International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)
Impact Factor: 5.22 (SJIF-2017), e-ISSN: 2455-2585
Volume 5, Issue 05, May-2019

APPLICATION OF SOLAR PASSIVE TECHNOLOGIES FOR REARING OF SILKWORM *BOMBYXMORI* LINN. IN MAHARASHTRA, INDIA

Tejaswini Jadhav[1], Attar A.C [1], Ashwini Jadhav[2] and Jadhav A.D.[3]

[1].*PG Rajarambapu Institute of Technology, Islampur- 415414,India.*
[3].*Department of Zoology, Division of Sericulture, Shivaji University, Kolhapur- 416004, India*
[2].*Department of food science and technology, Kolhapur- 416004, India*

ABSTRACT: Sericulture in India is an agro based rural industry, with present total raw silk production of 28708 MT. Maharashtra province is non -traditional province of silk production presently producing about 250 metric tons of raw silk. The present study was carried out with the farmers from western Maharashtra particularly from Kolhapur district during the year 2015-2017 by visiting 50 farmers to know what kind of rearing house facilities are available with them and to know how they are maintaining required temperature, humidity, environmental conditions in silkworm rearing to get successful cocoon crop. FC1X FC2 (Bombyxmori Linn.) silkworm hybrid (Bivoltine) and FC1, FC2 pure line races were used as a seed crop. However, expected yield of the cocoon production quality and quantity wise is not achieved so far because of non -use of certain applications to control internal environmental conditions in silkworm rearing house. In the present study attempt was made to suggest suitable alteration, modification with respect to solar passive arrangement to be done and its advantage over the normal rearing as well as according to need of farmers practices. In the present study it was also found that farmers with separate and isolated rearing house and with the use of solar passive applications use of effective disinfection and hygiene maintenance acknowledged better rearing results with respect to less disease percentage , improved ERR, more cocoon yield per 100 dfls, single cocoon weight , shell weight, and higher price for lot in a market and higher profitability over the control. In the present study it was observed that, arrangements like low cost solar passive alterations air inlet from north wall covered with wet gunny bags to increase humidity, solar chimney ventilator, false ceiling with use of thermocol application of, wooden bags, wet gunny cloth hanged in corridor, doors, windows, with arrangement of drip facility by using methods siphon, motor operated or bottles filled with water with facility to have droplets at regular intervals , sprinklers over the ceiling covered with grass, other dry material of coconut leaves, sowing of raggi, jawar wheat seed in sand all around the bottom ventilators of rearing house was found effective for creating more relative humidity and temperature maintenance. It can control the temperature by one of the method like underground cooling system, underground temperature can be very beneficial in balancing the thermal comfort of the rearing house. This method of cooling is cost not damaging to environment and is natural way to cool off. This shows healthy growth of adult silkworms over the control. The present work would be helpful for mass application, utilization and assessment of low cost solar passive technologies to increase qualitative and quantitative cocoon yield with farmers of Western Maharashtra region. Details are discussed in the pape .

KEY WORDS; Silkworm, Solar- passive, rearing house, FC1, FC2

1. Introduction

The sericulture provides a rear means for environmental conservation and checking migration of people from the rural to urban areas by proving productive employment in their houses itself. Sericulture also enables the woman to earn their livelihood. On the other hand , silk which is particularly produced by the poor farmers in the rural areas is sold to rich in the urban areas in which it is found that money flows from richer to poor.

Though India is the 2nd largest producer of silk in the world, bulk of the silk produced in the country is sourced from multivoltine crossbreeds, which are mainly used for the traditional dresses of Indian woman. The major challenge now facing in the industry is to replicate such successful model to larger areas to ensure that the country would be self-reliant in production of quality silk by the year 2020.The country is expected to reach the production target of 5000 MT bivoltine by the year 2017-2018 . It is also to be noticed that with the increase in production of bivoltine silk, the country's dependency for imported silk has now reduced to the extent of 30%. Sericulture industry provides employment to approximately 7.85 million persons in rural and semi-urban areas in India which comprises of land based activities like raising silkworm host plantation along with rearing of silkworm , reeling of cocoon, twisting ,wearing and processing of fabrics.(Jadhav and Sathe 2008) ,(Jadhav *et. al*, 2011).

Among the four varieties of silk produced, during the year 2014-15. Mulberry accounts for 74.51% (21,390 MT), Tasar 8.48%(2,434 MT), Eri 16.46% (4,726 MT) and Muga 0.55% (158 MT) of the total raw silk production of 28708 MT. Sericulture industry provides gainful employment in rural and semi urban areas in India, of these, a sizeable number of workers belong to the economically weaker sections of the society, including women.(Jadhav *et. al.*, 2016).

