)

- Due to the training program, the quality of honey is improving and beekeepers brought their honey with better container like food grade clean plastic jars unlike calabash and fertilizer bag before the intervention
- In the first year, 17 new bee colonies were obtained from bee colonies reproduction following the 2007 training (one farmer lost his colony due to chemical damage). In 2008, a total of 272 kg comb honey was harvested, mostly from Wereta Zuria PA, which generated approximately 8,000 to 9,000 birr. The price of bee colonies increased from 150 to 350/colony.
- One of the carpenters working for OoARD resigned from his job and he created a full time job for himself and three other people in his carpentry shop making hives.

5.3. Other indirect benefits

**Gender**

To improve women’s participation in apiculture production and marketing, IPMS project, together with stakeholders, initiated a couple training. As a result, following the training, women’s participation increased. The field assessment also shows that, though there are still cultural influences, the trend of females’ involvement in beekeeping has been improving through time with effective back up from field workers in the village.

According to many beekeepers, the new beekeeping technologies are very easy to be handled by women compared to traditional hives. Women’s involvement in top-bar hive technologies is very high as plastering of the hive, fumigation, protecting the colonies from ants and spiders; internal inspection, etc. can be easily taken care of by women. Even in the absence of their husbands, instead of asking neighboring men for help, they can easily harvest the honey.

**Environment**

The first and worldwide importance of beekeeping is pollination; bees play a vital role and are efficient pollinators among many other insect pollinators. Through pollination, biodiversity will be insured (Nicola Bradbear, 2004). In this case, the clearance of *Hygrophilla auriculata* (Amicala) coupled with livestock exclusion in communal grazing land or introduction of restricted grazing improves the diversity of the genetic resources, mostly *Trifolium*, spp. (IPMS 2009).

5.4. Institutional/organizational arrangements

The major institutional and organizational changes which have taken place are changes in the supply of inputs:
Formerly, the introduction of new technologies on beekeeping like frame type hives and all necessary inputs were supplied by the OoARD through credit or free supply beekeeping accessories like honey extractor and casting moulds. Nowadays, the top-bar hive, initiated by the project technical and financial support, is made from all local supply. Instead of beekeepers acquiring ready made hives, transmission of knowledge has allowed local carpenters and beekeepers to make hive from locally available materials.

Also, beekeeping accessories like smoker and protective clothing are now supplied through local shops instead of being brought from Bahir Dar through ANRS-BOARD.

Instead the OoARD now spends considerable more attention to capacity development and knowledge management on apiculture and stimulating linkages with other actors along the value chain. Table 7 provides an overview of the actors and their roles in the development of apiculture in Fogera district.

Table 7. Actors and roles in apiculture development in Fogera district

<table>
<thead>
<tr>
<th>Actors</th>
<th>Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beekeepers</td>
<td>• Produce honey from traditional and improved hives</td>
</tr>
<tr>
<td></td>
<td>• Share indigenous knowledge on apiculture</td>
</tr>
<tr>
<td></td>
<td>• Develop skills with neighboring farmers</td>
</tr>
<tr>
<td></td>
<td>• Increased role of female farmers</td>
</tr>
<tr>
<td>OoARD</td>
<td>• Build capacity and share knowledge on apiculture</td>
</tr>
<tr>
<td></td>
<td>• Organize production/supply foundation sheets</td>
</tr>
<tr>
<td></td>
<td>• Organize honey processing</td>
</tr>
<tr>
<td>Andassa Research Center</td>
<td>• Provide knowledge and capacity development skills fro OoARD staff and bee keepers.</td>
</tr>
<tr>
<td>Private carpenters</td>
<td>• Construct modern and transitional hives on demand</td>
</tr>
<tr>
<td>Private shops</td>
<td>• Sells accessories (clothing, smoker) for improved beekeeping/hives on cash basis</td>
</tr>
<tr>
<td>Traders</td>
<td>• Market and process honey</td>
</tr>
<tr>
<td>IPMS</td>
<td>• Support OoARD and other stakeholders in capacity development and knowledge management</td>
</tr>
<tr>
<td></td>
<td>• Facilitates linkages between stakeholders</td>
</tr>
<tr>
<td></td>
<td>• Documents processes and results</td>
</tr>
</tbody>
</table>

Source: IPMS progress reports

6. Challenges in the intervention process

6.1. Environmental threats

Honeybees are affected by agrochemicals application. The trends of chemical utilization including smallholders’ have been increased due to exposure to agriculture packages. The problem becomes more severe because of unsystematic utilization of these chemical and the type and time of application.
6.2. Bee forage

Deforestation and the extinction of some high nectar and pollen sources of bee forage spices like *Corridiana african* (Wanza) and substitutions of oil (noug) and other pulse crops by rice in the context of Fogera district are the other challenges for beekeeping as a whole.

