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Studies on the performance of pilot project centers (PPCs) of Sundargarh

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Abstract
The five different types of silk-mulberry, eri, muga, tropical tasar and temperate tasar-are uniquely produced in India (Selvaraj *et al*., 2020). Tropical tasar sericulture encompasses the cultivation of plants that serve as the hosts for tropical tasar silkworms, the rearing of silkworms for the production of raw silk, the preparation of disease-free layings (seed), and the reeling of cocoons for the subsequent processing of raw silk for weaving (Vishaka *et al*., 2021). Several states namely Andhra Pradesh, Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Maharashtra, Orissa, Telangana, Uttar Pradesh, and West Bengal, practise it (Nadaf *et al*., 2019). Favorable climate and participation of the cooperative sector in this field will lead to the development of silk industry to a greater height. This sector is regarding to set most appropriate while available of good quality of seed for farmers. As we know if the seed is good then 60% problems solved before rearing. Basically, Sundargarh district rears two tasar crops all year long. In addition to taking up third crop in a very small number of places, the first crop (Ampatia) is known as a seed crop and the second one (Daba) is known as a commercial crop and is widely reared. In tasar sector, Central Silk Board alone is meeting the requirement of entire nucleus and part of basic seed in the country for multiplication and further production for supply of commercial DFLs to the rearers. There was a need to explore alternative ways of including States/ NGOs/ Societies/ SHGs, Private Graineurs, etc. in order to broaden the supply source and increase the production of tasar basic seed to meet its expanding demand. Different Tasar Seed Production and Extension Centres (TSPECs), also known as Pilot Project Centres (PPCs), were established in this direction. Department Of Handlooms. Textiles and Handicrafts, Govt. of Odisha established 15 nos PPC in all over odisha for fulfilling the requirement of basic DFLs in odisha. NGOs also involve in this movement for supplying basic DFLs to the seed rearers in Banspal block of Keonjhar district and also some part of Lahunipada block of Sundargarh district. As performance of ecoraces varies with regions and seasons, the maintenance and multiplication of basic seed under different tasar growing locations will enhance overall productivity of the country besides replenishment of breeder's stock within the time schedule. The maintenance and multiplication of basic seed stock of Daba ecorace under different parental lines over varied rearing seasons and regions can open avenues for choice of appropriate and suitable line for optimal exploitation of commercial cocoon production and productivity.

Keywords: Pilot project centers, silk-mulberry, eri, muga

Introduction
The five different types of silk-mulberry, eri, muga, tropical tasar and temperate tasar-are uniquely produced in India (Selvaraj *et al*., 2020) [23]. Tropical tasar sericulture encompasses the cultivation of plants that serve as the hosts for tropical tasar silkworms, the rearing of silkworms for the production of raw silk, the preparation of disease-free layings (seed), and the reeling of cocoons for the subsequent processing of raw silk for weaving (Vishaka *et al*., 2021) [27]. Several states namely Andhra Pradesh, Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Maharashtra, Orissa, Telangana, Uttar Pradesh, and West Bengal, practice it (Nadaf *et al*., 2019).

In Odisha, where the tropical tasar silk is produced by the rearing of silkworm *Antheraea mylitta* D. (Nadaf *et al*., 2021) [14] is very old and traditional. Angul, Balasore, Boudh, Deogarh, Dhenkanal, Jajpur, Kalahandi, Keonjhar, Mayurbhanj, Nawarangpur, Nuapada, Sambalpur, Sonepur, and Sundergarh are some of the districts in the state that practise tasar culture. For the purpose of rearing tasar silkworms, tribal farmers in these districts use naturally grown tasar food plants from the forest. In several areas of the Sundargarh district, tasar rearing has been a significant traditional occupation of indigenous populations and district has a rich heritage of tasar culture. It is the third largest producer of tasar in Odisha.

With 17 administrative blocks, the Sundargarh district covers more than 3000 active farmers in the sericulture sectors in the following blocks: Balisankara, Badagaon, Bisra, Bonai, Koida, Lahunipara, and Kutra. In particular, the sericulture farmers of three blocks in the Bonai subdivision, as well as the Badagaon and Bisra blocks, are involved in Seed Crop Rearing (SCR) and Commercial Crop Rearing (CCR).They market cocoons via local primary cooperative societies (New Indian Xpress 2020) [17].

Tasar seed are of enormous biological and economic significance, and tropical tasar seed production is a component of tasar silk production (Nadaf *et al*., 2021) [15]. Basically, Sundargarh district rears two tasar crops all year long. In addition to taking up third crop in a very small number of places, the first crop (Ampatia) is known as a seed crop and the second one (Daba) is known as a commercial crop and is widely reared. In tasar sector, Central Silk Board alone is meeting the requirement of entire nucleus and part of basic seed in the country for multiplication and further production for supply of commercial DFLs to the rearers. There was a need to explore alternative ways of including States/ NGOs/ Societies/ SHGs, Private Graineurs, etc. in order to broaden the supply source and increase the production of tasar basic seed to meet its expanding demand. Different Tasar Seed Production and Extension Centres (TSPECs), also known as Pilot Project Centres (PPCs), were established in this direction.

Two TSPECs/PPCs are functioning in the Sundargarh district *viz.*, PPC Medinipur, Sadar block and PPC K.Bolang, Koida block. These TSPECs/PPCs are involved in multiplication of nucleus seed supplied by CSB for further production and supply of basic and commercial DFLs to tasar rearers. The inputs like bleaching powder, lime, Jeevan Sudha, depuratex, etc are also being supplied for rearing to the tasar farmers besides timely training them on adoption of newer technologies for increased productivity in rearing and grainages. The different activities carried out are seed cocoon production through rearers, disinfection, selection and sorting of seed cocoons, garlanding of cocoons for preservation, maintenance of optimum abiotic conditions during preservation, grainage operation with moth testing, degarlanding etc.

Considering the above activities of TSPECs/PPCs of Sundargarh, it was planned to study with the following objective:

- To study the trends of performance of TSPECs/PPCs Medinipur and K. Bolang from 2011 to 2022 in terms of basic and commercial seed production

Review of literature

The literature pertaining about Sundargarh, its climate, important statistics, agriculture, tasar sericulture and seed production of the district is reviewed and presented in this chapter.

About Sundargarh

During the first decade of the 20th century, the Sundargarh district was known as Suadihi (Suadi), but the then Maharaja Raghunath Sekhar Deo, the 18th successor of the throne, renamed it to "Sundargarh," which means "Beautiful Fort." (Nayak *et al*., 2018) [16].

