TASAR TECHNOLOGY COMPENDIUM 2016

TROPICAL AND TEMPERATE TASAR CULTURE:
HOST PLANT, SILKWORM REARING, SEED PRODUCTION
& POST-COCOON TECHNOLOGIES

Dr. V.P. Gupta
Susmita Das
S.K. Sinha

CENTRAL TASAR RESEARCH AND TRAINING INSTITUTE
(Central Silk Board - Ministry of Textiles - Govt. of India)
RANCHI - 835 303, JHARKHAND
Website : www.cttriranchi.co.in
# TECHNOLOGY

## A. TROPICAL TASAR - HOST PLANT
1. Nursery technique for raising *Terminalia arjuna* (Arjun) and *T. tomentosa* (Asan) seedlings
2. Vegetative propagation of *Terminalia* plants
3. Integrated package for raising and maintenance of tasar host plants
4. Establishment of Chawki garden for two crop system
5. Integrated farming system for augmenting the income of farmers
6. Application of secondary nutrient combination SM5 for boosting the leaf yield
7. Integrated management of leaf gall in *Terminalia* plants

## B. TROPICAL TASAR - SILKWORM ECORACES
1. Commercialization of tasar silkworm (*Antheraea mylitta*) ecorace – Daba Bivoltine & Trivoltine
2. Commercialization of tasar silkworm (*Antheraea mylitta*) ecorace – Sukinda
3. Commercialization of BDR-10 : An authorized race of tasar silkworm

## C. TROPICAL TASAR – SILKWORM REARING
1. Module for disinfection and hygiene in rearing field
2. Egg incubation and larval brushing technique
3. Chawki rearing of tasar silkworm under nylon net
4. Integrated technology package for rearing of tasar silkworm

## D. TROPICAL TASAR - SILKWORM PROTECTION
1. Foliar application of Sodium Hypochlorite to check Virosis and Bacteriosis in tasar silkworm.
2. Leaf Surface Microbe (LSM) for silkworm disease management
3. Silkworm disease management using ‘Jeevan Sudha’ formulation
4. Management of silkworm pests and predators

## E. TROPICAL TASAR - SILKWORM SEED PRODUCTION
1. Preservation of cocoons for tasar silkworm seed production
2. Moth mating and oviposition for higher production of tasar silkworm seeds
3. Mother moth examination for production of disease free seed of tasar silkworm
4. ‘Depuratex’ for cleaning and surface sterilization of tasar silkworm eggs
<table>
<thead>
<tr>
<th>#</th>
<th>TECHNOLOGY</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>F.</td>
<td><strong>TROPICAL TASAR – POST-COCOON ACTIVITIES</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Non-peroxide cooking method for tasar cocoons</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>2. Machines for reeling and spinning of tasar silk yarn</td>
<td>20</td>
</tr>
<tr>
<td>G.</td>
<td><strong>TEMPERATE (OAK) TASAR – HOST PLANT</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Raising and maintenance of block plantation of <em>Quercus serrata</em></td>
<td>21</td>
</tr>
<tr>
<td>H.</td>
<td><strong>TEMPERATE (OAK) TASAR – SILKWORM SPECIES / BREEDS</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Commercialization of RTRS-1 : A cross breed of Oak tasar silkworm</td>
<td>22</td>
</tr>
<tr>
<td>I.</td>
<td><strong>TEMPERATE (OAK) TASAR – SILKWORM REARING</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Oak tasar silkworm rearing technology</td>
<td>23</td>
</tr>
<tr>
<td>J.</td>
<td><strong>TEMPERATE (OAK) TASAR – SILKWORM SEED PRODUCTION</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Oak tasar silkworm seed production</td>
<td>24</td>
</tr>
</tbody>
</table>
A. TROPICAL TASAR - HOST PLANT

Title of the Technology: NURSERY TECHNIQUE FOR RAISING TERMINALIA ARJUNA (ARJUN) AND T. TOMENTOSA (ASAN) SEEDLINGS

Year of recommendation: During 1980's

Salient features:

 This technique assures higher seed germination (90%) and survival of seedlings (80%) in polythene bags for fast establishment of tasar host plant nursery.

Usages:

 Collect the mature seeds of Asan and Arjun during the month of April-May and select the heavier and bigger seeds weighing more than 2 gram.

 Soak the seeds (48 hours for Asan and 96 hours for Arjun) by packing them in gunny bag and sinking in water during June/July.

 Spread the soaked seeds over raised sand bed (3' x 1') under the shade and cover them with wet gunny bags or paddy straw. Maintain humidity in the beds by sprinkling water regularly. The seed germination starts after a week and continues for about 3 weeks.

 Sort out the germinated seeds every alternate day and sow them individually in polythene bags of 30 cm x 10 cm size filled with rooting mixture (FYM, soil and sand in a proportion of 3:2:1 for Arjun and 1:3:1 for Asan)

 Maintain the seedlings raised in polythene bags for about two months by regular watering, till they attain a height of 8-10". After that these seedlings can be transplanted in the field.

Expenditure: Rs. 2,350 for raising 1000 seedlings

Cost benefit ratio: 1 : 2.12

Do's

 Dip the seed packed gunny bags in the water properly by tying or putting with them some heavy weight articles to ensure perfect soaking.

 If pests or diseases appear, spray twice Rogor (0.3%) or Bavistin (0.2%), respectively.

Don'ts

 Do not pile the soaked seed on sand bag as thick layer. Spread them in a single layer.
Title of the Technology: VEGETATIVE PROPAGATION OF TERMINALIA PLANTS

Year of recommendation: 2007-08

Salient features:

 The protocol enables raising of plantlets from stem cuttings with a success rate of about 80%.
 The system facilitates propagation of desired genotypes true to their characters.

