Eri Silk
Production in Ethiopia

- The workshop report held on 20-21 October 2016 -

International Center of Insect Physiology and Ecology (ICIPE)
Japan International Cooperation Agency (JICA)
Ministry of Livestock and Fisheries of Ethiopia
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1. Executive Summary of Eri Silk in Ethiopia Workshop

JICA in collaboration with the MoLF, ICPE and the Ethiopian Institute of Agricultural Research (EIAR) hosted national consultation workshop on Eri Silk in Ethiopia at Friendship International Hotel in Addis Ababa on 21 and 22 October 2016. The purpose of this expert consultation was to collate current relevant information on current status as well as future prospects of Eri silk production in Ethiopia with the view to contributing to policy dialogue regarding export orientated commercial sericulture development in Ethiopia. The workshop was officiated by H.E. Ato Sileshi Getahun, Minister of Livestock and Fisheries and was attended by about 100 invited experts from key stakeholder public institutions at Federal and Regional level as well as representatives of the private sector. Two experienced Japanese sericulture experts also participated and shared their knowledge in the workshop. Several leading sericulture companies made displays of their products at the workshop venue.

Eri silk production technology was introduced into Ethiopia by Dr. Shimizu (JICA expert) in 2003 as a high potential commodity for agri-business development, consistent with the national policy direction to promote export orientated textile industry in the country. Suitability of Eri Silk to develop in many parts of the country coupled with superior fabric properties of Eri-silk reaffirm the high potential for agri-business development. In addition, the common knowledge and experiences of hand-spinning skills of Ethiopian women enable to produce Eri-silk yarns easily in rural villages, thereby creating many gainful employment opportunities. With some basic technical training, smallholder farmers can start rearing Eri worms, and the potential of feed castor and cassava production in many areas indicate that Eri silk production can be promoted at large scale in many parts of the country. Current estimated total production Eri cocoons of only about 2 tons per year is possible to increase towards realizing the potential production of 100 tons per year quickly.

Additionally, promoting Eri-silk production can generate employment and increase income for small farmers, especially for women and vulnerable family members who cannot be engaged on laborious work on crop fields. Cultivation of caster and cassava is quite easy and requires only two months of growing period before first leaf harvest. Furthermore, Eri silkworm cocoons can be harvested 6 – 7 times within a year, ensuring continual revenue even at times of variable weather to secure income and livelihoods. Furthermore, all byproducts are very useful as powerful organic fertilizers, or perfect feeds for small scale poultry and fish culture.
Lessons learned over the past ten years indicate that for sericulture development to succeed, high priority must be given to expansion of Eri cocoon production and hand-spinning to consistently supply quality yarns to major buyers which can ensure continued market access. This goes in line with the ambitious GTPII targets for emerging sericulture industry in Ethiopia, with focus on export-orientated agro-processing and industrialization. Because rearing Eri silkworms is not among the traditional farming practices in Ethiopia, basic knowledge and skills development interventions are very essential. The developing value chains and market linkages require substantive continued policy and investment support by both the private and public sectors. Also important is product grading and certification systems that are needed for market linkages to develop.

Keynote and invited presentations at the workshop demonstrated taking advantage of suitable agro-ecologies and abundance of rural labor force in need of gainful employment opportunities in many parts of the country, proven appropriate technologies in smallholder Eri silk production can be adopted to promote a commercial sericulture industry that can make a growing contribution to the global sericulture market. Recent encouraging developments by the few commercial sericulture companies in Ethiopia which have huge demands for quality cocoons and yarn to meet export demands have amply demonstrated this opportunity. Eri silk production in particular has got tremendous growth potential in many needy rural areas of the country except in Afar and Somali Regions if coherent policy and extension support is combined with investment and export promotion. (see Section 4-2 for details.).

Due to its specific fiber characters, Eri silk can be spun by hand very much like cotton yarn at large scale with options for adopting manual sipping machines to provide rural and urban women with gainful and regular employment opportunities right in their villages. Eri silk also lends itself for industrial scale machine spinning provided sufficient supplies of standardized quality cocoons can be made consistently available throughout the year. Hand-spun Eri silk and hand-made original Eri silk fabrics, combined with the traditional weaving culture, can also offer unique export opportunities in niche markets. As observed during the industrial revolution in England, China and Japan, the textile industry could serve as a spring board in rural transformation by tapping into low cost labor and natural resources whereby primary products like silk yarn supply raw materials for light industry. To date China and India are current major producers of silk, and millions of rural communities secure their livelihoods and income from sericulture. In developed countries, sericulture is no longer
profitable due to the high cost of labor. Ethiopia and other African countries are at early stage of their industrial revolution, and have the necessary conditions to develop the sericulture sector both for smallholder commercialization as well as large agribusinesses and textile industries.

To map out the way forward, workshop participants deliberated on three thematic areas — quality silk production, value addition and policy and certification — and put together the following sets of high priority recommendations:

For **quality Eri silk production**, apart from customized training of farmers in quality cocoon production and yarn spinning, it is essential to promote farmed cassava or caster production; setting up and maintenance of grainage, strong collaboration between research and extension, and introduction and institutionalization of cocoon and yarn grading system as well as quality based product pricing system. Specialized short and medium term training of experts in sericulture is necessary. More importantly, a comprehensive and inclusive national sericulture strategy should be developed to provide overall coherent direction for sustained growth in the industry.

Viable **value addition** activities opportunities were identified at various stages of the value chain, from egg production, through Eri worms rearing to cocoon processing, yarn spinning to manufacture of specialty fabrics. In all cases widely accepted product grading and pricing system is essential. Branding of original and specialty products and incentivized promotion of small and medium enterprises was strongly recommended. These need to be supported by current market analysis and research with the view to sustaining private sector investment.

In the areas of **policy and certification**, product standardization and grading, setting up of a credible grainage system and clear institutional ownership of federal as well as regional level sericulture development were highlighted. The need for a national sericulture strategy was re-emphasized, as was the need to robust public awareness on the merits and requirements of broad based sericulture development. Finally it was recommended to effectively coordinate and facilitate efforts by the public and privates through stakeholder platforms.
The life cycle of eri-silk worm has four stages — egg, larvae, 
pupa encased in cocoon and adult moth. A complete life cycle 
lasts about 45 days at 30°C and 85 days at 20°C.
Food plants for Eri-silk worm

Caster beans
(*Ricinus communis*)

Cassava
(*Manihot utilissima*)

Kesseru plant
(*Heteropanax fragrans*)
Eri-silk worm Rearing

- Optimum temperature for Eri-culture is 22-28°C
- DO NOT feed wet leaves

1. **Egg Stage**
   - 12 days Incubation
   - Hatching in the morning

2. **1st. Instar**
   - 85-90% humidity
   - Feeding for 3 days
   - 1 Bed cleaning

3. **2nd. Instar**
   - 85% humidity
   - Feeding for 3 days
   - 1 Bed cleaning

4. **3rd. Instar**
   - 80% humidity
   - Feeding for 3 days
   - 2 Bed cleaning

5. **4th. Instar**
   - 75-80% humidity
   - Feeding for 4 days
   - 2-3 Bed cleaning

6. **5th. Instar**
   - 5 days, 80%
   - 3 Bed cleaning
Eri-silkworm Rearing

5th Instar
5 days/80%
3 cleaning

Mounting Stage

Pupa

Moth

* Defecate excreta liquid and solid
* Worms translucent when matured enough
* Place on mountage
* Spinning for about 3 days straight and larval period are continued for more 3 days before metamorphosis to pupa

Differences between eating and molting period

![Eating Period vs Molting Period](image)

- Eating Period
- Molting Period

Front View
2 types rearing for young eri-silkworm
Flat rearing for grown eri-silkworm
Hanging rearing for grown eri-silkworm
Matured eri-lavae walk and climb to search for places to make cocoons, and begin to spin silk to make cocoons.
Two types of mounting
Collected cocoon
Differences between Male and Female

Pupa

Moth
Moth emergence from cocoon takes place after 2 weeks of cocoon formation. The emergence of moths takes place early in the morning and continues till mid-day. The moths slowly move towards the upper place and rest for one hour or two in vertical position till their wings are dry.
* Copulation is normally done in the night at the dark place
* After 12 hours copulation, moths start to oviposition on sticks
Egg Production
Rearing facility
Sanitation of rearing tools/facility

Wash by clean water then sterilized by saturated CaCO₃ supernatant.
(Diluted bleach solution (NaClO) for laundry purpose can be used for same purpose)
Degumming is the most important process of quality control of the Eri thread production. Highly recommended usage of high and same quality water, grading cocoons before degumming (because of boiling duration is different in each grade), and follow the manuals of degumming.
Hand Spinning in Ethiopia and India
Machine Spinning in Vietnam
Heat treatment effects on artificial feed and its processing for Eri worms

Gunma Prefectural Sericulture Research Station
Dr Osamu SHIMIZU

Two types of Artificial Feed utilization on Eri production

Artificial feed without caster leaves
Artificial feed made from Caster leaves paste
## Detail Composition of Artificial Feed for Eri

<table>
<thead>
<tr>
<th>Ingredient (unit)</th>
<th>Artificial Feed with caster leaves</th>
<th>Artificial Standard Feed without caster leaves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh caster leaves paste (g)</td>
<td>80</td>
<td>-</td>
</tr>
<tr>
<td>Raw Soy bean powder (g)</td>
<td>18.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Milk casein (g)</td>
<td>-</td>
<td>13.0</td>
</tr>
<tr>
<td>Sucrose (g)</td>
<td>-</td>
<td>10.0</td>
</tr>
<tr>
<td>Beer brew yeast (g)</td>
<td>-</td>
<td>10.0</td>
</tr>
<tr>
<td>Cellulose powder (g)</td>
<td>-</td>
<td>20.0</td>
</tr>
<tr>
<td>Vitamin C (g)</td>
<td>0.2</td>
<td>1.0</td>
</tr>
<tr>
<td>Citric acid (g)</td>
<td>0.8</td>
<td>1.0</td>
</tr>
<tr>
<td>Corn starch (g)</td>
<td>-</td>
<td>3.0</td>
</tr>
<tr>
<td>Vitamin B mix* (g)</td>
<td>0.1</td>
<td>0.4</td>
</tr>
<tr>
<td>Agar powder (g)</td>
<td>-</td>
<td>10.0</td>
</tr>
<tr>
<td>Potassium Sorbate (mg)</td>
<td>60.0</td>
<td>224.0</td>
</tr>
<tr>
<td>Propionic acid (mL)</td>
<td>0.4</td>
<td>1.1</td>
</tr>
<tr>
<td>Chloramphenicol (mg)</td>
<td>0.5</td>
<td>1.8</td>
</tr>
<tr>
<td>Water (mL)</td>
<td>25.0</td>
<td>280.0</td>
</tr>
</tbody>
</table>

* Vitamin B Mix: Amount of composition (mg)
- Inositol: 2000
- Choline chloride: 1500
- Calcium pantothenate: 150
- Niacin: 100
- Pyridoxine: 30
- Riboflavin: 20
- Thiamine: 20
- Biotin: 2
- Folic acid: 2

---

### Difference of artificial feed on Eri

<table>
<thead>
<tr>
<th>Type of feed</th>
<th>Cocoon weight</th>
<th>Cocoon Shell Weight</th>
<th>Cocoon layer percentage</th>
<th># of EGG LAYING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caster leaves paste feed</td>
<td>2.90</td>
<td>330</td>
<td>11.4</td>
<td>445</td>
</tr>
<tr>
<td>Standard artificial (w/o caster paste)</td>
<td>2.85</td>
<td>268</td>
<td>9.4</td>
<td>398</td>
</tr>
<tr>
<td>Caster leaves</td>
<td>2.58</td>
<td>350</td>
<td>13.6</td>
<td>462</td>
</tr>
</tbody>
</table>

---

### Increasing rate of stage 5 Eri worms weight

- Caster paste (M)
- Caster paste (F)
- Std Artificial (M)
- Std Artificial (F)

---

![Graph showing the increasing rate of stage 5 Eri worms weight over days](image)
Procedure of artificial feed using caster leaves paste

Fresh leaves ➞ Cut and Ground ➞ paste
other ingredients mix ➞ seal into plastic bag
water boil sterilization (65°C)
Store in Fridge (5°C)

Effects of feed Sterilization temperature on Eri

100°C sterilization

65°C sterilization
Eri cut cocoons buyer storage yard
(1995.12.5)
Eri production in Vietnam January 2004

Feed (Cassava) field 6 July 2013
Market seller's house production (6 Sep 2013)

Insects utilization for local dishes
Purchase Eri cut cocoons

Sampling for disease check
Typical symptoms of nuclear polyhedrosis virus (NPV) disease on Eri (*not invaded into Ethiopia)

* Facilities for isolated rearing room for quarantine purpose if Eri will introduce from overseas

July sampling pupa

September sampling pupa

Background of possible area for Eri production

• Area for eating insects
• Poor small holders area
• Availability of Local market
• Availability of cut cocoons buyers for spinning yarns
• Traditionally Hand spinning, hand woven area
1. Situation

1.1. Feed Plants

- Eri silkworms feed on leaves of castor and cassava plants and Mulberry silkworms feed on leaves of mulberry plants.