Climate of Sundargarh district

The district's climate is characterized by a hot, dry summer, followed by a rainy, cold winter. The summertime high temperature can reach 49 degrees Celsius, while the wintertime low is between 4 and 5 degrees Celsius. It has been classified as having a four-season cycle since it has a hot, dry summer, an intense rainy season, and a cold winter. The seasons are

The hot season from March to May
The Monsoon season from June to September
The post Monsoon months of October & November
The cold season from December to February

In May, which is regarded as the hottest month of the summer season, temperatures range from 41 degrees Celsius to 49 degrees Celsius. Heat waves start to become noticeable around the beginning of March. By mid-June, the monsoon has come, bringing relief, but as of that point on, the uncomfortable temperatures start to dip, ushering in winter starting in November. Between the months of December and January, the temperature ranges from 20 to 40 degrees Celsius.

The average rainfall in the district is 1676 mm (64.84”). The rainfall is uniform in the whole district. About 86% of the annual rainfall is received during the monsoon months between June and September, July being the month with heaviest rainfall. On an average there are 76 rainy days in the year in this district. Annual rainfall of the district was 1585.2 mm in 2020 (DSHBS 2020).

The Southeast monsoon season has high relative humidity. Later, the humidity goes down, and the winter months are relatively dry. Wind is light to moderate.

Important statistics in the Sundargarh district

Particulars	Odisha	Sundargarh	
	Number	Number	Per cent of Odisha
Number of villages	51,311	1,762	3
Number of normal households	96,05,629	4,76,142	5
Total population	4,19,74,218	20,93,437	5
Rural total population	3,49,70,562	13,55,340	4
Rural female population	1,73,84,359	6,79,272	4
SC total population	71,88,463	1,91,660	3
SC female population	35,70,655	95,195	3
ST total population	95,90,756	10,62,349	11
ST female population	48,63,024	5,35,493	11
Literate persons	2,67,42,595	13,42,322	5
Literate females	1,16,52,914	5,92,175	5
Total cultivators	41,03,989	1,84,273	4
Female cultivators	7,28,639	42,653	6
Total agricultural labourers	67,39,993	2,53,327	4
Female agricultural labourers	32,58,157	1,47,933	5

Source: District Census Handbook Sundargarh 2011

Sundargarh district Agriculture at a glance (2015-16)

Particular	Unit	Statistics
Total area	‘000 Ha.	971
Forest area under revenue village		180
Non-agriculture land		63
Barren & uncultivable land		64
Cultivable land		372
Net area sown		203
Forest area (2016-17)	Sq. km.	4957.32

Source: District at a Glance, 2018, Govt. of Odisha and Nayak *et al*., 2018 [16]

Sundargarh Zone information on tasar sericulture (2018-19)	
Particular	**Details**
Districts	Sundargarh and Jharsuguda
TRCS (No.)	09
Farmers (No.)	3000
New plantation (Ha.)	60
Plantation maintenance (Ha.)	350
DFls utilised (Lakh No.)	3.5
Cocoon produced (Kahan)	10106

Source: Disaster Management Plan 2018-19, Department of Handlooms, Textiles and Handicrafts Odisha

Tasar sericulture in Sundargarh

In particular, the Kendujhar, Mayurbhanj, and Sundargarh districts, which produce 90% of the state's tasar, have historically been significant traditional sites of employment for indigenous populations in north-west Odisha. In the state, a total of 47,284 families makes their living through tasar sericulture, which produced 107 MT of tasar raw silk in 2015–16 (CSB 2017).

The princely state of Mayurbhanj organised Orissa's Tasar culture at its inception. It was given royal support by the Bhanja dynasty (640-1952 AD). Mayurbhanj's Tasar fabrics gained fame in India and abroad. Today, the tribal people who live in the districts of Mayurbhanj, Keonjhar, Sundargarh, Dhenkanal, Angul, Deogarh, Sambalpur, Jajpur, Boudh, Sonepur, and Nuapada are thought to practise the Tasar culture as a secondary employment. More than 50,000 Kahans of tasar cocoons are generated each year, and tribal farmers can profit from them by earning roughly 6 crore rupees with only a small seed investment. Around 1220.80 lakh Tasar reeling cocoons were produced in Odisha in 2015–16. (Dash *et al* 2018) [5].

Singh 2012 [25] reported that the tropical tasar silk production originated in the Chotanagpur plateau of India and the Chotanagpur region constitutes the southern and eastern plateau of Jharkhand and contiguous districts in Orissa and West Bengal. Administratively, it comprises all the southern districts of Jharkhand, districts of Purulia and part of Bankura and western Medinapur district of West Bengal, and the Mayurbhanj and Sundargarh districts of Orissa. The other districts of the region include Singhbhum, Gumla, Ranchi, Lohardaga, Palamu, and Hazaribagh, and Santhal Pargana of Jharkhand.

Sundargarh district is said to generate high-quality tasar, according to Kalyan and Lakra 2021. To establish the Sundargarh Tasar as a well-known brand and create value-added goods from tasar, steps were taken and also reported that a "Tasar Silk Park" is being built at Khuntgaon in order to make the idea of "Soil to Silk" a reality.

Nayak *et al*., 2018 [16] reported tasar cocoons under major and MFP (Minor Forest Products) Items available in the Sundargarh district of Forest Division.

Odisha Economic Survey 2021-22 reports the yarn/ tasar cocoon sale of Rs. 2,698.35 lakh by the state cooperative organisation/societies like S. Bastralaya, Boyanika, Odisha Cooperative Tassar & Silk Federation Ltd (SERIFED) and Primary Weavers Co-operative Societies (PWCS) and 4014 households have been covered in Mahila Kisan Sashakthikaran Pariyojana (MKSP) for tasar cultivation in seven blocks of three districts.

Disaster Management Plan 2018-19 of Department of Handlooms, Textiles and Handicrafts Odisha reports tasar activities in Mayurbhanj, Keonjhar, Sundargarh, Deogarh, Dhenkanal, Angul, Jajapur, Boudh, Sonepur, Kalahandi, Nuapada, Nawrangpur, Balasore and Sambalpur with 16449 tasar farmers and 62 TRCS.

According to Shalya 2020 [24], the District Mineral Foundation (DMF) tasar rearing project is planting host trees, Arjun and Asan, on degraded revenue lands in Odisha that were chosen using a sericulture map created by the Central Silk Board, taking into account soil and climatic conditions favourable for tasar tree cultivation.

According to Das and Dwibedi (2012) [4], 90% of scheduled tribes and 05% of scheduled castes in Odisha pursue sericulture as their old and traditional profession and earn a decent amount. It gives many small and marginal farmers a livelihood in many tribally dominant districts. Only 20% of the state's silk needs are met by domestic production; the remaining 80% is imported from other states.