Usages:

 Select very young mother plants of 1 or 2 years age for preparation of cuttings. In case of non-availability of very young plants, use the aged plants by pruning them at lowest possible level of 1 foot height in the month of December or January.
 Take softer leaf node cuttings (2nd or 3rd node with a pair of leaves) and juvenile cuttings (apical node with one pair of just unfurled very tender leaves) from one month old branches of selected mother plants.
 Prepare the subsoil pits of 6’ x 3’ x 3’ at a shady place. Fill 8-10 inch sand in the pit and cover with thick transparent polythene sheet by supporting with wooden frame. This ensures 70-80% humidity inside the pit which is conducive for root induction.
 Fill the polythene bags of 20 cm x 10 cm size with pure fine sand as rooting media.
 Plant the prepared leaf node/juvenile cuttings in the bags and keep them in subsoil pits.
 After sprinkling water on the sand filled polythene bags and walls of subsoil pit, cover the pit properly with polythene frame. As per need, sprinkle the water to maintain high moisture level of 70-80% in the pit.
 Rooting of cuttings starts in 25-30 days and ample rooting takes place within 60 days.
 Transplant the rooted cuttings to polythene bags (30 cm x 10 cm) filled with FYM, soil and sand (3:2:1) mixture and keep them first under shade for about a week and thereafter transfer them to the place with diffused light.
 After maintaining the saplings for about eight months, transplant them to main field.

Expenditure: Rs. 3,000 for raising 1000 saplings

Cost benefit ratio: 1 : 1.67
Title of the Technology: INTEGRATED PACKAGE FOR RAISING AND MAINTENANCE OF TASAR HOST PLANTS

Year of recommendation: During 1980's

Salient features:

- The package comprises of growing of host plants through seedling or sapling, training the plants to provide shape, manuring and application of fertilizer dose.
- This ensures consistent leaf production of about 5-6 kg/plant from 5th year onwards.

Usages:

- Plough the land during the month of April-May by utilizing pre-monsoon showers.
- Dig the pits of 1' x 1' x 1' size following desired plant spacing of 6' x 6' (2988 plants/ha), 10' x 6' (1792 plants) or any other recommended spacing.
- Transplant the seedling to the field at the middle of monsoon season i.e., during the month of August.
- For transplanting, give an inverted 'T' shaped cut to poly-bags containing seedlings, then place them in pits and fill with soil and farm yard mixture (@ 2 kg FYM per pit).
- After 3-4 years of growth, provide a suitable height and shape to Terminalia plantation by proper pollarding and pruning.
- For pollarding, cut the bushes at 5-6 feet height once in two years during February for first crop rearing and during April for second crop rearing. It results in luxuriant flush of quality leaves.
- Maintain a plant height of 6-8 feet by regular pruning of thin branches.
- Attend regular weeding under and around the bushes.
- In order to replenish the nutrients in the soil and obtain optimum production of quality leaves, apply recommended dose of manure @ 2.0 kg FYM per plant by deep placement (6” depth).
- Apply fertilizers @ 100:50:50 NPK kg/ha/year. Apply Nitrogen in two split doses (36 gram Urea/plant in 6’x 6’ spacing and 60 gram Urea/plant in 10’ x 6’ spacing), first dose at the onset of monsoon during June-July and second dose during August-September. Apply Phosphate (104 and 174 gram SSP/plant in 6’ x 6’ and 10’ x 6’ spacing, respectively) and Potash (27 and 46 gram MOP/plant in 6’ x 6’ and 10’ x 6’ spacing, respectively) as a single dose at the onset of monsoon.
- To obtain luxuriant yield and quality leaves, spray 1.5% Urea solution (15 g in 1 litre of water) on plants 15 days before brushing of larvae.

Expenditure:

- Rs. 15,000 - 17,000 per hectare (one time expenditure on establishment of plantation)
- Rs. 4,000 - 5,000 per hectare (4th year onwards on maintenance of plantation)

Cost benefit ratio:

- 1 : 8.75 (4th year onwards)

Do's

- In termite prone area, treat the soil & FYM mixture with 10 ml solution of 0.065% Dursban at the time of transplanting the seedlings.
Title of the Technology:  ESTABLISHMENT OF CHAWKI GARDEN FOR TWO CROP SYSTEM

Year of recommendation:  2007-08

Salient features:

- It ensures the production of quality leaves for healthy growth of young age larvae and avoid loss of Chawki worm.

Usages:

- In order to maintain Chawki garden, select a portion of four years old economic plantation of Arjun or Asan planted in a spacing of 4' x 4', comprising 70 plants (for taking up rearing of 200 – 225 dfls per crop).
- Prune the plants at 3 feet height during first fortnight of March for first crop rearing and clipping of upper portion of branches during July for second crop rearing.
- Attend cultural operations after pruning.
- Apply manure @ 3 kg FYM or 2 kg Vermicompost per plant by deep placement (9” deep around the plant)
- Apply fertilizers @ 100:50:50 NPK kg/ha/year.
- Apply Nitrogen in two split doses (each dose of 16 gram Urea/plant in 4'x 4' spacing).
- Apply Phosphate (46 gram Single Super Phosphate/plant in 4' x 4' spacing) and Potash (12 gram Muriate of Potash/plant in 4'x 4' spacing) as a single dose at the onset of monsoon.

Expenditure:  Rs. 1,400 for two crops in a year

Cost benefit ratio:  1 : 3
Title of the Technology: INTEGRATED FARMING SYSTEM FOR AUGMENTING THE INCOME OF FARMERS

Year of recommendation: 2009-10

Salient features:

- Tasar host plant based integrated farming system comprising of leguminous and other cash crops has been developed for effective and sustainable utilization of available land resources.
- Integrated farming is more suitable under wider spaced plantation like 12' x 6', 10' x 5' or 6' x 6'.
- Integrated farming has been found economically viable and remunerative for tasar growers. Net income from integrated farming ranges from Rs. 23,000 to 41,000/ha.

