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Adoption of Tasar culture technologies in Mayurbhanj district of Odisha in context to socioeconomic improvement

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ABSTRACT

Tasar culture is traditional practiced by local tribes in Mayurbhanj district of Odisha since time immemorial. Earlier they used to collect cocoons from forest, keep them for moth emergence, mating and subsequently reared the tasar silkworm on forest based Asan or Arjun trees for cocoon production. Over period of time through research intervention, technologies developed. However, the adoption of technology is not uniform among farmers. So, a study was taken to ascertain the socio-economic conditions *vi-a-vis* adoption of tasar technologies. Farmers were categorized into three groups *viz.* Adopted Seed Rearers (ASR), Seed Rearers (SR) and Commercial Rearers (CR) where the first group gets opportunity of training and other support from government agencies. Most of the farmers are either below matriculation or uneducated. Only 16.84% of ASRs and 9.41% SRs were found to be matriculate and above. Family size with 4 to 5 members is most frequent with distribution of 45.26%, 49.41% and 44.06% in ASRs, SRs and CRs respectively. On an average, 52% of farmers earned less that Rs20000/- out of tasar cocoon production and majority of CRs fall under this group. However, ASRs occupied top position in income as their cocoon productivity was also highest among all exceeding Rs 40000/-. The adoption level of plantation management as well as tasar silkworm rearing technologies was also highest in ASRs. There has been increased awareness for silkworm disease control and pest, predator management. In order to increase the income of poor tasar farmers importance of dissemination of technologies as well as extending training support are discussed.

KEY WORDS: Socio-economic status, Tasar silkworm, rearing, plantation maintenance, adoption of technology

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1. INTRODUCTION

Silk has played an important role in the economic and social life of mankind ever since its discovery about 4000 years ago. Indian tasar silkworm, *Antheraea mylitta* Drury is exploited for commercial *vanya* silk production and about 2.82 lakh families are directly or indirectly associated with tasar culture in nine states[1]. Tasar culture provides livelihood to poor tribal and other backward class families through which they get a chance to improve their economic status and living standard. Thus, poorest of poor living in and around forest areas get opportunity to earn by adoption of tasar culture. Sericulture is an extremely labor intensive industry and occupies a pivotal position from the point of providing employment and additional income to weaker sections[2-4].

Odisha is one of the silk producing states of India where three types of silks *i.e.*, Tasar, Eri and Mulberry are produced. The state has favourable tropical climate, host plants and manpower required for tasar culture. It has about 30% forest area in which about one third of total forest cover bestowed with tasar food plants. Besides, the area under *Terminalia arjuna* (Arjun) and *T. tomentosa* (Asan) block plantation is about 12000 hectares. Predominantly tasar culture is practiced in nine districts out of which Mayurbhanj has unique place with highest cocoon production.

Earlier, tasar silkworm was traditionally reared on forest trees where cocoon production level was low. Gradually, with the development of different rearing technologies by Central Tasar Research & Training Institute (CTR&TI), Ranchi people started adopting them. However, the adoption level also varies from farmer to farmer where socio-economic conditions play a major role. Studies on socio-economic conditions and adoption level of technologies in tasar culture are scanty in tropical tasar sector baring a few citations[5-7]. Thereafter, several technologies are developed by CTR&TI, Ranchi, test verified in regional centres and also at selected farmers' level. However, till date the adoption level at farmers field in relation to their socioeconomic conditions has not been studied so far in recent years. Hence the present study was taken up with the objectives to assess the socio-economic status of tasar farmers associated with Tasar culture and also to assess the adoption level of different technologies by selected farmers of Mayurbhanj district of Odisha.

2. MATERIALS AND METHODS

2.1 Study places

The present study was conducted in Mayurbhanj district of Odisha. Four tasar villages viz. Gadargadi, Badtilaw, Chandua and Rathasol were selected under the command areas of Chandua Tasar Rearers' Cooperative Society (TRCS). Three villages viz. Chakadar, Patharghera and Kandalia were taken into account under Bhuasuni TRCS.