Malali *et al.* (2017) [11] found that the addition of a slug catcher during the reeling process did not affect productivity but did help to improve the quality of the reeled tasar yarn in their studies on Daba (tropical) tasar cocoons of A grade (Reelable quality) procured from the Keonjhar region of Odisha state.

The Central Silk Board is the nodal organisation that oversees the Catalytic Development Schemes and promotes tasar by providing loan support to TRCS for the fertiliser, asan plantations, rearing equipment, microscopes, and shed preparation in coordination with MNREGS (VCAFSPC n.d.).

According to Sahoo 2015 [12] typically in the tribal-dominated districts of Mayurbhanj, Keonjhar, Sundargarh, Kandhamal, Rayagada, Koraput, Gajapati, Kalahandi, Nawarangpur, Jajpur, Deogarh and Dhenkanal, tasar sericulture is the main source of livelihood for rural poor people and Odisha state features four different types of forests, with tropical humid forests making up 80% of the total forest area and abundant primary tasar food plants. The state therefore possesses 15,000 hectares of natural forest, and tasar farming is practiced on roughly 6000 hectares of economic plantation. A total of 66.62% of the production is made up of race daba that has been reared, while 33.38% of the last five years' production came from collecting wild cocoons. In these above-hilly districts, there are more than 46,828 SC/ST families registered as primary members of the tasar culture. The majority of these Tasar culture practitioners fall into the BPL category. Only 68%, 24%, and 3% of the 10,000 tasar farmers in the state who are registered raise a single crop, two crops, and three crops every year, respectively.

OSBSAP (n.d.) lists the ten districts in order of the amount of forest cover: Phulbani (5,116 sq km), Sundargarh (4,011 sq km), Mayurbhanj (3,942 sq km), Keonjhar (3,546 sq km), Sambalpur (3,172 sq km), Rayagada (2,700 sq km), Angul (2,511 sq km), Gajapati (2,445 sq km), Malkangiri (2,285 sq km), and Ganjam (2,160 sqKm) with over two-thirds of the state's (67.8%) forest cover being represented by these 10 districts.

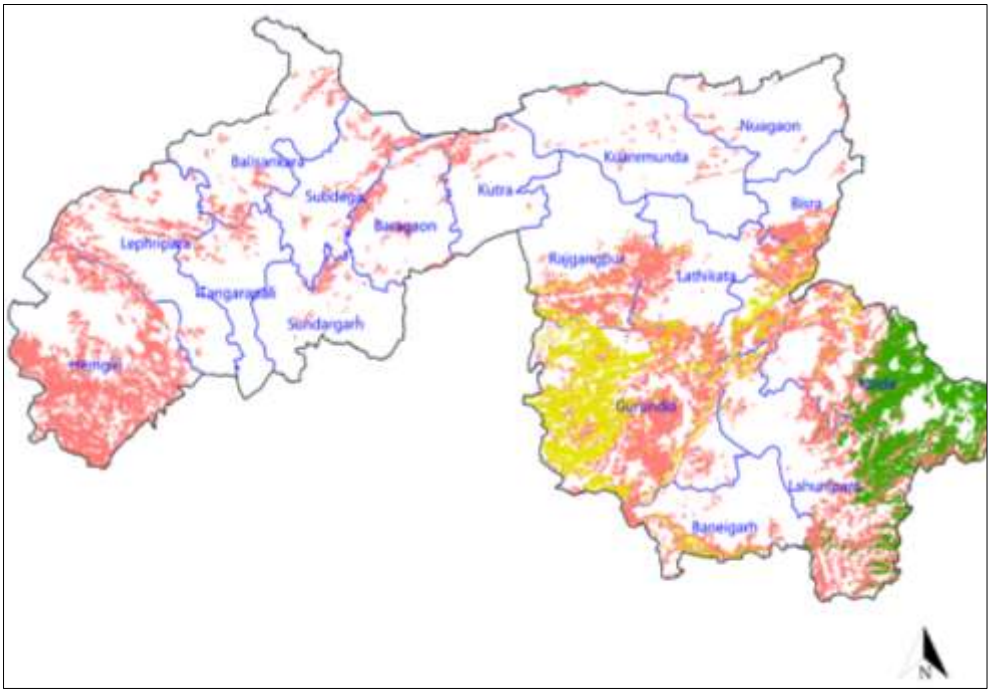
The highest cellulase activity was seen after 45 days of composting, according to Pandey *et al*., 2010 investigations on the fungal population and cellulase activity in vermicompost of rearing waste from eri and tasar cultures, where tasar waste was collected from Kirai, Sundargarh.

Achary *et al*., 2019 [1] reports that from the estimated 38 million tribal people, approximately 30 million (77%) are estimated to live in tropical (25.67 million) and temperate (4.23 million) zones, where tasar is grown. However, in

tropical and temperate tasar cultivating districts, respectively, 13.2 million and 3.2 million tribal people live. In the tropical zone, about 1.23 lakh families rear tasar silkworms.

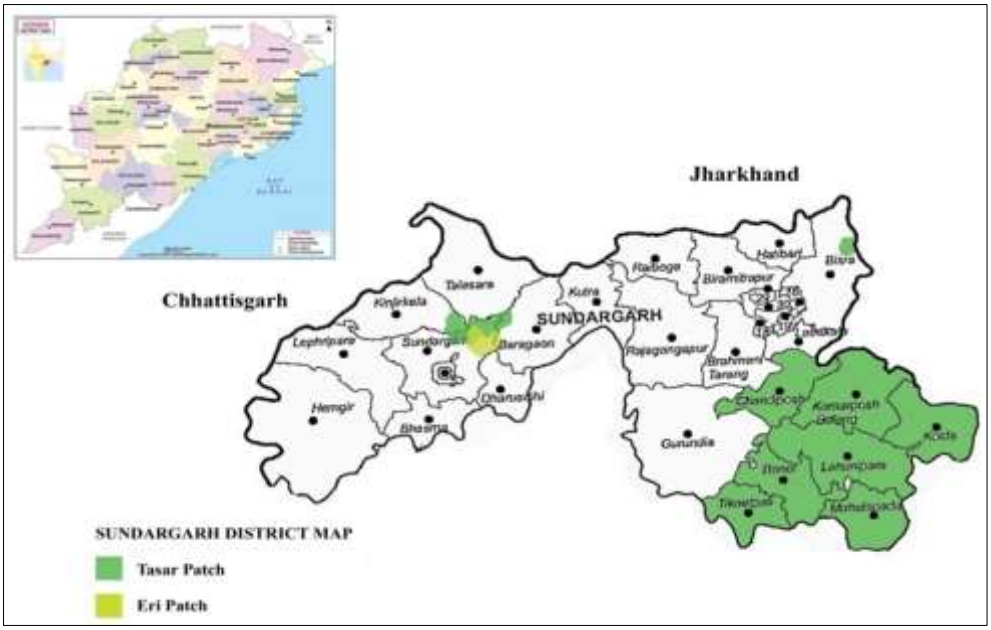
Potential Sites for tasar silkworm Food Plants

The potential sites for tasar silkworm food plants in the Sundargarh district is shown below in the map where green, yellow and pink indicates the areas with highly, moderately and marginally suitable potential sites respectively for tasar host plants (SILKS).



