

Underutilised Commercially Important Sal Seed in Jharkhand

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ABSTRACT

Shorea Robusta (Sal) belongs to the family of Dipterocarpaceae. Sal has an important role in the economics of Jharkhand. This states cover about 21% of forest area. Sal is a deciduous tree that reaches up to 50 m height. Sal is very important tree for the tribal of Jharkhand for the economic as well as cultural and religious point of view. Sal leaves, flowers and fruits are used as fodder. Sal wood and Sal leaves are used for religious and social rituals of tribal's. Sal is a crucial plant for veterinary medicines. Sal is famous for its seed and oil. Sal seed and oil have important use in food and cosmetic sectors. The refined oil from Sal seed is used for cooking and substitutes for cocoa butter in chocolate manufacturing industries. It is also used for the production of vanaspati, paints, lubricants, biogas and biodiesel. Besides, de-oiled cake also has a good export market for cattle, poultry and fish feed.

Key Words : *Shorea Robusta*, Sal seed oil, Tribal

INTRODUCTION

Sal (*Shorea robusta*) is an important non timber forest product. It is spread across 10 million ha in India, covering approximately 14% of the total forest area of the country (Singh *et al.*, 2014a). Also it plays an important role in the Economy of some Indian states *i.e.* Orissa, Jharkhand and Madhya Pradesh. Orissa has the largest Sal forest area that covers an area of 38,300 kms (NTFP, 2015). About 20-30 million forest dwellers, mostly tribal depend on Sal seeds, leaves and resins for their livelihood. In the months of May and June, primary collectors are engaged for about six weeks in Sal seed collection. Sal is a deciduous tree, that grows up to 50 m height, with a stem circumference up to 5 m. Under normal conditions it reaches 18-32 m height, with girth of 1.5–2 m. The stem is clean, straight and cylindrical, often bearing epimorphic branches. The pinnacle is spreading and spherical. The bark is dark brown in colour. The average temperature required for the growth of this tree is 22-47°C throughout the year. The tree requires mean annual rainfall around 3000 mm and maximum 6600mm. Sal grows in deep, well-drained, moist, slightly acid, sandy to

clayey soils (Singh *et al.*, 2014b). Leaves are reddish, delicate green, simple, shiny, about 10-25 cm long and broadly oval at the base, with the apex tapering into a long point. Flowers are yellowish-white colour arranged in large terminal or axillary racemose panicles. Sal fruit of full size is about 1.3-1.5 cm long and 1 cm in diameter, it has surrounded by segments of the calyx enlarged by 5 unequal wings about 5-7.5 cm long. Sal seed has brown in colour, it has calyx and wings. The decorticated or deshelled seed contain a thin and brittle seed kernel. The kernel has 5 segments covering the embryo (Pali, 2013). The seed contains 34.6% of fat (Singh *et al.*, 2014b). Sal seeds are rich in fat and constitute about 69% symmetrical triglycerides, which makes them potentially useful for the food industries. It forms the primary ingredient for a diverse range of products such as oil, soap, cocoa butter equivalent in chocolate manufacturing (Saini *et al.*, 2013). Sal fat is also used in the confectionery industries for processing and production of Vanaspati ghee. Sal seed is identified as a potential source of biodiesel production (Pali, 2013). At present about 1.50 million metric tons of Sal seeds are produced per year in India, which generates around 1.32 million

metric tons of de-oiled cake after oil extraction. Sal de-oiled seed cake can be considered as a prominent inducer for protease production (Saini *et al.*, 2013; Chaitanya, and Naithani, 1998). The de-oiled cake is used in proportions up to 20% in concentrates for cattle feed. At present the cake is used for non-biological processes such as fuel for boiling in solvent extraction plants, as a sizing material in textile industries and coal briquettes (Mahdi *et al.*, 2012; Saini *et al.*, 2013).

