



**RWANDA
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**Silk cocoon production — Code of practice
— Part 1: Mulberry leaves production**

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Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by Technical committees are ratified by members of RSB Board of Directors for publication and gazettment as Rwanda Standards.

DRS 357-1 was prepared by Technical Committee RSB/TC 029, *Textile and Leather Technology*.

In the preparation of this standard, reference was made to the following standard (s):

- 1) TAS 8201-2012 Good practices for silk cocoon production
- 2) Sericulture training manual for farmers in Rwanda

The assistance derived from the above source is hereby acknowledged with thanks.

DRS 357 consists of the following parts, under the general title *Introductory element — Main element*:

- *Part 1: Mulberry leaves production*
- *Part 2: Mulberry silkworm rearing*
- *Part 3: Silk cocoons handling*

Committee membership

The following organizations were represented on the Technical Committee on *Textile and Leather Technology* (RSB/TC 029) in the preparation of this standard.

Ministry of Trade and Industry (MINICOM)

University of Rwanda-College of Science and Technology (UR-CST)

National Agricultural Export Development Board (NAEB)

Rwanda Inspectorate, Competition and Consumer Protection Authority (RICA)

HeWorks Silk Rwanda Ltd

Rene Pharmacy

UTEXRWA Ltd

OXALIS Ltd

LIXIL/SATO

Rwanda Standards Board (RSB) – Secretariat

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Introduction

Sericulture is an agro-based sector, involving rearing silkworms to produce silkworm cocoons and raw silk by reeling cocoons. The major sericulture activities comprise of mulberry cultivation to feed the silkworm larvae, silkworm rearing to produce cocoons, reeling of cocoons to unwind the silk filament and silk processing and weaving to gain value added silk products.

The growth and development of silkworm is greatly influenced by environmental conditions. The biological as well as cocoon-related characters are influenced by ambient temperature, rearing seasons, quality mulberry leaf, and genetic constitution of silkworm strains. Different seasons affect the performance of *Bombyx mori*L.

Silkworm rearing depends on the availability of mulberry leaves. It is occasionally limited by the dry season, which is the time to avoid silkworm rearing because mulberry growing is retarded due to drought and exceeding high temperature gives rise to the retardation of silkworm growing.

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Silk cocoon production — Code of practice — Part 1: Mulberry leaves production

1 Scope

This Draft Rwanda Standard establishes guidance on activities of production of mulberry leaves intended to feed mulberry silkworms.

2 Normative references

There are no normative references in this document

3 Terms and definitions

For the purposes of this standard, the following terms and definitions apply

3.1

Silkworm

silkworm is the larva or caterpillar of the *Bombyx mori* moth

4 Cultivation of mulberry trees

4.1 Natural conditions suitable for mulberry cultivation

Silkworm *Bombyx mori* require highly nutritive mulberry leaves to achieve high quality cocoon production. The environmental conditions to be considered for good production of mulberry leaves are herewith specified in table 1.

Table 1- Environmental conditions for good production of mulberry leaves

S/N	Factor		Recommendation
i.	Temperature		24 ⁰ C - 28 ⁰ C ^a
ii.	water	annual rainfall	1,000–2,500mm
		water content in the soil	70-80%
iii.	Sunlight		sunshine of 9 to13 hours a day
iv.	Air quality		mulberry field should be located more than 100 meters away from tobacco plantation, factory smokes and agriculture chemicals.
v.	Elevation		1000-2000 metres
vi.	Plantation design vis-à-vis the land slope	Slope below 15⁰	mulberry trees can be planted in rows along the contour

		Slope of 15° to 30°	terraces in order to minimize soil and nutrient erosion
vii.	Soil	Type	Sandy, sandy loam, loamy soil and Clay loamy
		Condition	deep, fertile, and well drained with good capacity of holding moisture
		pH	6.5 - 6.8
^a When the temperature goes above 28°C, irrigation practices should be applied			

4.2 Treatment of acidic and basic soil

The acidic soils can be improved by the application of lime and green manure while Saline and alkaline soils can be improved by application of gypsum, sulfur or green manure as per Table 2.