Tasar rearing patches in Sundargarh

The areas of Sundargarh district where tasar and eri silkworms are being reared is depicted in the following map.



Tasar Marketing Co-operave Societies (TMCSs) of Sundargarh Zone						
Name of TMCS	**Established Year**	**Name of Block**	**Total Membership (No)**	**DFLs Utilization**	**Yearly Production of cocoons (No)**	**Host Plant (Ha)**
Badagaon	23-03-1965	Badagaon	788	80000	3601414	320
Bimlagrah	14-03-1975	Koida	521	65000	2605891	270
Bisra	14-03-1965	Bisra	199	11000	385877	450
Dalki	14-03-1981	Bonai	862	80000	3654257	300
Jamdihi	19-01-1974	Koida	1010	75000	3252456	240
K.Bolang	26-09-1979	Koida	723	62000	2454589	220

Khuntgaon	15-03-1978	Lahunipara	975	99000	3966547	550
Lahunipada	24-03-1981	Lahunipara	1191	75000	2696955	480
Sarsara	15-03-1978	Bonai	1860	80000	2464581	450

Tasar seed production in Sundargarh

According to Mohanty *et al*., 2015 [12], disease-free layings (DFLs) are a requirement for successfully harvesting of tasar crop. Through a network of its facilities, the Central Silk Board (CSB) is vital in the production of basic DFLs. In light of the CSB's recent decision to stop being responsible for commercial seed production, states have been instructed to make the necessary preparations to meet their own requirements for commercial tasar seed. Odisha requires over 26 lakh DFLs, and it was intended to create full-fledged SMCs (Seed Multiplication Centers) including testing chambers, oviposition rooms, washing and drying chambers and incubation facilities in order to lessen reliance on CSB. It was intended to create 10 model SMCs as part of the RKVY project, five in Mayurbhanj, three in Keonjhar, and two in Sundargarh districts.

Dash *et al*., 2018 [5] reports that there are 62 TRCS in Odisha and these societies supply tasar rearers with DFLs besides extending technical support.

According to Kalyan and Lakra (2021) [9], Sundargarh tasar farmers purchase disease-free laying (DFL) from the district's nine TRCS to begin the tasar rearing process and then resell their cocoon production to the TRCS at the end of the season.

According to Kar *et al*., 2019 [10], the Central Silk Board adopts and trains farmers to conduct nucleus seed and basic seed rearing to produce high-quality tasar seed cocoons. These farmers are known as Adopted Seed Rearers (ASR). Disinfectants and other inputs are given to these ASRs. While those farmers who rear the tasar silkworm for silk reeling with commercial value and not for seed purpose are known as Commercial Rearers, those farmers who do so for the purpose of producing cocoons that will be used for egg production at their own level or at TRCS level are known as Seed Rearers. Commercial rearers obtain DFLs from private grainages and TRCSs.

Chowdary and Srinivas 2021 [2] reported that a significant amount of the basic tasar silkworm seed produced annually by the Basic Seed Multiplication & Training Centre (BSMTC), Sundargarh, is given to the State Sericulture Department. To supplement the demand for tasar silkworm seed, nucleus seed are also prepared and supplied for further multiplication at Pilot Project Center (PPC) and Tasar Marketing Cooperative Society (TMCS). The centre conducts tasar silkworm rearing three times a year on its forest land to produce seed cocoons phase-by-phase, and it also buys seed cocoons from adopted rearers.

Sathyanarayana *et al*., 2022 [22] reported that BSMTC Sundargarh brushed 7680 DFLs and harvest 2.44 lakh seed cocoons @ 31.82 cocoons/DFL besides1.90 lakh DFLs were also prepared by the BSMTC. It has also been reported that 1.18 lakh DFLs (0.42 lakh basic and 0.76 lakh nucleus) were supplied to Odisha from different BSMTCs.

Material and Methods

Studies on the above objectives were carried out for the TSPECs/PPCs Medinipur and K. Bolang. The materials and methods followed in the present studies are described hereunder in detail.

TSPEC/PPC Medinipur

It was established in the year 1978, located at Medinipur of Grama Panchayat Kirai, Block Sadar, District Sundargarh. It is at 7 km away from district Head Quarter (HQ) and the nearest railway station is Rourkela at around 150 km.

Two grainage halls on the ground floor of a well-built double-story cement structure each have the capacity to preserve 80000 seed cocoons, for a total of 160000 preservable cocoons and the potential to yield 25000 DFLs. The building also has one office room, one ovi-position room, a moth testing lab, one room for egg drying and packing, and one room for storage in addition to the grainage halls.

TSPEC/PPC K. Bolang

It was founded in 1979 and is situated in the Sundargarh district's K. Bolang of Koida block. It is 157 km from the district headquarters, while Rourkela, at about 61 km, is the closest railway station.

A well double storeys cement building is having two grainage hall in the ground floor, each one having the seed cocoon preservation capacities of 80000 numbers, total 160000 cocoons are preserved and approximately 25000 DFLs can produced. Apart from grainage hall, the building is also having one office room, one ovi-position room, moth testing lab, one room for egg drying and packing and one room for store.

Significance of TSPECs/PPCs

Their activities were significant in view of maintaining the breeder’s stock and multiplying the silkworm seed for the ultimate basic and commercial seed production in adequate quantities, maintaining the basic seed purity, its vigor and vitality and supply of silkworm seed in time for stable cocoon crop production.

The photographs of PPCs are shown hereunder

TSPEC/PPC, Medinipur

TSPEC/PPC, K. Bolang

Observations

For IPT (Intensive Practical Training) part of course of PGDS 2021-22, the following observations were made.