Sal Fruit:

Sal fruit is green in colour. A matured fruit is of 1.3-1.5 cm long and have diameter of 1 cm. It is attached to calyx which is pink in colour and has 5 unsymmetrical wings ranging from 5-7.5 cm in length. Fruit contains kernel and pod (66.4%), shell and calyx (33.6%). The fruit generally ripen in month of May. Sal fruits pulp is edible, as it contains sugar, citric acid, malic acid and tartaric acid. Traditionally Sal seed is being used as medicine in veterinary science. Many report shows that feeding the Sal fruits to chicken is an excellent way to maintain their health. The fruit pulps are also used for fed to chickens as both a vaccine and medicine for respiratory and other diseases. Also the stem, bark and flowers of Sal exhibited antifungal activity (Saini *et al.*, 2013).

Sal Seed:

Sal seed, is light brown in colour, contains calyx and wings. It is mainly used for oil extraction. The de-shelled seeds contain a thin seed coat and seed pod. The kernel has five segments covering the embryo. Nearly 2 kg of seed yields 1 kg of kernel (Singh *et al.*, 2014a). The seed contains 34.6% fat, 8.46% of moisture, and 6% of ash. The proximate analysis of Sal seed is reported in Table I (Singh *et al.*, 2014b). Sanjoy (2015) were reported that Sal seed has a largest demand in Indian export market and seven multinationals companies that account for 60% of the global chocolate and confectionery production. Sal fat can also be used as a substitute for cocoa butter.

Post-Harvest Processing Harvesting:

Sal seeds are harvested and collected in second to third week of May. Strong wind or storm helps in bumper fall towards end of May. Forest dwellers get an opportunity and sufficient time to harvest the seed. In rural areas almost all men, women and children's from

poor or marginal farmers engaged in harvesting the Sal seeds. Generally harvesting is done in forenoon because during this time there is apprehension for casual storm or rainfall in the afternoon (Grover *et al.*, 1985).

Cleaning and Grading:

After harvesting, cleaning and grading is done manually, to remove the foreign, unwanted, contaminated or insect attacked seeds. Cleaned seeds are graded based on size and quality parameters of the seed manually. These two operations are the most important post-harvest operations, to increase the self-life and quality of the seeds (Sahay and Singh, 2004).

Drying:

Drying of agricultural products is an important unit operation under post-harvest operation. At the time of harvesting, Sal seed contains around 60 to 80% moisture. It is dried up to 8 to 10% moisture content (Rao *et al.*, 1971). The most common methods of Sal drying are by sun drying method. Drying process is carried out to minimize processing loss and storage loss. But this sundrying process is a time consuming process, low capacity, inefficient process and also it is depended on sunlight. Hence there is a requirement of efficient low cost drying methods for the Sal seeds in rural areas.

Storage :

Storage is a crucial issue in the process of Sal kernel collection and shipment. The quality of Sal fat depends on how the kernels have been processed and stored. Since in the month of May and June follows the Sal seed collection season, there is a risk that a high moisture content in the kernel increases the free fatty acid level, making it unfit for use in the food sector (Grover *et al.*, 1985). After drying, the primary collectors invariably store Sal seeds in their houses using gunny bags, at ambient room temperature (Sanjoy, 2015).

Processing:

Timely processing plays an important role in enhancing oil and other quality (Nasrallah *et al.*, 1981). The quality of oil increases if the kernel has minimum moisture content. Sal seeds are processed in two ways. In one process seeds are beaten on a plain hard ground area with a wooden stick to remove the wings. In this process the wings are separated from the seed kernel. This is the recommended process for manual collection