2.2 Data collection method

A set of questionnaire was prepared to evaluate the socio-economic status. A comprehensive questionnaire was also prepared for collection of data taking into consideration the objective of the study and the technologies developed by CTR&TI, Ranchi on tasar culture. The total size of the sample was 500, covering Adopted Seed Rearers (ASR, 100), Seed Rearers (SR,100), and Commercial Rearers (CR, 300). The nomenclature is described below. The data were collected through personal interview method at the farmers' residences and work places. The contents of the questionnaire were explained to farmers and the response was recorded meticulously.

Adopted Seed rearers (ASR) - Those farmers who are adopted and trained by Central Silk Board units like Basic Seed Multiplication and Training Centre (BSM&TC) to conduct rearing of elite seed/ nucleus seed/ basic seed to produce quality tasar seed cocoons are called Adopted Seed Rearers (ASR). They are provided with disinfectants by BSM&TC.

Seed rearers (SR) - Those farmers who conduct their rearing for the production of cocoons which are to be utilized for egg production at their own level or at TRCS level are called as seed rearers.

Commercial rearers (CR)- Those farmers who rear the tasar silkworm for silk reeling purpose having commercial value and not for seed purpose are called commercial rearers. They collect dfls from TRCSs and other private grainages.

2.3 Data analysis

The cultivation practices followed by the farmers/ rearers are presented as percentage to make simple comparisons. The percent adoption of recommended package and practices was calculated.

3. RESULTS AND DISCUSSION

3.1 Socio-economic status

Tasar culture in Mayurbhanj is an important livelihood of the tribal population, who practice it as occupation. These tribes are having their own perception of seed collection, egg production and rearing and accordingly they have modified the practice to suit the local conditions. However, with the advent of technologies, many of them have been adopting the modern system of Tasar culture. Thus, it is necessary to assess the socio-economic conditions of tasar farmers in order to know adoption level of technologies. The findings on the socio-economic status are given below.

3.1.1 Education status

Education status of farmers is presented in Fig 1. Most of them are either below matriculation or uneducated. Among the illiterate group some know their signature only. Only 16.84% of ASRs

and 9.41% SRs were found to be matriculate and above matriculation level. The percentage of illiteracy is comparatively low in ASRs (17.89%) and SR (24.71%) in comparison to CRs (42.19%) If we take all the tasar rearers into account it is found that 34.6% are illiterate, 42.2% are below primary level, 14.2% are non-matriculate, 6.4% are matriculate and only 2.6% have studied beyond matriculation level. Literacy rate is comparatively very low in case of CRs.