October

- Visited various plantation fields
- Guided for basal dressing to new plantation,
- Supervised the staggard trench work and fencing in field
- Advised to practice intercropping
- Farmers were rearing commercial crop
- Silkworms were in 2nd instar
- Closely observed the condition and growth of silkworms
- Guided the beneficiaries for taking necessary steps wherever was required

November

- Cultural operations were conducted
- Interacting with daily wage laborers
- Supervised the silkworm
- Advised for disinfection during silkworm transfer
- Last week the cocoons are harvested in phase wise

December

- Preparation of grainage buildings for TV seed Cocoons
- Disinfection of grainages,
- Selection of seed cocoons, garlanding etc

Data collection

Year-by-year statistics from 2011 to 2022 on the performance of aforementioned TSPECs/PPCs in terms of basic and commercial seed production like number of DFLs reared, hatching %, number of cocoons harvested, yield *i.e.*, number of cocoon/DFL, number of cocoons processed, number of DFLs prepared, cocoon: DFL and DFL: DFL were collected, tabulated, represented in graphical form and production trends were discussed.

Result and Discussion

The results on the performance of TSPECs (PPCs) Medinipur and K. Balam, Sundargarh, in terms of daba BV basic and commercial seed production are discussed hereunder.

Performance of TSPEC (PPC) Medinipur in terms of daba BV basic seed production

The PPC reared the nucleus Daba bivoltine DFLS received from CSB units with the help of its farmers to harvest the seed cocoons. Such cocoons were sorted out and the selected seed cocoons were summer preserved. In the subsequent year among so preserved cocoons the healthy un-infested and quality cocoons were processed for the grainage at PPC. In the Table 1 and Figure 1, it could be seen that PPC Medinipur on an average reared 4326 DFLs and harvested 184667 seed cocoons with 43 number of cocoons harvested per reared DFL during 2011 to 2022.

During the last eleven years a total of 47584 nucleus DFLs were reared to harvested 2031337 cocoons. out of these harvested cocoons, 1784000 seed cocoons were processed indicating that a total of 247337 (12%) cocoons were found to be non-seed cocoons and/or lost during the preservation. The highest and lowest non-processed cocoons were found to be 67000 (23%) and 4460 (4%) during the year 2016 and 2012, respectively. For the year 2013 the number nucleus DFLs were 2340 and rearing was found to be in increasing order till 2016 when maximum of 6210 nucleus DFLs were reared. However, from 2017 to 2021 more than 5000 nucleus DFLs were reared per year except during 2017 and 2019 when 4250 and 4780 nucleus DFLs were reared, respectively. Accordingly, the highest number of 287000 cocoons were harvested in the year 2016 @ 46 cocoon/ DFL but the highest cocoon/DFL i.e, 51 was registered for the year 2013 for the lowest number of reared DFLs of 2340. This might be due to proper and timely adoption of all the proven technologies.

During the grainage which started usually during the 3rd to 4th week of June, the highest number of 225000 cocoons were processed during the year 2018 in spite of harvesting highest number of cocoons of 287000 in 2016 *i.e*, due to comparatively lesser number of non-processed cocoons of 29000 (11%) during 2018 while it was 67,000 (23%) during 2016. This is probably because of maintaining optimum abiotic conditions during summer preservation and quality seed cocoons. During the last eleven years, PPC Medinipur processed a total of 1784000 nucleus Seed Cocoons to prepare 251300 basic DFLs with the cocoons: DFL of 7:1 for all the year. On an average, 162182 nucleus seed cocoons were processed that resulted in preparing 22845 basic DFLs. PPC Medinipur during the year 2011 to 2022 multiplied a total of 47584 nucleus DFLs received from CSB into 251300 basic DFLs i.e., nucleus DFLs to Basic DFL was found to be 1:5. The highest number of 35000 Basic DFL were prepared during the year 2016 for the reared highest number of nucleus DFLs of 6210 but it was multiplied into 6 times only. The highest multiplication i.e., each reared nucleus DFLs was multiplied to produce 8 basic DFL was registered for the year 2013 followed by 1:7 for the year 2011 & 2014. The lowest multiplication of nucleus DFL to basic DFL was reported during the year 2020 due to the impact of COVID-19.

Table 1: Performance of tspec (PPC) Medinipur, Sundargarh, Odisha during 2011 TO 2022 in terms of daba bv basic seed production

Year	Nucleus Seed rearing					Grainage					
	Rearing crop	No. of Nucleus DFLs Reared	Hatching %	No. of Cocoons harvested	Yield (No. of cocoon/DFL)	Year	Grainage crop	No. of cocoons Processed	No. of Basic DFLs Prepared	Cocoon: DFL ratio	Nucleus DFL: Basic DFL
2011	II	2989	90	150007	50	2012	I	145000	21500	7:1	1:7
2012	II	3328	93	104460	31	2013	I	100000	15000	7:1	1:5
2013	II	2340	89	120050	51	2014	I	114000	18000	6:1	1:8
2014	II	3440	90	164500	48	2015	I	160000	24000	7:1	1:7
2015	II	4160	93	192000	46	2016	I	160000	25000	6:1	1:6
2016	II	6210	97	287000	46	2017	I	220000	35000	6:1	1:6
2017	II	4250	92	134000	32	2018	I	129000	18800	7:1	1:4
2018	II	5340	93	254000	48	2019	I	225000	33000	7:1	1:6
2019	II	4780	95	180520	38	2020	I	160000	20000	8:1	1:4
2020	II	5287	91	220800	42	2021	I	160000	16000	10:1	1:3
2021	II	5460	92	224000	41	2022	I	211000	25000	8:1	1:5
Total/Avg.		47584/4326	92	2031337/184667	43	Total/Avg.		1784000/162182	251300/22845	7:1	1:5