- There is favorable agro-climatic conditions for the growth of both feed plant categories.

- Both feed plant groups are available in many parts of the country. However, castor is relatively drought tolerant and it grows abundantly in unused lands either sown or wild: in waste accumulation areas and around fences, farm plots, eroded areas, irrigation canals, river banks and lake areas, soil conservation sites. On the other hand, mulberry grows in cultivated farms (small and large scale) and soil conservation areas.

1.2. Silkworms

- There is ideal weather for silkworm rearing in the country. Both Eri and mulberry silkworms are found to be adaptable to Ethiopian agro-climatic conditions. So, both types are under utilization in the country.

- However, Eri silkworms are majorly utilized by small scale farmers to supplement their income because:

  - The eri silk worm is hardy, and disease resistant. This is a clear advantage over the mulberry silk worm especially given the typical rearing conditions in rural households which are not highly sanitary.

  - Food plants for eri-silkworm commonly grown widely and abundantly in many parts of the country compared to the mulberry silkworms.
Eggs of eri silkworms don’t require special treatments which can’t be practiced by local farmers.

Eri silk thread is produced by spinning the cocoon fibers. This spinning can be done easily on the drop spindle, which is the ancient but appropriate spinning technique used all over Ethiopia for spinning cotton. Women can gain extra income from their silk business if they spin and sell the thread rather than selling the cocoons.

But, mulberry silkworms are restricted around research centers, colleges and to some investors. However, currently SNNP is trying to promote mulberry silkworms for small scale farmers with the intention to increase income per unit area of land. This is because leaf yield of mulberry per ha per year could be four times more than that of castor.

2. Bottle necks

2.1. Feed Plants

a/ Shortage of improved feed plant varieties:

Improved feed varieties which have high leaf productivity, pest resistance resistance with wider adaptability is very essential. Therefore, appropriate appropriate linkage with international research and development organizations is very important to obtain improved germplasms.

b/ Land shortage:

Provision of land for individual producers or group of producers (farmers, investors, women associations, youth association, etc.) should be considered to increase feed production to the silkworms where available.
Individual producers or group of producers can be provided with unused lands in conservation sites, marginalized lands, etc.

However, investors should be provided with enough land at appropriate sites permanently in legal basis. For this to happen, all government organs should be cooperative and fast serving as there exists a delayed process and hesitation to provide land for investors.

c/ Irrigation problem:

- Irrigation is very essential to increase feed productivity per unit area. However, mulberry requires more irrigation access compared to castor. Generally, soil moisture is very important for vegetative growth of both crops.

d/ Shortage of enough seed multiplication & distribution centers:

- Seed multiplication and distribution is very important to transfer the technology to the wider society. Thus, Seed Multiplication Centers, Research Organizations, ATVET Colleges, HLIs, FTCs and investors should be encouraged to participate in multiplying and distributing seeds of feed plants.
2.2. Silkworms

a/ Shortage of improved silkworm varieties

Shortage of improved silkworm varieties is a one of the major bottlenecks for the sericulture sector. In addition, silkworm diseases are causing significant yield loss. Therefore, efficient government to government relationship and international organizational linkage should be established to gain improved silkworm varieties and disease preventive chemicals as well as to develop Ethiopian silkworm breeding program in terms of human and physical resources.

b/ Lack of adequate awareness and knowledge about the silkworm rearing:

adequate trainings and efficient promotion efforts should be carried out across the country to enhance the level of silkworm technology adoption and to increase the level of perception of the wider society to the technology in general. Furthermore, utilization of mass media and publication and distribution of package of production guidelines and leaflets should be part of the promotion efforts.

c/ Shortage of enough silkworm egg multiplication & distribution centers

Silkworm eggs multiplication and distribution is very important to transfer the technology to the wider society. Thus, Seed Multiplication Centers, Research Organizations, ATVET Colleges, HLIs, FTCs and investors should be encouraged to participate in multiplying and distributing eggs of improved silkworm varieties.
3. Potential

- The maximum castor leaf productivity in Ethiopia is about 13,000 kg/ha. However, a leaf productivity of about 25,000 kg/ha have been recorded in India.

- Similarly, mulberry leaf productivity in Ethiopia is about 30,000 – 40,000 kg/ha but it reaches up to 60,000 kg/ha in India.

- The maximum eri cocoon productivity in Ethiopia is about 3.00 gram/cocoon. However, a productivity of 3.52 gram/cocoon has been recorded in India.

- On the other hand, a maximum mulberry cocoon weight of 1.60 gram was obtained from bivoltine mulberry silkworms in Ethiopia but the maximum cocoon weight of 2.50 gram has been recorded in Europe.

As a result, it is clear that the sector requires having more research achievements to reach to the maximum level in productivity terms in both feed plants and silkworms.

- So, it will be very essential to introduce or generate better performing feed plants and silkworm varieties.
Basics of Eri Production Technology in Ethiopia

21-22 October/2016

Presentation outline

1. Introduction
2. Role of sericulture business
3. Opportunities of eri silk production in Ethiopia
4. Life cycle of eri silkworm and its requirements
5. Necessities for eri silk production
6. Previous Research and Promotion Efforts in Ethiopia
7. Challenges
8. Future direction
## 1. Introduction

- Sericulture is the science of rearing silkworms to produce silk fiber
- Historical evidences show that the Chinese were the first to develop and reel silk from cocoon 4500 years ago
- Gradually, the knowledge was spread by Monks, prisoners or Smugglers to Korea, Japan, India and Southeast Asia
- Although Africa has high potential for silk production, and the resources are untouched, the technology reached very late
- In Ethiopia, silk has strong attraction to the people starting from early period of Axum Kingdom
- However, the silk yarns used were imported from China, India and Arabia

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### Introduction ...

- In Ethiopia, the history of silk production goes back to the 1930s when the Italians realized the suitable agro-climatic conditions for growing feed plants and rearing silkworms
- They introduced the technology and grew mulberry plants over 30 sites and conducted silkworm rearing at 11 sites
- As a result, they proved the potential of growing mulberry plants and rearing silkworms in diverse agro ecologies and altitudes
- Sericulture technology got consideration by Ethiopian Institute of Agricultural Research (EIAR) in the mid 1970s as a component of coffee diversification following the sudden outbreak of coffee berry disease (CBD) and the devastation of coffee plantation in the country
Introduction ...

❖ As a result, research and development activities were initiated by Melkassa Agricultural Research Center and efforts continued for some years only in silk worm adaptation experiments

❖ Later on, research had developed integrated management of CBD that consisted resistant varieties and fungicides in early 1980s and the question of coffee diversification became low priority

❖ Sericulture research was subsequently discontinued in the late 1980s due to this priority rearrangement

❖ The importance of sericulture in creating employment opportunities and generating income was later realized and the sericulture project was reinitiated in early 2000

2. Role of sericulture business

2.1. Role of silkworms/silk production

❖ Silkworm is an important economic insect and also a tool to convert leaf protein into silk

❖ Sericulture is an agro-based cottage industry which plays an important role in improving the rural economy because of its high employment and income generation capability

❖ It can be practiced by a large number of people including women, youth, elderly and disabled groups without disturbing the existing normal farming activities

❖ It can be used as a means of diversifying agriculture and contribute to foreign exchange earnings
Role of sericulture business

- It also provides a tool for sustainable rural development and conservation practices
- It also reduces migration of people from rural to urban areas by providing high output with minimum investment in their locality from small portion of land
- Silk as a fabric used for making parachute, tyre manufacture, soft sky jackets, comforters and sleeping bags, scarves, ties etc. It is also used in surgery for internal suturing
- It opens a new commercial markets such as cosmetics and diverse medical products

2. Role of sericulture business

2.2. Role of byproducts

- Silkworm excreta for fertilizer (organic manure)
- Pupa can be used as feed for poultry and fish as well as food for human beings
- Castor bean used as lubricant
- Castor oil from the seed is very well known to clear the digestive tract in cases of poisoning, has antidandruff effect and also used in the treatment of dermatosis
- Stem of castor form good source as pulp in paper industry
3 Opportunities of eri silk production in Ethiopia

- Favourable agro climatic condition for silkworm rearing & feed plant growing
- Availability of self sown feed plant (castor) in diverse agro ecologies
- Availability of sufficient labour in a family in rural areas.
- Long standing traditional wisdom of spinning and weaving cotton
- Strategic location of the country to the leading consumers: Middle East and Europe

4. Life cycle of eri silkworm and its requirements

- Eri silkworm is reared indoors
- Eri silkworm rearing can be started when castor leaves are available
- Eri silkworm life cycle has four stages: egg, larva, pupa encased in cocoon and adult moth
- A complete life cycle of eri silkworm (eri-10/3.4) lasts about 51 days in wet rainy season, 59 days in hot dry season and 66 days in cold dry season (Abiy et al. unpublished)
- The larva is very important as it is the only feeding stage and requires curious management in brushing, feeding, cleaning, spacing, mounting, etc.
5. Necessities for eri silk production

5.1. Major production requirements

5.1.1. Feed plant cultivation (castor)

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Recommended practices for castor cultivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plant Spacing</td>
<td>75cm b/n rows and 50cm b/n plants</td>
</tr>
<tr>
<td>2</td>
<td>Planting date</td>
<td>3rd - 4th week of June and 1st - 2nd week of July</td>
</tr>
<tr>
<td>3</td>
<td>Sowing seeds</td>
<td>Sow seed @ 2-3 per hole but maintain only one plant per hole after 15 days of germination.</td>
</tr>
<tr>
<td>4</td>
<td>Fertilizer</td>
<td>FYM or compost, if possible</td>
</tr>
<tr>
<td>5</td>
<td>Leaf harvesting date</td>
<td>10 weeks after planting for 1st harvest but make successive harvests after a gap of 6 to 8 weeks period</td>
</tr>
<tr>
<td>6</td>
<td>Maximum leaf productivity/ha (Ethiopia)</td>
<td>• Commercial farmers who supplement the dry period with irrigation could produce 13000 kg/ha</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Landless poor resource farmers use self sown castor plants from their surrounding areas</td>
</tr>
<tr>
<td></td>
<td>Maximum leaf productivity/ha (India)</td>
<td>- Leaf yield per acre per year is 10,000 kgs (2.47105* 10000 kg/ha = 25000kg/ha)</td>
</tr>
</tbody>
</table>
5. Necessities for eri silk production

5.1.2. Silkworm rearing

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Recommended practices for eri silkworm rearing</th>
</tr>
</thead>
</table>
| 1   | Bed Spacing                               | ✓ For young larval stages 600 to 1200 worms per feeding tray (60cm x 90cm)  
    |                                             | ✓ For medium larval stages 400 to 1000 worms per feeding tray  
    |                                             | ✓ For mature larval stages 200 to 300 worms per feeding tray |
| 2   | Bed cleaning                              | ✓ 1-2 times bed cleaning frequency per day |
| 3   | Mountage type & size                      | ✓ Mountages made from plywood, carton, banana leaf and mango leaf  
    |                                             | ✓ 4cm x 5cm size in plywood & carton made mountages |
| 4   | Feeding frequency and feeding amount      | ✓ Feeding frequency: 2 times/day for 1st instar, 3-4 times/day for 2nd-5th instar  
    |                                             | ✓ Feeding amount: 5.045 kg leaf/100 larvae |
| 5   | Cocoon Degumming (boiling) period         | ✓ 80 minutes at boiling temperature |
| 6   | Cocoon productivity (Inside & outside country) | ✓ 3.00 gram/cocoon (Ethiopia)  
    |                                             | ✓ 3.52 gram /Cocoon( India) |

