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Government of Meghalaya



Directorate of Sericulture  
and Weaving



# Meghalaya Eri Silk

## General Guidelines

Climate Change Adaptation in North Eastern Region  
A project in cooperation between the Government of India and the  
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH is an enterprise owned by the German Government. GIZ implements sustainable development through international cooperation, on behalf of Germany and other partners. With a global footprint in over 130 countries, GIZ leverages its regional and technical expertise for local innovation.

GIZ India has a team of over 300 staff. To address India's need for sustainable and inclusive growth, in partnership with stakeholders, GIZ's key focal areas are:

- Energy (renewable energy and energy efficiency), Mitigation of greenhouse gas emissions
- Environment (sustainable urban and industrial development, natural resource management, climate change adaptation, biodiversity)
- Sustainable economic development (rural finance, social security systems, small and medium enterprises)
- Skill development



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Objectives of the manual is to give an overview of the GIZ programme on eri silk activities, its objectives, the approach and the different projects steps and outcomes. Based on the project findings, the guideline also helps in giving recommendations.

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ERI SILK  
OF MEGHALAYA

# ADAPTATION TO CLIMATE CHANGE AND PROMOTION OF INCLUSIVE ECONOMIC GROWTH

GIZ in partnership with the Ministry of Development of the North Eastern Region (MoDoNER) initiated a program with the objective “Rural people in the NER enhance their livelihood resilience and adaptive capacities to the impacts of climate variability and change”

Sericulture and weaving provide positive impact for Climate Change Adaptation (CCA) – in line with GIZ programme objectives to create climate resilience in rural areas. Both these occupations provide social economic growth and help in preserving the rich natural resources.

- ✦ Generate subsidiary income to farmers’ families;
- ✦ Curb migration from rural to urban areas;
- ✦ Maintain the rich heritage of the local tribes’, culture and way of life;
- ✦ Sericulture and weaving which also involves natural dyeing, encourages plantation and safeguard of food plant trees, and also have a positive impact on the environment and prevent soil erosion.
- ✦ Offer a greater role to women in social economic development as rearing and weaving silk is mainly done by women



# MEGHALAYA

## QUICK FACTS

- ✿ Meghalaya is a hilly state of North East India, surrounded by Assam in the north and Bangladesh to the south. Also known as the “abobe of clouds”
- ✿ Covers an area of approximately 300 kilometres in length and about 100 kilometres in breadth.
- ✿ Population of 29.67 lakhs (2011 census).
- ✿ Meghalaya has a sub-tropical climate, which varies with altitude therefore offering a large variety of species and crops, and makes it suitable for rearing silk .





Agriculture is the main occupation in the state. It is affected by climate change. While Meghalaya is blessed by nature, mountain ecosystems are among the most fragile environments. Small changes in temperature and extreme slopes lead to rapid changes in climatic zones over small distances, showing marked impacts in terms of biodiversity, water availability, agriculture hazards. This has an adverse impact on general human well-being.



Climate change which may lead to increase in temperature and humidity affects the mortality of silk worms.

# SILK

## IN MEGHALAYA

Silk industry in Meghalaya is a household activity with a rich traditional history. It helps in preserving the ecosystem of the region.

The State has a climate that is conducive for silk production and is home to three kinds of silk: Eri (which is the main crop), Muga and Mulberry.

In the absence of appropriate reeling facilities, most cocoons reared in Meghalaya State are exported to neighbouring states.



### ERI SILK

Traditional from the region and most commonly woven within the state



### MUGA SILK

Reared in the State and sold as cocoons to other neighbouring state  
Only few is further processed into yarn – raw stage



### MULBERRY SILK

Reared in the State and sold as cocoons to other States  
Only few is further processed into yarn – raw stage



Eri silk is the main silk (apart from very little of Muga) that is fully processed within the state i.e. right from the rearing to the finished product.



Rearing of eri silk is a household activity conducted exclusively by women within the State.

Eri silk is spun from open-ended cocoons. It is often termed “peace silk” as it is processed without killing the pupae inside. It is also

known as “poor man’s silk” as it is not so exorbitantly priced as other types of silk.

Since eri silk has an open-ended cocoon, it leads to a non continuous thread.

It is traditionally hand spun directly from the cocoon using the conventional spinning device “takli” – a ‘Drop Spindle’.



## WOMEN AND WEAVING

- ✿ Spinning and weaving in Meghalaya is done by women.
- ✿ Weaving is a subsidiary activity to farming, done by women during their spare time – approximately three hours a day.
- ✿ The traditional loom known as “floor loom” is basic but easy to use for women in their small living space. It is made of a bamboo reed with wooden sticks to maintain the warp. It only allows the production of one to three silk scarves, depending on the length of the weaving place.
- ✿ Weavers use these traditional looms to weave their hand spun yarn.
- ✿ Weaving designs are made of plain weave reproducing traditional patterns – red and yellow fine checks (scottish inspired type checks) and white cloths with delicate motifs at the bottom.



### Weaving is an age-old activity, representative of Meghalaya's tradition and culture

- ✿ Today most weavers are grouped under village weaving clusters.
- ✿ Each cluster has a weaving centre with improved weaving equipment, such as fly shuttle looms with jacquard devices and twisting equipment.
- ✿ These centres and equipment have been introduced by the government in order to increase weavers' productivity and create more weaving textures.







## DYES FROM NATURE

*In Meghalaya, dyeing methods are fully eco-friendly*

In villages, most weavers use natural, mainly vegetable ingredients for dyeing their silk. Colours or dyes are made from flowers, leaves and tree barks collected by women from their home back yards.

Meghalaya has a rich plant variety and not many weavers are trained to make dyes. Lack of a proper documentation on how dyes are made at the community level has resulted in dying of this technique. There is however a huge scope to further develop the dyeing process.







## GIZ SILK PROJECT APPROACH

## GIZ ERI SILK PROJECT

The Climate Change Adaptation in the North East Region project works with the Directorate of Sericulture and Weaving, Government of Meghalaya to formulate strategies and plans towards enhancing Eri Silk Value Chain.

Nowadays, competition in the silk sector is tough. Silk and handicrafts are produced in bulk and efforts to try and compete with the well-established silk industry is counterproductive.

Instead, the project aims to build on Meghalaya's uniqueness, its own strengths that will differentiate them from other players in the silk sector.

In order to enhance the development of eri silk, efforts have been undertaken to strengthen traditional practices and production so as to develop new products that cater to the needs of the new consumers. The products developed aim to make the product more comfortable to wear, soft in texture and lustrous.





