Republic of Rwanda
Ministry of Environment

TREPA
Transforming Eastern Province through Adaptation

CIFOR

World Agroforestry

BEE VALUE CHAIN – INFORMATION BRIEF FOR FARMERS

Transformation of livelihoods and ecosystems through nature-based enterprises, Eastern Province, Rwanda

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KEY HIGHLIGHTS

1. Bee production is a preferred nature-based enterprise in Rwanda due to its low investment, the high demand for bee products, and multiple livelihood and ecosystem benefits.
2. Unmet honey demand in domestic and international markets offers livelihood prospects to farmers but these require continuous value chain stakeholder engagement, quality control, certification and standardization of processed honey products besides connecting beekeeping to landscape restoration efforts.
3. The melliferous species most suitable for bee forages in Eastern Province include *Markhamia lutea*, *Leucaena diversifolia*, *Calliandra calothyrsus*, *Vernonia amygdalina*, *Senna siamea*, *Senna spectabilis*, *Acacia angustissima*, *Vachellia sieberiana*, *Mangifera indica* and *Persea americana*.
4. Modern hives involve higher initial investment costs but result in lower long-term expenses and yield higher long-term benefits compared to traditional hives.
5. Farmers and cooperatives gain market information from platforms such as *esoko* and *Smart Nkunganire Services* (SNS); climate information and services from METEO Rwanda and affordable credit from Savings and Credit Cooperative Societies (SACCOs) and tailored bank credit facilities.

INTRODUCTION

Beekeeping is one of the preferred enterprises in rural Rwanda (RAB 2022) occasioned by low investment, high returns and ease of integration with existing farm activities. Beekeeping supports different components of livelihoods and landscape restoration through (1) income generation and poverty eradication, (2) environmental conservation through increased numbers of bee forage trees within landscapes, (3) health benefits through consumption of honey products, and (4) food security through enhanced pollination within the landscapes. Bees are bio-indicators of healthy ecosystems.

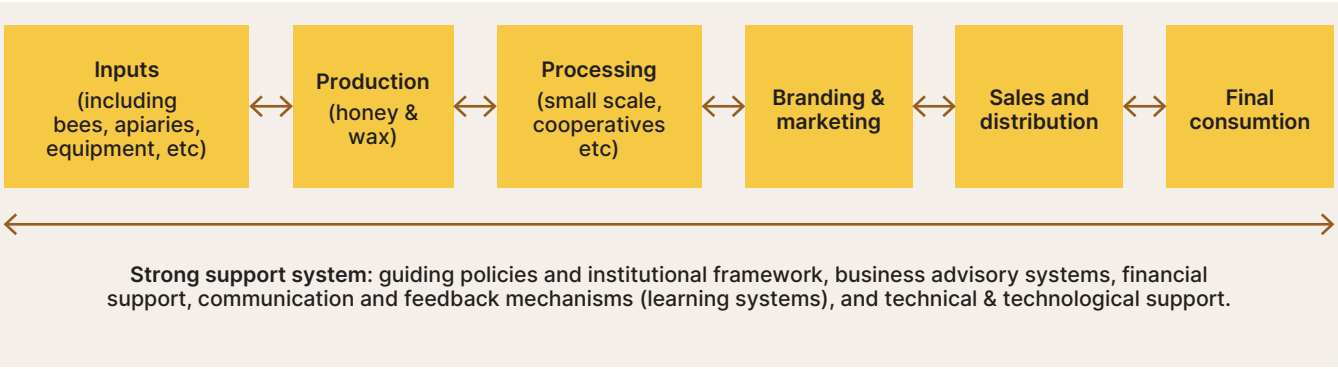
Rwanda's honey market has expanded from domestic to regional and international, with a target to increase production to 8,000 metric tons (MT) annually by 2024, which is still short of the domestic demand estimated at 17,000 MT (RAB 2022). To address this gap, World Agroforestry (ICRAF) and its consortium partners, through the Green Climate Fund (GCF)-funded TREPA project,1 aim to enhance climate resilience of tree crops, fodder and beekeeping in the Eastern Province of Rwanda. This farmer information brief describes pathways to enhance livelihood resilience through the beekeeping value chain.

Value chain resilience includes practices that help farmers cope with climate change impacts such as droughts and floods while building capacity of practices that prevent the impacts from worsening. The activities include growing of bee forage plants, quality control of honey products, processing, packaging, social grouping, branding, standardization of honey products (*S-Mark*), and access to and utilization of market, finance and climate risk information.

1 The Transforming Eastern Province through Adaptation (TREPA) project in the Eastern Province of Rwanda is funded by the Green Climate Fund (GCF). It aims to increase the resilience of 75,000 smallholder farmers and restore 60,000 degraded landscapes. The implementing partners include World Agroforestry (ICRAF), the International Union for Conservation of Nature (IUCN), the Ministry of Environment, Rwanda Forestry Authority (RFA), Enabel, World Vision and Cordaid.