Usages:

- Plough the land thoroughly at the onset of monsoon.
- After necessary cultural operations, apply farm yard manure @ 600 cft/ha and chemical fertilizer @ 100N: 50P: 50K as recommended for full-grown tasar food plantation.
- Sow locally grown agricultural crops like Green Gram (Phaseolus aureus), Black Gram (Phaseolus mungo) and Cowpea (Vigna sinensis) @ 16-20 kg/ha in the first week of July, and crops like Horse Gram (Dolichos biflorus @ 24-30 kg/ha) and Niger (Guizotia abyssinica @ 6-8 kg/ha) during third/fourth week of August.

Expenditure: Rs. 10,000 – 17,000 per ha

Cost benefit ratio: 1 : 3.8 to 1 : 4.6 depending upon intercrops.

Do's

- Spray twice Rogor (0.3%) and Bavistin (0.2%) for management of pests and diseases, if appear on tasar food plants as well as intercrops. Safe period : 15 days
Title of the Technology: APPLICATION OF SECONDARY NUTRIENT COMBINATION - SM5 FOR ENHANCEMENT OF LEAFYIELD

Year of recommendation: 2010-11

Salient features:

- SM5 is a combination of two chemicals - Calcium Carbonate / slacked lime and Magnesium Sulphate.
- SM5 increases the quality leaf yield by about 28% in *T. arjuna* and 27% in *T. tomentosa* with significant improvement in cocoon characters upon rearing on treated plants.

Usages:

- Apply Calcium Carbonate / slacked lime (commercial grade lime powder) as basal dressing @ 45 gram/plant in basal ring around the tasar plant on onset of monsoon, followed by digging.
- Spray 2% Magnesium Sulphate (commercial grade) on the plants in three equal splits (*i.e.*, 6.67 gram per litre of water in single dose) at an interval of 15 days after complete sprouting of leaves (April-May).

Expenditure: Rs. 6,400 per hectare

Cost benefit ratio: 1 : 1.7

Do's

- Spray the nutrient during cool hours of the day *i.e.*, early morning or late evening.
- Spray on a clear day to avoid washing out of the nutrients due to rains.
- SM5 gives best results when soil is moist and the leaves are tender.
- Routine inputs / cultural operations should be carried out.

*Terminalia plant treated with SM5*
Title of the Technology: INTEGRATED MANAGEMENT OF LEAF GALL IN TERMINALIA PLANTS

Year of recommendation: 2007-08

Salient features:

- Casual organism, *Trioza fletcheri minor* causes 10-15% damage to the foliage of tasar food plants rendering the leaves unsuitable for silkworm feeding.
- The integrated package reduces the gall infestation and facilitates availability of quality leaves for silkworm rearing of an additional 50 dfls per hectare.

Usages:

- Delay the pruning of economic plantation in the month of April at the height of 4-6 ft.
- Pluck and burn the infected leaves of the food plants.
- Apply dried and powdered Neem Cake @60 kg/acre in the soil during the month of May, before onset of the monsoon.
- Spray thrice 0.09% solution of Rogor (Dimethoate 30 EC) at an interval of 15 days after leaf sprouting, or alternatively one spray of 0.09% Rogor in the month of May-June followed by two sprays of 0.18% solution of Azaridichtin (0.15 EC) at the interval of 15 days.

Expenditure: Rs. 4,050 per hectare

Cost benefit ratio: 1 : 3.3

Do's

- Spray the insecticide during cooler hours of the day.
- Silkworm rearing should be conducted only after 15 days of last spray of insecticide.

Don'ts

- Don't spray chemical against wind.

*Leaf Gall affected Terminalia plants*
B. TROPICAL TASAR - SILKWORM ECORACES

Title of the Technology: COMMERCIALIZATION OF TASAR SILKWORM ECORACE – DABABIVOLTINE & TRIVOLTINE

Year of recommendation: Daba BV during early 1970's and Daba TV during 1978-79

Salient features:

- Fecundity: 200 - 220 eggs
- Cocoon colour: Grey
- Cocoon weight: 12 - 15 gram
- Cocoon shell weight: 1.5 - 2.0 gram
- Filament length: 850 - 1000 m
- Denier: 9 - 10
- Reelability: 50 - 69%
- Silk Recovery: 62 - 65%

Daba ecorace is commercially exploited by all tasar producing States.
Title of the Technology: COMMERCIALIZATION OF TASAR SILKWORM ECORACE – SUKINDA

Year of recommendation: During 1970's

Salient features:

- Fecundity: 200 - 220 eggs
- Cocoon colour: Yellow
- Cocoon weight: 10.0 - 13.9 gram
- Cocoon shell weight: 1.3 - 1.9 gram
- Filament length: 850 - 1000 m
- Denier: 9 - 10
- Reelability: 50 - 60%
- Silk Recovery: 55 - 65%

Sukinda ecorace is commercially exploited in various ecopockets of Odisha.

Title of the Technology: COMMERCIALIZATION OF BDR-10: AN AUTHORIZED RACE OF TASAR SILKWORM

Year of recommendation: 2014-15

Salient features:

- Fecundity: 215 - 230 eggs
- Cocoon colour: Grey
- Cocoon weight: 10.5 – 15.0 gram
- Cocoon shell weight: 1.5 - 1.9 gram
- Filament length: 900 - 1100 m
- Denier: 9 - 10
- Reelability: 50 - 60%
- Silk Recovery: 60 - 65%

BDR-10 is recommended for commercial exploitation in various tasar growing States.
C. TROPICAL TASAR - SILKWORM REARING

Title of the Technology: MODULE FOR DISINFECTION AND HYGIENE IN REARING FIELD

Year of recommendation: During 1980's

Salient features:

- It ensures healthy tasar silkworm rearing by avoiding disease contamination.
- It reduces disease incidence in tasar silkworm leading to enhancement of cocoon yield.