## MEGHALAYA ERI SILK ASSETS

Meghalaya eri silk has numerous assets that could be built on:

- ✦ Meghalaya as a State has a rich age-old tradition of eri silk weaving done in harmony with a rural lifestyle.
- ✦ Artisans in the village are engaged in all the steps of production of eri silk, from the cocoon to the finished product stage. This gives the opportunity to emphasise on a '100% made in Meghalaya' while also enabling a full production traceability.
- ✦ Production of eri silk is done by respecting the environment. Natural ingredients are used for dyeing. Therefore, the products are suitable for eco labelling.
- ✦ Traditional designs and texture are rich and unique. Motifs such as checks, vertical stripes and simple brocades are used. These represent the rich culture of Meghalaya. Enhancing the State's weaving tradition will help in targeting the growing tourism market.

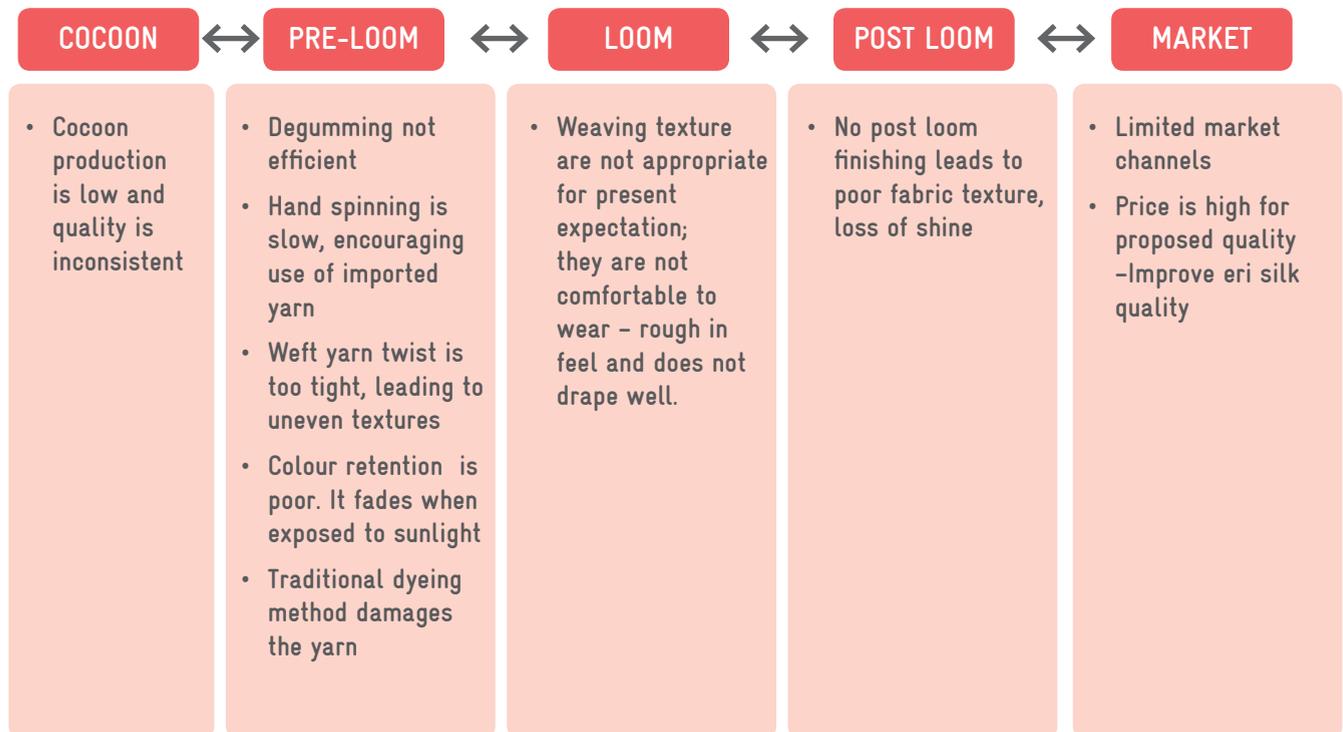


## GIZ ERI SILK VALUE CHAIN OBJECTIVES

- ✦ Improve the supply of good quality raw silk, fully processed within the State;
- ✦ Improve eri silk's inherent quality so that the fabric has a silky shine, soft and comfortable feel with a nice overall drape;
- ✦ Increase the products' value by improving the quality and designs;
- ✦ Develop existing natural dyeing methods and increase the range of colours;

## ERI SILK VALUE CHAIN MODEL

It is an excellent approach to identify bottlenecks along the production value chain and to address them in an appropriate manner.



# APPROACH

Project phases	Approach	Expected outputs	Time frame
Assessment of Meghalaya eri silk production potential	Jointly undertaken with Department of Sericulture & Weaving; assess the sector constraints, bottlenecks and strengths along the eri silk value chain	Prepare road map based on Meghalaya eri silk assets	October – December 2012
EXPERIMENT on traditional production practices	Conduct experiments at critical production steps of the eri silk value chain to address bottlenecks Adapt existing production practices Use of local ingredients and materials Work with local practitioners	Fabric textures for new consumers' needs Adapt production practices Eco-friendly fabrics locally produced in the state with 100% local ingredients	February – November 2013
Preparation of training modules based on best practices: November 2013 onwards	Based on Experimentation best practices and lessons learnt documented	Pedagogical modules for department staff to deliver training to a larger number of villagers to train them in production of fabrics in line with new consumers needs and thus maintaining rural jobs and traditional practices in a long run	November 2013 – April 2014
KNOWLEDGE TRANSFER – Dissemination of trainings to villagers jointly with the department	Training of Master Trainers from the silk department and target villages	Master Trainers are trained to disseminate knowledge to community members engaged in eri silk production	August – September 2014

# EXPERIMENTATION PHASE OBJECTIVES

In order to address the identified bottlenecks and overcome challenges as mentioned previously, experimentation is made at every critical production stage.

The main thrust of the experimentation phase is to develop a holistic approach to the whole eri silk value chain, evolving on what exists, instead of bringing readymade solutions that may not suit to Meghalaya's specific situation.