COMPONENTS OF THE BEE VALUE CHAIN

The bee value chain components include input providers, production, processing, branding, and marketing, sales and distribution channels, and final consumption (Figure 1). In addition, the cross-cutting components include government laws and policies, financing, communications and information as summarized in this paper.



Inputs into the bee value chain

Bees. Bees are primary producers of honey. Broadly, there are three types of bees – **workers, queen and drones** (Table 1). Bees transform from egg, larva, pupa to adult, to take up their roles in the hive.

Table 1. Types of bees in a hive

Worker	Queen	Drone
		
Workers are sterile females and their roles include cleaning the hive, feeding the queen, making beeswax, scouting for food and honey formation	The queen bee is a reproductive female whose role is to lay eggs and produce queen substance	Drones are the male bees whose role is to mate with the queen. There are about 200–500 in a hive

Equipment. Multiple types of equipment are essential at different levels of the bee value chain. These include protective gear (head gear with veil, overalls, gloves, and gumboots), smoker, hive tool and bee brush for honey harvesting. Other equipment required includes centrifugal extractors for honey production, packaging equipment, and means of transporting raw and processed honey and other products.

Apiary. An apiary is a place where one or more beehives are kept. Some of the factors to consider when setting up an apiary include: (1) water access and security, (2) environmental conditions such as right shade, drainage and proper fencing, (3) a secure location that is accessible and has good drainage and is near bee forage trees for nectar, and (4) minimal human and animal disturbance. There are three main types of beehives, each providing its own set of benefits and challenges as summarized in Table 2.

Different types of bee hives are in use in Rwanda (Table 2)

Table 2. Modern-vs-traditional bee hives

	Traditional hives (log hive)	Modern hives (top bar and Langstroth hives)
Advantages	» Simple to construct » Limited construction skills needed » Locally available building materials » Easy for bees to colonize the hives » Good for bee wax production	» Ease of bee inspection, swarming control, and hive management » Ease of honey harvesting with minimal damages, greater honey volumes » Easy to recycle honeycomb » Higher benefits
Disadvantages	» Low honey quality and productivity » High susceptibility to loss during harvesting » Difficulty of inspection due to hive design » Frequent need to replace hive	» High investment costs » Technical skills needed for construction and maintenance » Low hive colonization rates
Traditional Beehive 		**Modern Beehive** 

We provide cost-benefit analyses of different hive types in Table 3A–D

Table 3. Cost–benefit analysis of traditional hives and modern hives

A. Benefits analysis of 10 traditional hives

	Production/ year	Production from 10 traditional hives (kg)	Price Rwandan Franc (RWF)		Benefits/year 1/RWF
			unit cost	total cost	
Annual production of honey per hive	6 kg	60	4,000	90,000	240,000
Beeswax sheets (50 g/kg)	50 g	1.4	8,000	11,200	11,200
Total sales					**251,200**
Total annual benefits					**47,300**

Note 1 USD= 1378.42 RWF (as of November, 2024)

B. Costs analysis of 10 traditional hives

	Item	Unit (10 traditional hives)	Number	Unit price RWF	Total price RWF
1	Traditional hives	Number	10	5,000	50,000
2	Gloves	Pair	1	10,000	10,000
3	Double strainer	Number	1	30,000	30,000
4	Smoker	Number	1	25,000	25,000
5	Pail	Number	1	20,000	20,000

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B. Continued

	Item	Unit (10 traditional hives)	Number	Unit price RWF	Total price RWF
6	Beekeeping brush	Number	1	3,500	3,500
7	Bee colony for transfer	Colonies in traditional hive	10	8,000	80,000
8	Beekeeping suit+boots	Number	1	55,000	55,000
9	Transportation cost		1	25,000	25,000
	Total costs				**298,500**

C. Benefits analysis of 10 Langstroth hives

	Production/ year	10 Langstroth hives (kg)	Price RWF		Benefits/year 1/ RWF
			unit cost	total cost	
Annual production of honey per hive	32 kg	320	6,000	1,920,000	1,920,000
Beeswax sheets (90 g/kg)	90 g	18	8,000	144,000	144,000
Total sales					**2,064,000**
Total annual benefits					**717,500**

D. Costs analysis of 10 Langstroth hives

	Item	Unit	Number	Unit price RWF	Total price RWF
1	Langstroth with 2 boxes	Kits	10	50,000	500,000
2	Protective gloves	number	1	10,000	10,000
4	Honey extractor 3 frames	number	1	320,000	320,000
5	Double strainer	number	1	30,000	30,000
6	Spur embedder and hive tool	number	1	13,000	13,000
8	Smokers	number	1	25,000	25,000
9	Queen excluder	number	10	6,000	60,000
10	Wax foundation sheet	weight (kg)	10	8,000	80,000
11	Pail	number	1	20,000	20,000
12	Beekeeping brush	number	1	3,500	3,500
13	Bee colony purchase	colonies in traditional hive	10	8,000	80,000
15	Beekeeping suit+boots	number	1	55,000	55,000
16	Transportation cost	-	1	50,000	50,000
	Total				**1,346,500**

Outcome of value addition to bee products

Outcome

- Honey
- Money
- Improved livelihoods

Enhanced landscapes and ecosystem services

Important seasons in the beekeeping calendar.