Usages:

- Before rearing, clean the rearing site by removing weeds, etc. from around the tasar plantation/bushes.
- In order to maintain hygiene, dust a mixture of bleaching powder and lime (1 part of bleaching powder and 9 parts of slaked lime) on the ground under and around the bushes.
- Dust the bleaching powder and lime mixture @ 10-15 gram per bush, once before rearing and then regularly at an interval of 4 to 5 days during rearing.
- Near the bushes, always keep a solution of 2% bleaching powder in 0.5% slaked lime (add 20 gram bleaching powder and 5 gram slaked lime in 1 litre of water) and water in two plastic tubs for cleaning of hands before and after handling the worms.
- Before using for rearing, wash all the rearing appliances by spraying with 5% Formalin and then keep them for sun drying.
- To disinfect the nylon net, dip it in a tank filled with 2% Formalin solution and then keep for sun drying.

Expenditure: Rs. 450 for rearing of 200 dfls

Cost benefit ratio: 1 : 6.7
Title of the Technology: EGG INCUBATION AND LARVAL BRUSHING TECHNIQUE  
Year of recommendation: During 1990's  
Salient features:  
- It ensures proper embryonic development leading to timely and higher hatching of eggs, resulting in better cocoon yield.  
Usages:  
- Incubate the eggs at 28±2°C temperature and 70-80% relative humidity for a period of 8-10 days, using indigenous devices like earthen pitcher covered with wet gunny cloth (500-700 dfls in moderate size pitcher) or Khus mat lined Egg Carrying Basket (1500-1800 dfls in a basket). Basket can be used for long distance transportation of eggs.  
- Just before hatching, place the eggs in a basin in single layer and cover them with small twigs of fresh tender leaves of tasar food plants.  
- Allow hatched larvae to crawl over the leaves and transfer the left over larvae from the basin to food plant twig carefully with the help of a fine brush or feather.  
- Tie the larvae laden twigs with lower side branches of the plants selected for Chawki rearing and bearing more tender leaves.  
- To save time and prevent loss due to rain and wind, brushing can be done by using Tasar Brushing Bag made of nylon net and polythene sheet.  
- During early morning hours, keep hatching eggs in brushing bag (25 dfls or 50 gram eggs/bag) and insert a tender twig of food plant in the bag and tie it with twig by pulling the thread around its mouth in such a way that its polythene portion faces upward.  
- When sufficient number of larvae crawls and settles on the leaves, gently remove the bag from the twig and tie it to another twig of the same bush for uniform distribution of larvae.  
Expenditure: Rs. 800 for rearing 200 dfls  
Cost benefit ratio: 1 : 4.2  

Title of the Technology: CHAWKI REARING OF TASAR SILKWORM UNDER NYLON NET  
Year of recommendation: During 1990's  
Salient features:  
- Conducting Chawki rearing under nylon net protects young 1st and 2nd instars larvae from heavy rain, hail storm, pests and predators.  
Usages:  
- Cover the chawki garden by firmly erecting a nylon net of 40'x 30'x 10'size. One such net can cover 70 bushes which are sufficient to sustain 225 dfls up to 2nd instar.  
- Maintain cleaning and hygiene in the Chawki garden and use properly disinfected rearing appliances.  
- If there is rainfall, shake off the water droplets/water film adhered on the nylon net to allow free circulation of air. Also, pull out the nylon net partially for better circulation of air and removal of excess humidity.  
Expenditure: Rs. 4000 for rearing 200 dfls  
Cost benefit ratio: 1 : 3.2
Title of the Technology: INTEGRATED TECHNOLOGY PACKAGE FOR REARING OF TROPICAL TASAR SILKWORM

Year of recommendation: During 1980's

Salient features:

- Integrated package for rearing involves hygiene & disinfection, egg incubation, brushing of hatched larvae, transfer of late age larvae and cocooning.

Usages:

- Transfer the young age worms from Chawki garden to economic plantation or forest bushes one day after 2nd moult.
- For transfer, tie the worms laden twigs with the branches of leafy plants/bushes for further feeding.
- During transfer, distribute the worms on the plants uniformly to avoid overcrowding and handling of worms for frequent transfers.
- To prevent the worms from crawling down from the plants, wrap the plant trunk with 3” wide polythene strip coated with grease on its outer face.
- Likewise, to check the ant attack, smear the mixture of simple grease and Methyl Parathion (in a ratio of 100:15) on the plant trunk.
- When few worms start spinning, transfer all the worms to plants having sufficient leaves for 2 to 3 days eating and hammock formation.
- To protect the worms from pests and predators, down to dusk watch and ward of rearing field is essential.
- Harvest the cocoons 6 to 8 days after spinning when they become stiff.
- For cocoon harvesting, cut the twigs holding cocoons and remove them from twigs carefully by pulling out or cutting their rings with a sharp knife.
- After harvest, first clean the cocoons by removing the leaves attached to them, and then sort out them in groups of good, dead, cut, pierced, flimsy and pest infested.
- Properly garland the good cocoons to use them in silkworm seed preparation. Stifle other cocoons to be used for reeling and spinning purposes.

Expenditure:

- Rs. 1,500 (material cost) for rearing 200 dfls in forest plantation
- Rs. 4,500 (material cost) for rearing 200 dfls in economic plantation

Cost benefit ratio: 1 : 14 for forest plantation; 1 : 7.7 for economic plantation

Do's

- Harvest the cocoons during sunny days and avoid harvesting during rainy or cloudy weather.