2. Materials and Methods

The present study was carried out with farmers from Western Maharashtra particularly from Kolhapur district during the year 2015-2016 by visiting 50 farmers to know what kind of rearing house facilities are with them and how maintenance is done to manage required temperature humidity and overall environmental conditions in silkworm rearing to get successful cocoon crop. Arrangements and applications of low cost solar passive alterations like air inlet from north wall covered with wet gunny bags to increase humidity, solar chimney ventilator, false ceiling with thermocol , wooden bags, wet gunny cloth hanged in corridor, doors, windows, with drip facility by way of siphon method , motor operated or bottles filled with water with facility to have droplets on an gunny cloth at regular intervals , sprinklers over the ceiling covered with grass, other dry matter of coconut leaves, sowing of raggi, jawar wheat seed in and around the bottom ventilators of rearing house were created as a solar passive alterations in rearing houses whereas in control rearing houses were without any specific arrangement for maintenance of environmental conditions .FC1 x FC2 silkworm hybrid (Bivoltine) and FC1 , FC2 pure line of (*Bombyxmori* Linn.)breeds were used for rearing and to access performance . Internal environmental conditions like temperature, relative humidity were recorded with digital hygrometer daily thrice a day. Rearing performance of breeds with separate and isolated rearing house having solar passive applications. Where as in control rearing houses these facilities were not available. The data of rearing was analyzed for accessing parameters like disease percentage , improved ERR, cocoon yield per 100 dfls, single cocoon weight , shell weight, price for lot in a market and profitability , data was analyzed for further study

Solar passive rearing house:

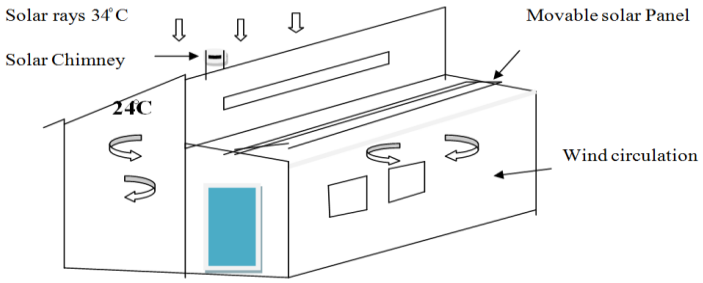

Figure 1: Solar passive rearing house

Strategies for summer:
Roof pond with insulation, Insulated wall and roof, Wall shading
Solar chimney on south wall with adjustable vents (to improve ACH in the rearing room)
Air Inlet from north wall covered with wet gunny bags for added humidity

Thermal comfort requirement:
Rearing room: 23 to 25 deg C with 70-80% RH
Non uniform heating/cooling leads to loss in 50-70% of yield

3. Results and Discussion

Silk worm hybrids such as FC_1 x FC_2, and Pure Lines FC_1 and FC_2 are potentially practiced in Maharashtra for production of profitable commercial and seed cocoons respectively. It was observed that, an ideal rearing house should have some basic requirements like good site, raised platform, high roof, false ceiling for rearing house construction, sufficient rearing space, good ventilation arrangements for light etc., (Jadhav *et. al*,2016).
Low cost solar passive alterations like air inlet from north wall covered with wet gunny bags for added humidity, solar chimney ventilator, false ceiling with thermocol , wooden bags, wet gunny cloth hanged in corridor, doors, windows, with drip facility siphon, motor operated or bottles filled with water with facility to have droplets at regular intervals , sprinklers over the ceiling covered with grass, other dry matter of coconut , sowing of raggi, jawar wheat seed in sand around the bottom ventilators of rearing house were found more suitable over the control as far as environmental conditions are concerned. Less temperature of (+,-) 10-12 Celsius was observed in solar passive houses over the control. And humidity was more by 20 to 30 percent in solar passive houses over the control. The rearing performance of FC1 x FC2 silkworm hybrid (Bivoltine) and FC1, FC2 pure line (*Bombyxmori* Linn.) breeds was analyzed for rearing results like disease percentage ,

improved ERR, cocoon yield per 100 dfls, single cocoon weight , shell weight, price for lot in a market and profitability . Detail results of rearing performance are tabulated in table1.