since quality and nature of kernels remains unchanged. In second process seeds are spread on plain dry hard ground area and putting a light fire to Sal seed. With the light fire the wings are burnt. The round seed kernel with shell and covers remain unhurt. This is a risky process, but easier for de-winged. Sometimes fire adversely affects seed and oil contents. In case of cloudy weather or pre-monsoon showers this is the only process for de-winged fruits. Other methods like Sal seeds are spread on hard ground area and pressed by a wooden roller or stone roller. During the process of rolling under pressure the kernels come out from the whole seed. This can be separated by using natural air blowing or artificial air blower. After this process Sal seed kernels are kept in dry place to increase the quality of oil (Sanjoy, 2015). Sanjoy (2015) was reported that, of late, it is being suggested that in order to collect a dry kernel, the seed should not be burn, as this affects the quality of the kernel and enhances the free fatty acid content, making it highly uncompetitive in the export market. Besides, another area of concern for Sal seed processing is the time taken between collection and shipment to factories for crushing. Oil quality is high if the gap between collection and crushing is kept to a minimum. The ideal gap is up to a maximum of 72 hours, to maintain a low free fat acid level. But normally the process of procurement and shipment to traders is so lengthy that the gap can be more than 4 or 5 months. There is no equipment's available for Sal seed decortication or processing. Separation of Sal kernel from the whole seed, is done by manually, which is a labour intensive process, time consuming, low efficiency and it is also affect the health hazards.

Sal Fat or Oil:

The extracted crude Sal oil is greenish-brown colour and has a characteristic odour. Due to the presence of more saturated fatty acids, it is solid at room temperature. Because of this, it is known as Sal fat or Sal butter (Grover *et al.*, 1985). Sal fats were extracted by three methods. Traditionally, fat is determined by water rendering method. Secondly, in mechanical method, oil is extracted by oil expeller and rotary mills. In the third method, oil was extracted by solvent extraction, in which the Sal seeds are pressed as flacks first in a flaker mills and then exposed to solvent extraction. The oil contains 45-60% stearic acid, 18-carbon saturated fatty acid, and 35-50% of oleic acid, which is a mono unsaturated fatty acid, with 18 carbon atoms. The extracted fat is used as

cooking oil, after refining. And also refined oil is used as substitute for cocoa butter in chocolate manufacturing (Nasirullah *et al.*, 1982). Mishra (1980) has reported that physicochemical properties, hydrolysis, vitamin contents and storage study of seed oil and its component of fatty acids compared well with those of other edible vegetable oils. Mishra (1980) has reported that, it can be used for edible purposes and their studies showed a good digestibility.

Application of Sal Seed Oil:

Sal seed is an important industrial crop, widely available in central part of India. Due to lack of technology, low level processing and unsustainable harvesting methods it remains underutilized. It has a wider opportunity in confectionery and cosmetic industries and in international terms of trade reserving space for Sal oil in chocolate making (NTFP, 2015: Geover *et al.*, 1985). Some important points on Sal seed oil are highlighted below:

- a) Refined modified Sal seed oil is used for cooking.
- b) Sal fat is used in the manufacturing of edible ghee or Vanaspati.
- c) It is also used for soap manufacturing industries up to 30%.
- d) It is also used for paints, pigments, lubricant, and auto oil.
- e) Sal seed oil can also be used for production of bio gas and biodiesel (Saini *et al.*, 2006).
- f) The de-oiled seed cake is a cheap natural substrate for lipase production under submerged fermentation (Saini *et al.*, 2013; Mahdi *et al.*, 2012).
- g) The Sal seeds are also used in tribal medicine for example seeds are used for the cure of digestive ailments.

Other Uses of Sal:

- a) **Fodder:** Leaves, flowers and fruits are lopped for goats and sheep. Seed cake is also fed to cattle (Mukhopadhyay and Ray, 1997).
- b) **Leaves:** The dry leaves of Sal are a major source for the production of leaf plates and leaf bowls called as patri and donain Jharkhand. The leaf is knitted so nicely that it is used as leaf plate or saucer plate during the festivities. The non veg items are covered with the lead made

temporarily of Sal leaf which adds to the smoky taste of the food.