Table 1. Economic return for poor resource silkworm growers in case of wild feed plant collection or planting around fences and farm lands

<table>
<thead>
<tr>
<th>Type of silkworm</th>
<th>Average single cocoon wt (gms)</th>
<th>No. of cocoons from one laying</th>
<th>Cocoon yield from 100 layings (kg)</th>
<th>income/100 layings (1 kg cocoon=100 birr)</th>
<th>100 layings leaf consumption (1laying=10.09 kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eri-silkworm</td>
<td>2.375</td>
<td>200</td>
<td>47.5</td>
<td>4750</td>
<td>1009 kg</td>
</tr>
</tbody>
</table>

Assumptions
- 200 larvae will make cocoons from 1 laying
- Cocoon weight will be reduced to about 2.375 gram/cocoon while research achievements showed up to 3.00 gram/cocoon.
- Leaf collection will be done from the surrounding areas without using his farm land. Thus, he may collect up to 1009 kg of leaves to rear 100 layings.
- He will use family labor for leaf collection and silkworm rearing.
- As a beginner the farmer can use his whole purpose living room for silkworm rearing.
Table 2. Economic return for poor resource farmer but having a land

<table>
<thead>
<tr>
<th>Type of silkworm</th>
<th>Average single cocoon wt (gms)</th>
<th>No. of cocoons from one laying</th>
<th>Cocoon yield from 100 layings (kg)</th>
<th>Leaf consumption/layings (kg)</th>
<th>1 ha feeding capacity</th>
<th>Cocoons yield/ha (kg)</th>
<th>Income/ha/yr</th>
<th>Average Income/month (Birr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eri-silkworm</td>
<td>2.375</td>
<td>200</td>
<td>47.5</td>
<td>10.09</td>
<td>10000 kg castor leaf</td>
<td>991.08</td>
<td>470.76</td>
<td>47076</td>
</tr>
</tbody>
</table>

Assumptions

➤ 200 larvae will make cocoons from 1 laying.
➤ Cocoon weight will be reduced to about 2.375 gram/cocoon while research achievements showed up to 3.00 gram/cocoon.
➤ Leaf collection will be done from his own land (1 ha) or he may collect additional leaves from the surrounding areas if in case he has less than 1 ha of land. Thus, he may generally collect up to 10,000 kg of leaves.
➤ He will use family labor for leaf collection and silkworm growing.

Table 3. Economic return for commercial farmer

<table>
<thead>
<tr>
<th>Type of silkworm</th>
<th>Average single cocoon wt (gms)</th>
<th>No. of cocoons from one laying</th>
<th>Cocoon yield from 100 layings (kg)</th>
<th>Leaf consumption/layings (kg)</th>
<th>1 ha feeding capacity</th>
<th>Cocoons yield/ha (kg)</th>
<th>Income/ha/yr</th>
<th>Average Income/month (Birr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eri-silkworm</td>
<td>3.05</td>
<td>200</td>
<td>61</td>
<td>10.09</td>
<td>13000 kg castor leaf</td>
<td>1288.4</td>
<td>785.93</td>
<td>78593</td>
</tr>
<tr>
<td>Mulberry silkworm</td>
<td>1.37</td>
<td>200</td>
<td>27.4</td>
<td>6.74</td>
<td>40000 kg mulberry leaf</td>
<td>5974.72</td>
<td>162</td>
<td>162611</td>
</tr>
</tbody>
</table>

Assumptions

➤ 200 larvae will make cocoons from 1 laying.
➤ Cocoon weight will be reduced to about 3.05 gram/cocoon while research achievements showed up to 3.44 gram/cocoon.
➤ Leaf collection will be done from his own 1 ha of land. He will harvest up to 13,000 kg of leaves from that land.
➤ He use casual labor in addition with his family labor.
➤ Therefore, he should increase his land size to get better benefit and/or he should go for cocoon collection and value addition to be more profitable.
5. Necessities for eri silk production

5.1.3. Processing

➢ The farmers should be able to add values to their cocoon products so that their income can be increased. So, processing is very essential. However,

➢ The level of knowhow and experience is very limited (mounting, harvesting, sorting, drying, storing, degumming, spinning, dyeing, weaving, finishing).

➢ The practice of spinning eri silk is being implemented like that of cotton at farmers’ level.

➢ Cottage industries like Saba Har and Bere PLC are practicing a bit modernized techniques which include pedal driven spinning tools.

➢ Therefore, processing needs strong attention by business organizations, GOs and NGOs
5.2. Required development and supportive efforts to sericulture promotion

1. Administrative structure along the ministry of livestock and fishery resource

2. Training and capacity building to the level of value addition
   - Experts at federal, regional, zonal and district levels
   - Development agents at Kebele level
   - Researchers
   - Experience sharing mechanisms
   - Laboratories and equipments

3. Silkworm eggs production centers (grainages) and castor seeds multiplication and supply system

4. Market prices and linkage systems

5. Land availability

6. Credit and Incentive system

7. Equipments and model rearing rooms

8. International partnership
6. Previous Research and Promotion Efforts in Ethiopia

6.1. Achievements (Research and Promotion)

- One eri silkworm breed was recommended for its better adaptability and cocoon yield.
- Castor variety namely Abaro was recommended for its superior results in leaf yield & rearing performance of eri silkworms.
- Package of information on easy and economically feasible silkworm and cocoon management practices have been generated.
- Package of information on major and minor pests of castor plant has been generated.
- Information on opportunities and constraints of silk production and marketing has been produced.

- Package of information on agronomic practices for castor cultivation is generated.
- Demonstration, pre scaling up, multiplication and distribution activities of improved sericulture technologies were made for small scale farmers, commercial farmers and other stakeholders in the country.
- Results obtained from the various conducted experiments have been published in journal articles and proceedings. Similarly manuals and leaflets are produced to be used by farmers.
6. Previous Research and Promotion Efforts in Ethiopia

6.2. Publications of Sericulture Research by EIAR researchers

A. Journals (12)

• Abera Hailu (2016). Assessment of Growth and Performance of Silk Worms (Bombyx mori L.) on Mulberry Leaves at Jimma, South West Ethiopia. Journal of Biology, Agriculture and Health care, 6(9): 10-16


6. Previous Research and Promotion Efforts in Ethiopia


6. Previous Research and Promotion Efforts in Ethiopia

Proceedings (6)


6. Previous Research and Promotion Efforts in Ethiopia

C. Production Manuals and leaflets (4)


Technology promotion at Shebedino (SNNP)
Technology promotion at Shebedino (SNNP)
Technology promotion at Shebedino (SNNP)

Technology promotion around Shebedino
Technology promotion at Arbaminch Zuria Woreda (chano chalba kebele silk producer association)

Gomugofa zone, Miirab Abaya Woreda
Wolaita zone, Sodo zuria woreda (Bosa kacha kebele silk producer association)

Wolaita zone, Sodo zuria woreda
Silk producers at Ambo town

Technology promotion at Adama woreda
Promotion effort in collaboration with Debreberhan university for Showarobit area

Market linkage among producers and processors

1. BERE PLC
2. SABAHAAR COMPANY
3. DATOOO PLC
Bere Plc at Arbaminch

Datoo plc at Hawassa
7 Challenges

1. Shortage of skilled human power and staff turnover
2. Ineffective technology promotion (extension) scheme for sericulture
3. Weak linkage among different partners and stakeholders
4. Low cocoon production both in quantity & quality
5. Shortage of enough seed multiplication & distribution centers
6. Lack of appropriate post cocoon production technologies and processing technologies
8 Future directions

➢ Further promotion of the technology and widening market opportunities
➢ Support the technology promotion with strong research backup
➢ Build the capacity of actors at various levels in terms of human & physical resources
➢ Give incentives for early adopters and quality producers
➢ Strengthening linkage and partnership with national and international partners and stakeholders
➢ Establishing grainages and post harvest processing plants /technologies

Thank you
Brief history of Sabahar

- The idea of Sabahar started in 2000, with a vision to produce and export hand spun and hand woven textiles, using mainly locally produced silk.
- Learned about eri silk production and processing from & with Melkassa EIAR (Ato Metafaria)
- Started with a one weaver and a group of women to spin eri silk on drop spindles (enertz)
- Established relationship with Beresericulture in Arba Minch in about 2005
- In 2006, Sabahar became a Private Limited Company with 4 shareholders (2 Canadian and 2 Ethiopian) using private funds
- Worked only through Ministry of Agriculture extension agents and systems until 2015
• Between 2007-2014, Sabahar staff made 3 trips to India to learn about silk and weaving (sabahar fund)
• Starting importing silk from India in 2009 to meet export and local demand for silk products
• In 2015, hired our own silk promoter, who is based with Beresericulture in Arba Minch.
• Produced and published 1,000 Amharic training manuals for distribution to our silk producers (from sabahar funds)
• Purchased 200 rearing trays and 200 montages frames which we distributed freely to our silk producers (from sabahar funds)
• Have trained over 255 silk producers at no charge
• Have trained about 90 women to spin silk at no charge
• Have seen dramatic increase in eri silk production in last year

<table>
<thead>
<tr>
<th>Year</th>
<th>Kgs of Eri cocoons</th>
<th>Price/kg 1st grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-05</td>
<td>960 kg</td>
<td>30 birr</td>
</tr>
<tr>
<td>2005-06</td>
<td>1,500 kg</td>
<td>30 birr</td>
</tr>
<tr>
<td>2006-07</td>
<td>2,646 kg</td>
<td>30 birr</td>
</tr>
<tr>
<td>2007-08</td>
<td>2,465 kg</td>
<td>30 birr</td>
</tr>
<tr>
<td>2008-09</td>
<td>1,052 kg</td>
<td>35 birr</td>
</tr>
<tr>
<td>2009-10</td>
<td>976 kg</td>
<td>40 birr</td>
</tr>
<tr>
<td>2010-11</td>
<td>964 kg</td>
<td>40 birr</td>
</tr>
<tr>
<td>2011-12</td>
<td>737 kg</td>
<td>50 birr</td>
</tr>
<tr>
<td>2012-13</td>
<td>94 kg</td>
<td>60 birr</td>
</tr>
<tr>
<td>2012-14</td>
<td>48 kg</td>
<td>60 birr</td>
</tr>
<tr>
<td>2014-15</td>
<td>15 kg</td>
<td>80 birr</td>
</tr>
<tr>
<td>2015-16</td>
<td>58 kg</td>
<td>100 birr</td>
</tr>
<tr>
<td>2016 (3 months)</td>
<td>180 kg</td>
<td>100 birr</td>
</tr>
</tbody>
</table>
### Purchase of Eri silk thread by Sabahar