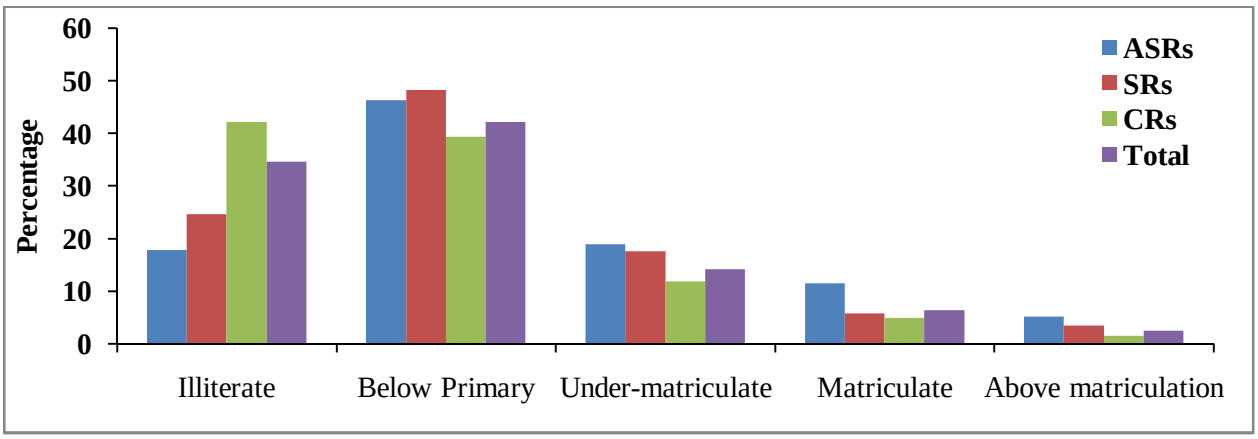

Fig 1. Educational status of tasar farmers in Mayurbhanj area

3.1.2 Family size

A rearers' family can rear 100-300 dfls or silkworm layings in a crop depending upon their family size. During the rearing season almost all of their family members are engaged, even children undertakes the watch and ward activities. Minimum family size with 4 to 5 members in a family was most prevalent with distribution of 45.26%, 49.41% and 44.06% in ASRs, SRs and CRs respectively and overall it was 45.2%. If we consider overall distribution of the family size 31.4% had 6 to 8 members, 17.4% had 8 to 10 member and only 6% of them comprised of more than 10 members in their families (Fig 2).

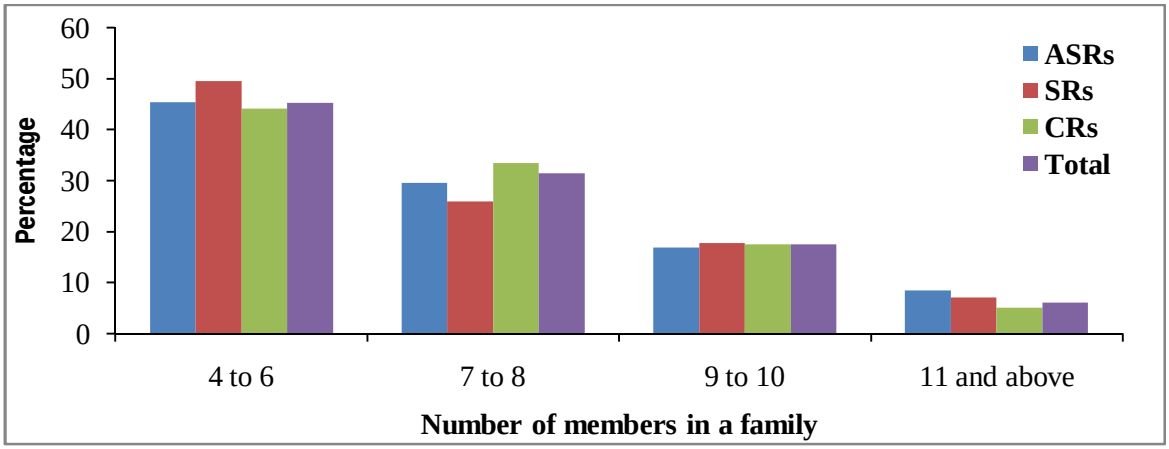

Fig 2. Distribution of tasar farmers according to their family size

3.1.3 Annual Income from Tasar

The farmers usually take one crop in a year, may be the seed crop or commercial crop. Thus, the crop is seasonal and within 30 to 45 days of rearing period the cocoons are produced and sold. According to the income the farmers were distributed in four groups (Fig 3). On an average, 52% of farmers earned less that Rs20000/-, Thirty percent earned Rs20000 – 30000/-, 14% earned Rs 30001 to 40000/- and only 4% could earn beyond Rs40000/- per annum. It may also be noted that none of the CRs earned above Rs40000/- per annum.