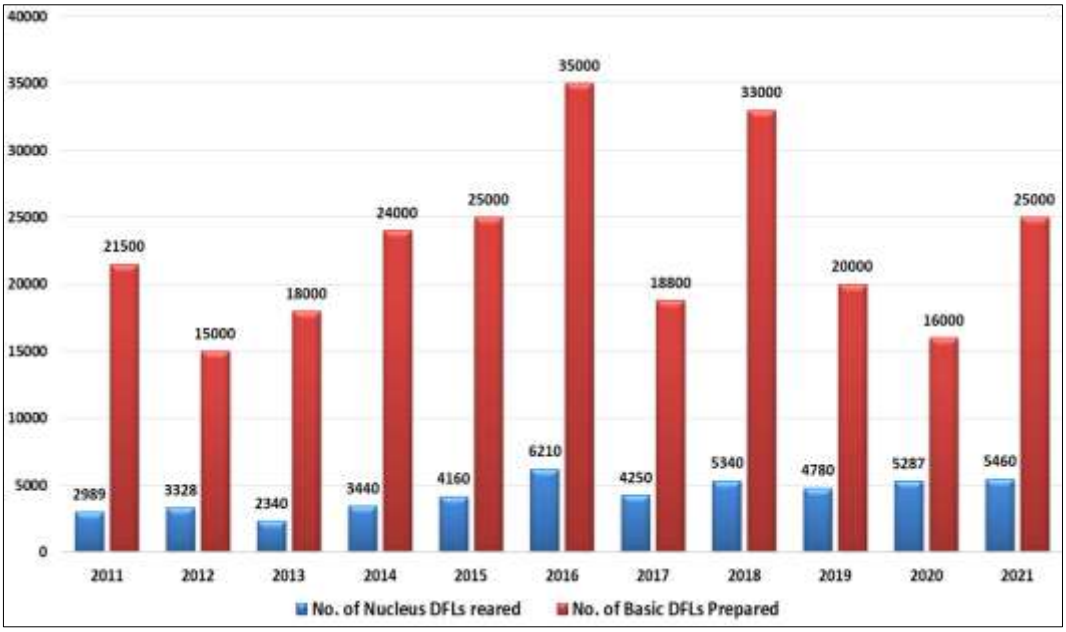


Fig 1: Nucleus seed multiplication into basic seed at PPC Medinipur during 2011 to 2022

Performance of TSPEC (PPC) Medinipur in terms of daba BV commercial seed production

The Basic DFL prepared during each year were reared to produce seed cocoons which were processed subsequently to produce commercial DFLS. The highest Basic DFLs reared were of 35000 during the year 2016 as correspondingly highest Basic DFLs (1265487) were prepared during that year followed by rearing of 33000 DFLs in 2018. Although highest number of 35000 Basic DFLs were reared in the year 2016, but the highest number of cocoons were harvested (1353000) @ 41 cocoons/DFL during the year 2018 as the year 2016 registered lowest cocoons of 38 per basic DFL reared. This might be due to influence of abiotic factors during the year 2016 especially during the rearing period. However, during all the other year, a minimum of 40 cocoons per DFL were recorded indicating proper care at the time of cocoon production process.

For the commercial seed production, the harvested basic seed cocoons were processed at PPC Medinipur where during the second grainage one commercial DFLs prepared using average 6 basic seed cocoons. The number of cocoons processed were ranging from 126887 in 2018 to 1265487 in 2016. Correspondingly, more Basic DFLs were prepared during the year 2016 i.e., 180782 DFLs, but in the year 2018, 166502 Basic DFLs were prepared @ 1:1 cocoon: DFL and the lowest number of commercial DFL were registered for the year 2012 i.e., 79714 DFLs from 558000 cocoons i.e., the ratio between cocoon and DFL was 7:1. The 1:1 cocoon DFL ratio during the year 2018 may be due to abiotic factors like extreme temperature, fluctuation in relative humidity, photoperiod etc. Each reared Basic DFL was multiplied into 5 times to produce commercial DFLs. the lowest multiplication rate (1:4) was reported for the year 2017 (Table 2 & Figure 2).

Performance of TSPEC (PPC) K. Balam in terms of daba BV basic seed production

PPC K. Bolam reared 38404 (Avg. 3491) nucleus DFLs to harvest 1843900 (Avg. 167627) cocoons during the year 2011 to 2022 with average of 48 Cocoon/DFL. Out of the 1843900 harvested cocoons, nearly around 153900 cocoons were not processed, and during the year 2021 harvested only 144900 cocoons but processed 211000 *i.e.*, additional cocoons to the tune of 66100 were sourced from Keonjhar zone of Odisha.

This PPC had reared maximum of 4250 basic DFLs in 2018 to minimum of 2320 in 2013 and correspondingly maximum (212500) and minimum (104400) cocoons were harvested for the respective years. The Year 2014 (51 cocoons) and from 2015 to 2018 (50 cocoons) recorded good yield per reared basic DFLs. Out of the total processed cocoons of 1690000 to produce basic DFLs, during each year from 2014 to 2020, 160000 cocoons were processed. The highest number of basic DFLs were recorded for the year 2016 and 2021 with cocoon: DFL of 6:1 and 8:1, respectively while lowest basic DFLs (16500) were prepared during the year 2013 @ 6 cocoons:1 DFL.

Table 2: Performance of TSPEC (PPC) Medinipur, Sundargarh, Odisha during 2011 to 2022IN terms of daba bv commercial seed production

Year	Basic Seed rearing					Grainage				
	Rearing crop	No. of Basic DFLs Reared	Hatching %	No. of Cocoons harvested	Yield (No. of cocoon/DFL)	Grainage crop	No. of cocoons Processed	No. of Commercial DFLs Prepared	Cocoon: DFL ratio	Basic DFL: Commercial DFL
2011	I	21500	90	881500	41	II	811000	115857	7:1	1:5
2012	I	15000	93	615000	41	II	558000	79714	7:1	1:5
2013	I	18000	89	738000	41	II	698000	99714	7:1	1:6
2014	I	24000	90	960000	40	II	908500	151416	6:1	1:6
2015	I	25000	93	1025000	41	II	996575	142367	7:1	1:6
2016	I	35000	97	1330000	38	II	1265487	180782	7:1	1:5
2017	I	18800	92	752000	40	II	688244	81256	8:1	1:4
2018	I	33000	93	1353000	41	II	126887	166502	1:1	1:5
2019	I	20000	95	789000	39	II	714652	102093	7:1	1:5
2020	I	16000	91	640000	40	II	614854	97836	6:1	1:6
2021	I	25000	92	1025000	41	II	989632	141376	7:1	1:6
Total/Avg.		251300/22845	92	10108500/918955	40	Total/Avg.	8371831/761076	1358913/123538	6:1	1:5