Table — 2The quantity of gypsum or lime to be applied in different cases to maintain the pH range

Gypsum for alkaline soil		Lime for acidic soil			
pH range	Amount of gypsum, tonnes/ha	pH range	Type of soil	Lime, tonnes/ha	
				Plain	Hilly areas
7.4 to 7.8	2.0	5.5 to 6.5	Sandy	1.25	2.5
7.9 to 8.4	5.0		Sandy loamy	2.50	5.0
8.5 to 9.0	9.0		Loamy	5.0	7.5
9.1 and above	14.0		Clay loamy	7.5	8.75

4.3 Site Selection for mulberry field

The following factors should be observed:

- The mulberry field (s) should be in close proximity to the rearing house to minimize labour costs and the risks of leaf withering during transport;
- On sloped landscapes soil conservation measures such as trenches and management of contour bunds must be done well to prevent soil erosion; and
- Mulberry trees can be grown in saline, alkaline and acidic soils after suitably amending the soils as per Table 2.

4.4 Propagation of mulberry trees

Mulberry plantation can be raised by planting hard wood cuttings directly in the field, or saplings from nursery beds. The following activities are carried out:

4.4.1 Preparation of mulberry nursery

4.4.1.1 Site selection

To prepare nursery bed, place where there is source of water should be selected. The soils must be free from pests and have high water holding capacity. Preferably place under shade is recommended as per Figure 2.

4.4.1.2 Establishment of nursery bed

The soil should be dug with weeding and removing stones, followed by the application of enough humus, lime and fertilizers at the rate requested according to the soil fertility; then a raised bed of 1.5 meter wide and 10 cm high is prepared as per Figure 1. The length of each bed may be adjusted to 5-10 meters, depending on the size of land.

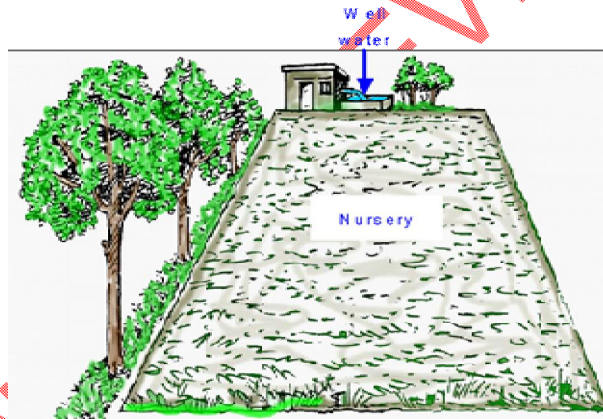


Figure 2: Selection of nursery bed

4.4.1.3 Selection and preparation of cuttings

The following should be considered during the selection and preparation of cuttings:

- The cuttings are made from mature hard wood using 6-8 months old branches as per Figure 1, after removing leaves;
- top part of green and tender branches should be removed;
- branches should be free from disease and pest;
- cuttings of size 15-20 cm length with 2-3 healthy buds are to be prepared;

- e) cuttings should be cut at 45° and the top end should be 2 cm away from bud;
- f) cutting should be prepared without damaging the bark or splitting the base;
- g) keep the cuttings in wet gunny cloth/bag, till it used for planting;

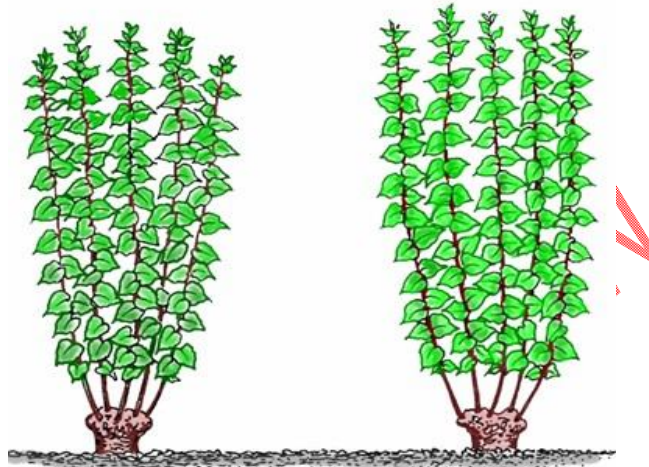


Figure 1: Mother trees of 6-8 months old

4.4.1.4 Planting cuttings

Cuttings should be planted in the bed exposing only one bud over soil surface with spacing of 20cm by 20cm. After planting, soil around the cutting should be pressed firmly to avoid entry of dry air.