- c) **Sal Mushroom:** During the pre- monsoon and first rain in the forest, the villagers collect sakhua mushroom (locally called Kukhri) which grows in and around the sakua tree. More often this Sakhua mushroom is sold in the local haat for a handsome price ranging from Rs. 400 to 500 per kg. Besides this the villagers also hunt for Rugra which is also found in the sal forest hidden under the mud, comes out during the first rain in the monsoon period. These are high priced local cuisine which is gifts of Sal forest.
- d) **Sal Bark:** The villagers also use the Sal bark for any digestive related problem
- e) **Timber:** The hardwood is dark brown colour, strong, and durable. It is used for house construction, naves and felloes of cartwheels, door and window frames.
- f) **Sal twigs:** Sal twigs are used as tooth brush.
- g) **Sal Resin:** Sal Resin is used for medicinal purpose.
- h) **Erosion control:** Sal has a large spreading superficial root system that holds soil together.
- i) **Water conservation:** Sal has the capacity to hold water in itself which supports water conservation .
- j) **Soil improver:** The seed cake has been used as fertilizer.
- k) **Boundary or barrier or support:** It is planted along the boundaries of fields.

l) **Intercropping:** Sal plant can be raised with agricultural crops.

m) **Cultural importance:** Sal trees and leaves have religious implications for Tribal people.

Intribal marriages Sal wood and Sal leaves are used to make madap known as madwa to carry out marriage religious rituals under it.

The present study is conducted to keep all above facts under consideration and evaluate the underutilised commercially important Sal Seed in Jharkhand

METHODOLOGY

Study area:

The present study is conducted taking both primary and secondary approaches. Primary data has been gathered through field monitoring carried out in different villages in four districts of Jharkhand. The following eight villages from four districts of Jharkhand were taken for sample study.

The detailed profile of the 20 sample Villages from four districts namely Hazaribagh, West Singhbhum, Latehar and Ranchi districts of the state Jharkhand.

The primary data was conducted through structured interview with purposive selection of the samples. 200 structured interviews were conducted from four villages from four districts of Jharkhand. Both men and women were interviewed.

FGDs (Focus Group Discussions), observation and visit to local markets were also done and used as the tools to closely examine the activities involved in studying

Table 1: Profile of the sample villages of Hazaribagh district

Sample Villages Census Parameter	Bartua	Bhurkunda	Chainpur	Jarjara	Lurunga
Total Population	514	446	1695	2276	1194
Total No of Houses	88	71	290	437	249
Male Population	257	221	870	1164	634
Female Population	257	225	825	1112	560
Scheduled Tribes Population	492	175	618	1820	171
Working Population	152	182	879	923	483
Child(0 -6) Population by 2011	84	69	232	336	159
Main Workers	51	85	362	616	258
Cultivators	35	7	179	153	194
Agricultural Labourer	10	22	50	144	35
Marginal Workers	101	97	517	307	225
Marginal Workers(Male)	65	51	289	113	93
Marginal Workers(Female)	36	46	228	194	132

<https://www.census2011.co.in/>

Table 2: Profile of the sample villages of West Singhum district

Sample Villages Census Parameter	Babaria	Baihatu	HaldiPokhar	Khandkhori	Kumardungi
Total Population	992	1307	1020	1977	3195
Total No of Houses	197	289	189	405	670
Male Population	517	660	531	982	1615
Female Population	475	647	489	995	1580
Scheduled Tribes Population	702	1045	1000	1607	1961
Working Population	525	631	521	1035	1464
Child(0 -6) Population by 2011	194	238	209	443	618
Main Workers	233	228	62	327	878
Cultivators	177	58	14	22	513
Agricultural Labourer	25	93	34	195	148
Marginal Workers	292	403	459	708	586
Marginal Workers(Male)	138	168	232	277	172
Marginal Workers(Female)	154	235	227	431	414

