

From President's Desk.....

Management of natural resins and gums sector during and after COVID – 19 crisis.



The COVID-19 crisis in India has left farm and forest produce un-harvested in the fields, collapsed supply chains and disturbed the transport network. March-May is the peak of Minor Forest Produce (MFP) season and farmers are finding it difficult to sell their produce. In most places the *Mandis* in tribal areas are constrained to lockdown which impacting adversely on livelihoods. During this crisis, there is need to support farmers with input provision, providing extension and advisory services to members, procurement of products from members, post-harvest operations, marketing, income support to members. In the absence of raw materials and non-availability of skilled man-power, the processing industries also are either shut down or working much below their capacity.

In this situation, *Van Dhan Vikas Kendras* (VDVKs) and Farmers Producer Organisations (FPOs) can be a link between producers and consumers. We should fully leverage the Governance and Implementation mechanism established under Prime Minister *Van Dhan Yojna* (PMVDY) by appointing PMVDY SHGs as Procurement Agents under MSP for MFP which will enable aggregating the produce of member farmers and collectively transporting them to industry. There are 1,205 VDVKs, 3.6 Lakhs MFP Gatherers, 18, 075 SHGs across 28 States/UTs and about 7,000 FPOs registered in the country. There is need to take policy decisions and formulate guidelines for state governments to make efforts to connect VDVKs / FPOs to the processing industry, exporters, bulk buyers and big retailers to maintain the supply line. The VDVKs / FPOs should be allowed to sell their produce through e-National Agriculture Market (e-NAM) that does not require the produce to come to markets.

Impact of COVID-19 is likely to prevail for some more time, therefore, bringing VDVKs / lac based FPOs on board to a consortium is extremely important to keep the supply chain normal and they also need to diversify their activities with value addition, direct marketing etc. Market linkages are still weak and VDVKs / lac based FPOs are disconnected from urban consumers. Innovative models using ICT platforms are required to gather inputs about demand. VDVKs / lac based FPOs need to be an integral part of coordination and convergence of extension services along with ATMA and KVK in the district. A mechanism is needed at district level to share with VDVKs / lac based FPOs the advisories that go to ATMA and KVKs. During times of disaster, this will help in fast dissemination of reliable information. Employing agricultural students during their industrial training, RAWE programme or research project to work with VDVKs / lac based FPOs. They could be tasked with developing business models for them and improve their performance in the supply chain.

In the present circumstances of lockdown and extreme distress faced by tribals, Ministry for Tribal Affairs has written a letter to the 15 States to advise the State Nodal Agencies for undertaking procurement of MFP at Minimum Support Price. Presently, price of lac in open market is higher than the MSP, therefore, how much succour this step will provide the cultivators remains to be seen. We need to learn lessons from the current situation and prepare ourselves for a future with unforeseen disasters and crises.

About NRGs....

Indian subcontinent is a major hub of biodiversity. Several forest products have significant importance in social and economic life in tropical areas. These forest products are classified into wood and Non-Wood Forest Products (NWFPs). NWFPs include natural resins, gums and exudates, leaves (*tendu*), turpentine, perfumery oils from roots, stumps and

fruits of various tree species. These are also natural sources of spices, medicines, dyes and tannins. Most of NWFPs are exported, but some are consumed locally also. In many areas, NWFPs are more profitable than timber; despite of having more value, the sustainable management of forests has been traditionally focused on timber production. However, in the recent decades the interest for NWFPs have been increased,



as a result of the international shift to multifunctional sustainable forest management, which aims at optimizing the provision of multiple goods and services, while maintaining the equilibrium of forest ecosystems. Within this framework, the promotion and utilization of NWFPs is identified as a priority area by the FAO. However, the particularities in harvesting these products distinguish their management from that of timber. For example, some NWFPs have short harvesting period and products perish soon after this period. Additionally, their frequent, uncontrollable and illegal harvest may have negative effects on the forest ecosystem.

Current status of NRG sector

NRGs of commercial importance like lac (*Kerria lacca*(Kerr)), pine resin (*Pinus roxburghii* Sarg.), guar gum (*Cyamopsis*

tetragonoloba L.), gum karaya (Sterculia urens Roxb.), dhawada gum (Anogeissus latifolia Roxb.), tamarind gum (Tamarindus indica L.), char /piyar gum (Buchanania lanzan Spreng.) and babool gum (Acacia nilotica L.) are produced in our country. India holds monopoly in international trade over some of the NRGs such as lac, gum karaya and guar gum.