In the district, vetch, one of the major pulse crop sown immediately after rice harvest, is nowadays affected by Aphids and trips. These pests are relatively new to the district and can destroy from 50 to 100% of the crop yield. Consequently, farmers applied various types of pesticide, including malathion, to protect vetch at the time of flowering in December and January, at the time when bees are collecting nectar and pollen. As a result, a massive number of bees die every year.

Protection and conservation of natural vegetation and plantation of bee forage in farm boundary and homestead, using multipurpose bee forage species should be well promoted. Also the positive impact of grazing area enclosures should be promoted.

6.3. Honey processing

The introduction of modern hive has been constrained by lack of honey extractor and casting mould. From the field experiences, it is concluded that for every 50-60 box hive, at least one honey extractor is required for harvesting. At a price of birr 6,000 and an estimated depreciation period of 5 years, average annual depreciation cost is birr 1,200 or birr 20 -24/hive. Besides honey extractor, one casting mould used for making comb foundation can serve up to 90 modern hives. So far the service of casting mould has been provided centrally at the district office of agriculture, which is not sustainable. Therefore, there is a number of modern hives in shortages of foundation combs. Without artificially made foundation combs in modern hive, the advantage of modern hive is not realized and the colonies will be disturbed. Private sector involvement in alleviating this constraint may be considered.

The project also attempted to overcome these major problems through the introduction of top-bar hive, which neither required expensive beekeeping equipment like honey extractors and casting moulds nor sophisticated skills as how to operate and handle the bee colony in this hive. When using top-bar hive, beeswax is the second product, unlike modern hive which need wax as input. Hence using top-bar hive will immediately solve the shortage of beekeeping equipment like extractor and casting mould. Still, productions of beeswax will be maximized so that more exportable items can be generated rather than consumed in the case of modern hive.
6.4. Marketing

Variation in farm gate price is relatively high because beekeepers do not have any mechanisms to fix common farm gate price in the district, due to a lack of marketing organization. Also the marketing channel for honey from modern hives is poorly developed, resulting in a limited price differential. Hence, marketing beekeepers groups need to be established, possibilities of involving cooperatives could be explored and attention paid to market parameters and better linkages for liquid honey.

7. Lessons learned

For a better technology adoption, the introduction of new technologies should go hand in hand with the familiarization of beekeepers on handling and management techniques.

7.1. Training

Introduction of technologies should go along with skill training programs. Training should be practical and allow for more discussion than lecturing since beekeepers have their own long years of experiences and indigenous knowledge.

• At the end of the training, participatory action plans should be formulated by the trainees themselves. Monitoring and evaluation should be part of the plan and identifying the trainer input is essential for further support in the course of implementation.

• Couple training is very important to adopt since it qualifies the household level decision making process.

7.2. Approach/Technologies

Introduction of new technologies should not be based on free handout inputs.

• The changes in bee forage availability changes the honey harvesting period. In the case of Fogera district, the replacement of oil and pulse crop by cereals and the plantation of more eucalyptus trees changed honey production pattern from November-December to June-early July.

• The level of honey production is increased by more than one fold in the case of top-bar hive and two fold in the case of modern hive.

• Creation of input suppliers locally is very important to sustain the technology.

• To sustain the bees and beekeepers and maintaining crop production, especially fruits, oil crops, pulses, etc., agrochemical utilization policies should be prepared to avoid massive death of bees during pesticide and herbicide application.
8. References


Assegid, Yirgalem, 2006. Progresses, On Going Activities and Way Forward Based on two years experiences, IPMS final report.


CACC 2003 Ethiopian Agricultural Sample Enumeration 2001/ 02 Results for Amhara Region. Statistical Reports on Livestock and Farm Implants (Part IV), Central Agricultural Census Commission, Addis Ababa, Ethiopia, pp 45-46