<https://www.census2011.co.in/>

Table 3: Profile of the sample villages of Latehar district

Sample Villages Census Parameter	Betar	Mahuamilan	Manatu	Marma	Nagar
Total Population	721	2078	618	642	2078
Total No of Houses	114	388	122	110	364
Male Population	373	1033	308	323	1072
Female Population	348	1045	310	319	1006
Scheduled Tribes Population	543	1273	353	254	865
Working Population	380	1036	304	259	901
Child(0 -6) Population by 2011	136	357	100	132	379
Main Workers	279	116	281	223	73
Cultivators	245	92	159	222	34
Agricultural Labourer	17	15	67	0	9
Marginal Workers	101	920	23	36	828
Marginal Workers(Male)	38	449	15	16	495
Marginal Workers(Female)	63	471	8	20	333

<https://www.census2011.co.in/>

Table 4 : Profile of the sample villages of Ranchi district

Sample Villages Census Parameter	Bangaon	Chama	Chamranga	Chora	Lapra
Total Population	679	3622	693	2052	3559
Total No of Houses	129	703	136	356	682
Male Population	336	1854	331	1035	1846
Female Population	343	1768	362	1017	1713
Scheduled Tribes Population	519	1953	634	1557	1677
Working Population	401	1413	166	825	999
Child(0 -6) Population by 2011	117	647	109	350	610
Main Workers	175	1249	159	671	787
Cultivators	166	923	136	270	128
Agricultural Labourer	0	294	17	314	60
Marginal Workers	226	164	7	154	212
Marginal Workers(Male)	112	59	1	55	127
Marginal Workers(Female)	114	105	6	99	85

<https://www.census2011.co.in/>

the commercial viability of Sal products in the State.

Survey and data collection:

Under the present study, data were collected through household surveys, trader surveys, focus group discussions, and collation of secondary information. Structured questionnaires were used to capture the primary information from forest village communities and small traders. The questions were grouped into the following categories *i.e.* production/collection, processing, storage, value addition, price, transport and sale. The focus of the survey was confined to

(a) Volume collected for sale of Sal products,

(b) Household income through commercialization of Sal products and

(c) Major barriers associated with collection/production, processing/storage and trade of Sal products. The survey was conducted by visiting each village mentioned in Table 1, 2, 3 and 4. Interviews with a group of collectors (including men and women separately and together) were used for this purpose, along with more participatory research methods such as FGDs. FGDs with selected groups on the basis of purposeful sampling were conducted to obtain maximum information. The samples were selected from the age groups 15-46 and above. These included local youth, village representative, elderly person, men and women.

For the secondary source, the information was available through various literatures like books, journals,

periodicals, government data, reports, schemes, notification and consultation with expert organizations and local NGOs..

Besides, the household survey, small traders associated with concerned villages were also contacted for the survey. Market rates and market-chain was further cross-verified through visiting local traditional markets (locally called Hat) nearest to sample villages.

Data Interpretation:

The state of Jharkhand is spread over an area of 7.97 million hectares. Around 29% of the Jharkhand's area is under forest covering and 3.4% of the forest cover of India ranks 10th among all states. Jharkhand is also known as the land of the forest. A vast majority of the tribal population live in or near the forest, trying to make both ends meet on a living based on Non- timber Forest products and subsistence agriculture. Since the early 1990s, the role of NTFPs for sustainable forest use and poverty alleviation has received increased attention.

This study Analyses the Commercial importance of Sal products (The Minor Forest Produce) in Jharkhand. It specifically focusses to find out the potential financial benefit for the tribal who are involved in collecting and selling of Sal products. Sal products are seasonal and collected once in a year. The tribals of the sample villages collect and sell it either to the small paikaries (middle men) or directly in the local haat.