Don'ts

- Avoid touching the larvae with hands while brushing and transferring them.
- Do not disturb worms settled for moult and during spinning.
C. TROPICAL TASAR - SILKWORM REARING

Title of the Technology: FOLIAR APPLICATION OF SODIUM HYPOCHLORITE TO CHECK VIROSIS AND BACTERIOSIS IN TASAR SILKWORM.

Year of recommendation: During 1990s

Salient features:

- Sodium hypochlorite checks the virosis and bacteriosis diseases of tasar silkworm, resulting in enhancement of productivity to the tune of 10-12 cocoons/dfl against control.

Usages:

- Prepare 0.01% solution of Sodium Hypochlorite (NaOCl) by mixing 2.5 ml of NaOCl with 1 liter fresh water.
- Spray NaOCl solution on the bushes once in each instar from II to IV and twice in V instars after a gap of 5-7 days.

Expenditure: Rs. 150 for rearing of 200 dfls

Cost benefit ratio: 1 : 10

Title of the Technology: LEAF SURFACE MICROBE (LSM) FOR SILKWORM DISEASE MANAGEMENT

Year of recommendation: 2010-11

Salient features:

- Leaf Surface Microbe (LSM) is used for biological control of tasar silkworm diseases. It has strong antagonistic action against bacterial and fungal pathogens of tasar silkworm.
- The use of LSM reduced diseases by 44%, resulting in an improvement of 10-12 cocoons/dfl.
- LSM has been patented bearing Patent No.247635.

Usages:

- Collect 4-5 kg of soil from 6-8 inches below the soil surface and thoroughly mix with 10 litres of water in a bucket.
- Allow the suspension for 12 hours (overnight) to settle down the soil particles on the bottom of bucket. On the next day, collect the clean water (supernatant) from the upper layer of the bucket in a separate container.
- Mix the content of supplied LSM ampoule (5 ml) with 5 litres of freshly prepared soil water.
- Spray prepared LSM suspension on the leaves of food plants being used for rearing of 2nd instar larvae, preferably 24 hours after moult out.
- One ampoule LSM is sufficient for 100 dfls rearing.

Expenditure: Rs. 200 for rearing of 200 dfls

Cost benefit ratio: 1 : 6
Title of the Technology: **SILKWORM DISEASE MANAGEMENT USING 'JEEVAN SUDHA' FORMULATION**

**Year of recommendation:** 2011-12

**Salient features:**

- 'Jeevan Sudha' is a botanical formulation developed from medicinal plants for containment of virosis in tasar silkworm. It reduces virosis by 37%, resulting in an improvement of 10-12 cocoons/dlf.

**Usages:**

- The total requirement of 'Jeevan Sudha' powder is 300 gram for rearing of 200 dfls. Instar-wise requirement of formulation is as follows:
  - 1st instar: 50 gram or 8 teaspoonful in 5 litre water
  - 2nd instar: 100 gram or 15 teaspoonful in 10 litre water
  - 3rd instar: 150 gram in or 22 teaspoonful in 20 litre water
  - Soak the formulation in clean water as per required dose for 8-10 hours (overnight) and filter it using muslin cloth and squeeze completely.
  - Spray filtered solution on the foliage of bushes used for feeding the silkworm larvae, once each in 1st, 2nd and 3rd instar during feeding stage.

**Expenditure:** Rs. 200 for rearing of 200 dfls

**Cost benefit ratio:** 1 : 6

Title of the Technology: **MANAGEMENT OF SILKWORM PESTS & PREDATORS**

**Year of recommendation:** During 1990's

**Salient features:**

- Due to attack of pests and predators, the loss caused to cocoons is reported to be 10-15% which may be checked by adopting the practices recommended for pest/predator management in tasar silkworm rearing and grainage.

**Usages:**

- Use sticky trap (Lassa-adhesive) for collecting and killing of various pests such as adult uzi fly, wasp, Canthecona, Ichneumon fly, etc.
- Spray 2% bleaching powder solution on silkworm body to kill uzi fly eggs, 3 to 4 times during 4th and 5th instars.
- Release biocontrol agent, *Nesolynx thymus* in the rearing field and grainage house @ 1 lakh adults per 100 dfls of silkworm rearing (30,000 at the time of cocoon harvest & 40,000 after 7 days of harvest and 30,000 in cocoon preservation hall).

**Expenditure:** Rs. 220 for 100 dfls

**Cost benefit ratio:** 1 : 5.7
E. TROPICAL TASAR - SILKWORM SEED PRODUCTION

Title of the Technology: PRESERVATION OF COCOONS FOR TASAR SILKWORM SEED PRODUCTION

Year of recommendation: During 1990's

Salient features:

1. Preservation of seed cocoons in model grainage house minimizes loss of preserved cocoons during summer by reducing inside temperature by 5-7°C.
2. It reduces unseasonal moth emergence and pupal mortality, and facilitates high seasonal moth emergence and mating, thus ensures the production of maximum quantity of seeds.

Usages:

1. The cocoons are preserved in model grainage house constructed with low cost mud walls and country tiles having high roof with a false ceiling from within.
2. Model grainage house has a central preservation hall to accommodate seed cocoons and a verandah all around the hall to prevent direct sunlight.
3. Six windows fitted with wire mesh are provided in the hall for cross ventilation and only one door is provided to restrict the movement.
4. Disinfect the grainage house by cleaning with 5% bleaching powder solution followed by fumigation with Formalin and Potassium Permanganate.
5. For fumigation, add 2 litres of commercial Formalin (Formaldehyde) and 500 gram of Potassium Permanganate in 3 litres of water and boil the mixture in a wide mouthed vessel. Close and seal the doors and windows of grainage house for 48 hours.
6. Keep the surroundings clean and sprinkle 2% bleaching powder around the grainage house in order to maintain proper hygiene.
7. To prepare cocoon garlands, tie both male and female cocoons at their peduncle ends with jute thread in a bunch of 5 cocoons each and form a garland of 20 such bunches (total 100 cocoons) providing space of 2-3” between two bunches.
8. Hang cocoon garlands in the preservation hall by tying them to bamboo frames or wire strings leaving a space of about 6 to 8” between two garlands in a row and 1.5 to 2.0 feet between two garland rows to provide proper air circulation and operational movements.
9. Hang cocoon garlands 2 feet above the ground level to facilitate cleaning of the floor.
10. During hot summer, fix Khus mats or gunny cloth on the windows and door, and wet them by sprinkling water during day time only.