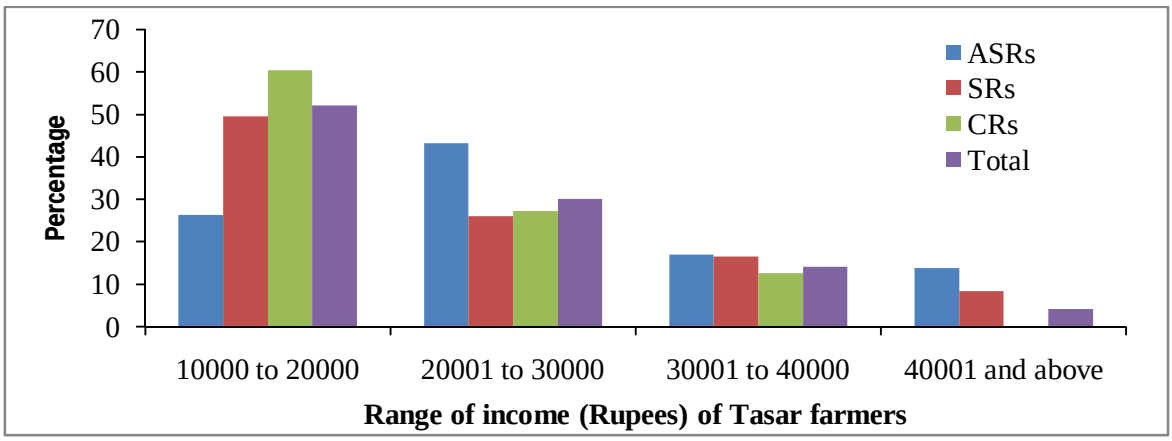

Fig 3. Distribution of tasar farmers according to their annual income

3.1.4 Land holding and experience in Tasar

The land holding and experience in tasar culture have been presented at Table 1. None of the farmers were landless when it comes to the case of tasar culture, because they conduct tasar rearing in *Adapahis* or patches of Asan plantations with tree *patta* allotted in their names. The ASRs possess maximum land holdings (3.11 ± 1.12 acres) followed by SRs and CRs. It was also revealed that some of the farmers were new in the field. On the other hand many of them have vast experience. So experience ranges from 2 to 45 years.

Table 1. Details of land holdings, experience in tasar culture and cumulative earning

Item	Adopted Seed Rearers	Seed rearers	Commercial rearers
Land holdings (acres)	3.11 ± 1.12 (0.5 – 6.3)	2.87 ± 0.88 (1.1 – 5.2)	2.08 ± 0.57 (0.5 – 3.2)
Experience in tasar culture (years)	14 ± 6 (2 – 30)	12 ± 14 (4 – 45)	11.1 ± 9.35 (2 – 35)

3.1.1 Tasar cocoon productivity

The tasar cocoon productivity assessed through production of cocoons per disease free laying (dfl) of a female moth (200 eggs) is presented in Fig 4. According to the availability of host plants and family size they conduct rearing of 150 to 500 dfls of tasar silkworm. Perusal of table revealed that Cocoon productivity was very low in CRs as 35.31% harvested 10-20 cocoons/dfl and majority i.e. 45.94% could produce 21-30 cocoons/dfl. Only 1 person (0.31%) was able to produce more than 51 cocoons/dfl. On the other hand ASRs were the best for cocoon productivity followed by SRs.