## Experimentation phase objectives

- Improve end fabric textures in terms of softness, drape and shine
- Identify production practices that can be easily adopted by villagers

## Experimentation approach

- Built on existing production methods
- Focus on locally available ingredients and material
- Work with best practitioners within the area
- Engage external expertise when not available within the State

## Experimentation phase expected outcomes

- Fabric textures that meet the demands of the new consumers
- Good practices training modules to train villagers - weavers



The main areas of intervention in the experimentation phase are:

#### PRE-LOOM PHASE

- Degumming process
- Spinning

#### LOOM PHASE

- Warp setting
- Sizing (starch) ingredients
- Weaving quality

#### POST LOOM PHASE

- Washing ingredients and methods
- Drying process
- Calendaring

# KNOWLEDGE TRANSFER

Based on the findings of the experimentation phase, training manuals are developed for each of the production stage and identified critical steps needed to be taken to produce new fabric textures.

Training modules on the following production stages were developed:

- ✦ Degumming
- ✦ Hand spinning
- ✦ Natural dyeing
- ✦ Weaving
- ✦ Promoting eri silk handmade goods.

The purpose of the training modules is to develop teaching methodology tools for master trainers to deliver trainings to villagers on critical production steps adopted during project experimentation phase.

Transmission of experimentation phase lessons learned through dissemination of training in close collaboration with the Department of Sericulture and Weaving, Government of Meghalaya.









## PROJECT EXPERIMENTATION PHASE GUIDELINES & OUTCOMES

Different methods were tried and tested – both in use of material and the process – during the experimentation phase.

The guidelines presented here mainly focuses on the process/ methods, with a focus on traditional production methods and processes for eri silk:

- ✿ Eri silk degumming
- ✿ Hand Spinning
- ✿ Soft method of natural dyeing
- ✿ Weaving on floor looms
- ✿ Post weaving treatment

The methods and materials used laid a strong focus on locally available raw material that are used in order to make sure weavers can easily integrate them in their daily use.



# BEFORE DEGUMMING

## SELECTION OF ERI SILK COCOONS

Cocoons are of different quality and should therefore be carefully selected before degumming:

- ✦ First quality cocoons are soft, bulky and white. They give best results, especially for weft thread.
- ✦ Second quality cocoons are small, brownish with less fibre on it. Resulted thread is coarser and more difficult to work with.
- ✦ Red cocoons; may appear in a first quality or a second quality cocoon. They should be separated from others as they maintain a different colour shade after degumming



- ✦ Quality of cocoons depend on the season, the quality of the seed and food plants.
- ✦ For second quality cocoons, time of degumming should be increased as well as fermenting.
- ✦ Red cocoons should simply be separated and used to create different natural colour shade, (it gives a beige colour).

# DEGUMMING OF ERI SILK COCOONS

**Silk filaments are similar to human hair, they must be treated with gently care**

Eri silk is made of fibroin and 10-15 % of sericin or gum that stick the filaments together. This needs to be removed so as to separate the fibres and ease the spinning process of both hand and motorise machine spinning.

Delicate degumming is necessary as it should not spoil the structure of the fibre's continuity and should help with the cocoon opening process.

Good degumming of the cocoons is an important aspect. It will have a direct impact on the silk thread. For hand spinning, it helps in getting a very particular thread, unique to eri silk, with a woolen aspect along with the shine and softness of silk.

Efficient silk degumming will also drastically improve the dyeing absorption capacity and colour retention.

Main degumming steps are the following:



# REQUIRED MATERIAL FOR DEGUMMING

Few essential materials and equipment are required for an appropriate degumming process. These are available locally and are easy to use:



## Equipments needed:

Weighing machine  
White muslin cloth  
Vats  
Small bowl  
Wooden spatula  
Plastic bags

## Raw materials:

Eri silk cocoons  
Local soap  
Clear water  
Gas heater or Fire wood



Soda ash is most commonly used elsewhere for silk degumming, however, the locally made soap is also very efficient. In addition, it nourishes the fibres and is eco-friendly.



# STEP 1

## DEGUMMING OF COCOONS

### Process for 500 gm of Eri silk cocoons:

#### PREPARATION OF RAW MATERIAL

1. **Weigh silk cocoons:** It is important to respect the ratio (Cocoons:Water)
2. **Put the cocoons in a white muslin cloth:** This helps in holding the cocoons together and avoids the fibres from getting entangled during the stirring process.

*Tip: Before placing the bags of cocoons into the pot, allow the soap water to cool down to 40° C. This avoids temperature shock that may damage the fibre.*

3. **Measure 15 litres of clear water** (30 times the weight of the cocoons) and then heat

*Tip: Clear water should be used to avoid staining/discolouration of the cocoons.*

#### COCOON COOKING

4. **Add 100 grams of soap:** This could be a local soap (sabon lieh) cut in small pieces. Add when the water is boiling. Allow all of the soap to melt in the water and then add the packed cocoons
  - a) **Using gas stove:** Boil cocoons at 100 ° C temperature for 50 minutes
  - b) **Using firewood:** Maximum time for cooking the cocoon is 45-50 minutes. After 30 minutes the cocoon is stirred. When the cocoon opens only on the outer layers, the inside layers does not open eg: (fibres) are stuck together this means that the cocoons are not ready. Leave the cocoon for another 5-10 minutes for the cocoons to be fully cooked, when cooked the cocoons looks fluffy and soft and the whole cocoon opens up easily.
5. **While cooking measure the temperature regularly.** Temperature of water should be at 80-85° C
6. **When cooked remove from the fire** and leave it for sometime to cool.
7. **Drain** the cocoon
8. **Cocoon can be fermented in a plastic bag for one night.** This will help the uncooked cocoons to open.

PREPARATION OF RAW MATERIAL



Weigh eri silk cocoons



Put them in a white muslin cloth



Cut the soap into pieces and let it melt in the water

COCOON COOKING



Take cocoon out of the water and keep it in a plastic bag for fermenting



Allow the water to gently boil at 100 dg for 50 minutes



When water reaches 90 ° C soak the cocoon in the pot



## STEP 2 "CAKES" PRODUCTION

### Process for making cakes:

1. Wash the cocoons with cold water until the water is clear
2. Each individual cocoon is separated for making the fibre sheets
3. Dip a single cocoon in a small amount of cold water and tap it gently on the full surface to get a round shape fibre sheet. (This help to open the fibre regularly)  
*Tip: If cocoons are soak individually in warm water, it open naturally, no need to tap it: This can fasten the process*
4. Overlap 3-4 fibre sheets to make "cakes"  
*Tip: Single fibre sheets can also be used to speed the drying process. This method can be used when the weather is very humid and cloudy*
5. Dry cocoons outside, preferably not in direct sun to avoid damage. If the weather is cold or humid, dry the cocoon sheets individually.