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount</th>
<th>Price/kg</th>
<th>Source</th>
<th>Amount</th>
<th>Price/kg</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-05</td>
<td>160 kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ethiopia</td>
</tr>
<tr>
<td>2005-06</td>
<td>250 kgs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ethiopia</td>
</tr>
<tr>
<td>2006-07</td>
<td>440 kgs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ethiopia</td>
</tr>
<tr>
<td>2007-08</td>
<td>400 kgs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ethiopia</td>
</tr>
<tr>
<td>2008-09</td>
<td>250 kgs</td>
<td>300 birr</td>
<td>India</td>
<td>228 kgs</td>
<td>350 birr</td>
<td>Ethiopia</td>
</tr>
<tr>
<td>2009-10</td>
<td>130 kgs</td>
<td>350 birr</td>
<td>India</td>
<td>150 kgs</td>
<td>400 birr</td>
<td>Ethiopia</td>
</tr>
<tr>
<td>2010-11</td>
<td>450 kgs</td>
<td>400 birr</td>
<td>India</td>
<td>150 kgs</td>
<td>400 birr</td>
<td>Ethiopia</td>
</tr>
<tr>
<td>2011-12</td>
<td>450 kgs</td>
<td>400 birr</td>
<td>India</td>
<td>130 kgs</td>
<td>400 birr</td>
<td>Ethiopia</td>
</tr>
<tr>
<td>2012-13</td>
<td>200 kgs</td>
<td>650 birr</td>
<td>India</td>
<td>18 kgs</td>
<td>400 birr</td>
<td>Ethiopia</td>
</tr>
<tr>
<td>2012-14</td>
<td>580 kgs</td>
<td>650 birr</td>
<td>India</td>
<td>11 kgs</td>
<td>500 birr</td>
<td>Ethiopia</td>
</tr>
<tr>
<td>2014-15</td>
<td>600 kgs</td>
<td>800 birr</td>
<td>India</td>
<td>22 kgs</td>
<td>800 birr</td>
<td>Ethiopia</td>
</tr>
<tr>
<td>2015-16</td>
<td>450 kgs</td>
<td>900 birr</td>
<td>India</td>
<td>68 kgs</td>
<td>1100 birr</td>
<td>Ethiopia</td>
</tr>
<tr>
<td>2016 (3 months)</td>
<td>115 kgs</td>
<td>1200 birr</td>
<td>Ethiopia</td>
<td></td>
<td></td>
<td>Ethiopia</td>
</tr>
</tbody>
</table>

### PURCHASE OF ERI COCOON

```
<table>
<thead>
<tr>
<th>Year</th>
<th>Price/kg 1st grade</th>
<th>Purchase of Eri cocoons</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-05</td>
<td>30</td>
<td>960</td>
</tr>
<tr>
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<td>30</td>
<td>1,500</td>
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</tr>
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<td>2011-12</td>
<td>50</td>
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</tr>
<tr>
<td>2012-13</td>
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<td>2012-14</td>
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</tr>
<tr>
<td>2013-15</td>
<td>80</td>
<td>15</td>
</tr>
<tr>
<td>2014-15</td>
<td>100</td>
<td>18</td>
</tr>
<tr>
<td>2015-16</td>
<td>100</td>
<td>180</td>
</tr>
<tr>
<td>2016 (3 months)</td>
<td>100</td>
<td>180</td>
</tr>
</tbody>
</table>
```
PURCHASE OF ERI SILK THREAD LOCALLY

Distribution of trays and montage for cocoon producers

<table>
<thead>
<tr>
<th>Number of trays</th>
<th>Number of montage</th>
<th>Location of producers</th>
<th>Number of producers who received equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>45</td>
<td>SNNPR (Arebaminch)</td>
<td>15</td>
</tr>
<tr>
<td>55</td>
<td>55</td>
<td>SNNPR (Welayta)</td>
<td>18</td>
</tr>
<tr>
<td>85</td>
<td>85</td>
<td>SNNPR (Shebedino)</td>
<td>24</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>Oromia (Ambo)</td>
<td>17</td>
</tr>
</tbody>
</table>
Household silk production: Model #1

- Farm size: 0.25 hectare with 250 caster plants.
- Materials required: 30 trays, 3 wood stands, 15 montage and 2 buckets. Around 2,250 birr.
- 250 castor plants @ 12 kgs leaf per plant = 3000kgs leaves/year.
- Leaf requirement of 12kgs leaves per 200 larva so 600 kgs/cycle of leaves available.
- 5 cycles of production with 10,000 larva/cycle.
- Labour requirement – 3 people.
- Yield per cycle = 15-17 kg dry cocoon (5 cycles is 75-85kgs)
- Yearly income by selling cocoons is 7,500-8,500 (100 birr/kg)
- Yearly production of thread is 15-20 kgs.
- Yearly income by selling thread is 15,000 to 20,000 birr (1,000 birr/kg)

Household silk production: Model #2

- Farm size: 0.125 hectare with 125 caster plants.
- Material required: 15 trays 2 wood stands, 5 montages and 2 buckets = 1,175 birr.
- 125 castor plants @ 12 kgs leaf per plant = 1,500 kgs of leaves/year.
- Leaf requirement of 12 kgs of leaf per 200 larva so 300 kg/cycle.
- 5 cycles of production with 5,000 larva per cycle.
- Labour requirement – 1 person.
- Yield per cycle = 7-8 kgs (5 cycles is 35-40)
- Yearly income by selling cocoon is 3,500-4,000 birr (100 birr/kg)
- Yearly production of thread is 7.5-10 kgs.
- Yearly income by selling thread is 7,500 to 10,000 birr (1,000 birr/kg)
Case studies of Eri silk producers

- Mrs. Dubise Bua from Shebedino Woreda Holso village
- Started producing eri silk cocoons on 2001 E.C.
- Produced 42 kg of cocoon with 25 square meters of land in 2008 E.C. (4,200 Birr income)
- Plans to produce 100kg dry cocoon in 2009 E.C.
- Shortage of leaf and silk worm seed are her challenges.

- Mrs. Elfenesh - a role models in Welayita area Kuwakute village
- Started producing cocoon in 2004 EC and sold 53 dry cocoon to Sabahar.
- Supports her family by the income getting from the selling of the cocoon.
- Shortage of land and availability of silk worm seed are her challenges.
Mr. Tamene lives in Antsokia, Kemise zone
He started producing 2002E.C.
He has sold 135kg cocoon to Sabahar.
For the future, he wants to spun the cocoon to thread.

Challenges for Eri silk production in Ethiopia

- Lack of well organized silkworm seed multiplication centers, and therefore lack of sufficient seed for producers.
- Shortage of land restricts the amount of castor leaves available, and therefore reduces silk production.
- Poor management leads to low productivity of cocoons.
- Absence of effective technical support for producers.
- Lack of good and affordable rearing equipment.
- Shortage of water during dry season for castor plants.
- Lack of reliable information regarding the market for eri cocoons and yarn.
Conclusions and Recommendations

1. Even though Ethiopia has many potential silk production areas, little attention is given to the sector.
2. Seed multiplication centers should be established in potential areas (i.e., at farmer training centers).
3. Extension workers should be well trained in silkworm rearing to effectively promote sericulture and support producers.
4. NGOs should coordinate with other sericulture agencies in the area.

5. In order to increase household income, it is better to encourage the women to spin silk yarn, and provide spinning wheels.
6. Government of Ethiopia/appropriate agencies should search for reliable, external markets for both processed and raw eri silk.
7. Government of Ethiopia/appropriate agencies should explore branding of Ethiopian eri silk.
Background to the project

Promote Biodiversity
Conservation

Management of pollinator bee disease and pests

Spill over benefits

Honey and hive-based products

Scope of the project (1)

Promotor: ICIPE

Development partner (Grant): The MasterCard Foundation

Timeframe: Five years from November 2015

Total budget: USD10.3 million

Geographical coverage: Two Regions, few Zones.
Scope of the project (2)

Numbers of youth to be targeted:

- Unemployed interested youth from 10th grade up, and between 18 and 24 years of age
- 12,500 youth from the target areas
  - 10,000 in apiculture (in Amhara Region)
  - 2,500 in sericulture (in SNNP Region)

To promote gender equality, the project will target:

- 70% male and 30% female participation for beekeeping, and
- 35% male and 65% female for silk farming

Scope of the project (3)

Implementing partners and stakeholders:

- Government agencies, Ministries, Finance Institutions
- Ethiopian honey and silk agribusiness drivers: Ethiopian Honey & Beeswax Producers and Exporters Association (EHBPEA), Ethiopian Apiculture Board (EAB), Ethiopia Beekeeping Association (EBA),
- Technical and Vocational Training Institutions (TVTs): TVTs in Amhara and Gamo Gofa
- Local organizations, cooperatives: e.g. Zembaba Bees Products Development and Marketing Cooperatives Union
- Private sector partners within the honey and silk value chains: Beza Mar Agro-Industry Plc, Sabahar Silk Enterprise, Paradise Fashion
- NGOs: SNV, JICA, Bees4Development
Objective of the project

Goal:
To reduce youth unemployment by providing economic opportunities in silk farming and beekeeping for young people through training and job creation, and entrepreneurship support.

Objectives:
1. To undertake in-depth value chain analysis of beekeeping and silk production
2. To increase the knowledge, improve capacity and technology-based entrepreneurship within the currently unemployed youth population
3. To develop silk and beekeeping entrepreneurship skills for youth through business incubation and development
4. To create market opportunities for youth in beekeeping and silk value chains
5. To facilitate learning and monitor progress
6. To raise awareness on progress and outcomes for dissemination amongst key stakeholders

Objectives of the project (1)

Objective 1: To undertake in-depth value chain analysis of beekeeping and silk production in the targeted project zones.

Activities:
1.1. Map the major processes that the raw materials produced (honey, beeswax, cocoons) go through before reaching the final consumption
1.2. Identify and map the main actors involved in the processes
1.3. Identify the flows of products as well as information flow and knowledge in the value chain
1.4. Quantify the volume of different products in the value chain
1.5. Identify relationships and linkages between market actors
1.6. Identify the bottlenecks within the supply chain and where possible identify/refine interventions.
Objectives of the project (2)

Objective 2: To increase the knowledge, improve capacity and technology-based entrepreneurship within the currently unemployed youth population.

Activities:

2.1 Identify, profile and select youth to form groups with a good balance in gender
2.2 Establish training centres for beekeeping and silk farming activities
2.3 Build capacity through training (technical, business and life-skills) of 12,500 youth and 4 government staff from the Ministry of Agriculture, provision of starter kits and material support to improve beekeeping and silkworm rearing technologies and post-harvest for high quality production and income
2.4 Increase participatory tree plantation to improve bee biodiversity, provide silkworm feed and enrich the ecosystem
2.5 Provide technical support using existing egg production facility (grainage) within the region

Objectives of the project (3)

Objective 3: To develop silk and beekeeping entrepreneurship skills for youth through business incubation

Activities:

3.1 Identify, profile and select youth to form groups with a good balance in gender
3.2 Establish training centres for beekeeping and silk farming activities
3.3 Build capacity through training (technical, business and life-skills), provision of starter kits and material support to improve beekeeping and silkworm rearing technologies and post-harvest for production and income
3.4 Increase participatory tree plantation to improve bee biodiversity, provide silkworm feed and enrich the ecosystem
3.5 Provide technical support
**Objectives of the project (4)**

Objective 4: To create market opportunities for youth in beekeeping and silk value chains.

Activities:

4.1 Facilitate the establishment of legalized Cooperatives and Unions that are youth-led

4.2 Develop youth-led marketplaces and collection centers for harvesting, bulking, processing (value addition) and packaging of quality honey and silk products

4.3 Work with relevant Ethiopian Government organizations and NGOs to increase honey and silk market opportunities — import substitution and export promotion

4.4 Facilitate the use of by-products of the silk and honey industries to benefit youth and their associations.

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**Objectives of the project (5)**

Objective 5: To facilitate learning among the project participants and capture key project learning and disseminate amongst the key stakeholders.

Activities:

5.1 Develop a M&E plan for the project including a detailed learning plan to ensure uptake of the technologies

5.2 Implement the M&E plan including baseline data, collection and analysis, review and refinement of methodology after completion of cohort one and subsequent ongoing evaluation including end of project review

5.3 Develop an outcome mapping strategy including impact pathways in order to understand and document the impact generated by project

5.4 Monitor different partners (NGOs and Government Ministries) in order to document the extent to which beekeeping and silk farming are used for solving youth unemployment problem.
Objectives of the project (6)

Objective 6: To raise awareness and access to the outcomes and information on the project progress and achievements among project partners, relevant key stakeholders and the communities

Activities:

6.1 Create a project website for use as a dissemination vehicle for the wider audience, including project activities, progress and results; project publications and presentations.

6.2 Organize conferences and workshops to maximize the impact of dissemination and the sustainability of project outputs.