NWFPs based on their chemical composition may be classified in three categories namely natural resins, natural gums and gum resins. Natural resins are solid or semi-solid materials, usually a complex mixture of organic compounds called terpenoides, which are insoluble in water but soluble in certain organic solvents. Resins are secretion of several plants, particularly coniferous trees.

Resins are used in the production of varnishes, adhesives and food glazing agents. These are also used as raw material for synthesis of incense and perfume. This group of natural resins includes lac secreted by an insect *K. lacca* (Kerr) and plant originated products like rosin, copal and dammer. Solidified resin from which the volatile terpene components have been removed by distillation is known as rosin. Natural gums are polysaccharides of natural origin, capable of causing a high viscosity in the solution. Most often these gums are found as exudates from woody elements of plants or in seed coatings. In the food industry these are used as thickening, gelling and emulsifying agents and stabilizers.

These are also used as adhesives, binding agents, crystal inhibitors, clarifying agents, encapsulating agents, flocculants, foam stabilizers, swelling agents, etc. Natural gums can be classified according to their origin. Firstly, tree exudates e.g., gum arabic, gum ghatti, gum tragacanth, gum *karaya*, *guar* gum, locust bean gum, chicle gum, dammar, mastic gum,

psyllium gum and spruce gum. Secondly, originated from seaweeds e.g., agar and carrageenan and thirdly, produced by bacterial fermentation e.g., gellan gum and xanthum gum. They can also be classified as uncharged or ionic polymers (polyelectrolyte).

Gum-resins are the natural mixtures of gums and resins in variable proportions therefore possess properties of both the groups. They contain traces of essential oils and are partly soluble in water. They have a penetrating and characteristic odour and taste and obtained from the plants. Olibanum/salai gum (*Boswellia serrata*), guggal (*Commiphora wightii*), myrrh, asafoetida, etc. are the major gum resins of national importance.







Fig. 2. World import flow of lac, natural gums, resins, gumresins and balsams

According to ITC calculations based on UN COMTRADE statistics, the world trade aggregation of lac, natural gums, resins, gum-resins and balsams during 2018 was about



1381.13 million US dollars.Out of this, the world export aggregation of lac, natural gums, resins, gum-resins and balsams during 2018 was about 496.60 million US dollars. A decadal data (2008-2018) on world EXIM aggregation of lac, natural gums, resins, gum-resins and balsams were analyzed and presented in Fig.1 and Fig. 2. Since 2012, deceleration in the value of world export aggregation was observed and stagnation was found in the value of world import aggregation during the similar period.



Fig. 3. Breakup of the World export aggregation of NRGs during 2018



Fig. 4. Breakup of the World import aggregation of NRGs during 2018

However, the value of world export aggregation of lac, natural gums, resins, gum-resins and balsams during 2017 increased over the previous year and again declined by about 10% in 2018.

Major suppliers of NRGs contributing about 88.16% share in international market are France (28.07%), India (14.08%), Indonesia (10.96%), USA (6.78%), Germany (6.48%), Brazil (6.25%), Thailand (3.43%), Greece (2.56%), Italy (2.43%), UK (2.39%), UAE (2.31%), China (1.28%) and Singapore (1.14%). Rests of the 11.84% NRGs are supplied from 87 countries across the world (Fig. 3).

Similarly, the world import aggregation of lac, natural gums, resins, gum-resins and balsams during 2017 was about 868.27 million US dollars.

Major importers of NRGs contributing about 83.90% share in the international market are India (19.30%), France (11.10%), United States of America (7.20%), China (5.50%), Germany (5.10%), Portugal (4.20%), Italy (3.30%), Russian Federation (3.30%), Viet Nam (3.10%), United Kingdom (3.00%), Spain (3.00%), Bulgaria (2.30%), Singapore (2.00%), Netherlands (1.90%), Ireland (1.40%), Switzerland (1.30%), Turkey (1.30%), Japan (1.10%), Brazil (1.10%) and Canada (1.10%). Rest of the 16.10% demand of NRGs arose from the 109 countries across the world (Fig. 4).

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Challenges of Marketing and value addition of tribal based commodities during COVID19 period:

There are two major Challenges in post Covid19 scenario, one is dislodgment of labour force and another is distracted supply chains.