4.4.1.5 Maintenance of nursery bed for hard wood cuttings

The maintenance of the nursery is done as follows:

- a) Regular irrigation is necessary for rooting and growth of mulberry saplings;
- b) Weeds should be removed; and
- c) Fertilizer such as urea may be applied after two months of planting to enhance growth.

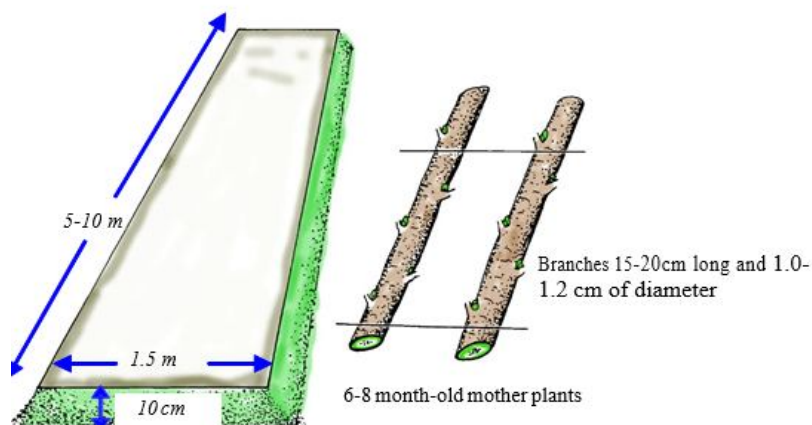


Figure 3: Preparation of nursery bed and hard wood cuttings

4.4.2 Plantation of mulberry trees

4.4.2.1 Establishment of mulberry plantation

To cultivate mulberry trees, the following points should be considered:

- The conditions of the field site should be investigated before planting regarding the location and soil fertility etc;
- The feeder roads are needed for access to the field for the cultivation and harvesting;
- Before planting saplings, the soil should be ploughed deeply; make the surface soil flat; compost and fertilizers including lime are applied to improve soil fertility;
- At a place where water drains poor in the rainy season, a drainage plan should be worked out and outlets installed;
- To facilitate silkworm rearing, the mulberry plot for young silkworms is prepared separately from the ordinary plantation; and
- In the dry season, irrigation should be applied to allow mulberry grow continuously.

4.4.2.2 Planting ditch and base fertilizer

The planting ditch is prepared 50 cm deep and 40 cm wide. At the bottom of ditch, organic matters (about 10,000 kg/ha) are put in 15 cm deep and cover it with soil of 5 cm deep. During digging the soil, upper and lower parts of soils are piled up separately and the upper soil is put downside and the lower soil upside when mulberry trees are planted.

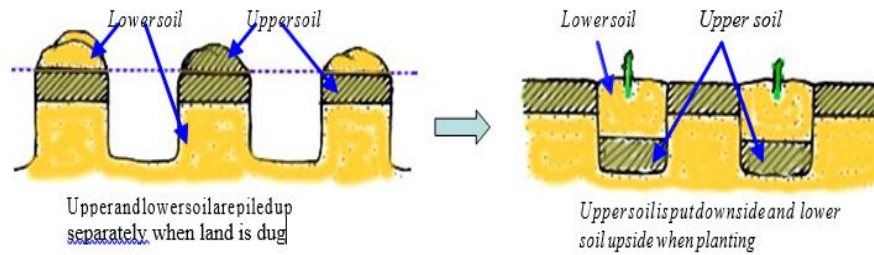


Figure 4: Preparation of planting ditch changing the position of soils

4.4.2.3 Spacing of mulberry plantation

It is recommended to have the space of 1.5 meters between rows and 50 cm of distance between trees.

4.4.2.4 Planting method of mulberry saplings

4.4.3.4.1 Two pieces of bamboo or wood sticks of 60 cm long are struck into the ground at both ends of the ridge. A piece of strong rope is marked to show the inter-tree space (e.g. 50 cm). This rope is tied to the piles and tightly stretched. The mulberry saplings are put in the ground, according to the guide on the rope, leaving their upper portion about 5 cm above the ground.