6.3 Develop a communication plan in order to identify relevant key stakeholders (internal and external) and enhance communication among all parties involved in the project.

Project budget by objectives

<table>
<thead>
<tr>
<th>Activity</th>
<th>Proposed Budget (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective 1: To undertake in-depth value chain analysis of beekeeping and silk production in the targeted project zones</td>
<td>683,558 (7%)</td>
</tr>
<tr>
<td>Objective 2: To increase the knowledge, improve capacity and technology-based entrepreneurship within the currently unemployed youth population</td>
<td>6,159,764 (60%)</td>
</tr>
<tr>
<td>Objective 3: To support the development of youth-led and owned, silk farming and beekeeping enterprises through business development/Incubation.</td>
<td>1,159,605 (11%)</td>
</tr>
<tr>
<td>Objective 4: To create market opportunities for youth in beekeeping and silk value chains</td>
<td>908,831 (9%)</td>
</tr>
<tr>
<td>Objective 5: To facilitate learning among the project participants and capture key project learning and disseminate amongst the key stakeholders</td>
<td>1,149,909 (11%)</td>
</tr>
<tr>
<td>Objective 6: To raise awareness and access to the outcomes and information on the project progress and achievements among project partners, relevant key stakeholders and the communities</td>
<td>287,940 (3%)</td>
</tr>
<tr>
<td>Total budget</td>
<td>10,349,607</td>
</tr>
</tbody>
</table>

Estimated average investment of US$800 per beneficiary
The Project Road Map

- Site and youth selection
- Training (technical, business, life skills)
- Enterprise / Cooperative formation
- Provision of starter kits and other inputs
- Project management
- Follow up and supervision (M&E, Research)
- Credit services
- Production, post-harvest management and marketing

Economically viable enterprises (1)

1 Beekeeping starter kit

- 2 Langstroth hives
- 1 bee suit/gloves
- 1 hive tool
- 1 smoker

Production

80kg of honey/year

Income

US$480

- Average 20kg of honey/hive/harvest
- 2 honey seasons per year
- US$6/kg for semi-processed honey
Economically viable enterprises (2)

Fruits → Mulberry Juice → Mulberry Jam

Silkworm waste

Management of the project

- National Steering Committee (stakeholders)
- Project Coordinator (*icipe*)
- Periodic report to donor
- Periodic project evaluation (midterm and final)
Perceived potential risks to success

1. Impacts of natural forces such as drought and floods
2. Environmental conditions leading to decline in bee populations (e.g., diseases, pests)
3. Loss of participants
4. Poor technology adoption rate by participants
5. Pesticide poisoning and contamination
6. Land degradation issues
7. Delays in recruitment of new staff
8. Slow implementation by partners
9. Lack of commitment by the youth beneficiaries
10. Lack of ability to market the honey and silk supply generated by project beneficiaries.

Assumptions made for the success the project

1. Conducive macroeconomic environment and incentives exist for enhancing agricultural growth and productivity
2. Adequate political, economic and social stability prevails
3. Government increases investments in agriculture and particularly in agricultural beekeeping and silk farming activities
4. Relevant regional and national policies are implemented effectively
5. Government, non-government, regional and national organizations operate effectively at appropriate levels
6. Minimal disruptions from biophysical and environmental catastrophes.
Common aspects of Silk

- Natural protein fibers
- Naturally Organic produced
- Good for sensitive skins
- Superior characters under various climate condition
- Agricultural products (Industrial usage)
- Common side business for small farmers in Asia
- Useful by-products

World trend of Silk Production

- Based on the Stable world market demands;
  - Cocoons 2.4M tons per year (2015)
  - Yarns 200,000 tons per year (2015)
- China: Mulberry ↑
- India: Mulberry → Wild silk ↑
- Latin America: Mulberry →
- West Asia: Mulberry →
- South East Asia: Mulberry → Wild silk →
Production Countries

- **1. China (75% cocoons, 80% of yarns)**
- **2. India*(18% cocoons, 15% of yarns)**
  
  Apx. 95% production by China and India

- **3. Uzbekistan**
- **4. Brazil**
- **4. Vietnam***
- **5. Iran**
- **6. Japan and Turkey**

### World Silk Production (MT)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>115,000.0</td>
<td>104,000.0</td>
<td>126,000.0</td>
<td>130,000.0</td>
<td>146,000.0</td>
<td>170,000.0</td>
<td>↑</td>
</tr>
<tr>
<td>India</td>
<td>21,005.0</td>
<td>23,060.0</td>
<td>23,679.0</td>
<td>26,480.0</td>
<td>28,708.0</td>
<td>28,523.0</td>
<td>→</td>
</tr>
<tr>
<td>Brazil</td>
<td>770.0</td>
<td>558.0</td>
<td>614.0</td>
<td>550.0</td>
<td>560.0</td>
<td>600.0</td>
<td>→</td>
</tr>
<tr>
<td>Uzbekistan</td>
<td>940.0</td>
<td>940.0</td>
<td>940.0</td>
<td>980.0</td>
<td>1,100.0</td>
<td>1,200.0</td>
<td>↑</td>
</tr>
<tr>
<td>Vietnam</td>
<td>550.0</td>
<td>500.0</td>
<td>450.0</td>
<td>475.0</td>
<td>420.0</td>
<td>450.0</td>
<td>→</td>
</tr>
<tr>
<td>Japan</td>
<td>54.0</td>
<td>42.0</td>
<td>30.0</td>
<td>30.0</td>
<td>30.0</td>
<td>30.0</td>
<td>→</td>
</tr>
<tr>
<td>Madagascar</td>
<td>16.0</td>
<td>16.0</td>
<td>18.0</td>
<td>18.0</td>
<td>15.0</td>
<td>5.0</td>
<td>↓</td>
</tr>
<tr>
<td>Turkey</td>
<td>18.0</td>
<td>22.0</td>
<td>22.0</td>
<td>25.0</td>
<td>32.0</td>
<td>30.0</td>
<td>→</td>
</tr>
<tr>
<td>South Korea</td>
<td>3.0</td>
<td>3.0</td>
<td>1.5</td>
<td>1.6</td>
<td>1.2</td>
<td>1.0</td>
<td>→</td>
</tr>
<tr>
<td>Thailand</td>
<td>655.0</td>
<td>655.0</td>
<td>655.0</td>
<td>680.0</td>
<td>692.0</td>
<td>698.0</td>
<td>→</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>40.0</td>
<td>38.0</td>
<td>42.5</td>
<td>43.0</td>
<td>44.5</td>
<td>44.0</td>
<td>→</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>9.4</td>
<td>6.0</td>
<td>8.5</td>
<td>8.5</td>
<td>8.0</td>
<td>8.0</td>
<td>→</td>
</tr>
<tr>
<td>Indonesia</td>
<td>20.0</td>
<td>20.0</td>
<td>20.0</td>
<td>16.0</td>
<td>10.0</td>
<td>8.0</td>
<td>↓</td>
</tr>
<tr>
<td>Iran</td>
<td>75.0</td>
<td>120.0</td>
<td>123.0</td>
<td>123.0</td>
<td>110.0</td>
<td>120.0</td>
<td>→</td>
</tr>
<tr>
<td>TOTAL</td>
<td>139,100.0</td>
<td>129,661.8</td>
<td>152,845.6</td>
<td>159,737.1</td>
<td>178,057.6</td>
<td>202,072.8</td>
<td>→</td>
</tr>
</tbody>
</table>

Data source: International Sericultural Commission
World Production of Silk

- Only less than 0.2% of total global textile market
- Produced in over 60 Countries in the world
- Mainly produced in Asia (almost 90% mulberry silk and 100% of wild silk)
- 1 million workers are employed in China
- **8.2 million** workers in India
- 20,000 weaving families (HHs) in Thailand (650t/y)
- Keeping rural population and to **prevent migration**
- Required small investments while providing raw materials for textile industries

Category of silk products

1. Natural silk (yarns, fibers)
2. Fabrics (dress materials, sarees, scarves, stoles)
3. Made-ups (Bed covers, room decoration items)
4. Ready made garments
5. Silk carpets
6. Silk wastes
World Consumption of Silk

- 1. USA
- 2. Italy
- 3. Japan
- 4. India
- 5. France
- 6. China
- 7. UK
- 8. Switzerland
- 9. Germany
- 10. UAE

Both Production and Consumption

- China: Increasing both consumption and Production
- India: Rapid increasing of wild silk production but mainly consumed in domestic and production of mulberry silk
- Japan: Keep stable consumption and small but high quality production

Stable demand on mulberry silk / Suggested additional market mainly in western countries for wild silk
India: A case study

- 8.2 million persons employed by sericulture
- 76% of domestic consumption of mulberry silk
- Sericulture is considered as a subsidiary occupation
- Providing continuous income to farmers
- Silk and silk goods are very good foreign exchange earners
- Government says “The present global scenario indicates the enormous opportunities of silk industry”

Silk Production details of India

![Graph showing silk production in MT from 2008-09 to 2015-2016 for Mulberry raw silk and Total raw wild silk](chart.png)
Wild silk in India

- Strong Up trend
- Mainly consumed in India

<table>
<thead>
<tr>
<th>Year</th>
<th>Eri Spun yarn</th>
<th>Tasar raw silk</th>
<th>Muga raw silk</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011-12</td>
<td>0</td>
<td>1000</td>
<td>2000</td>
</tr>
<tr>
<td>2012-13</td>
<td>1000</td>
<td>2000</td>
<td>3000</td>
</tr>
<tr>
<td>2013-14</td>
<td>2000</td>
<td>3000</td>
<td>4000</td>
</tr>
<tr>
<td>2014-15</td>
<td>3000</td>
<td>4000</td>
<td>5000</td>
</tr>
<tr>
<td>2015-16</td>
<td>4000</td>
<td>5000</td>
<td>6000</td>
</tr>
</tbody>
</table>

Silk vs Wild silk (commercial)

- Mulberry Silkworm *Bombyx mori*
- Eri silkworm *Philosamia cynthia ricini*
- Chinese oak silkworm *Antheraea pernyi*
- Muga silkworm *Antheraea assama*
- Japanese oak silk worm *Antheraea yamamai*
- Tasar silkworm *Antheraea mylitta*

etc...
### Mulberry VS Eri

<table>
<thead>
<tr>
<th>Character</th>
<th>Eri</th>
<th>Mulberry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed plants</td>
<td>Caster</td>
<td>Mulberry</td>
</tr>
<tr>
<td>Period of start-up for feed</td>
<td>Cassava</td>
<td></td>
</tr>
<tr>
<td>production</td>
<td>2 months</td>
<td>(from seeds)</td>
</tr>
<tr>
<td>from seeds</td>
<td>(from branches)</td>
<td>3 years</td>
</tr>
<tr>
<td>Quality of cocoons made in</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Environmental adaptability</td>
<td>Not Necessary</td>
<td></td>
</tr>
<tr>
<td>Disease-free rooms with</td>
<td></td>
<td>Necessary</td>
</tr>
<tr>
<td>temperature control</td>
<td>2-7 days</td>
<td>Several months</td>
</tr>
<tr>
<td>Training period for beginners</td>
<td>100 ETB</td>
<td>120 - 150ETB</td>
</tr>
<tr>
<td>Dried cocoons price per KG (2016)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Mulberry VS Eri (2)

<table>
<thead>
<tr>
<th>Character</th>
<th>Eri</th>
<th>Mulberry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal reproductive cycles per</td>
<td>5-6 times</td>
<td>2-3 times</td>
</tr>
<tr>
<td>year</td>
<td>Easy</td>
<td>Very Difficult</td>
</tr>
<tr>
<td>Eggs self-reproduction</td>
<td>Unnecessary</td>
<td>Necessary</td>
</tr>
<tr>
<td>Chemical treatment for breaking</td>
<td>Sun light</td>
<td>Machine dry</td>
</tr>
<tr>
<td>eggs dormancy</td>
<td>(natural dry)</td>
<td></td>
</tr>
<tr>
<td>Drying cocoons</td>
<td>Hand Spinning</td>
<td>Reeling by</td>
</tr>
<tr>
<td>Producing yarns</td>
<td></td>
<td>machine</td>
</tr>
<tr>
<td>Fiber type</td>
<td>Soft, airy, short</td>
<td>Shiny, soft, long,</td>
</tr>
<tr>
<td>(hollow multi fibers)</td>
<td></td>
<td>thin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(single fiber, 1500m)</td>
</tr>
<tr>
<td>Cocoon cutting</td>
<td>Possible</td>
<td>No for yarns</td>
</tr>
</tbody>
</table>
Africa: new countries of Silk Production

- Kenya
- Ethiopia
- Nigeria
- Madagascar
- Botswana
- Zimbabwe
- Zambia
- Uganda
- Ghana

Ethiopia Domestic demands estimation

- A company = at least 10-15 t spun yarns needed per year (in case of mixed woven cloth production)
- Current production <2t/ year

× 10,000 pcs per year → 1,000KG Eri 100g with cotton yarn (5,000KG cocoons)

Currently at least 100t yarn per year for domestic market
International Eri market potential

- After 2009, slowly recovered EU/USA market
- Mulberry silk has stable market demand
- Wild silk is still new natural fiber and with different characters

Unknown but not so small!!