Current Status PMVDY: It has been decided to provide a support of Rs. 9 Lakhs per *Van Dhan Vikas Kendra* (VDVK) towards procurement of Minor Forest Produce to the State level Implementing Agencies of PMVDY. One VDVK consists of 15 Self Help Groups (SHGs) of 20 members – total 300 members per VDVK with a provision of Revolving Fund (Rs. 60,000) for SHG level procurement. It will enable the direct benefit transfer of Rs. 3,000/beneficiary. About 18,075 SHGs have been mobilized across 28 States/UTs (Fig. 5).

Key reforms needed for Tribal MFP Haat Bazaars

Re-boot the existing 10,000 tribal *Haat Bazaars* as micromarkets for tribal-centric trade of NTFP by linking it to the *Van Dhan Kendras* to minimize the unfair trade practices.

Procurement sheds, weighing machines, Storage (short and long term) and transportation facilities need to be ensured. Accounting systems and payment system require information dissemination and IT enabled monitoring network to speed up the process.





Self Help Groups by State



Source: TRIFED 2020

Fig. 5. State wise status of Van Dhan Vikas Kendras and SHGs

Options to reduce the impact due to COVID 19

 Manage the panic buying by the lac industry: About 5-6 lakh tons of the NRGs including guar gum need to be procured from the farm gate.

Out of this only 50000 tons of the NRGs excluding *guar* gum need to be disposed during May to July period. Annual export value of NRGs is about Rs. 8743 crores including Rs. 320 crores from lac industry with a significant contribution to foreign exchange.

- 2. More use of family labor and machines: As migrant labor will join the family, the availability of family labour will increase and it may be utilized.
- 3. Scheduling of market arrivals through traders who have direct contact with farmers, procurement centres in the villages and price incentives through MSP (Table 1, Table 2, Table 3 & Fig. 6) for farmers in May or later.



- Fig. 6. Trends in Minimum Suport Price for Natural Resins and Gums
- 4. There are fixed market channels and only transport needs to be allowed and linked with the availability of the product in the producing centres (like Jharkhand, Chhattisgarh, Maharashtra, MP and West Bengal).
- 5. Harvesting of lac is normal with proper safety measures like social distancing.
- 6. The expansion of the reach of organized LAMPS (Large Area Multi-purpose Cooperative Societies) for NWFPs collection, processing and value addition can be explored to reduce the pain of farmers
- 7. Farmers may shift to seedlac making to reduce income losses.
- 8. Private companies can deliver inputs in villages through the network of their dealers.

Opportunities

- 1. Use of existing resources for creating employment in farm sector to control the migration problem specially from the tribal areas.
- 2. Establishing efficient supply chains, linking NWFPs production to the local weekly *haats* /markets and minimize the handling losses.
- 3. The restrictions under Transport Permit (TP) can also be abolished, allowing lac farmers to sell their produce even outside the market directly to aggregators or processors.
- 4. A special Steering Lac Promotion Committee (SLPC) may be constituted under the Chairpersonship of the Chief Minister of leading state in lac production (Jharkhand) to take the initiatives for lac promotion in consultation with the major lac producing states including Chhattisgarh, Madhya Pradesh, West Bengal, Maharashtra and Odisha.



Table 1. Minimum Suport Price for Natural Resins and Gums (Plant/Insect exudates) & Wild Honey

Name of MFP	MSP 2019	MSP 2020
<i>Rangeeni</i> Lac	130	200
Kusumi Lac	203	275
Guggul (exudates)	700	812
Gum <i>Karaya</i>	98	114
Wild Honey	195	225

Table	2.	Minimum	Suport	Price	for	NWFPs
	(Ro	oots/Stems/Le	eaves) in IN	IR		

Name of MFP	MSP 2019	MSP 2020
Arjuna Bark (<i>Terminalia arjuna</i>)	18	21
Ban Tulsi Leaves (dried) (<i>Ocimum</i> tenuiflorum)	19	22
Nagarmotha (Cyperus rotundus)	27	30
Kutaj (dried bark) (Holarrhena pubescens/ Holarrhena antidysenterica)	27	31
Kalihari (dried tubers) (<i>Gloriosa</i> <i>superba</i>)	27	31
Sal leaves (<i>Shorea robusta</i>)	30	35
Kalmegh (Andrographis paniculata)	33	35
Sugandhmantri roots/ tubers (<i>Homalomena aromatic</i> a)	33	38
Tejpatta (dried) (<i>Cinnamomum tamala and Cinnamomum sp</i> .)	33	40
Giloe (<i>Tinospora cordifolia</i>)	21	40
Gudmar / Madhunashini (<i>Gymnema</i> <i>sylvestre</i>)	35	41
Bakul (dried bark) (Mimusops elengi)	40	46
Hill Broom Grass (<i>Thysanolaena</i> <i>maxima</i>)	30	50
Shatavari Roots (Dried) (<i>Asparagus</i> <i>racemosus</i>)	92	107