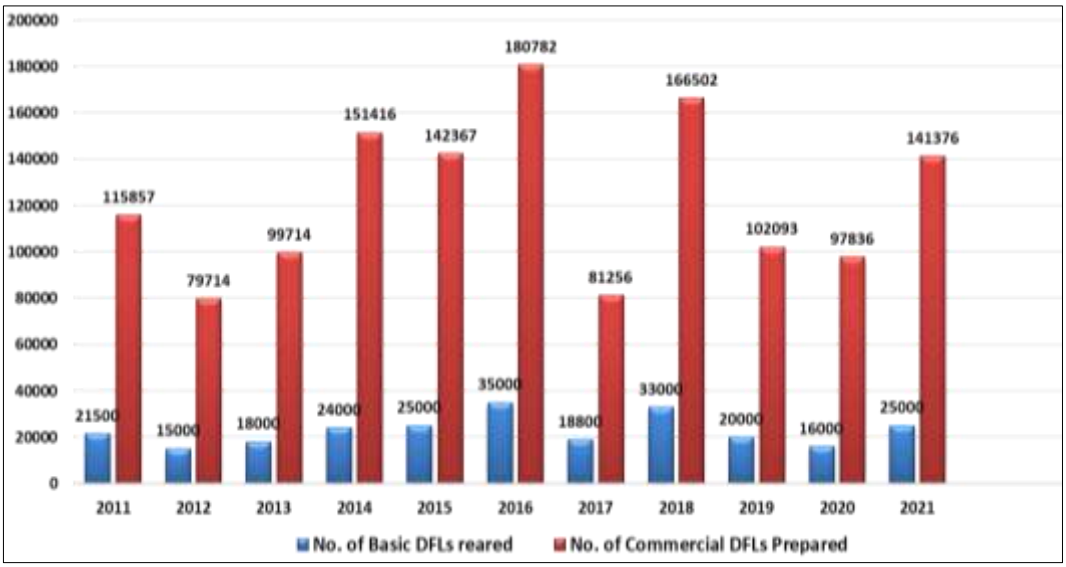


Fig 2: Basic seed multiplication into commercial seed at PPC Medinipur during 2011 to 2022

Table 3: Performance OF TSPEC (PPC) K. Bolam, Sundargarh, Odisha during 2011 to 2022in terms of Daba bv basic seed production

Year	Nucleus Seed rearing					Grain age					
	Rearing crop	No. of Nucleus DFLs Reared	Hatching %	No. of Cocoons harvested	Yield (No. of cocoon/DFL)	Year	Grain age crop	No. of cocoons Processed	No. of Basic DFLs Prepared	Cocoon: DFL ratio	Nucleus DFL: Basic DFL
2011	II	3114	97	140130	45	2012	I	125000	20800	6:1	1:7
2012	II	3300	92	148500	45	2013	I	135000	22500	6:1	1:7
2013	II	2320	93	104400	45	2014	I	99000	16500	6:1	1:7
2014	II	3200	95	164500	51	2015	I	160000	23000	7:1	1:7
2015	II	4100	91	205000	50	2016	I	160000	24000	7:1	1:6
2016	II	3500	92	175000	50	2017	I	160000	25000	6:1	1:7
2017	II	4200	90	210000	50	2018	I	160000	23800	7:1	1:6
2018	II	4250	93	212500	50	2019	I	160000	24000	7:1	1:6
2019	II	3560	89	164250	46	2020	I	160000	22000	7:1	1:6
2020	II	3640	90	174720	48	2021	I	160000	21000	8:1	1:6
2021	II	3220	93	144900	45	2022	I	211000	25000	8:1	1:8
Total/Avg.		38404/3491	92	1843900/167627	48	Total/Avg.		1690000/153636	247600/22509	7:1	1:6

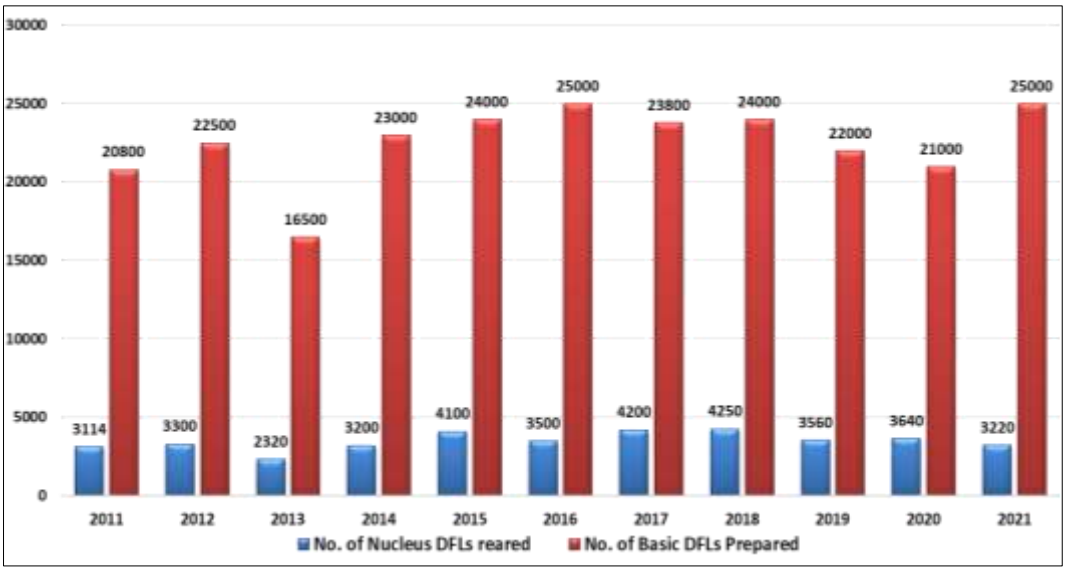


Fig 3: Nucleus seed multiplication into basic seed at PPC K. Balam during 2011 to 2022

The PPC was able to multiply each reared nucleus DFL into 6 times of basic DFL with highest nucleus to basic DFL ratio being recorded (1:8) for the year 2021 followed by 1:7 from 2011 to 2014. Thus, it converted 38404 nucleus DFLs into 247600 Basic DFLs (Table 3 & Figure 3).

Performance of TSPEC (PPC) K. Balam in terms of daba BV commercial seed production

During the last eleven years PPC K. Balam reared a total number of 247600 basic DFLs to produce 9818800 seed cocoons @ 40 cocoons per DFL. During this period on an average 22509 DFLs were reared and 892618 seed cocoons were harvested. Out of the total harvested cocoons of 9818800, around 9020000 were processed in the grainages indicating non-seed cocoons and/or for preservation loss of 798800 *i.e.*, around 8% and from the processed cocoons commercial DFLs produced were 1319026 @ 7 cocoons for each commercial DFL. On an average 820000 cocoons were processed to produce 119911 commercial DFLs during the year 2011 to 2022.

From the table it could be seen that maximum Basic DFLs reared was 25000 in 2016 and 2021 while the minimum was 16500 in 2013. Correspondingly, the minimum number of cocoons *i.e.*, 643500 were harvested in the year 2013 @ 39 cocoons/DFL but the maximum cocoons harvest of 1050000 was registered for the year 2016 when the highest cocoons of 42 /DFL was recorded. While the lowest cocoons /DFL was for the year 2012 @ 35 cocoon/DFL. For the year 2021 recording highest brushing and record lowest cocoon/DFL *i.e.*, 38 per DFL could be due to COVID-19 restrictions leading to no-timely activities. Correspondingly, highest number of cocoon 960000 and lowest of 580000 were processed during the year 2016 and 2013, respectively while the highest commercial DFL of 145320 were produced during the year 2017 by processing 872000 cocoons @ 6 cocoon/DFL.