Silk production steps for SHHs

- Caster/Cassava hedge planting
- Training
- Start Eri production
- Keep continuous small scale production
- Start hand spinning
- Self Eggs propagation establishment

Step-up to mulberry silk production
Value addition

1. Hand spinning – under proper grading
2. Dying threads
3. Keep continuous production amounts
4. Cooperative production (nursery)
5. Plying
6. Proper certification system

Value chain

1. Cocoons Collecting Network + infrastructure
2. Learning system (Capacity building)
3. Cooperative activities (nursery, buying materials and selling)
4. Additional income from by products
Varieties of By-products

- 1. Boiled Cocoon waste (3 grades)
- 2. Reeling waste
- 3. Yarns/fibers waste
- 3. Wadding
- 4. Cut cocoons
- 5. Degummed fiber waste
- 6. Pupa

Nutritional aspects of pupa

- Pupa meal (Dried, non defatted)
- Protein Rich 60%
- Fiber 3.9%
- Fat included 25% Gross energy 25.8 MJ/kg
- All 18 amino acids are contained
- High Anti-oxidation effects
- Ca, Zn, Fe rich (+ P, Mg, Cu)
- TME poultry 10.2MJ/kg
HH level estimation (*5 cycles, 0.25ha)

<table>
<thead>
<tr>
<th>Cocoons Production per year</th>
<th>&lt; 10 t (Current in Ethiopia)</th>
<th>50t</th>
<th>100t</th>
<th>500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yarns (t) (20%)</td>
<td>&lt; 2</td>
<td>10</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Byproducts (t)(80%)</td>
<td>&lt; 8</td>
<td>40</td>
<td>80</td>
<td>400</td>
</tr>
<tr>
<td>Feed area* (ha)</td>
<td>33</td>
<td>166</td>
<td>332</td>
<td>1,660</td>
</tr>
<tr>
<td># of HHs*</td>
<td>133</td>
<td>665</td>
<td>1,330</td>
<td>6,650</td>
</tr>
<tr>
<td>Spinning</td>
<td>hand</td>
<td>hand</td>
<td>hand and machine</td>
<td>Hand and machine</td>
</tr>
</tbody>
</table>

A sample case of small holders

- Income generation
- Employment opportunity
- Sustainable Farm management
- Women empowerment
- Nutritional improvement
- Increase climate change resilience
Other utilization of Eri silk
Medical purpose

• Fibroin (microfibrils: small fiber unit) utilization
• Artificial organ (skin, blood vessel etc.)

Health and Beauty products

• Anti-aging, beauty effects
• Enhancement of liver functions
• Immune effect support
• Decreasing body fat
• Reduction of cholesterol
## Silk Value chain activities/step, Required and recommendation

<table>
<thead>
<tr>
<th>Activities/Steps</th>
<th>Required</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>End Market</strong></td>
<td>- Design</td>
<td>- Branding of Ethiopia silk and good reputation</td>
</tr>
<tr>
<td></td>
<td>- Color</td>
<td>- Specialty Fabric</td>
</tr>
<tr>
<td></td>
<td>- Timing on delivery</td>
<td>- Ethiopian design for Fabric</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Market analysis and linkage where to sell, what product to sell</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Skilled manpower and quality control</td>
</tr>
<tr>
<td><strong>Fabric/Finished products</strong></td>
<td></td>
<td>- Support SMEs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Encourage Private sector to exempt for big machinery</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Research potential of yarn for export</td>
</tr>
<tr>
<td><strong>Yarn</strong></td>
<td>- Locally made spinning machine and imported</td>
<td>- Research on what to add value</td>
</tr>
<tr>
<td></td>
<td>- Capacity building</td>
<td>- Quality control on chemical ratio</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Certification/grading on the product</td>
</tr>
<tr>
<td><strong>Fiber</strong></td>
<td>- Technical capacity and improved processing technology (standard method for degumming)</td>
<td>- Research for economic value of pupa</td>
</tr>
<tr>
<td></td>
<td>- Facilities like boiler and chemicals</td>
<td>- Market assessment on viability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Incentivize Private sectors involved on Value addition</td>
</tr>
<tr>
<td><strong>Cocoon</strong></td>
<td>- Good management (sanitation, feed, humidity)</td>
<td>- Technical capacity</td>
</tr>
<tr>
<td><strong>Production/pupa</strong></td>
<td>- Technical capacity</td>
<td>- Avail facilities through linkage with Private sectors and NGOs</td>
</tr>
<tr>
<td></td>
<td>- Facilities</td>
<td>- Avail access to finance</td>
</tr>
<tr>
<td><strong>Silkworm rearing</strong></td>
<td>- Good management (sanitation, feed, humidity)</td>
<td>- Establish reliable, affordable, accessible egg production Centers &amp; facilitated laboratory</td>
</tr>
<tr>
<td></td>
<td>- Technical capacity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Facilities (Tray, montage, shed)</td>
<td></td>
</tr>
<tr>
<td><strong>Egg</strong></td>
<td>- Diseases free laying</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Improved breed</td>
<td></td>
</tr>
</tbody>
</table>

Comments from panel: 1) By-products value chain is also needed, 2) Quick market analysis is needed for benefits of silk
Discussion Points;

- There is gap on how policymakers see this issue, so here we will try to influence these policy makers and feed them information instead of sitting and waiting for them to do something.
- As a country, where do we want to go in terms of silk farming?
- Incentives to those who want to take part in silk farming
- Standardized farming
- Genetic resource maintainace:
Discussion

• Incentives: there used to be a lot of problem in terms of market which is now better though not fully solved. But first we need to make clear why sericulture is important. First in my opinion, capacity building is very important. Structural adjustment is very important. Sericulture as a sector used to be under many bureaus ...
• Incentive: now it is only one incentive to allow cars (heavy duty) duty free, from commercial bank there is chance for loan ... nothing further. Availing loan and loan needs to be clearly stated in the strategy. Strategy should create link the value chain from farmers to exporters. Now sericulture has its own department, but it may be important to set up agency only for sericulture. Progress is okay but should continue

Discussion

• To grow this sector, genetic resource is crucial. Do we have studies on genetic line (back makeup) establishment is key otherwise always by importing hybrids we can not move forward.
• Strategy should set out studies to study parent line. This is the ground a major sericulture sector.
• Disease susceptibility: is very serious issue which needs to be clearly studied in the policy. Establishing healthy colony .... SILK WORM BEEDING PROGRAM needs to be one focus of the policy strategy.
• Disease preventing chemicals: it is necessary to create linkage with international agents to get these chemicals which can be done at government level.
Discussion

• Employment creation: (youth and women) is one focus of the government. MFIs should provide credit to facilitate employment creation. As the government allocated recently 10 billion ETB for youth employment creation, silk can be one sector for organizing youth groups for eradicating unemployment. For this, the policy needs to create opportunity to experience sharing
• Regulation: it is important to create one independent organ under the ministry.
• Agency for sericulture: might be very difficult process. Now a days, the structure is there, didn’t go to grass root level. Most experts assigned to do this work are Apiculture experts not sericulture experts. These experts need capacity building...

Discussion ...

• On structure: we should take example from (Floriculture). There is no enough human resource. (production policy, marketing policy, etc.)
• Production policy:
• Marketing policy: infrastructure and policy gap
• Seed multiplication: is one big issue identified in the workshop. The potential for seed is now found scattered.
• Ecological study: which areas have potential for sericulture
• Land: is big problem as it is now for people who would want to engage in sericulture
Discussion ..

- DA s: Capacitating DA s, showing them the importance of sericulture and allow them to take experience from other countries
- Certification: lesson from other countries
- Government should engage in silk worm farming as it engages in other agricultural activities
- Feed: plants .. Has inventory been done on castor varieties, nutritional value, (strengthening research by higher educational institutions: breeds, feed plants, etc.)
- Based on experience of government policies: government policies focus on farmers not competition. It is obvious that all farmers cannot go to the international market ...

Discussion ...

- Only those who can produce quality products. Policy should focus on those ones..... Poverty reduction is important but if we are thinking about market, we have to be selective..... Eg: selecting and focusing on model farmers...
- Has the importance of sericulture been recognized by the government? At various levels? Not so until now. We need to work on the promotion part very strategically. We need to show the comparative advantage of silk worm rearing as opposed to other sectors. The fact that it is not perishable, as a side business, not labour intensive...... these kinds of ideas are the ones we need to focus on to convince the government and farmers. Strong promotional activity
Discussion ...

- The policy should put light on mixed agriculture. Integrated agriculture should be promoted to make the most out of small scale landholdings.
- Structure: needs to be strengthened. The structure is there but focus is only on Apiculture. Therefore, need for separate agency on sericulture in the long term. Capacity building is crucial
- Production and marketing incentives: ...

Summary of the discussion

- 1. **Capacity building** in terms of human and physical resources.
- 2. **Disease preventive chemicals**: are very important for current production therefore, government should create link and get them in
- 3. **Credit facilities**: show and consider silk production
- 4. **Cooperatives and unions**: to easily create marketing linkage
- 5. **Linkage with partners**: government organizations, non-governmental, processors, buyers
- 6. **Agroecology**: Identify best corridors
- 7. **Land availability**: investors need to be encouraged in this sector.
Summary...

- 8. **Small scale farmers**: mixed agriculture needs to be promoted, as land is limited, making most out of the small landholdings
- 9. **Awareness creation**: on policy makers themselves. Designing systematic promotional activities
- 10. **Establishing grainages**: disease free rearings
- 11. **Feed plants**: research is crucial here. Strengthening research, including sericulture in the curriculum in higher education levels.
- 12. **Selecting model farmers**: so that the technology will not fail. Providing incentives to farmers ... providing inputs....

Summary ...

- 13. **Strengthening the structure**: from federal up to district level
- 14. **Certification/standardization**: Grading system: the policy should facilitate for setting up laboratory in the long term but until then the laboratories which already exist can be used to set up starting point for grading system.
- 15. **Employment creation/ poverty reduction/ income generation**:
- 16. **Introducing silk worm breeds**: government needs to build linkage with international research and development organizations.