 Table
 3.
 Minimum
 Suport
 Price
 for
 NWFPs

 (Flower/Fruits/Seeds) in INR

Name of MFP	MSP 2019	MSP 2020
Marking Nut (Semecarpus anacardium)	8	9
Bhava seed/ (Amaltas) (<i>Cassia fistula</i>)	11	13

Soap Nut (dried) (<i>Sapindus</i> emarginatus)	12	14
Myrobalan (<i>Terminglig chebulg</i>)	15	15
Puwad seeds (<i>Cassia tora</i>)	14	16
Baheda (Terminalia bellirica)	17	17
Noni/Aal (dried fruits) (<i>Morinda</i> <i>citrifolia</i>)	15	17
Sal seed (Shorea robusta)	20	20
Kaunch seed (<i>Mucuna pruriens</i>)	18	21
Sonapatha/ Syonak pods (<i>Oroxylum indicum</i>)	18	21
Karanj seed (Pongamia pinnata)	19	22
Kusum seeds (<i>Schleichera oleos</i> a)	20	23
Makoi (dried fruits) (Solanum nigrum)	21	24
Neem seeds (Azadirachta indica)	23	27
Apang plant (Achyranthes aspera)	24	28
Mahua seed (<i>Madhuca longifolia</i>)	25	29
Kokum (Dry) (<i>Garcinia indica</i>)	25	29
Bael pulp (Dried) (Aegle marmelos)	27	30
Mahua Flowers (dried) (<i>Madhuca</i>	17	30
Chirata (Swortig chiravita)	20	2/
Kshirni (Hemidesmus indicus)	30	35
Tamarind (with seeds) (<i>Tamarindus</i> <i>indica</i>)	31	36
Dhavai phool dried flowers (<i>Woodfordia</i> <i>floribunda</i>)	32	37
Jamun dried seeds (Syzygium cumini)	36	42
Nux Vomica (Strychnos nux- vomica)	36	42
Chanothi seeds (Abrus precatorius)	39	45
Dry Shikakai Pods (<i>Acacia concinna</i>)	43	50
Dried Amla pulp (deseeded) (Phyllanthus emblica)	45	52
Tamarind (De-seeded) (<i>Tamarindus indica</i>)	54	63
Vaybidding / Vavding (Embelia ribes)	81	94
Chironji pods with seeds (<i>Buchanania</i> <i>lanzan</i>)	109	126

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Half-yearly Newsletter



How much do you know about Kerria chinensis?

People are well aware about the species of K. lacca for their good quality resin and its commercial importance. This K. lacca is exploited for commercial production of lac and prevalent in most of the states like Jharkhand, Chhattisgarh, West Bengal, Odisha, Madhya Pradesh, Maharashtra etc., where else K. chinensis one of the commercially exploited species of lac is prevalent only in North East India. In Assam context, lac is naturally available in abundance from time immemorial in few districts. However, due to lack of awareness among the people and deforestation ultimately led to downturn of lac in recent times. Extensive survey throughout the states of Assam and West Bengal are carried out by the lac team of Assam Agricultural University, Jorhat, under the Network Project on "Conservation of Lac Insect Genetic Resources", to identify the potential pockets of naturally available lac insect and its host plants (Fig. 7). The team reported that the tribals of Karbi Anglong district of Assam are cultivating lac for livelihood and naturally available lac are found in abundance in that area. During the survey and through questionnaire and research it was noticed that the time of inoculation and harvesting of broodlac and complete life cycle of lac in Assam is different from the timing of K. lacca. So, there arise a question: Is the genus or species of lac prevalent in Assam different from the rest of India? Or Since Assam has great diverse range of ecological variation, where K. lacca may adapt itself with its unique environmental condition? Research on complete life cycle of lac in lac park and laboratory of Department of Entomology, AAU, Jorhat along with its morphological and molecular studies reveal that lac insect lines that is predominant in Assam condition is K. chinensis (GenBank accession number MH562710).