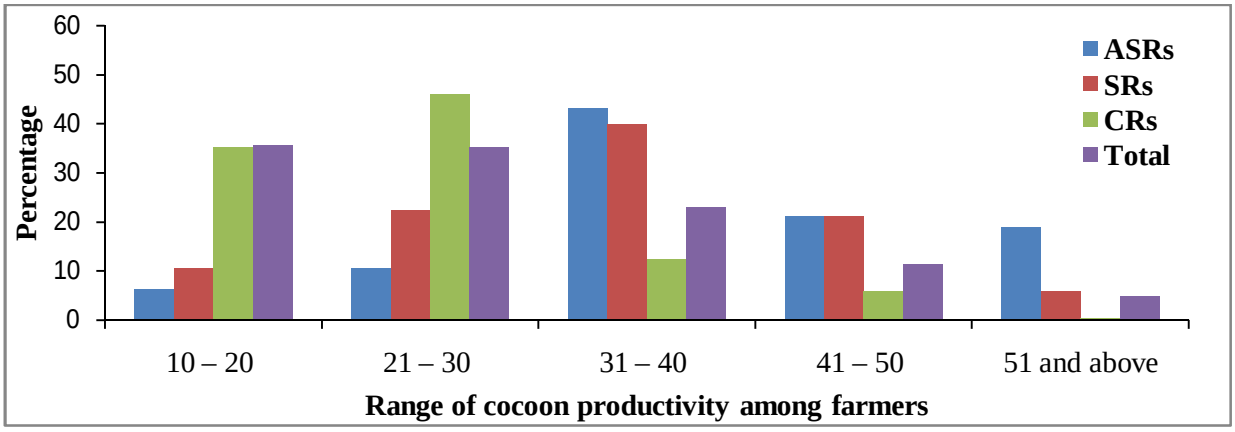

Fig 4. Cocoon productivity status (cocoons per dfl) of tasar farmers

3.2 Adoption of host plant management practices

The details of plantation maintenance and utilization by the three groups of rearers are presented in Table 2.

3.2.1 Plantation

Farmers did not raise any economic plantation but they conduct rearing of tasar silkworms in forest patches, mostly dominated by Asan (*T. tomentosa*). About 74.74% of the ASRs and 50.59% of SRs have the opportunity to utilize the economic plantations of *T arjuna* developed through state government agencies. However, the CRs get less opportunity of using economic plantations. They (96.25%) depend on the forest patches of Asan or isolated trees in the bunds of paddy fields.

3.2.2 Preference of plantation and site

Majority of farmers prefer high land for tasar silkworm rearing free from water logging as the crop gets adversely affected due to virosis and other diseases in water logged condition. Precisely, 71.58% of ASR, 72.94% of SRs and 95.31% of CRs were found to select high land and rest conduct rearing in low land terrain. The height of the trees is an important parameter for the ease of rearing tasar silkworm. As CRs mostly depend on forest based trees, the height is more than 10 feet (96.88%). However, tall trees are not preferred by farmers. The survey revealed that 10.53% of ASR, 17.65% of CR and 48.44% of SR prefer Asan plant. The preference for Arjun was 43.16%, 41.18% and 12.81% for ASR, SR and CR respectively. Availability of host plants is most important part for tasar silkworm rearing, hence more than 87% of all types of farmers were in the opinion of conducting rearing on both types of plants.

Table 2. Adoption of plantation maintenance technologies by ASRs, SRs and CRs

Sl. no.	Technology	ASR (95)	SR (85)	CR (320)
1.	Adoption of rearing in economic plantation	71 (74.74)	43 (50.59)	12 (3.75)
2.	Adoption of rearing in forest plantation	24 (25.26)	42 (49.41)	308 (96.25)
3.	Selection of site			
	a. High land	68 (71.58)	62 (72.94)	305 (95.31)
	b. Low land	27 (28.42)	23 (27.06)	15 (4.69)
	c. Free from water logging	95 (100)	85 (100)	320 (100)
4.	Height of host plant/tree			
	a. Less than 10 feet	45 (47.37)	25 (29.41)	10 (3.13)
	b. More than 10 feet	55 (57.89)	65 (76.47)	310 (96.88)
5.	Food plant used for rearing			
	a. Only Asan	10 (10.53)	15 (17.65)	155 (48.44)
	b. Only Arjun	41 (43.16)	35 (41.18)	41 (12.81)
	c. Both Asan and Arjun	83 (87.37)	74 (87.06)	295 (92.19)
6.	Organic manure applied	25 (26.32)	(0)	0 (0)
7.	Chemical fertilizer applied to soil	63 (66.32)	(0)	0 (0)
8.	Pruning and pollarding method adopted	85 (89.47)	23 (27.06)	36 (11.25)
9.	Protection against gall insect	41 (43.16)	15 (17.65)	0 (0)
10.	Chawki garden maintained	20 (21.05)	0 (0)	0 (0)
11.	Leaf enrichment measures for leaf yield (Foliar spray of urea)	85 (89.47)	61 (71.76)	0 (0)

(Figures in parentheses indicate percentage)