Expenditure: Rs. 17,500 as cost of preservation for 1.00 Lakh cocoons
Title of the Technology: MOTH MATING AND OVIPOSITION FOR HIGHER PRODUCTION OF TASAR SILKWORM SEEDS

Year of recommendation: During 1990's

Salient features:

- It involves effective use of female & male moths and oviposition system for grainage, thus increases the dfls production.

Usages:

- During grainage operations, maintain temperature of 25 - 30°C and relative humidity of 70 - 80% in grainage house by fixing wet Khus mats or gunny cloth on the windows and door.

- Usually moth emergence starts late in the afternoon and reaching its peak during 7.00 pm to 9.00 pm.

- Mating of moths takes place 2-3 hours after emergence, preferably in dark, cool and humid conditions. About 60 to 70% of female moths undergo natural mating inside the grainage house itself on the day of emergence. To obtain higher oviposition and hatching, allow moths to mate for 8 hours.

- In order to increase efficiency of grainage, the moth mating percentage can be enhanced up to 95% by releasing unmated moths inside the nylon net erected under cool and shady place which provides natural environment for mating. Release 1 virgin female moth surrounded by 3 males, maintaining moth density of 0.25 sq. ft per moth.

- In case of crisis, female and male moths are induced to undergo mating by hand coupling i.e., by rubbing the genitalia of both sexes with each other. Even, decoupled males can be reused for second mating with virgin females.

- To obtain higher egg recovery, carry out oviposition in a separate room with dark and hygienic conditions, maintaining temperature of 25 - 30°C and humidity of 70 - 80%.

- To ensure better fecundity and disease freeness, select healthy female moths for oviposition and destroy the moths with wrinkled wings, loose abdomen, less weight and less body scale.

- For oviposition, first decouple the female moths and provoke for urination by gently press their abdomen.

- Clip the wings of female moths and place them in egg laying devices like earthen cup, paper box, plastic box, nylon bag, Netlon pouch, plastic tray, bamboo box (Monia), etc. Allow the moths for 72 hours to lay eggs, as about 90% eggs are laid in this period.

Expenditure: Rs. 8,000 as cost of consumables for grainage operation of 1.00 Lakh cocoons.
Title of the Technology: MOTHER MOTH EXAMINATION FOR PRODUCTION OF DISEASE FREE SEED OF TASAR SILKWORM

Year of recommendation: During 1990's

Salient features:

- It ensures production of disease free seeds (dfs), resulting in higher cocoon productivity.

Usages:

- After oviposition for 72 hours, conduct individual mother moth examination for detection of Pebrine disease.
- Cut the lower middle portion of abdomen (4 to 7 segments) of a female moth with the help of a scissor and pestle it well in a ceramic mortar by adding 5 ml of 0.5% K₂CO₃ solution (5 gram K₂CO₃ in 1 litre of water).
- Filter the abdomen homogenate through cheese cloth and centrifuge it at 4000 rpm for about 5 minutes.
- Discard the supernatant and add 5-6 drops of 2% KOH solution (20 gram KOH in 1 litre of water) to dissolve the sediment.
- Take a drop of smear so prepared on the glass slide under coverslip and examine the smear under microscope with 675x magnification (Eye piece 15x and Objective 45x) at 5-6 different microscopic fields.
- If centrifugation is not possible, then add 0.85% NaCl (8.5 gram NaCl in 1 litre of water) and 0.5% K₂CO₃ solutions in equal volume before crushing or homogenizing the abdomen portion and observe the smear under three-tier microscope examination.
- For large scale moth testing, prick the moth abdomen (3/4 segment) with the help of a pointed stick (tooth pick) to collect a drop of haemolymph.
- Add haemolymph drop to a drop of 0.5% K₂CO₃ or 2% KOH solution placed on a slide and cover it with a coverslip to examine under microscope for pebrine detection.
- Pebrine spores are observed under microscope as rice grain/oval shaped and bluish in colour.
- Destroy the infected moths and their layings by burning at a far off place to avoid contamination.

Expenditure: Rs. 3,000 as cost of consumables & chemicals for production of about 20,000 dfs from grainage operation of 1.00 Lakh cocoons.
Title of the Technology: 'DEPURATEX' FOR CLEANING AND SURFACE STERILIZATION OF TASAR SILKWORM EGGS

Year of recommendation: 2013-14

Salient features:

- Depuratex is an ideal disinfectant used for the surface cleaning and sterilization of tasar silkworm eggs.
- It is cost effective, user-friendly and easily adoptable to achieve qualitative and quantitative seed production of tasar silkworm.
- It not only ensures proper surface cleaning and disinfection but also reduces the danger of egg damage caused due to scrubbing effect.

Usages:

- Prepare 5% solution of Depuratex.
- Collect the silkworm eggs after the mother moth examination in a nylon net bag.
- Dip the tasar silkworm eggs in prepared Depuratex solution and allow them in the solution for 10 minutes provided with frequent stirring.
- Take out the eggs along with nylon net and rinse/smooth rub in the running water for one or two minutes.
- Spread the surface disinfected tasar silkworm eggs in thin layer on the newspaper/blotting paper and allow them for shade drying or using egg drying table fitted with netted tray and small exhaust fan.