Fig.7: Survey and collection of broodlac from Karbi Anglong, Assam

Major biological and morphological differences between *K. lacca* and *K. chinensis*observed are:

Morphological characteristics:

- Brachial plates of adult female of *K. chinensis* are elongated and cylindrical with 17-19 numbers of punctations whereas brachial plates of *K. lacca* are elongated and club-shaped having 10-12 punctations.
- *K. chinensis* is reddish in colour and *K.lacca* is crimson in colour (Fig. 8 and 9)

Timing of broodlac inoculation and harvesting:

Species	Inoculation	Crop harvesting	
	April/May	October/November	
K. chinensis	October/November	April/May	
К. Іасса	June/July	October/November	
(Rangeeni)	October/November	June/July	
К. Іасса	June/July	January/February	
(Kusmi)	January/February	June/July	

Kerria chinensis have high potential in Assam in terms of production, commercial and social significance. Cultivation of lac not only provides livelihood to millions of tribals but also conserves biodiversity associated with lac complex.



Fig. 8: a) Crawlers, b) Adult male, c) Adult female of *K. chinensis*





Fig. 9: Brachial plates of adult female of *K. chinensis* with punctations

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Jacaranda mimosifolia: A new lac insect host plant from Manipur

Botanical Name: *Jacaranda mimosifolia* D. Don Family: Bignoniaceae

It is a magnificent deciduous tree with its clusters of fragrant blue trumpet-shaped blooms. In April month the entire leafless tree is covered with blue flowers, turns the ground below into blue carpet. It is a very popular tree among gardens and along roadsides as an ornamental tree for its showy bloom. It is popularly known as jacaranda, blue jacaranda in English and *Neeli gulmohar* in Hindi. The bark is brownish and peeling off in small thin flakes. The foliage of jacaranda consists of fern-like bipinnate compound leaves, leaflets 12-20 pairs per pinnae, narrowly elliptic. Flowers appear from March-April, in terminal racemose panicles, and bluish in colour. Fruits (Capsules) appear from April-May, ellipsoid-orbicular in shape and woody in nature. Origin of this tree is South America. J. mimosifoliawas first reported as lac host for rangeeni strain of K. lacca Kerr. by Kapur in 1954 from Jamshedpur, Bihar (now Jharkhand). He described that the lac encrustation on this tree was sparse to moderately thick. Later on he was able to successfully infect lac on Jacaranda at ILRI campus (now ICAR-IINRG). Mahadihassan (1936) was able to rear Laccifer (=Lakshadia) communis (Mahd.) by artificial infection on this species in Bangalore. In a recent visit (February 2020) by us to Sendra Park, Lokhtak lake, Imphal (Manipur), natural population of lac insect (*K.chinensis*) was observed on Jacaranda (*J. mimosifolia*). Good lac insect encrustation was observed on the top of young shoots. Occurrence of lac insect on Jacaranda and its popularity as avenue and garden tree throughout India makes it a potential lac host. (Fig. 10).



Fig.10.Jacaranda mimosifolia a) Tree; b) Lac encrustation; c) Flowers; d) Pods with seeds

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Guar: A Natural Gum for Multipurpose Application

Guar gum is the ground endosperm of the legume plant *Cyamopsis tetragonoloba*; an annual plant, grown in dry regions of India. India is the largest producer of guar gum in the world. India's production contributes to 80% of the world total production and the average guar seed production for the last five year is around 26 lakh ton (Source: Directorate of Economics and statistics, MoA, GoI). India is also the leading exporter of guar gum and the average annual export of guar gum for the last five year is 4.8 lakh ton (Source: APEDA). Guar gum is a polysaccharide, galactomanan consisting of a long chain galactose and mannose and the average molecular weight of guar gum is in the range of $1-2 \times 10^6$ Dalton.

The major application areas of guar gum (Fig. 11.) are depicted as follows:



- Food: In food Industry, guar gum is used as gelling, viscosifying, thickening and binding agent as well as used for stabilization, emulsification, preservation, water retention etc. The largest market for guar gum is in the food industries like in frozen food, confectionery, bakery, beverages, dairy products, ketchups and pickles *etc* as food additives (E 412).
- Pharmaceutical: Guar gum is used as a binder and disintegrating agent pharmaceutical industries in tablet manufacturing and in micro-encapsulation of drugs. Guar Gum is an important non-caloric source of soluble dietary fiber. Guar gum powder is widely used in capsules as dietary fiber.
- Cosmetics: Guar gum used as thickener, protective colloids in skin care products, creams and lotions for cosmetic industries and also used in toothpaste and shaving cream for easy extruding from the container tube.