WASHING OF COCOONS



Wash cocoons until water is clear



Open each cocoon by tipping it gently



DRYING

Dry cakes in the sun



3 to 4 cocoons can overlap to make the cake

MAKING CAKES

## BEFORE

### COCOONS:

The gum is not sufficiently removed. Fibres are therefore stuck together making the spinning process difficult



### HAND SPINNING:

Threads look more like cotton than silk. They are rough in feel. The white natural colour is sometime not even and the shine of the silk is missing. Fabric done out of such threads are coarse.



### MECHANISED MACHINE SPINNING:

Tension on filaments is higher when cocoon is not properly degummed, leading to a thread with more twist and thus less shine.



## AFTER

### COCOONS:

The cocoon is shiny and white, the fibres are well separated without impurities. This allows the fibre to run smoothly while the drawing stage in the spinning process.



### HAND SPINNING:

Threads have a very nice shine and soft texture. Fabrics made out of these threads will be much softer and will drape well.



### MECHANISED MACHINE SPINNING:

Though the results are yet to be achieved, it is expected that tension of the thread will improve and are more regular and shiny. This will make the fabric drape well with improve lustre of the thread.



## ERI SILK HAND SPINNING – SOFT SILK

Traditional hand spun threads are made into fabrics that lasts for a long time. They are spun strongly to create the warp and weft threads.

Traditional method of spinning gives eri silk a cotton feel. The aim of the new method is to give eri silk it's intrinsic silk quality. This new improved spinning technique helps in developing the silk's soft and comfortable textures.



Hand spinning is a very slow process. Nearly one month labour time is required to make a single bobbin. A training on hand spinning was organised for more than 60 villagers. This helped in rapidly evaluating the results of the new technique and produce enough threads for conducting weaving trials at a later stage.

During the training, participants were exposed to various methods of producing different quality of threads. There were varied thread textures – fine, regular and well-twisted for the warp and soft threads with less twist for the weft.

Participants were divided into groups according to their aptitudes and spinning strengths. Each group was spinning either fine, medium and thick warp threads, or thin, medium, and thick weft threads. A total of six groups were formed.

At the end of the training villagers had the opportunity to also create fancy threads by hand spinning.



# ERI SILK HAND SPINNING

## - SOFT SILK

Procedure to get soft silk threads, for different functions



**Warp Fine**

Small amount of fibres are drawn from the eri cake and made smooth, then the “heavy weight” takli is made to turn faster and for a longer period which leads to higher twist yarn



**Warp Medium**

Medium amount of fibres are drawn from the eri cake and smoothened. Then the “heavy weight” takli is made to turn faster and for longer period that leads to a higher twist yarn



**Warp Big**

Big amount of fibres are drawn from eri cakes and made smooth. Step two: the “heavy weight” takli is made to turn faster and longer period which leads to higher twist yarn



**Weft Fine**

Small amount of fibres are drawn from the eri cake, then the “light weight” takli is made to turn slower which leads to less twist yarn



**Weft Medium**

Medium amount of fibres are drawn from the eri cake, then the “light weight” takli is made to turn slower which leads to less twist yarn



**Weft Big**

Big amount of fibres are drawn from the eri cake, then the “light weight” takli is made to turn slower which leads to less twist yarn

Eri hand spinning give endless possibilities to create different thickness and thread textures

# HAND SPINNING OUTCOMES

## BEFORE



Threads are raw in texture and fabric looks like cotton.  
Same strong threads for both warp and weft.  
Texture made out of traditional threads are stiff, raw, without shine.



After a trial on the loom, it was found that the yarn for the warp should be more regular and strong. This is required especially when one uses the frame looms with metallic reeds. Two threads can be plied together and twisted in the opposite direction (Z is first twisted with S).

70 women were trained during the experimentation phase.

## AFTER



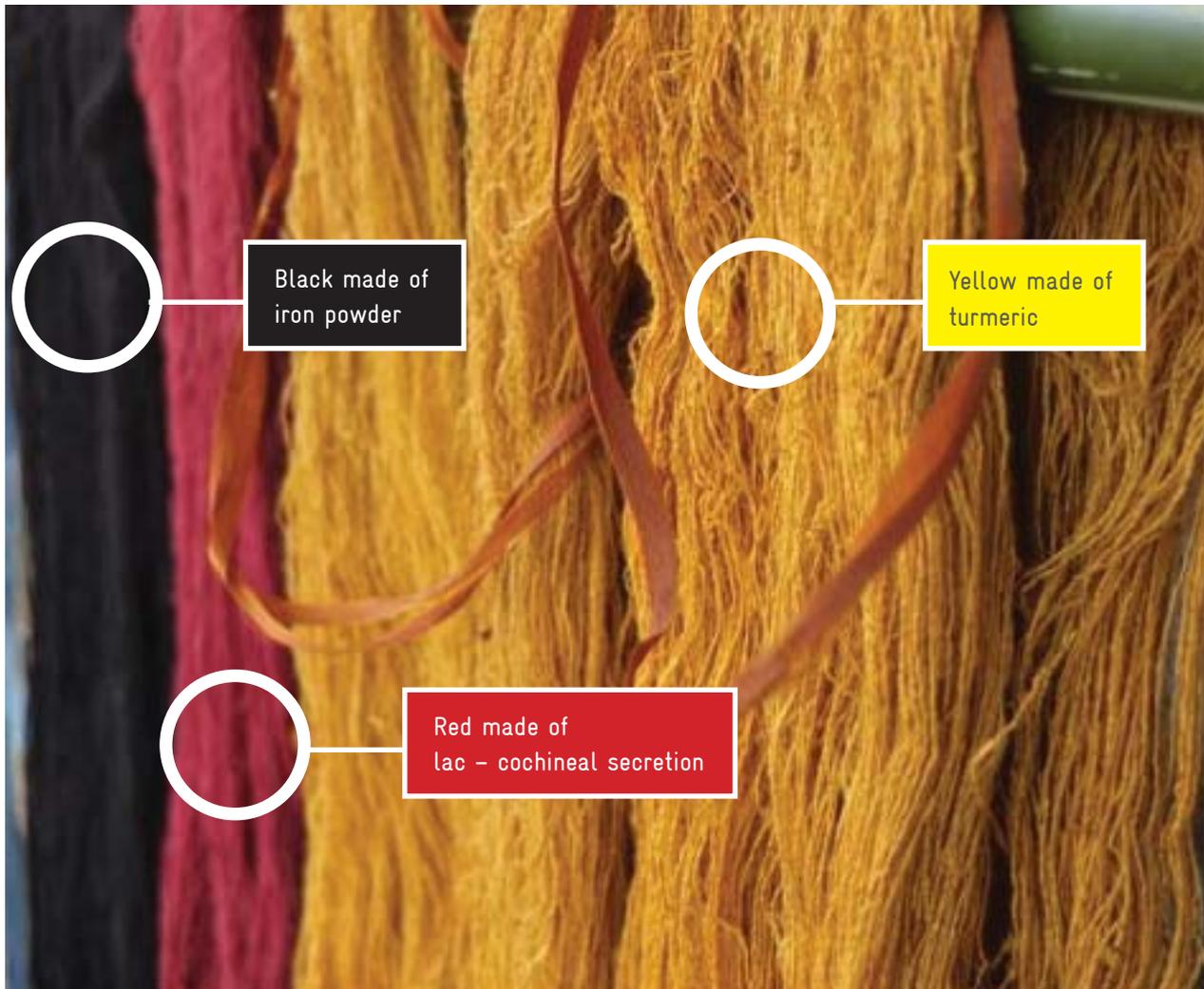
Threads are of different quality for both warp and weft.  
The silk fabric has a soft and delicate feel. It has a unique woolen aspect that gives comfort and gives warmth. But one cannot compare it to woolen fabrics.