3.2.3 Management of plantation

Only 26.32 and 66.32% of ASR applied organic manure and chemical fertilizer to the soil at plantation field but only through government support. The other two categories of farmers did not apply manure or fertilizer. The farmers are not in the habit of following proper pruning and pollarding schedule. But during the process of cocoon harvesting towards late winter, they use to cut branches from which new leaves come out. In that case also ASRs (89.47%) and SRs (27.06%) have the opportunity to maintain the economic plantations in manageable height through pruning. The CRs are mostly dependent on forest patches for tasar silkworm rearing, where they are not allowed to prune the food plants. The care for the control of gall insect is taken by 43.16 and 17.65% of ASRs and SRs while CRs are not able to do so because of forest trees. Farmers do not maintain any separate chawki garden for rearing early age tasar larvae. Instead, they brush the young larvae on the regular forest trees right from hatching and complete the rearing there itself till the harvest of the cocoons. Only 21.05% of ASRs have access to chawki garden. About 89.47% of ASR and 71.76% of SRs apply urea as foliar spray for food plants as they get it from respective centres, while none of CRs use at their own level.

3.3 Adoption of silkworm rearing practices

The rearing practices followed by farmers in the area are presented in Table 3.

Table 3. Adoption of tasar silkworm rearing technologies by ASRs, SRs and CRs

Sl. no.	Tasar silkworm rearing technology	ASR (95)	SR (85)	CR (320)
1.	Awareness on brushing period	95 (100)	85 (100)	305 (95.31)
2.	Silkworm race reared (Daba bivoltine & tivoltine)	95 (100)	85 (100)	320 (100)
3.	Method adopted for silkworm brushing			
	a. Through leaf cup	15 (15.79)	13 (15.29)	91 (28.44)
	b. Through leaf-twig transfer	80 (84.21)	72 (84.71)	229 (71.56)
4.	Chawki rearing adopted	10 (10.53)	4 (4.71)	0 (0)
5.	Nylon rearing net used	10 (10.53)	4 (4.71)	0 (0)
6.	Awareness about diseases	95 (100)	85 (100)	298 (93.13)
7.	Use of Jeevan Sudha for control of virosis	83 (87.37)	71 (83.53)	25 (7.81)
8.	Spray of Sodium hypochlorite	89 (93.68)	67 (78.82)	23 (7.19)
9.	Disposal of diseased and infected silkworm			
	a. Collect and bury/burn	95 (100)	85 (100)	125 (39.06)
	b. No action at all	-	-	195 (60.94)
10.	Method of worm transfer			
	a. By individual picking	0 (0)	5 (5.88)	123 (38.44)
	c. By branch cutting	95 (100)	80 (94.12)	197 (61.56)
11.	Cares during moult period (not to disturb)	95 (100)	85 (100)	320 (100)
12.	Maintenance of hygienic conditions of field by using Bleaching powder and lime dusting	90 (94.74)	78 (91.76)	178 (55.63)
13.	Maintaining normal density of larvae per tree/plant and avoiding overcrowding	91 (95.79)	78 (91.76)	225 (70.31)
14.	Care during spinning (not to disturb larvae)	95 (100)	85 (100.00)	320 (100)
15.	Foliage left on plant for hammock formation	95 (100)	85 (100)	305 (95.31)
16.	Checking of crawling down of silkworms by			
	a. Wrapping cellotape strip	25 (26.32)	10 (11.76)	0 (0)
	b. Making ring of paddy straw or grass around truck	70 (73.68)	60 (70.59)	90 (28.13)
	c. Picking individual crawled down worm	10 (10.53)	25 (29.41)	230 (71.88)
17.	Use of sticky trap for pest & predator	95 (100)	85 (100)	305 (95.31)
18.	Protection from ants by using wood ash or repellent	78 (82.11)	52 (61.18)	5 (1.56)
19.	Care for cocoon harvesting time	95 (100)	85 (100)	300 (93.75)
20.	Care for harvesting day (dry, sunny day)	95 (100)	85 (100)	310 (96.88)
21	Transportation of cocoons to TRCS			
	a. Cocoon garland making	42 (44.21)	33 (38.82)	0 (0)
	b. Loosely packed in gunny bags	2 (2.11)	5 (5.88)	38 (11.88)
	c. Tightly packed in gunny bags	4 (4.21)	5 (5.88)	45 (14.06)
	d. In bamboo/plastic basket	47 (49.47)	42 (49.41)	237 (74.06)
22.	Watch & ward / monitoring during crop period	95 (100)	85 (100)	297 (92.81)