Expenditure: Rs. 1,000 for washing and surface sterilization of 1 Lakh egg layings

Cost benefit ratio: 1 : 10
F. TROPICAL TASAR - POST-COCOON ACTIVITIES

Title of the Technology: NON-PEROXIDE METHOD FOR COOKING OF TASAR COCOONS
Year of recommendation: 2014-15

Salient features:

- It is an economically feasible, user friendly method for softening of tasar cocoons for reeling and spinning.
- It is suitably used for cooking of cocoons of all tasar silkworm ecoraces.
- Besides retention of natural colour of tasar silk yarn, it ensures better cooking efficiency and physical properties (tensile strength and cohesion) of yarn which are helpful in weaving.

Usages:

- Tie 200 cocoons in netted cotton cloth.
- Prepare 15 litres solution of a mixture of Borax (1.5%) and Sodium Bicarbonate (0.5%) in water (15 gram Borax and 5 gram Sodium Bicarbonate in one litre of water).
- Soak the cocoons in prepared solution for 10-15 minutes in a Pressure Cooker or domestic utensil having capacity of 30 litres and cook them by continuous boiling for 30 minutes, followed by steaming for 30-45 minutes.
- After 10-15 minutes holding time, the cocoons can be deflossed and used for reeling/spinning.
- Maintain 6-8 cocoons to get average 60-70 denier for reeled tasar yarn.

Expenditure: Rs. 140 cooking cost for 1000 tasar cocoons.
PEDAL-CUM-MOTORIZED REELING-CUM-TWISTING MACHINE

Year of recommendation: During 1980s
Salient Features:
- It is a four spindle motor-cum-pedal operated machine.
- It facilitates reeling and twisting simultaneously.
- The yarn produced can directly be used as warp thread without sizing or further twisting.

Productivity: 150 - 175 gram per person working for 8 hours.
Economics: Rs. 160 - 180 per day

HAND OPERATED WET REELING MACHINE

Year of recommendation: 2010 - 11
Salient Features:
- It has six reeling ends and requires two persons for its operation.
- It has a capacity to reel 800 tasar cocoons (600 - 650 gram raw silk) per 8 hours operation.
- The yarn produced is lustrous, fine textured having 50/70 denier.

Productivity: 300 - 325 gram per person working for 8 hours.
Economics: Rs. 250 - 300 per day

KAMDHENU: IMPROVED VERTICAL REELING-CUM-SPINNING MACHINE

Year of recommendation: 2013 - 14
Salient Features:
- It is portable, user friendly machine and occupies very less working space.
- It has an option to operate by electricity or solar power.
- The yarn produced can be used as warp and weft thread.
- It reduces drudgery to operator and saves cost of work in bulk reeling.

Productivity: 200 - 250 gram per person working for 8 hours.
Economics: Rs. 190 - 220 per day

MOTORIZED TASAR REELING MACHINE

Year of recommendation: 2014 - 15
Salient Features:
- It is a 4-ends machine provided with 4 Jetteboutes and 4 sub-sections of basin for easy and quick cocoon casting resulting in uniform denier of yarn.
- Machine is user-friendly provided with appropriate height for women, which increases their working efficiency by reducing drudgery.
- It has dual option to operate by hand and electricity or solar energy.

Productivity: 350 - 400 gram of 60/70 denier raw silk by working of one person for 8 hours
Economics: Rs. 250 - 300 per day
G. TEMPERATE (OAK) TASAR - HOST PLANT

Title of the Technology: RAISING AND MAINTENANCE OF BLOCK PLANTATION OF QUERCUS SERRATA

Year of recommendation: 2009-10

Salient features:

- This technique facilitates raising of *Quercus serrata* seedlings in polythene tubes for quick establishment of tasar plantation.
- This ensures consistent quality leaf production for rearing of oak tasar silkworm.

Usages:

- Collect mature healthy seeds of *Quercus serrata* during October - November.
- During March - April, soak the seeds in water for 72 to 96 hours by packing them in gunny bag.
- Pile the soaked seeds over raised sand bed under shade by covering them with wet gunny bags and sprinkling water over them every day till the completion of germination.
- Sow the germinating seeds in one polythene bag filled with a mixture of sand, soil and FYM (1:1:1 ratio) and water regularly. The seedlings will attain a height of 9-11" within 90 days of sowing.
- During June-July (monsoon), dig the pits of 1.5' x 1.5' x 1.5' size following plant spacing of 4' x 4' or 6' x 6' and transplant the seedlings in pits by removing polythene bags containing seedlings and filling with soil and farm yard mixture (@ 1.5-2.0 kg FYM per pit).
- To facilitate the intercropping with *Q. serrata*, transplant the seedlings under paired raw system [(4’x4’) x 8’] or [(6’x6’) x 6’].
- After 4 year of growth, maintain the plant height at 4' or 5' by pruning them during December (spring crop) followed by light pruning, clipping and plucking of leaves (autumn crop) during July, 45 days prior to brushing.
- To maintain the soil health, apply 1-2 kg FYM/plant per year as basal dose around the plants (6-9” depth in 45 cm radius) during December-January. Growing and mulching of green manuring crops may also be practiced to improve soil fertility.
- To obtain better leaf yield, apply FYM/biofertilizers every year and alternated every third year with a dose of NPK (75:25:25), by making 3-4 holes 25-30 cm depth around the plants.

Expenditure: Rs. 1.75 (Imphal) & Rs. 2.30 (Bhimtal) per seedling; Rs. 10,500 per hectare (on block plantation)
H. TEMPERATE (OAK) TASAR - SILKWORM

Title of the Technology: COMMERCIALIZATION OF OAK TASAR SILKWORM, ANtheraea proylei

Year of recommendation: 1970

Salient features:

- Fecundity: 121-150 eggs
- Hatching: 70-80%
- Larval duration: 35-48 days
- Cocoon weight: 5.0 - 10.0 gram
- Shell weight: 0.5 – 1.0 gram
- Silk Ratio: 10 - 11
- Filament length: 300 – 600 m

Antheraea proylei Jolly is commercially exploited in north-eastern and north-western regions.

