

## B. DETAILED REPORT

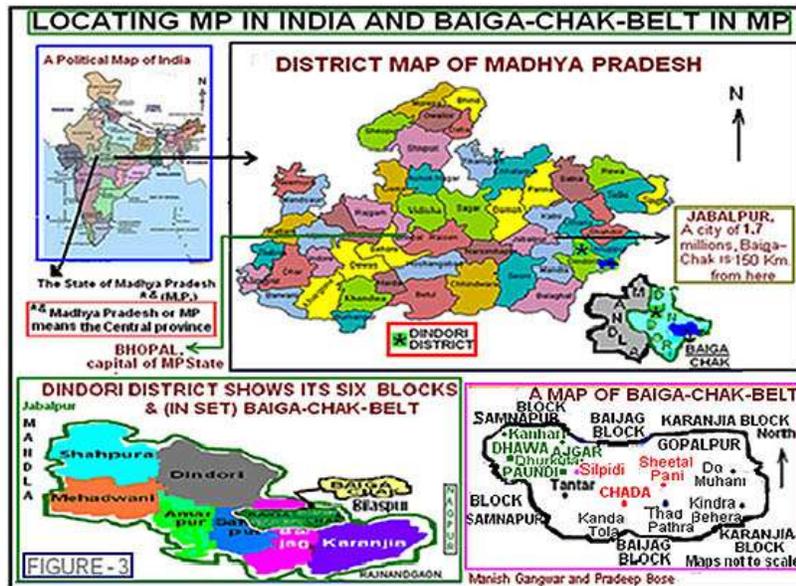
### **Development of Sisal Based Livelihood Income Generation Activities for Baiga Primitive Tribal Groups (PTG) of Mandla District of Madhya Pradesh.**

#### **1. (NEED IDENTIFICATION \* S & T NEEDS IN PROPOSED AREA OF INTERVENTION):**

**THE BAIGA** tribe is one of the most vulnerable, forest-dwelling aboriginal tribes of India included in Particularly Vulnerable Tribal groups owing to their primitive nature. Specifically, the Baigas are concentrated in the Central part of India covering the states viz. Madhya Pradesh **INTRODUCTION**, Chhattisgarh, Uttar Pradesh and Jharkhand. About 65 percent of the entire populations of Baigas in India (some Baigas are in Bangladesh also) live in six districts of Madhya Pradesh and Chhattisgarh. There are about 3,50,000 Baigas living in India. If we also include the Binjwars of Chhattisgarh and Odisha as a Baiga clan, and add their population, then the total number of Baigas in India is about 3,90,000.

Madhya Pradesh has about 23% (119.87 lakh) of tribal population of India. Their origin of Baiga tribe is said to be traced back to Mandla and Dhindori and Balaghat districts of M.P (Elwin, 1936). Since early days, as old as 1860s, the baigas were engaged in hunting, gathering and traditional agricultural system of mixed cropping known as Benwar or Dahiya Cultivation (Swidden) (Archana Prasad, 2010). They are said to live in proximity with nature deriving their livelihoods from the forest produce and hunting. Their economy, culture and traditions are linked with the nature. Forest is their home. Almost 90 percent of the tribal population is directly or indirectly dependent on land for their survival (Verma, 1995). They are primarily an agro-based community which depend on cultivating crops like kodo, kutki, paddy and vegetables (Biswas, 2007), hunting and gathering of Non Timber Forest Produce like Mahua, Tendu patta (leaves), wild mushrooms (Gangwar and Bose, 2012). As forest dwellers they are concentrated in the dry deciduous forest of central India, and when water scarcity causes decline in agriculture, more often than never NTFP collections help them to make out their sustenance (Bhattacharya & Hayat, 2004). There's a high incidence of poverty among the Baigas.

In Madhya Pradesh, Baigas (PTG) is one of the oldest aboriginal tribes and classified as one of the primitive tribes of the state living with pre-agricultural technology, low literacy and stagnant and diminishing population. There are four Baiga-major districts in MP — Mandla, Dindori, Balaghat and Shahdol (along with Umaria and Anuppur, two newly carved out districts from Shahdol). They reside in the forest covered hilly tracks of Mohgaon area in Mandla district. The Baiga's economy is still highly depended on agricultural pursuits and collection of minor forest produces. The tribal areas where Baiga population lives contain huge sisal plantations, which are forest, based.



However, Baigas of Baiga-Chak are still dependent significantly on hunting, fishing and forest produce gathering and they were engaged in primitive forms of agriculture. Gautam further adds that earlier the Baigas collected only food items, but now they collected some such forest produce too that they could sell in the market.