Table 1: Temperature analysis in solar rearing house

Stages of worms	Optimum temperature	Temperature of solar passive rearing house for different stages
I	26℃ – 28℃	23℃ – 25℃
II	26℃ – 28℃	23℃ – 25℃
III	24℃ – 26℃	23℃ – 25℃

Table 2: Performance of FC1, FC2 and FC1 xFC2 hybrids *B.mori.* L. in Solar passive rearing house

Sr. No.	Name of the Breed	Avg.single cocoon wt. gms.		Avg. yield / 100 dfls.		Gross income Rs. / 100 dfls.
		Control House	Solar – passive house	Cocoons (Kg.) Control house	Solar passive house	
1	FC1 x FC2 (Double Hybrid)	1.5	1.92	44.0	64/Kg.	25600/- @400/kg
2	FC1 (Marked) Seed Crop	1.6	1.9	47.0	62/Kg.	40300/-@ 650/kg
3	FC2(Plain) Seed Crop	1.56	1.74	52.0	64/Kg.	41600/-@ 650/kg

4. Conclusion

The scientific way of rearing silkworm means, good rearing house facility, providing required temperature and humidity, sufficient space for growth & prevent diseases and pests all leading to sustainable sericulture for higher yield of cocoon and higher returns in silkworm rearing .Remember a good rearing house should provide the most congenial atmosphere for the good growth of silkworms at a minimum cost. Solar passive alterations and some principles for construction of rearing house are to be followed.

i. A separate rearing home to avoid cross contamination or centrally located in the garden itself to facilitate easy transportation of mulberry leaves. In these rearing house temperature and humidity was ideal as compared to control rearing house .
ii. Orientation of the rearing house should be north south facing and built on a raised platform.
iii. Plant shade trees all around to provide cool surroundings preferably mulberry tree plants. Have a good number of windows and ventilators iii. It was observed that, solar passive rearing houses were able to provide optimum temperature of 26-28º c and RH of 60-70% for the growth of silkworm at minimum operational cost. The most important principles to be remembered in silkworm rearing house are avoid damp condition, stagnation of air, direct and strong drift of air, exposure to bright sun light and radiation. Ensure an equable temperature and humidity good ventilation.

- It was also observed that, growing trees around rearing house helps to maintain favourable environment during rearing. Rearing house construction having face east-west direction, facilities to maintain the required environmental conditions.
- From the present study it can be concluded that, it is essential to use solar passive technologies particularly in tropical areas. Effective use of these technologies are found useful for sustainable cocoon crop production by helping to create desirable environmental conditions in silkworm rearing house. Indigenous methods of local importance can also be used for application of solar passive technologies in sericulture.
- Solar -passive technologies are highly required and preferred by farmers particularly for bivoltine silkworm rearing as it assures them a successful cocoon harvest with low investment.

References

A.D. Jadhav and T.V. Sathe, *Fecundity Life tables and intrinsic rate of increase in bivoltine strain NB4D2 Bombyxmori L.* Biotech. Approach Entomol. 5, 205-211, (2008).

T.N. Hajare, A. D. Jadhav, J. P Undale, N.G. Patil, and Sohanlal, *Performance of silkworm breeds (Bombyxmori L.) in Vidarbha region during summer*. Indian Journal of sericulture 47, (1), 111-114. (2008)

A.D. Jadhav, R.S. Dubal and S.R. Yankanchi, *Status of Sericulture in Maharashtra –A Study*. Proceeding,22nd Congress of International Sericulture Commission Organized by International sericulture Commission France and Queen Sirikit Dept., of Sericulture ,Thailand, 14th -18th December-.pp. 271-283. (2011).

www.CSB.org.(2015)

A.D. Jadhav and T. V. Sathe ,*Host preference by Uzifly Exoristabombycis L. in pure line bivoltine breeds FC1 and FC2 (Bombyxmori L.) and Economical loss in seed cocoon production.* Biolife, 4(1), pp 88-93.(2016).

Tejaswini Jadhav, Sayali Belwadikar, Rasika Pimpalkar, Vidhyanand Kadam and Jadhav A.D. Design and construction of solar passive rearing house for silkworm rearing *Bombyxmori* Linn., National Conference on recent advances in integrated Pest management, March 1st -2nd ,2016. (RAIPM-2016).

Fig. 2 Solar passive rearing house in Cuba **Fig. 3** Use of coconut leaves covered on rearing house wall

Fig. 4 Rearing house in mulberry garden **Fig. 5** Good quality FC1&FC2 cocoons with roof top covered with dry grass, drip facilities