Title of the Technology: COMMERCIALIZATION OF C27: A CROSS BREED OF OAK TASAR SILKWORM

Year of recommendation: 2004-05

Salient features:

- Fecundity (Av.): 155 eggs
- Hatching (Av.): 65%
- Larval duration: 40 days
- Cocoon weight (Av.): 7.06 gram
- Shell weight (Av.): 0.75 gram
- Silk Ratio (Av.): 10.28
- Filament length (Av.): 650 m

Title of the Technology: COMMERCIALIZATION OF RTRS-1: A CROSS BREED OF OAK TASAR SILKWORM

Year of recommendation: 2010-11

Salient features:

- Fecundity (Av.): 212 eggs
- Hatching (Av.): 79%
- Larval duration: 40 days
- Cocoon weight (Av.): 7.65 gram
- Shell weight (Av.): 0.77 gram
- Silk Ratio (Av.): 10.06
- Filament length (Av.): 725 m

RTRS-1 and C27 are commercially exploited in north-eastern and north-western regions.
I. TEMPERATE (OAK) TASAR - SILKWORM REARING

Title of the Technology:  OAK TASAR SILKWORM REARING
Year of recommendation:  During 1980's

Salient features:

- It involves egg incubation, indoor Chawki rearing, outdoor late-age rearing under nylon net and hygiene & disease management. It improves the crop output by 10 to 15% over conventional method of outdoor rearing.

Usages:

- To facilitate better hatching, wash the eggs with 2% bleaching solution and incubate at 23±2°C temperature and 75±5% relative humidity for 9-10 days.
- On the day of hatching at about 4 o'clock in the morning, illuminate the eggs by 40 Watt Bulb to concentrate the hatching.
- Brush the hatched larvae on the twigs of *Quercus serrata* (inserted in the water filled bottles or pots) having tender and succulent leaves sufficient for Chawki rearing of 10-12 days. Dip the leaves in 0.02% Sodium Hypochlorite solution for disinfection before feeding.

Rearing schedule: Preponed spring crop at low altitude (up 1000 ft) – Last week of February on *Q. serrata*; Spring crop at middle altitude (up to 5000 ft) - 2nd week of March on *Q. incana* and *Q. semecarpifolia*; Commercial crop at high altitude (5000 to 9000 ft) – Last week of April to 2nd week of May on *Q. semecarpifolia* & *Q. himalayana*; Autumn crop (low & middle altitude) – 1st / 2nd week of September.

- Maintain the temperature of 22±2°C and relative humidity of 70-75% in the room during Chawki rearing period.
- Disinfect the outdoor rearing field and appliances with 5% bleaching powder solution before 7 days of rearing.
- At 3rd instar, transfer the Chawki reared worms directly on outdoor *Q. serrata* plants covered with nylon net (12’ x 12’ x 9’) or polyhouse (at higher altitude) for late-age rearing and cocooning.
- Spray 3-5% bleaching powder solution in the rearing field one day before transfer of worms and 0.02-0.05% Sodium Hypochlorite solution on the silkworms and leaves once in every instar (1st to 4th) and twice in 5th instar as prophylactic measures.

Do's

- Maintain hygiene in rearing room by using disinfected polybags and sleepers, regular cleaning of excreta and removal of weak worms.
- Maintain proper air flow in rearing house by using exhaust fan or air coolers (during summer crop).

Don'ts

- Avoid touching of worms with hands.

Expenditure:  Rs. 3,500 (Bhmital) & Rs. 4,300 (Imphal) for rearing of 500 dfls, with family labour

Cost benefit ratio:  1 : 4 (Bhmital) & 1 : 2.32 (Imphal)
J. TEMPERATE (OAK) TASAR - SILKWORM SEED PRODUCTION

Title of the Technology: OAK TASAR SILKWORM SEED PRODUCTION

Year of recommendation: 2006

Salient features:

- This technology ensures production of quality silkworm seeds in oak tasar sector.

Usages:

- Subject the selected seed cocoons to hygro-photo-thermic treatment (Humidity 75-80%, photoperiod 16-17 hours using 40 watt Tube Light and temperature 25±2°C) for diapause termination.

- To enhance the coupling, retain 30% male cocoons for 10 days at normal room temperature and re-consign them later for synchronizing with emergence of female moths. It results in maximum coupling up to 98%.

- Provide resting period of 2 to 4 hours to the moths after their emergence and allow 10 hour coupling period. It increases fecundity up to 179 in spring and 223 in autumn crop with higher hatching of 85 and 90%, respectively.

- After decoupling, place the female moths in hanging nylon netting bags (6” x 10”) for oviposition. It yields higher fecundity.

- After cleaning of eggs with soap solution, disinfect them by treating in a mixture of equal volume of Hydrochloric Acid (3%) and Formaldehyde (3%), or Hydrochloric Acid (3%) and Sodium Hypochlorite (3%) solution.

  To delay the hatching, preserve dfls at 4 - 6 °C for 20 days

Do's

- Regular cleaning and disinfection of grainage and egg laying room by lime and bleaching powder solution.

Expenditure: Rs. 2,62,174/- for production of one lakh dfls

Cost benefit ratio: 1 : 1.05
For further details, please contact:

Director
Central Tasar Research and Training Institute
(Central Silk Board, Ministry of Textiles, Govt. of India)
Piska-Nagri, Ranchi - 835 303 (Jharkhand)

Tel: 0651-2775815, 2775035  Fax: 0651-2775629
Email: ctrticsb@gmail.com / ctrtiran.csb@nic.in
Website: www.ctrtiranchi.co.in