Districts	Division	Community/C ommunities	Location/Village	Interviewed		Total number of respondents
				Men	Women	
Hazaribagh	North East part of North Chotanagpur Division	Oraon	Bartua, Bhurkunda, Chainpur, Jarjara, Lurunga	25	25	50
West Singbhum	SinghbhumKolhan division	Ho	Babaria, Baihatu, HaldiPokhar, Khandkhori, Kumardungi	25	25	50
Latehar	Palamudivision	Oraon	Betar, Mahuamilan, Manatu, Marma, Nagar	25	25	50
Ranchi	South Chotanagpur division	Oraon, Munda	Bangaon, Chama, Chamranga, Chora, Lapra	25	25	50
Total Respondents						200

Sr. No.	Activities involved	Data Collection	Places visit	Total
1.	Personal interviews	Structured Interview	In all twenty sample villages from four districts of Jharkhand	200
2.	Focused Group Discussion	Interaction with participants	In all twenty sample villages of four districts of Jharkhand	20 x10 = 200
3.	Local market visit	Observation / Visit	In all twenty sample villages of four districts of Jharkhand	20

Field observation:

Table 7 : Seasons and Economy of Sal Seed Commonly in Twenty Villages

Seasons	NTFPs Collection for Commercial	Economy
April-June	Sal Seeds	All forest dwellers tribal people work 90 days full employment with average earning 3500-6500 per family.

Sources: Field Survey

Table 8 : Sal seed Used for commercial purpose by the Tribals

Name of the Sal Products	Availability	Monetary Value
Sal Seeds	3 months	5-12/Kg

Sources: Field Survey

of collection of seed is by hand-plucking from tree in the forests. Some villagers practice the method of burning the ground litter for easy collection of seed. After picking the seeds are sun dried. After sun drying they burn it so that it is easy to de- seed the outer cover of the fruit. Then the seed coats are separated manually to obtain the seeds. After separation, it is sold to middlemen in local haat bazar. Now a days the paikaris(middle-men) visit the houses from door to door and collect the produce in a measure called 1 tina which generally holds 16 to 17 kg . In return the household member get Rs. 5 to 10 per kg. Study showed that no value addition of Sal Seed is taking place in all the districts of Jharkhand. In the districts of Hazaribagh, West Singbhum, Latehar and Ranchi, the villagers are selling the Sal seed at the local market. Although, other districts of Jharkhand have abundance of Sal trees in their areas, the people are not involved in

Table 9 : Income (in Rs.) generated through potential Sal seed collection in studied villages

Districts	Village	Collection for sale (in Quintal)/ Year (average)	Sale Price (in Rs.)/ kg	Income (in Rs.)/ Year
Hazaribagh	Bartua,	510	12	6,12,000
	Bhurkunda	550	12	6,60,000
	Chainpur	450	12	5,40,000
	Jarjara	545	12	6,54,000
	Lurunga	530	12	6,36,000
West Singbhum	Babaria	180	7	1,26,000
	Baihatsu	215	7	1,50,500
	Haladi Pokhar	250	7	1,75,000
	Khandkhori	219	7	1,53,300
	Kumardungi	250	7	1,75,000
Latehar	Betar	550	12	6,60,000
	Mahuamilan	620	12	7,44,000
	Manatu	450	12	5,40,000
	Marma	550	12	6,60,000
	Nagar	650	12	7,80,000
Ranchi	Bangaon	80	12	96,000
	Chama	52	12	62,400
	Chamranga	51	12	61,200
	Chora	50	12	60,000
	Lapra	75	12	90,000

Sources: Field Survey

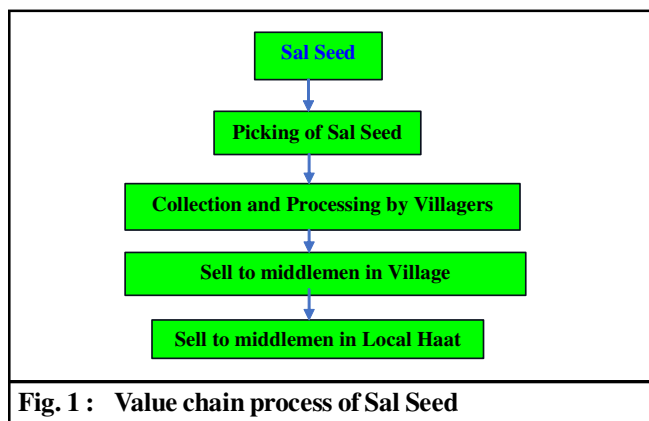
RESULTS AND DISCUSSION

Findings and Analysis of Sal Seed:

Sal Seeds are collected by the villagers after ripe fruits start falling. The collection of seeds continues till the onset of monsoon. After rain set in, the collection is discontinued as many areas becomes inaccessible and the fallen seeds start germinating. Most common method

the value chain process (Fig. 1).