# ERI SILK

## ORGANIC DYEING

Meghalaya's silk has deep and strong natural colours. Natural dyeing is common in their culture. The traditional colours of the silk are:





Traditional method uses Sohkhru tree leaves (local name) and Diengrnong (local name) tree bark as mordant ingredients.



The simultaneous approach is applied; both dyeing and mordanting ingredients are mix together with the yarn and brought to high temperature.

Several baths are needed to get the rich and strong traditional colours.

## NATURAL DYEING OUTCOMES

Few new techniques were tried on the traditional dyeing method. These were controlling the dyeing temperatures, colour and water ratio, yarn washing, etc. Colour retention and yarn quality was also improved. However, after dyeing processed eri silk using the new degumming and spinning method, the softness of the silk was reduced.

In itself, natural dyeing requires time, specific know-how and experience. Therefore a dye specialist was assigned to make series of experiments during the two weeks mission in Meghalaya. A yarn specialist from France, who has been dyeing eri silk with natural dyes since 40 years, was engaged. In the framework of the project, the mission was to come

up with new dyeing methods that can be applied in Meghalaya, at the village level, using traditional organic ingredients only.

In addition to experimentation, training was organised at the end of the mission to share outcomes and also train master trainers on the softer dyeing method.



## Findings of the Initiative:

- ✿ In general, the traditional method is good in the context in which products are used
- ✿ For the new eri threads (thin/medium/big) developed within the GIZ, CCA-NER project, a new and softer dyeing method needs to be applied so as to keep shine and softness after dyeing
- ✿ Silk threads suffer temperature shocks – from cold to hot to cold – which damage the yarn and its softness
- ✿ Dyeing temperatures are too high and effect the silk thread's shine
- ✿ Too many dyeing ingredients are applied causing over saturation . This diminishes colour fastness, while requiring quantity of colouring ingredients
- ✿ Meghalaya is one of the only place using natural ingredients for fixing colours - mordanting, which makes it challenging, but interesting and unique from others – most natural dyers use alum (potassium aluminum sulphate)
- ✿ Iron is a highly corrosive ingredient that damages eri silk threads with time. It is not eco-friendly. Also, it is unhealthy for people' skin.
- ✿ Turmeric is not a solid colour. It fades when being exposed to sunlight
- ✿ Diengrnong ingredient used to fix colours – (mordant), is becoming scarce.
- ✿ As Meghalaya is rich in flora and has conducive climate, the state is capable of producing more colouring ingredients.



# SOFT DYEING METHODS

Softer threads are obtained from the new degumming and hand spinning methods (refer to degumming and spinning training manuals). The traditional dyeing method is too aggressive. In that all positive improvements – yarn softness and shine – are lost after dyeing.

Soft Natural Dyeing means:

- Avoiding over-cooking threads in high temperature. This results in damaging the thread softness
- Slow processes are applied to make sure the colour goes deep inside the thread and not only on its surface thus increasing colour fastness. As a result, colours obtained are of paler shades
- Avoiding temperature shocks when dipping dry and cold threads into the hot water. Temperature shocks stresses the yarn and reduces its shine.

Soft method is divided into four key steps:

1. **Pre-mordanting:** preparing yarn to deeply absorb the colour
2. **Dyeing:** in a slow and soft manner so as to ensure that the colours enter the fibre and not just remain on the surface
3. **Post-mordanting:** reinforcing the colour and create different shades from the same ingredients
4. **Washing with citrus water** to improve silk aspect

As for other experimentation steps, only local ingredients and equipments are used to make sure weavers can further practice the method. Only ph paper and thermometer were introduced to better control water quality and temperature, but after some times of practice, weavers may not need them anymore.

The overall method is quite complex, also detailed procedure may be found in the training module on “Eri Silk natural dyeing”.

# NATURAL DYEING TRAINING



The objective of the training was to expose the weavers to new methods that will allow them to expand their colour range. It encourages them to come up with new colours.

Overall 11 villagers and 6 Department staff were trained in this method.

The participants were first introduced to the basic knowledge on mordants:

- All mordants have tannic substance to fix colour
- All ingredients with **tannic substance** can be used as mordant: tea leaves, specific tree barks, nuts skin, etc.
- In order to see if an ingredient has a tannic substance, it has to be heated and mixed with iron bath. Iron bath preparation can be found in the training module. If the colour changes it has a tannic substance
- Mordant bath can be used as colouring ingredient, and also to obtain pale shades.

During the training, the two main traditional red and yellow colours were retained. Two types of mordants were used: Sokhu leaves and areca nuts skin - locally also known as the betel nut. This replaced Diengnong bark tree – which is increasingly scarce.

In total, 12 colour shades were developed: four basics from colour ingredients and an additional eight shades from post mordant baths – iron and ashes baths.

# DYEING PROCESS

## OUTCOMES

Due to the new soft dyeing method, quality of threads is preserved.

**Before:** Traditional method: Colours are strong and bright, the yarn/thread however loses its lustre and softness



**After:** New soft method: Eri silk threads are soft and the delicate shine is maintained. However, the colours come out pale.