The PPC on an average had multiplied 22509 basic DFLs into 5 times to produce commercial DFLs of 119911. Except for the year 2013 and 2017 when each basic DFL was multiplied 6 times, the ratio between the basic DFL to commercial DFL for all other years was 1:5 (Table 4 & Figure 4).

Table 4: Performance of TSPEC (PPC) K. Balam, Sundargarh, Odisha during 2011 TO 2022 in terms of DABA bvcommercial seed production

Year	Basic Seed Rearing					Grain age				
	Rearing crop	No. of Basic DFLs Reared	Hatching %	No. of Cocoons harvested	Yield (No. of cocoon/DFL)	Grain age crop	No. of cocoons Processed	No. of Commercial DFLs Prepared	Cocoon: DFL ratio	Basic DFL: Commercial DFL
2011	I	20800	92	832000	40	II	750000	107142	7:1	1:5
2012	I	22500	91	787500	35	II	720000	102857	7:1	1:5
2013	I	16500	85	643500	39	II	580000	94225	6:1	1:6
2014	I	23000	92	943000	41	II	850000	121428	7:1	1:5
2015	I	24000	95	960000	40	II	888000	126850	7:1	1:5
2016	I	25000	92	1050000	42	II	960000	137140	7:1	1:5
2017	I	23800	94	975800	41	II	872000	145320	6:1	1:6
2018	I	24000	89	936000	39	II	865000	123560	7:1	1:5
2019	I	22000	92	880000	40	II	826000	117750	7:1	1:5
2020	I	21000	94	861000	41	II	798000	113000	7:1	1:5
2021	I	25000	92	950000	38	II	911000	129754	7:1	1:5
Total/Avg.		247600/22509	92	9818800/892618	40	Total/Avg.	9020000/820000	1319026/119911	7:1	1:5

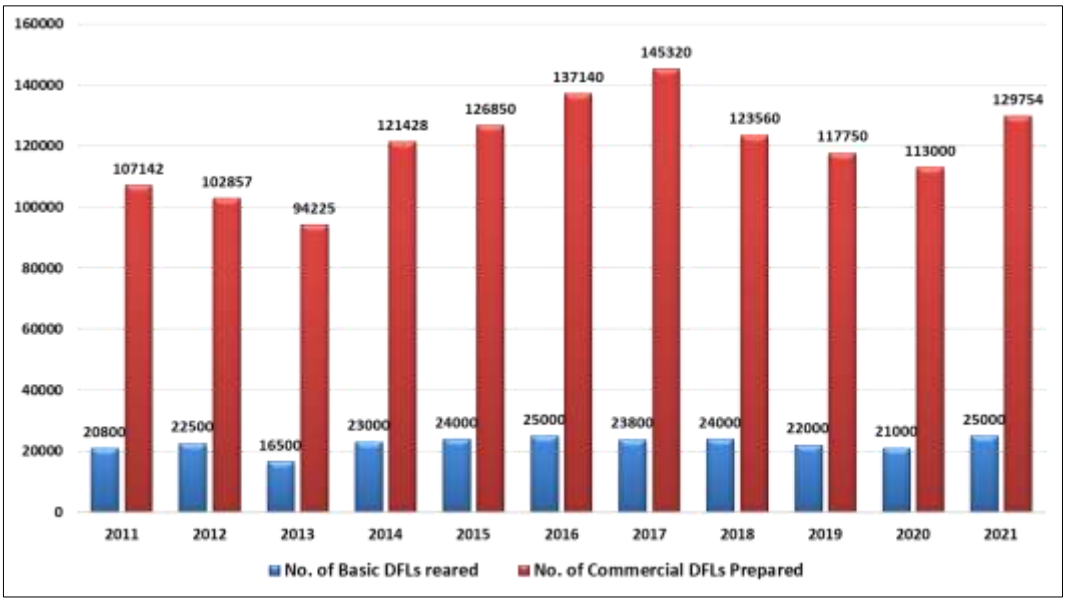


Fig 4: Basic seed multiplication into commercial seed at PPC K. Balam during 2011 to 2022

Conclusion

Sericulture based on four basic components like seed, breed, feed & management. Seed (DFLs) is the primary and basic reason for better production of silk. Odisha is a unique state in production of three varieties of silk, namely tasar mulberry and eri. Favourable climate and participation of the cooperative sector in this field will lead to the development of silk industry to a greater height. This sector is regarding to set most appropriate while available of good quality of seed for farmers. As we know if the seed is good then 60% problems solved before rearing. Basically, Sundargarh district rears two tasar crops all year long. In addition to taking up third crop in a very small number of places, the first crop (Ampatia) is known as a seed crop and the second one (Daba) is known as a commercial crop and is widely reared. In tasar sector, Central Silk Board alone is meeting the requirement of entire nucleus and part of basic seed in the country for multiplication and further production for supply of commercial DFLs to the rearers. There was a need to explore alternative ways of including States/ NGOs/ Societies/ SHGs, Private Graineurs, etc. in order to broaden the supply source and increase the production of tasar basic seed to meet its expanding demand. Different Tasar Seed Production and Extension Centres (TSPECs), also known as Pilot Project Centres (PPCs), were established in this direction. Department Of Handlooms. Textiles and Handicrafts, Govt. of Odisha established 15 nos PPC in all over odisha for fulfilling the requirement of basic DFLs in odisha. NGOs also involve in this movement for supplying basic DFLs to the seed rearers in Banspal block of Keonjhar district and also some part of Lahunipada block of Sundargarh district. As performance of ecoraces varies with regions and seasons, the maintenance and multiplication of basic seed under different tasar growing locations will enhance overall productivity of the country besides replenishment of breeder's stock within the time schedule. The maintenance and multiplication of basic seed stock of Daba ecorace under different parental lines over varied rearing seasons and regions can open avenues for choice of appropriate and suitable line for optimal exploitation of commercial cocoon production and productivity. 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.

Glimpses of TSPECs/PPCs & TSP, Khuntugaon

"Above Pictures are the new asan/arjun plantation field of TSP, Khuntugaon at baraguda of Sundargarh district for increasing the area of host plant for tasar rearing"

"After rearing of basic tasar cocoons its harvested by the nucleous seed rearers and sale to the PPCs for preservation of summer diapause".

”After collection of seed cocoons are sorting of good quality cocoons for preservation”

“After sorting of cocoons making garlands and hanging for summer preservation”

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