Other comments from the floor;
- Incentives for private producers
- Strategy for silk should be included in the policy
- Access to finance for lease, machines, linkage with technical support services etc.
- Policy should prioritize silk as export product
Discussion points;

- Grading system
- Quality control and promote production
- From input supply to final cocoon grading
- Ideas need to be rearranged

Summarized outputs;

**Input level**
- **Seed production**: its health is not guaranteed in eggs from Bere and saba har
- Use of less quality inputs for production affects quality
- Mother moth selection is important for quality
- Garden for technology incubation is needed

- **Management of worms** at farm level is not good; too traditional practices which affect quality

- **Promotion**:  
  - not well known by farmers;  
  - attitude towards worm management. Awareness is not created as the practices are being ridiculed

- Quality should start from feeds-60%; castor should be planted on well prepared farms and use of wild castor have effect on quality.
- Housing: should be standardized albeit in local materials
Summarized outputs:

- **Research is basis for quality**: improved variety of worms should be generated
  - There should be technology on shelf as package is needed for silk
  - There is no package and standard for housing system
  - Standards for input use and rates for worm rearing
  - Should be linked formally with extension system
- Micro credit as farmers lack capacity in using quality materials
- **Research extension linkage**
  - should work closely to create awareness as the tech is new;
  - extension should promote silk production first.
  - Research extension system linkage is crucial
  - Attitude change is still a major challenge as acceptance for worms is a challenge.
  - work on model farmers first:
  - Work starting from all levels including admin.
- **Government attention has been lacking:**

---

Capacity building

- **Knowledge gap:**
  - Curriculum for human resource development
  - TVET and research are currently providing ad-hoc and fragmented trainings
  - Not only lack of curriculum but also demand for the field is low
  - Curriculum need to be designed and human resource should be produced so that every body can get from the market
  - Graduate program at some HE institution is needed; we need to focus on quality experts not quantity
  - No need to integrate in all regular system / program
  - There should be some center of excellence that can provide training
Grading

- National laboratory for quality test
- It is duty of ECAE but we can give inputs for ECAE
- Define quality parameters: White, shell ratio, pupa extracted etc.
- Quality of cocoons: non defective, silk content, shape and not cracked cocoons, etc.
- Quality control for local use: Eg. For price differentiation
- Quality based pricing system was suggested under GTP II; which we have to capitalize on.

Quality control

- How to control the quality: two ways
  - The first → Mandatory based: to deter the product not to enter the market
  - The second → Price based: Pricing for quality control
  - The second one is recommended- we are at the early stage

Promotion

- Promotion of Ethiopia silk through exhibition, brochures, labeling for premium price is needed
Recommendations;

• Input:
  • There is a need for egg propagation/providing facility at appropriate place (Eri can propagate farmers level, community or cooperatives can establish the facilities under appropriate technical training or support)

• Research and extension: strong linkage is needed

• Curriculum and human resource
  • Few higher institutions need to open post graduate training in sericulture

• Grading
  • Quality based pricing system need to be established as incentive for producer
  • Criteria based grading system is needed (cocoon ration, visual inspection)

Benefits of silk production

• Contributes to climate resilient growth strategy
• Mulberry is a multipurpose productive crop, Caster is bioenergy oil crop and Cassava is used as stable food and also bioenergy crop
• For stability
• Engages huge amount of labor in the VC
• Fetches high price
• Export oriented commodity: product diversification can be source of export income
• Gainful employment at rural level including for the disabled, or elderly and gender
• By products can be of different uses up to medical inputs-
• Medicinal values, fiber products, feeds, cosmetic industry etc.
• Compatible with different production systems: poultry
• Production cycle is short and yield income continuously throughout the year.
• Can be done as side business with other activities and during off seasons
4. Reference Information of Eri Silk

4-1. “Eri Production Flow”

**Eri Silk Production**

- Eri silk worm: *Philosamia cynthia rincini*
- Feed plants: Caster (*Ricinus communis*) Tree of heaven (*Ailanthus altissima*) and Cassava (*Manihot esculenta*),
- Period of one Cycle: 40-60days (depends on the temperature)
- Current Production: India, Vietnam, Thailand, Ethiopia

Butterfly /Eggs (seed) ➔

Rearing Worms (age 0 to 5) ➔

Mounting/ Cocooning ➔

Dried Cocoons ➔

Boiling/Spreading ➔

Hand Span Yarns ➔
### Comparison Characteristics of Eri Silk with Mulberry Silk

<table>
<thead>
<tr>
<th>Eri</th>
<th>Character</th>
<th>Mulberry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caster Cassava</td>
<td>Feed plants</td>
<td>Mulberry</td>
</tr>
<tr>
<td>2 months (from seeds)</td>
<td>Period of start-up for feed production</td>
<td>3 years (from branches)</td>
</tr>
<tr>
<td>high</td>
<td>Quality of cocoons made in Ethiopia</td>
<td>low</td>
</tr>
<tr>
<td>High</td>
<td>Environmental adaptability</td>
<td>Low</td>
</tr>
<tr>
<td>Not Necessary</td>
<td>Disease-free rooms with temperature control</td>
<td>Necessary</td>
</tr>
<tr>
<td>2-7 days</td>
<td>Training period for beginners</td>
<td>Several months</td>
</tr>
<tr>
<td>100 ETB</td>
<td>Dried cocoons price per KG (2016)</td>
<td>120 - 150ETB</td>
</tr>
<tr>
<td>5-6 times</td>
<td>Normal reproductive cycles per year</td>
<td>2-3 times</td>
</tr>
<tr>
<td>Easy</td>
<td>Eggs self-reproduction</td>
<td>Very Difficult</td>
</tr>
<tr>
<td>Unnecessary</td>
<td>Chemical treatment for breaking eggs dormancy</td>
<td>Necessary</td>
</tr>
<tr>
<td>Sun light (natural dry)</td>
<td>Drying cocoons</td>
<td>Machine dry</td>
</tr>
<tr>
<td>Hand Spinning</td>
<td>Producing yarns</td>
<td>Reeling machine is required</td>
</tr>
<tr>
<td>High</td>
<td>Color absorption in dying</td>
<td>High</td>
</tr>
<tr>
<td>Soft, airy, short (hollow multi fibers)</td>
<td>Fiber type</td>
<td>Shiny, soft, long, thin (single fiber, 1500m)</td>
</tr>
<tr>
<td>Yes</td>
<td>100% cloth washability</td>
<td>No</td>
</tr>
<tr>
<td>Preferable &amp; Easy</td>
<td>Mixed woven with cotton</td>
<td>Much less than 100% silk</td>
</tr>
<tr>
<td>Yes (Pupa, all residues)</td>
<td>Useful by-products</td>
<td>Yes (Pupa, all residues)</td>
</tr>
<tr>
<td>Possible</td>
<td>Cocoon cutting</td>
<td>No fiber purpose only</td>
</tr>
</tbody>
</table>
Value Addition on Ethiopian Eri Silk

QUALITY CONTROL
- Degumming and Washing
- Hand Spinning
- Grading

QUALITY ADDITION
- Plying (by machine)
- Dying (natural / chemical)

SYSTEMATIC VALUE AND CERTIFICATION
- Made in Ethiopia Certification
- Organic Eri Silk Certification
- Eco- Friendly and low carbon footprint

FURTHER PROCESSING

<table>
<thead>
<tr>
<th>Cocoons Production per year</th>
<th>&lt; 10 t (Current in Ethiopia)</th>
<th>50t</th>
<th>100t</th>
<th>500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yarns (t) (20%)</td>
<td>&lt; 2</td>
<td>10</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Byproducts (t) (80%)</td>
<td>&lt; 8</td>
<td>40</td>
<td>80</td>
<td>400</td>
</tr>
<tr>
<td>Feed area* (ha)</td>
<td>33</td>
<td>166</td>
<td>332</td>
<td>1,660</td>
</tr>
<tr>
<td># of HHs*</td>
<td>133</td>
<td>665</td>
<td>1,330</td>
<td>6,650</td>
</tr>
<tr>
<td>Spinning</td>
<td>hand</td>
<td>hand</td>
<td>hand and machine</td>
<td>Hand and machine</td>
</tr>
</tbody>
</table>

*0.25ha, 5 cycle per HH
Income Generation through Sustainable Silk Production at Mizan-Tepi University and Sericulture Technology Transfer to Farmers in Southwestern Ethiopia

Project Progress Report

A Project Progress Report submitted to Mizan-Tepi University
Directorate of Research and Community Development Support

By
Bizuneh Adinew and Bewuketu Haile

October, 2016
Mizan-Tepi University, Ethiopia
Introduction

Sericulture is an agro-based industry. It involves rearing of silkworms for the production of raw silk, which is the yarn obtained out of cocoons spun by certain species of insects. The major activities of sericulture comprises of food-plant cultivation to feed the silkworms which spin silk cocoons and reeling the cocoons for unwinding the silk filament for value added benefits such as processing and weaving [1]. Ethiopia is granted with diversified climate, vegetation and topography and this is also true for diversified options of sericulture industry which are adopted on different vegetation (for rearing of silk-worms) and different species of silkworms. Endowed with favorable conditions for mulberry and castor trees growth in Mizan-Tepi university compound in particular and silkworm rearing, the sericulture is developing as an important income generating subsidiary occupation to augment the income of the local farms. Silkworm production has advantages like; high employment potential, provision of vibrancy to village economics, low gestation, high returns, women friendly occupation, ideal program for weaker sections of the society, eco-friendly activity, and the satisfaction of equity concerns [2]. Due to the presence of sufficient land (irrigation and rain always accessible throughout the year and weather condition suitability in the area) for cultivation of mulberry and castor tree and low investment cost attract us to start silk worm farm project in the university compound. Therefore, the objectives of this project were:-

Ω Production of raw silk from Eri silk worm (Fig.,1)
Ω Offer training and technology transfer to the local farmers (Fig., 2 & Table 2)
Ω Create job opportunities for the local communities (Table 1)
Ω Create market linkage to sell silk cocoons producer farmers (Sabahara plc., Addis Ababa)
Fig. 1: Raw silk production from silk worm (in MTU)

- Eri silk worm larvae
- Silk cocoons

Processed and weaved silk

Fig. 2: Silk worm rearing and silk reeling training for the local communities in collaboration with expertise from Sabahar

- Training in class room (partial view)

- Demonstration on caster and Mulberry production (feed of silk worm)
Table 1- Number of employers participated in silk worm rearing (Mizan-Tepi University)

<table>
<thead>
<tr>
<th>S.NO</th>
<th>Activities</th>
<th>Sex</th>
<th>Quantity</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Coordinator</td>
<td>F</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Silk worm feeders</td>
<td>F</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Feeds cultivators</td>
<td>M</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Silk reeling</td>
<td>F</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>20</strong></td>
<td></td>
</tr>
</tbody>
</table>

Table 2:- Silk worm rearing and silk reeling technology transfer through training for the local communities

<table>
<thead>
<tr>
<th>Training topic</th>
<th>Residence of trainees</th>
<th>No. of trainees</th>
<th>Trainers</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Caster and mulberry (Silk worm feed) production</td>
<td>6 selected kebeles from yeki woreda</td>
<td>12 farmers</td>
<td>2 (from Saba-har, A.A)</td>
</tr>
<tr>
<td>- Silk worm rearing</td>
<td>Women from Tepi town</td>
<td>10 women</td>
<td></td>
</tr>
<tr>
<td>- Silk cocoons handling and quality control</td>
<td>6 selected kebeles from yeki woreda</td>
<td>6 Development agents (DA)</td>
<td></td>
</tr>
<tr>
<td>- Silk reeling process</td>
<td>Yeki woreda</td>
<td>2 Expertise from agriculture offic</td>
<td>2 (MTU)</td>
</tr>
<tr>
<td></td>
<td>MTU (5 departments)</td>
<td>14 (teachers, TA, employed workers in the project)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>44</strong></td>
<td><strong>4</strong></td>
</tr>
</tbody>
</table>
Project Summary

This project has two phases

1. Phase 1:- Establishment of silk production Technology at MTU

Under this phase the following activities were successfully performed:-

- Building containing silk worm rearing room, cocoon store and office was built as per the standard
- Plantation and cultivation of silk worm feeds (Improved caster and mulberry)
- Introduction and adaptation of silk worms
- Rearing of Silk Worms and Cocoon Production
- Silk processing (silk reeling/Yarn making)

In this phase we successfully established sericulture center that can be used as technology incubation center (comprises silk production up to processing/ Yarn making) and potentially generate income.

Phase 2:- Sericulture Technology Transfer

I. Provision of training:- Training is one of the limiting factors for the promotion of sericulture technology. As indicated above practical training was provided in sericulture center in collaboration with Sabahar to local communities and experts in the area

II. Provision of input:- from the sericulture centers trained farmers are provided with important input (improved caster seed and mulberry planting material/cuttings). After establishment caster and mulberry (feeds) the center will provide the worms.