(Figures in parentheses indicate percentage)

3.3.1 Brushing schedule and time

With regard to rearing, 100% ASRs and SRs and 95.31% of CRs were aware about brushing time but they did not know about brushing calendar. All farmers preferred Daba race of tasar, but for seeds (eggs) they depend on government agencies and associated private graineurs (egg producers).

3.3.2 Brushing method

Leaf-twig transfer method for the brushing of newly hatched silkworm is beneficial for survival and 84.21% of ASRs, 84.71 and 71.56% of CRs adopt to this method. Farmers keep eggs in plastic or bamboo trays and small Asan/Arjun twig is kept on the eggs of silkworm. The newly hatched worms crawl on the twig and then the twig is tied to food plants to facilitate crawling of

worms to leaves of the food plants. Rest of the farmers use the age old method of tying leaf cup containing tasar eggs on the twigs of food plants.

3.3.3 Rearing practices

No farmers were found to adopt the chawki rearing and only 10.53% of ASRs and 4.741% of SRs have the opportunity to use chawki garden. These rearers use nylon net for rearing of early age silkworms in chawki garden and net is provided by state government. Majority of CRs did not know about the importance of young age rearing in chawki garden.

3.3.4 Awareness and control measure for disease

All the ASRs and SRs and 93.13% of CRs were aware of tasar silkworm diseases. They have gathered knowledge of silkworm diseases and control measure through training by government agencies. The ASRs and CRs are also aware of using "Jeevan Sudha" for the control of virosis of tasar silkworm as 87.37% and 83.53% use it respectively during rearing period. Similarly, they are also ahead in the use of sodium hypochlorite as prophylactic measure. All the ASRs and CRs use to collect and bury or burn the diseased silkworms whereas 60.94% of CRs did not care about the disposal of diseased and dead silkworms. All ASRs and SRs take prophylactic measures like sprinkling of bleaching powder and lime dusting provided by government agencies.

3.3.5 Care for late age rearing

The awareness on the moulting period of the worms was 100%. During this period they do not transfer or disturb the silkworms. For transferring silkworms from one tree to other trees after the leaves are consumed, all ASRs and 94.12 of SRs follow branch cutting method. Individual picking of silkworms is still practiced by 38.44% of CRs. The population of larvae in the tree depends on the foliage of the food plants, so a moderate density of silkworms is ideal. ASRs and SRs judiciously adjust the density but CRs are yet to follow as they use forest based plants. To facilitate proper spinning, some quantity of foliage was retained on the plant, and all farmers are aware of that. To check crawling down of silkworms from plants different methods are adopted, and ASRs (73.68%) and SRs (70.59%) use paddy straw ring around the plants. Similarly 26.32% of ASRs and 11.76% of ARs use cellotape or polythene material around the trunk. The silkworms which crawl down were picked up individually and transferred to another plants by majority of CRs.

3.3.6 Protection from pest and predators

To protect the crop from predators/birds all framers resorted to watch and ward. They monitored their crops in morning and evening hours when the birds attack are at the maximum. They used catapult to protect the crop from birds. Nearly all farmers know about the sticky trap and use it to capture enemies like yellow fly, uzi fly, *Eucanthecona furcellata*, praying mantis and wasps. To protect worms from ants, 82.11% of ASRs use wood ash or repellents.