The training brought out 12 new shades. It also demonstrated to the participants techniques of using natural ingredients in their dyeing methods. They were encouraged to experiment so as to get new shades of colours.





lime



annato seeds



areca nuts (betel nuts)



onion skin

### Introduction of new ingredients:

- Areca nuts skin has been introduced as an alternative mordanting ingredient
- Iron powder was turned into **iron acetate**. This does not harm the skin or the environment
- Ashes and iron were introduced to modify colours shades
- Dyeing with **Annato seeds** was tried. It gave a rich orange colour
- **Onion skin** as well as **indigo** was used but it gave mixed results. However, recipes were shared to allow further experimentation.
- **Citrus water** was used to improve yarn aspect

Prior to this specific activity, other trials had been done that gave interesting outcomes are:

- **Cold dyeing method:** Fermenting threads in mordant and colouring bath for 15 days. This process ensures that the silk is not heated and thus not damaged due to high temperature
- **Cocoon dyeing:** Dyeing the cocoons instead of the threads before the spinning process and after the degumming process. This allows preserving the yarn softness and creating multi-colour yarn. It is a very interesting approach that can be further experimented upon.



# CONCEPTUALISING WEAVING DESIGNS

The purpose of this initiative is to help weavers adapting their fabrics to new consumers needs.

The initiative's mandate may differ from one place to another. It will be dependent on the consumer's demand of that region. Before the weaving process starts consumer's expectations should be well assessed so as to develop designing textures that meet their requirements.

Product design is about conceptualising new patterns, motifs, weaving structures, playing with thread qualities and creating new weaving textures. Product design is what will differentiate one weaver or community from others.

Today, with increasing competition, design plays a major role in an artisan's success. Also, before conceptualising a design, the target consumer and its expectations should be assessed well.



- 1. Domestic traditional use:**  
Adhere to existing patterns and production methods. Traditional weaving textures are unique and representative of the local ethos and culture, demands will remain.
- 2. New domestic consumers:**  
Consumers that might be a little tired of traditional designs but will be proud to wear locally made products. Design could then be simple but comfortable and useful: warm for winter and decorative, smaller and lighter for summer. Price might be an issue, so raw material used should be reduced as much as possible.
- 3. Foreign visitors/tourists:**  
Globally people have diverse tastes. However, tourists always prefer to take souvenirs from the places they visit. They might want to have a touch of tradition but they are also conscious of their own personal tastes and comfort. Designs should be thus in



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3



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varied styles and should be offered in various price ranges. Combining traditional weave with other fibres such as muga silk can also be potentially adding value to the original product. .

- 4. **Connoisseurs:** a niche market: Buyers that look for special and unique products, representative of a culture, and are particular about specific techniques and fibres qualify as niche

customers. The quality of the patterns and finishing might be more important than comfort and style as the product will be used as a collection piece.

- 5. **Export:** The export market is competitive. Consumers usually have no link with the artisans of a region and are unaware of their culture or the way traditional products are made. There are many intermediaries and the prices

usually inflate three to five times by the time it reaches the end consumers. Design, quality, and price are main areas of concern. Export and production chains are sensitive to these issues. Simple designs with a nice texture, comfort, good finishing and affordability are some aspects that are taken seriously.

# WEAVING ON TRADITIONAL FLOOR LOOMS

Floor looms are typical to Meghalaya. Most weavers still use it as it is easy and convenient for their daily routine.

Fabric woven following the traditional method can last for ages. They have beautiful timeless patterns, but are raw in feel and often resembles cotton.



traditional floor loom



bamboo reeds



"ktang luwi" for shedding



warp bobbins stand



"latai" & "kla" for winding yarn



"dieng long" to feed pirn



pirn and shuttle



wooden sticks



wooden beating sword

Materials used on floor looms are manufactured within the State and are made of raw material from the region. They are cheaper and easy to operate for the weavers.

The main challenge of the weaving trials during the experimentation phase was to retain the softness and shine of the eri silk threads. To achieve this, warp threads were reduced and more space was given to the soft weft threads. This improved the fabric comfort, shine and resulted in a graceful fall.

Reeds were also adapted with the help of a local manufacturer so as to increase the space in between each reed dent, thus reducing reed count of dents per two inches.

Traditionally, weavers use reed count of 26 to 28, leading to very tight and thick textures.

Earlier, during experimentation on hand spinning, different warp thread qualities were developed. Each of them required different reed counts:

**Reed count 10 to 14** for big size threads

**Reed count 16 to 18** for medium size threads

**Reed count 20 to 28** for finer threads



# TRADITIONAL WEAVING PROCESS

Weaving consists of two distinct set of yarn -- warp and weft. These are interlaced to form a fabric.

Weaving on traditional looms is a very lengthy process that starts with setting up of the loom - warp. Two to three days are required to weave a shawl as full process needs to be set contrary to the frame loom that allows warping for a large number of fabrics.

It is recommended to use regular and strong yarn on the warp, to avoid damaging the silk threads and creating breakage.



In general, best results were obtained when warp threads are finer than the weft as it gives more surface to it, with a softer feel and shine.

Other combinations can also be used:

- Fine warp with medium weft.
- Medium warp with big weft thread, medium weft can also be used.
- Big warp thread with fine weft thread.

Difference of eri silk threads qualities allows greater possibilities to diversify the weaving textures.

### Steps:

1. Warp threads are prepared into bobbin and arranged on the stand. Loom set up is determined by the desired fabric dimension. Warping distance between the two pillars correspond to the expected fabric dimension and fringes.
2. Sizing is applied to protect the yarn from abrasion on the loom. It is made from cooked rice water extraction.
3. Drafting/denting consists of introducing threads in between reed dents' space i.e. the comb. One or two threads can be used depending on the desired fabric density and strength. While denting or drafting one should know the lease count or adjust with the lease. To make straight strong edges, more yarn should be added, such as four in one comb.
4. Weaving with softer threads and less warp threads leads to a very comfortable woollen texture. This also has a nice and unique shine.
5. To get a soft fabric, beating of the sword should be lighter, especially when weaving big threads.



# FLOOR LOOM TRIALS

Simple weaving on floor looms with only eri hand spun silk for assessing the best yarn quality mix. Some examples of trials done below:



Description	Simple weave
Warp threads	Eri silk fine
Weft threads	Eri silk fine
Weaving structure	Plain weave
Outcome	Net type

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Description	Simple weave
Warp threads	Eri silk medium
Weft threads	Eri silk medium
Weaving structure	Plain weave
Outcome	Promising texture

---



Description	Diff. warp density
Warp threads	Eri silk fine & big
Weft threads	Eri silk big
Weaving structure	Plain weave
Outcome	A little tight

As a spun thread, eri silk offers many possibilities to play with. Different textures were developed trying different yarn qualities, weaving densities and patterns. These may highlight eri uniqueness and softness.