Guar gum powder a versatile product and finds applications in different industries as well.

- Paper Industry: Guar gum imparts improved writing properties, better bonding strength and increased hardness in paper.
- Textile Industry: Guar gum used for textile sizing, finishing and printing for excellent film forming and thickening properties.
- Oil Field Applications: Industrial grade high viscosity Guar gum powder is used as a stabilizer, thickener and suspending agent as drilling aids in oil well drilling.
- Metallurgical and Mining: Guar gum is widely used as a flocculant and floatation agent to produce liquid solid separation

Wood apple (Limonia acidissima L.): A gum producing tree

Wood apple tree belongs to the family Rutaceae. The tree is native to India, but it is also cultivated in Sri-Lanka, Bangladesh and Pakistan. It is one of the hardy trees of arid and semi arid regions. It can be grown in dry tracts of tropical and sub-tropical regions. The fruit of the tree resembles the shape of an apple and have a hard outer shell (Fig. 12a), due to which it is named as wood apple. The fruit is also known as monkey fruit, elephant apple or crud fruitand kaitha in Hindi. After the rainy season tree naturally exudes gum on trunk or branches. The color of gum is transparent or white-yellow transparent to redish-timber (Fig. 12b). Like gum Arabic, wood apple gum is completely soluble in water. But, it is more viscous than gum Arabic. The paler samples form a thick, colorless, tasteless, mucilage. The gum contains 35.5% arabinose and xylose, 42.7% d-galactose, and traces of rhamnose and glucuronic acid. This gum can be used as a substitute for, or adulterant of gum Arabic.Wood apple gum is also used to make paints such as watercolors, dyes, inks, and varnishes. Powdered wood apple gum, mixed with honey, is given to overcome dysentery and diarrhea in children





(a) Fruit **Fig. 12:** Wood apple fruit and gum

(b) Gum tears

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Success story of IINRG-ICRAF collaborative project at Silda, Khunti

World Agro-forestry sponsored project entitled "Enabling tribal communities to improve their livelihoods through Agroforestry systems on a sustainable basis" is being conducted at Silda village, Khunti district by ICAR-IINRG, Ranchi since October 2017. Initially base line data of general profile of the identified areas was collected. During the baseline survey and participatory rural appraisal of identified villages, it was found that limited livelihood options were the major cause of migration in the selected areas. It was found that cropping system is dominated by paddy with livestock activities in



Fig. 11. Application areas of Guar gum

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majority of villages. Although the people were aware about the lac cultivation, but not practicing it since 10 years due to mortality of the lac insect and consequently shortage of broodlac. Hence, Lac based Agro- forestry Model in the identified villages was introduced with planting of Flemingia semialata, Calliandra spp., and, other lac host and fruit trees. and broodlac was distributed among the interested farmers. Twenty-three farmers were selected from three different districts viz., Ranchi, Khunti and Seraikela Kharsawan. Out of 23 farmers, six farmers were selected at Silda, Khunti. Provision of non-credit inputs including lac production kit and pest management kit enabled the beneficiaries in adoption of recommended practice. We have conducted 38 Field Level Demonstration, 3 Field Days and one each Kisan Ghosti and Farmers Field School. A four days training program on "Lac Integrated Agro-forestry System for Livelihood Security" was organized at ICAR-IINRG during October 29 to November 1, 2019 in which 23 farmers participated. Under this scheme 68 tribal farm households of 9 villages used about 766 kg of broodlac for inoculation on pruned lac host trees and harvested 2400 kg of broodlac/scraped lac. Out of these 4 farmers of the Silda village adopted the Lac Integrated Agro forestry Model (LIAF). Consequently, a total of Rs 1.85 lakh was earned within two years of the project period. Thus, average annual income of these farmers enhanced by Rs 20000/- as an additional income through mobilizing the local resources under technological interventions. Thus, participatory model could impact the livelihood of the tribal community significantly by providing additional employment and income by utilizing the existing resources. These models can be very useful and strategic option to control the migration issue as well as mitigating the adverse impact of climate change on lac cultivation particularly in lac producing areas of the country





Before intervention of LIAF model

of LIAF After intervention of LIAF Model J Ghosh, A Mohanasundaram and R K Yogi ICAR-IINRG, Ranchi

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