3.3.7 Cocoon harvesting

All farmers studied were found to keep the cocoons on trees for hardening of the shell after spinning for 6-7 days. They harvest cocoons 6-7 days after spinning. None of the farmers harvest cocoons before 6 days. Majority of them harvest cocoons on dry sunny

3.3.8 Transportation and marketing

Generally farmers sell their cocoons to TRCSs. Some farmers sell their cocoons to Mahajans also when they get more price but this is at a very low level in Odisha. ASRs and SRs are in the habit of garlanding of cocoons as 44.21% and 38.82% of them are habituated to do so. Majority farmers transport the cocoons transport cocoons in plastic crates provided by state government units.

Odisha has a unique place in the tasar silk production is about 33% of the total tasar silk produced in the country. Tasar culture has been kept alive by the people who are economically and socially backward. The tribes gathered knowledge of tasar crops simply by trial and error from generation to generation. Even agriculture is not a full time job for them because villagers of the area use to grow mostly paddy and they are mostly dependent on forest resources. The tasar culture is largely practiced in the nearby forests on Asan plants and in some cases on developed Arjun plantations. The average production under such condition comes to very low with 15-20 cocoons per dfl. In this regard the role of improved technologies of tasar holds promises[6]. The improved technologies have potential to increase the cocoon productivity.

From the present study it was clear that the adoption level of the improved technologies among the farmers of the cluster studied varied considerably. The adopted seed rearers were at the top as they obtained training and facilities provided by government agencies. In general, the traditional farmers follow the age old method and only a few recommended technologies bearing low or no cost in nature were adopted. On the method of brushing silkworms, transfer and disposal of dead worms etc. are practiced. But regarding other improved technologies, in most of the cases of CRs, the study revealed little or least awareness of the technologies. Similar observation of importance of adoption of technologies was reported in mulberry silkworm cultivation[8,9]. Earlier studies on socio-economic conditions of tasar farmers revealed the poor economic status of tasar farmers resulting in lesser4 adoption of new technologies[5-7].

A number of workers studied socio-economic conditions of mulberry silkworm farmers, adoption of technologies by the sericulturists and impact of the technologies on economy of the farmers[9-20]. It appears that the illiteracy prevailing in the community may be one of the factors responsible for the poor awareness and poor adoption level which was also advocated in mulberry sericulture[13,20].

As tasar culture is linked with the age old tradition of the tribes, in practices, in due course of time they have developed their own method of technologies of tasar culture and majority of them do not want to desist from it. Therefore extension efforts need to be taken to realize the farmers that improve technologies of tasar culture if adopted by them will increase their economic gain.

Another factor responsible for poor adoption level is their economic condition. It was revealed in the present study that the commercial and majority of seed rearers are unable to spend any money on purchase of materials related to tasar culture practice. They expect the materials like bleaching powder, lime and sodium hypochlorite etc. to be provided by Central Silk Board or state government. Besides for popularization of improved technologies for mass adoption the tasar culture may be integrated with agriculture which need a master plan at high level for augmentation of the tasar food plants[7].

Tasar culture has given a boost to the economy of farmers in Chhattisgarh[21]. In addition to income generation and checking urban migration, sericulture activities also contribute to conservation of environment. CTR&TI, Ranchi has developed a number of technologies for tasar culture but there is the need for large scale dissemination leading to adoption at farmers' level[22]. So, along with emphasis on adoption of modern technologies, tasar culture should be promoted on a larger way.

4. CONCLUSIONS

Tasar culture provides the livelihood of the tribal population, who practice it as a subsidiary occupation. They continue to adopt the age old practices resulting in poor cocoon yield and in many instances complete crop failure. With the development of improved technologies in tasar culture, the productivity level has shown improvement. However, it has been observed that among the majority of tasar grower the level of adoption of improved technologies is low. In order to formulate strategies for improving the field productivity, it is important to analyze the scenario at ground level with regard to adoption of technologies. In order to improve the income from tasar culture, effective extension for dissemination of technology, adoption of more farmers, training and popularization of improved technologies by the field functionaries and extension units is a dire need of the hour.

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