Description	Over weft yarn
Warp threads	Eri silk medium
Weft threads	Eri silk medium
Weaving structure	Plain weave
Outcome	Interesting texture

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Description	Diff. weft density
Warp threads	Eri silk medium
Weft threads	Eri silk medium & big
Weaving structure	Plain weave
Outcome	Promising texture

---



Description	Diff. warp density
Warp threads	Eri silk fine & big
Weft threads	Eri fine silk
Weaving structure	Plain weave
Outcome	Promising texture



# FLOOR LOOM

## TRIALS WITH COLOURS

Simple weaving on floor looms with only eri hand spun silk for assessing the best yarn quality mix. Some examples of trials done below:



Description	White eri silk
Warp threads	Eri silk medium
Weft threads	Eri silk medium
Weaving structure	Plain weave
Outcome	Very soft

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Description	2 colours plied threads
Warp threads	Eri silk fine
Weft threads	Eri silk fine & big
Weaving structure	Plain weave
Outcome	Nice shine & look

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Description	Multi-colours
Warp threads	Eri silk medium and gaps on the warp
Weft threads	Eri silk big
Weaving structure	Plain weave
Outcome	Nice shine

Description	Combination of colours
Warp threads	Eri silk fine
Weft threads	Eri silk medium
Weaving structure	Plain weave
Outcome	Very soft and comfortable



Description	Combination of colours -2
Warp threads	Eri silk medium and gaps on the warp
Weft threads	Eri silk medium
Weaving structure	Plain weave
Outcome	Nice lustrous



# WEAVING ON FRAME LOOMS

Weaving on frame looms allow many possibilities of weaving structures, which highlight the weft soft threads. Three type of structures had been tried:

- Twill weaving
- Satin weave and
- Rib structure

Use of irregular handspun silk on the warp was the main challenge faced during the trial, especially with big threads. Big threads tend to get blocked in the reed. Further, threads tend to stick to each other when they criss-cross.

Big threads should be avoided on frame loom and the count should be less so that the threads do not stick together. Warp threads should be twisted so that they are regular and strong.

With these weaving structures, warp threads have a role only in terms of fabric support. One can hardly see it. It can thus be made of other thread qualities, such as machine spun silk/ other fibres.



# WEAVING ON STRUCTURES

As a spun thread, eri silk offers many possibilities to play with. Different textures were developed trying different yarn qualities, weaving densities and patterns. These may highlight eri uniqueness and softness.

Description	Over weft yarn
Warp threads	Eri silk medium
Weft threads	Eri silk medium
Weaving structure	Twill weave
Outcome	Interesting texture

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Description	Diff. weft density
Warp threads	Eri silk fine
Weft threads	Eri silk fine
Weaving structure	Rib weave
Outcome	Nice texture

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Description	Diff. warp density
Warp threads	Eri silk big
Weft threads	Eri big
Weaving structure	Satin weave
Outcome	Promising texture



## MIX OF DIFFERENT SILK

Another method to embellish eri silk is to mix it with other silk. Mulberry for instance is so fine that when used as warp yarn, it highlights eri silk's special beauty. Furthermore, mulberry silk shine gives eri silk a little more lustrous.



Description	Simple weave
Warp threads	Eri silk fine
Weft threads	Mulberry
Weaving structure	Plain weave
Outcome	Great texture

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Description	Texture weave
Warp threads	Eri silk big
Weft threads	Mulberry
Weaving structure	Plain weave
Outcome	Interesting texture

---



Description	Weft densities
Warp threads	Eri silk medium
Weft threads	Mulberry silk
Weaving structure	Plain weave
Outcome	Great texture

Muga silk with its unique golden colour and shine create interesting and contrasting combinations with eri silk. It give the fabric more value. Muga is not required on the warp as it was done for trials below and this can add value to the price. Unfortunately, these designs cannot be replicated unless reeling devices for muga and mulberry silk are fixed so as to complete the process – twist S + Z.

Description	Over weft yarn
Warp threads	Muga
Weft threads	Eri silk medium
Weaving structure	Plain weave
Outcome	Interesting design



Description	Diff. weft density
Warp threads	Muga
Weft threads	Eri medium & muga
Weaving structure	Plain weave
Outcome	Promising



Description	Diff. warp density
Warp threads	Muga
Weft threads	Eri medium & muga
Weaving structure	Plain weave
Outcome	Comfortable



Usually weavers from Meghalaya do not apply proper post loom finishing, this is partly the reason for roughness in the fabric and it's lack of shine. With time and regular use, traditional cloth tends to get soft. Today clients prefer this softness at the time of purchase.



Soap nuts can be used to wash and treat eri silk



# POST LOOM FINISHING

Method:

Soh-pairah soap nuts: Five nuts are enough but if they are not available, local soap can also be used

These nuts are crushed and then tied into in a small white cotton cloth or bag. The bundle/bag is then dipped into the water where saponins from the nuts react.

Fabric washed in the soap nut solution: Be careful! Only use with

dyed fabrics as it will otherwise tint white fabrics

Steam iron the fabric when the weather is humid: Use steam (if available), as humidity and temperature will open the fibres and make them softer and shinier.

A last bath with citrus should be given to improve the fabric's silken qualities



As mentioned earlier, weavers use starch to ease the weaving process. It should be properly washed after weaving as it may give a rigid texture aspect

Objective of the finishing trials were two folds:

- Improve the cloth aspect,
- Find out the best washing and drying instructions,
- Use of locally available eco-friendly ingredients: local

soap and a local nut named “sohpairah”.

Do not wash white cloths as it might slightly tint. Local soap should be used for washing white cloths.

Eri silk fibres are more sensitive to heat than others silks due to its special spun aspect. For the trials, steam ironing was used giving good results: fibres liaise, leading to a smoother and shinier feel.





## FURTHER RECOMMENDATIONS

## GENERAL RECOMMENDATIONS

- The outcome of the trial phase proves that the main bottlenecks along the value chain can be addressed and good results can be achieved. It shows that traditional methods are not obsolete, on the contrary they represent Meghalaya's uniqueness and identity.
- Essentially, eri silk weaving in Meghalaya is organic. Therefore focus should be given on increasing the demand for eco-friendly products. There is a niche market for 'Slow Textile' to tap in.
- In order to meet the demand and improve income of the weavers, traditional practices and new technologies could be married without affecting hand-made market:
  - Adapting traditional looms to produce three to four scarves per loom, instead of one presently,
  - Replace warp threads – loom set up, with motorised spun threads. Today, many weavers use mild spun yarn imported from Assam.
- With regard to hand spinning, some trainees wanted to focus on spinning. They face difficulty in finding the market. Weavers in other villages however prefer to weave and supply readymade silk. The creation of a cooperative silk thread store/bank may help resolve the situation.
- Domestic and tourism markets are good to tap into as they are more sensitive to the traditional designs. They do not require high level of standardisation



as expected by export buyers. Price too is less of an issue as there are few intermediaries.