4.4.3.4.2. In case mulberry saplings are prepared, the ditch is prepared and the organic matters are applied as described above, and the sapling is planted in the ditch according to the guide of the mark on the rope. Then, the ditch is filled with the soil surrounding the sapling and trod down (Figure 5).

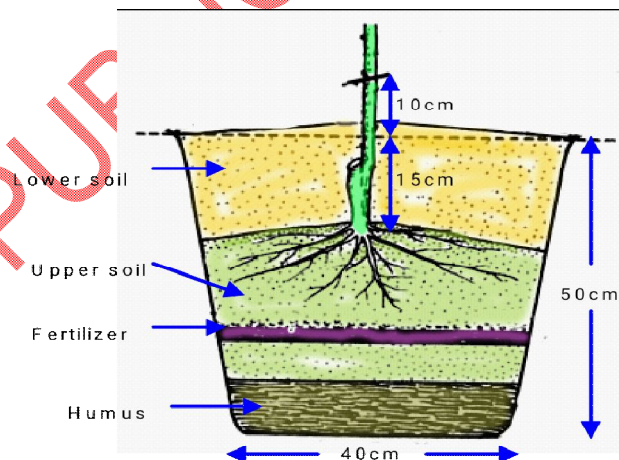


Figure 5: Planting method of a mulberry sapling

4.4.3 Pruning of mulberry trees

4.4.4.1 Pruning is done after four months of planting

4.4.4.2 When the old mulberry branches are cut off at the bottom, the new shoots sprout and grow, by which more fresh leaves are produced and it makes easy to harvest mulberry leaves. The proper number of branches **per one mulberry tree is 8-10 per trunk.**

4.4.4.3 Care should be taken to ensure that the stem does not split and the bark does not peel off during **pruning to prevent infections by pathogens.**

4.4.4 Maintenance and fertilization of mulberry fields

In order to produce good mulberry leaves in abundance, the field should be maintained in good condition by weeding, ploughing, preventing drought or moisture damage, and applying composts and chemical fertilizer to make the soil suitable for a good growth of mulberry.

4.4.4.1 Weeding

Grass grows thick in the rainy season and hinders the growth of mulberry trees by absorbing nutrients and moisture from the soil. Therefore, weeding should be done in early stage by controlling grass before budding.

4.4.4.2 Ploughing

Ploughing is to turn over the uppermost soil while burying weeds and crops remains to decay, and facilitate soil aeration to activate microorganism action and hasten the decomposition of organic matter in the soil.

4.4.4.3 Mulching

Mulching consists of spreading organic matter (rice straw, cut grass, stalk of sorghum, waste of sugarcanes, and maize stalk, etc, over the soil surface to prevent drought damage through evaporation of soil moisture.

4.4.4.4 Fertilization

Mulberry trees need three components namely nitrogen, phosphorus and potassium from organic or/and inorganic fertilizers

4.2.6.4.1 On one hectare of mulberry garden N: 230 kg, P₂O₅: 150 kg, K₂O: 170 kg are recommended annually in three doses for medium fertile soils.

4.2.6.4.2 Organic matters can fertilize soil effectively. It is recommended to apply: annually 10,000 kg or more of compost per ha.

4.5 Leaf harvesting and storage

a) Leaf harvesting should be done during the cool hours of the day such as early morning and late evening;

- b) Leaves harvested in the morning could be used for the afternoon and night feeding;
- c) Leaves harvested in the late afternoon for the morning feeding of the following day;
- d) Harvested leaves should be transported in gunny bags or baskets made of plant straws;
- e) Leaf storage is done in a separate room or in a corner of specially designed veranda or wooden leaf chamber well ventilated and covered with gunny cloth Mulberry leaves for young silkworms;
- f) Leaves should be spread on shelves;
- g) Periodic turning of leaves is essential to avoid leaf fermentation and to vent out metabolic heat;
- h) Water sprinkled on leaves on hot days and cover with wet gunny bag ;

NOTE Low temperature and high humidity are critical in leaf preservation

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