In West Singbhum District, extensive study has been done on awareness and value chain process of Sal seeds, but people’s involvement less as was seen during field visit. This is because the collection and processing of Sal Seed is a tedious job. Second, the market value of Sal seeds and government rate is very less (Rs. 5-12 only),



therefore people are not interested. The effort put in for collection of the Sal seed is tedious and not lucrative enough for the villagers to earn profit out of it.

Third, in most of the districts villagers are not aware of value addition of the Sal Seed. Fourth, According to experts the factors that lead to the extinction of Sal trees from India are Commercial logging, used to build homes, furniture, railways sleepers etc. There are also illegal cutting of Sal Trees taking place in these areas. Villagers are cutting the trees for the wood which in turn is used for furniture making, in building houses etc. As told by the villagers sometimes the forest department discouraged the villagers to collect Sal seeds and sell those in the local markets. The forest department argues that there is large number of deforestation taking place and for conservation of forest the villagers are not allowed to pick the Sal seeds so that seeds will grow into sapling and ultimately reforestation will take place.

There is need for conservation and protection of Sal trees. Though the Government and forest department is trying to protect the deforestation of Sal forest yet the same is not enough. The responsibility should be given to the Gram Sabha so that they own the responsibility of protecting and conserving the Sal forest.

The district of Hazaribagh and West Singhum are putting lots of effort in collection of Sal seed and during the season almost all the houses in the village are involved in collection of Sal seed and therefore the local authorities as well as the Government mechanism should make an effort to help them and encourage them in collection of the same in large numbers.

The traditional method like burning the Sal wings or sun drying or beating the Sal wings is an ancient method. An empirical research has to be done which will help the separation of Sal wing and the produce is easily separated

from the kernel.

Conclusion:

Shorearobusta or Sal is one of the most important oil yielding forest plants in India. It is a semi evergreen or deciduous tree, widely distributed in tropical regions of India. It is also an important industrial crop having industrial uses. Sal oil is also known as Sal butter. It is used as cooking oil after refining. Sal fat is used in the confectionery industries, for processing and production of vanaspati and ghee. Also, Sal fat is used in the pharmaceuticals and cosmetic sector, for manufacturing of medicine. Sal seed oil can also be used economically for production of bio gas and biodiesel. Due to the lower value and lack of technology for Sal seed decortication or processing, it remains underutilized largely and hence it is available at a very cheap cost.

Recommendations and Suggestions:

In order to execute the livelihood development of tribal people, the Sal forest must be developed by the Government and Non-government Agencies. The following recommendation and suggestion may be implemented in this regard.

Sal forest cover should be increased by converting the waste land into Sal forest land. Here, in this case Sal seed and Sal Saplings should be distributed to tribal people for plantation and management of Sal forest should also be carried out by the tribal people with the supervision of forest department.

- The Sal seeds should be purchased by the TRIFED (Tribal Cooperative Marketing Federation of India), LAMPS or SHGs from the village collectors at proper price.

- The tribal people should be made aware about the sustainable uses of Sal seeds.

- Tribal people especially the tribal women should be included in forest conservation and management system.

- The government should reconsider increase in MSP of Sal seed to encourage villagers in collection of same and selling the same in the local haat bazar.

- The Local youth should be incentivised in collection of the same from the household in place of paikars or the middleman. Alternatively, there should be a cooperative form to look into the collection and selling of Sal seed to the TRIFED or LAMPS at appropriate rate.

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