Dearth Season
- Flowers drop to the ground and bees have limited access to forage
- Most planning activities (such as purchasing hives and preparing the apiary) take place.

→

Build-up season
- The flowering season starts
- New colonies are set up

→

Honey flow period
- Tree flowering reaches a peak and consequently there is sufficient nectar and pollen for honey production
- Colonies are strengthening for maximum production

Adapted from Koech et al. (2023)

Suitable bee forage plants

The availability of bee forage is characterized by marked seasonality. It is important to increase bee forage opportunities through cultivation of agroforestry tree species that provide preferred bee forage during the off-season. Suitable bee forage plants include melliferous species for agroforestry (see Tables 4 and 5). Agroforestry is the growing of trees on the same piece of land with crops and/or animal fodder. The melliferous species are ecologically suitable for the Eastern Province and produce nectar and pollen over a span of 6 months to 3 years.

Table 4. Bee forage plants suitable for Eastern Province.

No.	Scientific name	Local name
1	*Markhamia lutea*	Umusave
2	*Leucaena diversifolia*	Lesena
3	Calliandra calothyrsus	Caliyandara
4	*Vernonia amygdalina*	Umubilizi
5	*Senna siamea*	Gasiha
6	*Senna spectabilis*	Gasiha
7	*Acacia angustissima*	Akasiya
8	*Vachellia sieberiana*	Umunyinya
9	*Mangifera indica*	Umwembe
10	*Persea americana*	Avoka

Table 5. Bee forage plants suitable for Eastern Province and their flowering period

No	Scientific name	Local name	Flowering month	End of blooming
1	*Markamia lutea*	Umusave	March	July
2	*Leucaena diversifolia*	Lesena	January	February
3	*Calliandra calothyrsus*	Caliyandara	February	March
4	*Vernonia amygdalina*	Umubilizi	June	September
5	*Senna siamea*	Gasiha	March	July
6	*Senna spectabilis*	Gasiha	March	July
7	*Acacia angustissima*	Akasiya	March	April
8	*Vachellia sieberiana*	Umunyinya	February	April
9	*Mangifera indica*	Umwembe	June	August
10	*Persea americana*	Avoka	February	April
11	*Titthonia diversifolia*	Nyiramunukanabi	July	September
12	*Sesbania sesban*	Umunyeganyege	March	May
13	*Tephrosia vogelii*	Umuruku	April	August

Peer-2-peer learning on best practices
Photo by Egide Gwaneza, CIFOR-ICRAF Rwanda

Pathways to a successful and resilient honey value chain

Pathways to resilient honey value chain include:

1. **Peer-to-peer learning –** Engage in study tours and field visits to cooperatives that are more advanced in beekeeping, bee forage growing and value addition (see Figure 4).
2. **Capacity development for bee cooperatives –** More capacity is needed for hands-on training on beekeeping, bookkeeping, business plan, and value addition and financing of modern equipment. This is essential to increasing honey production to meet domestic and international demands.
3. **Standardization –** Improved honey quality requires awareness of quality and standards set by the Rwanda Standards Board (RSB). RSB needs to create awareness among beekeeping farmers on national quality standards and the certification process (*S-Mark*).
4. **Improved honey hygiene –** This is critical to improve honey prices in the market. This can be achieved through developing modern honey collection centres, using modern beehives and the right set of equipment, and farmer training on honey management across the value chain.
5. **Connecting beekeeping and landscape restoration –** This is crucial for achieving multiple livelihoods and ecosystem benefits and enhancing climate change adaptation. Trees (especially the melliferous species) are essential sources of nectar and pollen for bees. Trees are also important sources of a home for the bees as they offer sites for apiaries and also aid in soil erosion control and biodiversity conservation.
6. **Information communication and technology (ICT) –** ICT is needed to support beekeeping value chain resilience. Farmers can access market information through *esoko* at MINAGRI, *Smart Nkunganire Services* (Rwanda Agricultural Board), while the METEO provides climate information services. Affordable credit to farmers and cooperatives can be accessed from SACCOs and tailored bank credit facilities.
7. **More inclusivity of all interest groups –** Include women and youth in different nodes of the value chain to enhance equity.
8. **Extension services and support –** These assist in the selection of bee forage plants and the appropriate use of pesticides.

Reference

Koech G, Carsan S, Mukuralinda A, Niyigaba L, Onyango M, Mwiza W and Bourne M. (2023). Integrating Beekeeping in Land restoration. World Agroforestry, Nairobi.

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