III. Market development:- since the technology is new in the area development of market linkage is vital to encourage the farmers to produce cocoons in a sustainable way. Cognizing this fact, we have created market linkage and all aspect partnership with Sabahar (the pioneer silk weaving factory in Ethiopia) to promote sericulture in southwest Ethiopia.
Acknowledgement

We profoundly acknowledge Mizan-Tepi University research and community service directorate and the top management for financial support and their strong commitment for successful establishment of the sericulture center.

References

4-5. Example of Grading (Provided by Sabahar)

Sabahar Eri Silk Yarn Grading System

First Grade Eri Silk Yarn
- The cocoon quality should be clean and first grade.
- The cocoon fiber should not be cut.
- The yarns should have consistent thickness.
- The Eri silk yarn should not be too much twisted.

Second Grade Eri Silk Yarn
- The cocoon quality should be clean and second grade.
- The spinning yarn should have medium twist.
- The yarn should be well degummed.
- The yarn has some thick and thin and should be somewhat uniform.

Third Grade Eri Silk Yarn
- The cocoon quality is third grade.
- The spinning yarn has too much twist.
- The quality of the yarn is too much thick and thin.
- It is fuzzy fiber on the yarn.
### 4-6. Comparison Characters of Materials (Mr. Yoshida; Japan Wild Silk Research Association)

<table>
<thead>
<tr>
<th>Character/Material</th>
<th>Eri</th>
<th>Mulberry silk</th>
<th>Cashmere</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yarn price USD/Kg</td>
<td>20 - 25</td>
<td>20 - 60</td>
<td>150 - 300</td>
</tr>
<tr>
<td>Category of natural fiber (JPN)</td>
<td>Silk</td>
<td>Silk</td>
<td>Wool</td>
</tr>
<tr>
<td>Utilization</td>
<td>Garment</td>
<td>Garment</td>
<td>Garment</td>
</tr>
<tr>
<td></td>
<td>Made-up</td>
<td>Made-up</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Carpet</td>
<td>Carpet</td>
<td></td>
</tr>
<tr>
<td>Seasonality</td>
<td>All seasons</td>
<td>Spring / summer</td>
<td>Autumn / Winter</td>
</tr>
<tr>
<td>Touch</td>
<td>Very soft</td>
<td>soft</td>
<td>Very soft</td>
</tr>
<tr>
<td>Levity</td>
<td>Light</td>
<td>Heavy</td>
<td>Light</td>
</tr>
<tr>
<td>Deodorant power</td>
<td>High</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Bulkiness</td>
<td>High</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Getting wrinkles</td>
<td>Resistant</td>
<td>Easily</td>
<td>Resistant</td>
</tr>
<tr>
<td>UV proof</td>
<td>High</td>
<td>Medium</td>
<td>None</td>
</tr>
<tr>
<td>Washability</td>
<td>Yes</td>
<td>No (Dry cleaning only)</td>
<td>No (Dry cleaning only)</td>
</tr>
<tr>
<td>Hollow fiber</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Single fiber</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

### 4-7. Competitive/Replaceable natural fibers production and market possibility of Eri

<table>
<thead>
<tr>
<th>Fiber name</th>
<th>Origin</th>
<th>Annual Production (t)</th>
<th>Bottlenecks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cashmere</td>
<td>Mammal</td>
<td>7,000</td>
<td>Only produced in Mongolia and China</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Significant price fluctuations</td>
</tr>
<tr>
<td>Mulberry Silk</td>
<td>Insect</td>
<td>100,000</td>
<td>Produced mainly in China and India</td>
</tr>
<tr>
<td>High-grade</td>
<td>Plant</td>
<td>10,000</td>
<td>N/A</td>
</tr>
<tr>
<td>Cotton</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Down / Feather</td>
<td>Bird</td>
<td>30,000</td>
<td>Anti-animal welfare way of harvest</td>
</tr>
</tbody>
</table>
Important points for getting additional Eri market are:
1. Competitive price
2. Stable quality
3. Descriptive labeling, certification
4. Observance of delivery time

Recommendations for Ethiopian Eri production are:
1. Cost reduction (development efficient tools, utilization of byproducts)
2. Grading cocoons and hand spinning yarns (at least 5 levels based on dirtiness)
3. Establish degumming methods depends on cocoon grading (Key technology for stable quality production)
4. Limitation of degumming facility (usage of same quality of water for degumming)
5. Certification and quality test facility (Quality control)
6. Branding of Eri
Your Excellency Minister Ato Selashie Getahun, Distinguished Guests, Ladies and Gentlemen,

First, I would like to welcome all of you to our eri silk workshop. I am very glad to host this timely and purposeful event in Ethiopia.

Let me start my speech by talking about social change. Modernization, economic growth and globalization always create changes of social values, lifestyle and rules of game in the society. People face both opportunities and threats under the change. And people who adapt to new environment can make success in many cases and those who refuse to change often left behind. That is a nature of economic growth and social change. And in the new environment, traditional systems are not always workable. Ethiopia has already experienced a decade of double digit economic growth so that many things have been already changing. So people have to make new systems, rules and regulations.

Though you may not know, Japan experienced two big social changes in modern era. One is Meiji restoration in 1867 and another is end of the World War II in 1945. Each change forced us to redesign systems of the society. After Meiji restoration, Japan promoted silk production as export commodity to earn foreign currency. That was very successful case of Agriculture Development led Industrialization by using local production capacity and local skills.

Rapid growth creates economic gap between urban and rural in many cases. Therefore, we need to promote economic activities in rural areas in order to minimize the gap. Silk production in Meiji era played an important role to stimulate industrial development in farming areas in Japan which made development process more inclusive.

Ethiopia is now in the crucial turning point. The country is transforming and starts incorporating modern economic systems. Agriculture Development Led Industrialization and rural job creation are urgent issues in Ethiopia in order to sustain growth trajectory. There are a lot of appropriate technologies with high value of products you can learn from abroad. Production of Eri-silk is one of them. I am very glad that Japanese experts have introduced Eri-Silk
production technology into Ethiopia 10 years ago. Since then, Eri-Silk has been attracting growing interest of people because of increasing production of the Ethiopian style but modernized garments and linens.

The lesson learned from ten years experiences on sericulture is that we need to expand cocoons and hand spinning yarns production. Because of rearing worms is not a traditional way of agro-production in Ethiopia, capacity building and training activities are still very important on the ground. In addition, we need to work on marketing, building value chain, grading and certification system of its quality.

Therefore, today’s workshop is an opportunity to share these lessons obtained in Ethiopia and also know-how the experts have accumulated through experiences in other countries. I sincerely hope that the workshop will be a milestone of sericulture development in Ethiopia through your active participation.

Finally, I would once again appreciate your participation and close my remarks.

Thank you very much for your attention.

Kimiaki JIN
Chief Representative
JICA Ethiopia Office
Eri-silk (*Philosamia cynthia ricini*) is produced by one of wild silk worms originated in India. These wild silk worms can grow on Caster/Cassava under subtropical/tropical condition. Comparison with the normal mulberry silk worms, those of Eri-silk are tough and easy for rearing under normal farmhouse condition in Ethiopia. The Eri silk fibers have unique characters such as washable, airy, and suitable for mixed woven with cotton fibers.

Eri silk production technology was introduced into Ethiopia by Japanese experts 10 years ago. In terms of flourishing textile industry in Ethiopia, the domestic demand of Eri-silk yarns have been increased for production of the Ethiopian style garments and linens every year. These superior properties of Eri-silk fibers suggest a high potential of Eri-silk cocoons and hand spinning yarns productions in rural area of Ethiopia. In addition, the common knowledge and experiences of hand-spinning skills on Ethiopian women enable to produce Eri-silk yarns easily in rural levels. Although some basic trainings are necessary for small holders at their start of rearing worms, the current conditions on the ground level indicate that Eri silk production is ready to start in many area of Ethiopia and possible to expand the harvest quickly.

The total Eri-silk production world-wide is estimated over 2000 tons per year, mainly produced in India (1500 tons in 2008), Vietnam and other South East Asian countries come later due to the priority of their specific insect market demand as a nutritional food. Eri silk yarns are byproducts in those south Asian countries so the quality of cocoons and thread are not high than those of made in India. Currently Ethiopia production amount of the cocoons is at most 2000 kg per year, despite the potential of domestic demand of Eri-silk yarns are already estimated over 100 tons per year at least.

Promoting Eri-silk production can increase income for small farmers, especially for women and vulnerable peoples who cannot work on the field. Cultivation of Caster/ Cassava is quite easy and required only two months after sowing, and harvesting tasks are also suitable for elderly or women. Eri silk cocoons can be harvested 6 – 7 times at most per year, so that rearing Eri silk worms can increase not only their income but also getting resilience against climate change risks and improving their nutrition. Additionally, all byproducts are very useful as powerful organic fertilizers, or feeds for small scale poultry and fish culture.

The lessons learned from these ten years experiences on Sericulture, the first priority must be the expansion of cocoons and hand spinning yarns production for
further development of Eri-Silk industry in Ethiopia. GTP II is focusing to promote industrialization especially in agri-processing area, and Eri-Silk is one of the basic agro-industrial products. Because of rearing worms is not a traditional way of agri-production in Ethiopia, capacity building and training activities are still very important on the ground. Additionally, we have been already facing major challenges such as marketing, building value chain system, grading, and an official certification system, all should be resolved for the further development. Obviously, both private and public sectors related to Eri-silk industry need more collaboration, and sharing with same goals is necessary for the bright future of Eri silk industry in Ethiopia. The purpose of this Workshop is to provide necessary information and potential aspects of Eri-silk industry in Ethiopia.

| Agenda |
|---|---|
| **Time** | 20 October (Day 1) | 21 October (Day 2) |
| 0900-0930 | Registration | Registration |
| | Opening remarks | Opening Remarks |
| 0930-1030 | What's Silk? Let's think about Sericulture and Eri-culture (Dr. Shimizu, Former Gunma Prefectural Sericulture Research Station) | Domestic and International market potential of Eri Silk (Dr. Teramoto, JICA Ethiopia Office) |
| 1030-1100 | <Coffee break> | <Coffee break> |
| 1100-1200 | Basics of Eri production technology in Ethiopia (Mr. Abiy Tilafun, EIAR Melkassa Research Station) | Exhibitor’s session time (Sabahar, Mr Yoshida, Mr Gereta) |
| | <Lunch> | <Lunch> |
| 1330-1630 | Panel Discussion “Eri Silk production in Ethiopia (planning session) The current situation, bottlenecks and the potential” | Group Discussion “Eri Silk market expansion and value addition” |
| | | Group 1: Value addition Group 2: Policy and Certification Group 3: Quality Production |
| 1700 | Closing Remarks | Closing Remarks |
7. Acknowledgements (ICIPE)

The International Centre of Insect Physiology and Ecology (icipe) through the Country office in Ethiopia is privileged to have collaborated with the Ministry of Livestock and Fisheries (MoLF), the JICA-Ethiopia country office and the Ethiopian Institute of Agricultural Research (EIAR) in the organization and facilitation of this national expert consultation in Eri Silk production in Ethiopia. Its contribution directly relates to its current activities in the country. In partnership with the MasterCard Foundation, icipe in collaboration with several local stakeholders has been implementing since December 2015 a five year silkworm and beekeeping development project designed to empower unemployed Ethiopian youth, through technology based entrepreneurship. The sericulture component of the project is being implemented in the Gamo Gofa Zone of SNNP Region in recognition of the comparative advantage of some areas to promote commercial silk farming by smallholder farmers. The project focuses on youth to alleviate unemployment by exploiting natural resources for enterprise creation and represents a great potential to establish employment options and improve livelihoods. It set out to create a total of 2,500 gainful employment opportunities in the sericulture sector alone in areas that have high potential for commercial silkworm farming and associated agri-business development. The project recognises that Eri silkworm farming offers extensive opportunities for rural employment generation and enterprise development in these areas with potential also for large scale commercial farming and industrialization in the long-term.

It is on this premise that icipe supports Eri Silk development in Ethiopia and looks forward to collaborating further with the MoLF, JICA and the EIAR to promote sustained export-orientated growth of the emerging sericulture industry in Ethiopia.