- Different options could be considered to increase domestic sales and promotion:
  - Increase cooperatives' sales through governmental outlets
  - Setting up a demonstration center in Nongpoh sericulture farm where visitors are introduced to eri silk production steps.



# SERICULTURE.

## ERI SILK YARN PRODUCTION

- Sericulture is an important aspect of the silk value chain. This could not be sufficiently addressed during the project phase. The Department should consider recommendations made by GIZ sericulture Consultant.
  - One of the recommendations was to assign an eri silk rearing, reeling and weaving technician for a period of two to three months. S/he will address some specific needs: Farming management methods, reeling devices, improving traditional and non-traditional weaving equipments, creating cross learning opportunities on eri silk, etc.
  - Eri hand spun yarn offers a unique quality. It gives more possibilities to play with than machine spinning. It provides intricate threads with a nice shine and a soft woollen aspect that no other silk can offer.
  - Focus should be on this traditional spinning method, especially when promoting silk made in Meghalaya.
  - However, in terms of impact on productivity and livelihood, motorised spinning plays a greater role. As per the study conducted by GIZ consultant, both methods need to be addressed; one to preserve and promote traditional methods and one to enable producers' livelihood. While trial on hand spinning is quite advanced, attention should be given to the also encourage motorised spinning that can bring in greater income for the artisans.
- Introduction of wooden paddle spinning device can be interesting. And it is also more user-friendly. It is easier to use than a mechanised one. Spinning speed can be adjusted. Often weavers complain that the high speed in mechanised devices results in the over-twisting of threads. Wooden paddle devices don't need electricity and can be easily manufactured by local carpenters.



# NATURAL COLOURING

## FOLLOW UP SUGGESTIONS

- The experimentation with natural dyes has given positive results. Efforts to adopt traditional practices to preserve softer eri yarn quality was undertaken. There is a scope of using new ingredients to produce new colours keeping in mind Meghalaya's rich flora.
- During experimentation phase it appeared that some traditional ingredients are harmful. For instance, black colour added at the raw stage is a strong irritant for the human skin.
- When producing the shade yellow from tumeric the colour fastness is poor and it fades when exposed to sunlight. Traditional mordant extracted from Dieng rnonng tree and lac – cochineal secretions are no longer being used.
- Efforts should be made in natural dyeing so as to preserve the tradition of eri silk weaving.
- Installing a dyeing unit within Ri-Bhoi area in Nongpoh, along with a botanical garden, will help weavers to access dyes and experiment with their traditional ingredients.
- A study on available colouring organic ingredients within the State will be of help.
- An exercise to encourage the creation of new colours was done during the GIZ dyeing training. This could be an action plan for the Department so as to boost creativity in the use of natural ingredients.



# RECOMMENDATIONS ON WEAVING

- In terms of “image”, traditional weaving on floor looms are the most representative of Meghalaya’s silk production and the emphasis should be on this method. But, this practice may result in high price of the end product. This is mainly due to the long production time and restricted production capacity. Also, different approaches should be taken into consideration:
  - Design goods for high-end market segment,
  - Reduction of raw material as suggested in the experimentation phase and new weaving approaches,
  - Use of less expensive yarn for warp.
- With regard to frame looms, there are challenges in using eri hand-spun threads on the warp. It could be replaced with other materials in combination such as mulberry silk. This will give a very nice texture. However, in order to encourage 100% local made material, twisting of raw

mulberry and at times muga silk should be introduced. This gives an additional value to the eri silk fabric when used on the weft for creating patterns, stripes, combinations, textures, etc.

- Use of eri silk lends value addition to hand-woven fabrics. It justifies the higher pricing. Because of high price weavers earn better. On the contrary, weaving industrialised cotton or synthetic wool on traditional/ frame handloom proves to be a disadvantage. It reduces the hand woven fabric’s value. This leads to a lower product price and thus a poor income for the weavers.
- Instalment of an eri silk ‘Development Unit’ is the way forward to pursue these efforts and consistently ensure such good results as was observed during the testing phase. It is recommended to develop textures that can be applied to traditional looms and frame looms.

- Sample looms were introduced by GIZ for further testing. Trials concentrated on highlighting the weft soft yarn with weaving textures and structures - twill, satin weave, etc.

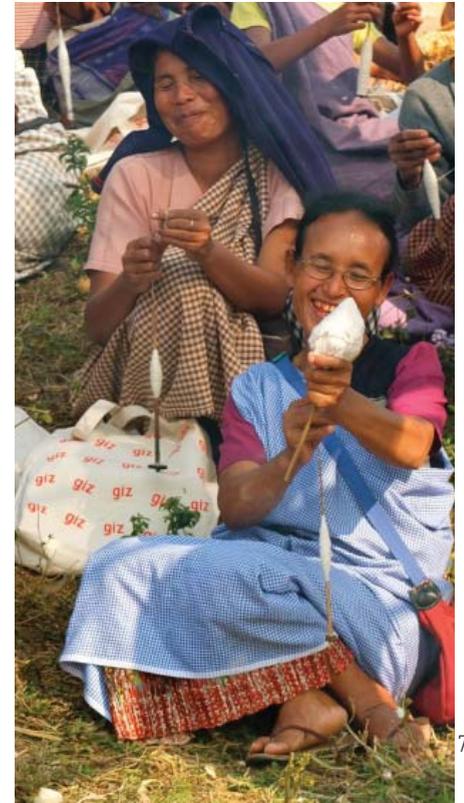




# POST WEAVING IMPROVEMENTS

- Meghalaya has excellent locally available eco-friendly ingredients that can improve the post weaving treatment and washing:
  - Local soap, that is nourishing,
  - Citrus to give a silky soft touch,
  - Soap nuts, locally called: sohpairah
  - Some vegetable oils can also be tried instead of using starch made out of rice that is difficult to remove.
- Additional methods of using soap nuts are seen here: <http://www.davidsuzuki.org/what-you-can-do/queen-of-green/faqs/green-cleaning/what-are-%20soap-nuts/>
- Calendaring also is effective on the finished product . It makes it shiny and soft. In the long run, a proper calendaring unit may be set up for the weavers' use.







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