Detailed documentation of sociological, anthropological and economic spheres of Baigas' lives has been depicted by legendary

British scholar Dr. Verrier Elwin (1939, 1943). Besides the work of Russell and Hira Lal (1919), Philip McEldowney's (1980) Ph.D. thesis on Baigas and books by Gadgil and Guha (1993, 1995) have also made substantive contribution to building the corpus of knowledge related to the Baiga tribe. Verrier Elwin (1939) in his book *The Baiga* made an intrinsically Indian ethnic expression about the livelihoods of the Baigas. He wrote that Baigas were like the bare holy cows of India who were timid, innocuous and did not have any foresight to plan for their livelihoods; for they were dependent on the there and then unlimited resources of the forests, wherever they lived. However, since Elwin wrote his book, through the seven and a half decades of a complex acculturation process, the contemporary Baigas have changed significantly, not only into street-smart human beings but also as an indigenous tribal community that is very conscious and protective of its limited available portfolio of just four to five livelihoods. McEldowney (1980) refers to a study conducted in 1888 by the district administration which investigated the earnings of a Baiga family in Balaghat district, who made bamboo baskets to earn money to buy food. The family consisted of a Baiga man, his wife and two small children. They made twelve baskets a week, selling each for two pounds of rice or millet. The earnings of 100 pounds of un-husked grain, or less than Rs. 1 per month got supplemented by the collection of forest roots and fruits. They saved about Rs. 1 each year for clothing.

Trading forest produce like mahua (*Madhuca indica*), fish, honey, musli (*Chlorophytum borivilianum*) and in recent years tendu (*Diospyros Melanoxylon*) leaves etc. for turmeric, common salt, wheat, condiments, cloth has been known to the Baigas for about 300 years now. Earlier they used to drink from sulfi-wine palm (*Caryota urens*) trees. Later they picked up making bamboo baskets and brewing mahua-liquor to barter for market goods too. However, the tribal community of Baigas, who used to have open and ample access to their commons, i.e. forests, has since the days of Baiga-Chak formation, had to diversify their livelihoods for mere subsistence. The new generation of the Baigas now understands the limitations of private property and value of skilled labor in modern markets. However, they are still trying to

internalize the concept of building surplus and saving money and these ideas have gradually been adopted by some Baiga households.

R. K. Gautam states that the Baigas in the twenty first century is not dependent upon hunting and food-gathering alone rather they have been exploring for alternative means of agriculture to earn more money for improvement of livelihood. In Mandla district of Madhya Pradesh where most of the Baiga are of below poverty line, adaptation of alternative agriculture practices like cultivation of SISAL can become a useful mean of income generation activity for improving their livelihood.

#### **Data in terms of research issues:**

A general review of data relating to Sisal production is given below:

#### **Status of Sisal: World**

The total area of sisal growing in the world is 428.1 thousand ha and the total fibre production is 220.2 thousand tons. Brazil occupies the lion's share both in terms of area and production. Although the sisal area in China is not very significant, but the productivity of sisal in China is the highest (4706 kg/ ha) which is about 9 times of the world's average productivity. Sisal area for the last two decades is increasing with moderate positive trend.

Hence Brazil, East African region, Asia (particularly China) are the highest producers of sisal fibre. Continuous research and development going on in use of sisal fibre has ensured that in coming years the use of the fibre will be many. The sisal fibre is a sustainable renewable resource for its cordage, woven and pharmaceutical products. The synthetic substitutes of sisal fibre have created havoc to the environment and threatened the very existence of the earth. Thus, the ecological appeal of sisal must be utilized to ensure that there are positive developments in future prospects of this natural fibre.

#### **Status of Sisal: India**

Several species of sisal are indigenous to India and are growing freely in wild state. It was primarily used by crude method as the fibres are used for ropes/mats etc. Before invention of sisal extractor, the manual leaf fibre extraction process from sisal leaves was so laborious that Indian jail authorities (Motihari and other places) gave sisal leaves to the inmates of the jail for fibre extraction merely to keep the prisoners employed on sufficient laborious and punitive work. With the development of sisal fibre extraction machines in British East Africa and other parts of the world, sisal fibre became a regular industry. After few years of such machine development in East Africa, in India Mr. J.M. Casey started sisal plantation as the main pioneer of sisal enterprise in the country. Mr. Casey had some more sisal plantations in Odisha and adjoining areas and most of them were in profitable production tune. In 1964, Mr. and Mrs. Casey sold two of their important sisal farms at Nildungri (751 acres or 304 ha) and Beldungri (730 acres or 295 ha) of Sambalpur district to the State Govt. of Odisha. The Govt. of Odisha owned 'Govindapur Sisal Farm' at Bamra having an area of tribes/villagers to provide fence/hedges but are not often cultivated in the true sense. Although the tribes/villagers use the leaf for extraction of fibre through laborious 266.13 acres which was handed over to Indian Central Jute Committee (ICJC) through an agreement signed on 17th June, 1962 and subsequently the same had been given to Indian Council of Agricultural Research (ICAR). In the said sisal farm of BAMRA, the sole research station on sisal, i.e. Sisal Research Station is

operational as a regional research station of Central Research Institute for Jute and Allied Fibres (CRIJAF). In India, sisal is generally not grown by organized sectors, whereas, it is scattered over isolated areas predominantly as live fence or grown by the tribals for their own consumption of natural fibres. The main fibre producing sisal is *A. sisalana* and *A. cantala*, but in some places, other species of agave (*A. vera-cruz*) give more fibre. In Mysore area of Karnataka, *A. americana* performed better than other species of sisal. The area and production statistics of sisal for India is not directly available from any published and authentic source. However, based on information on demand of planting materials, availability of sisal fibre, interactions with different sisal producing agencies (Govt., NGO and Private entrepreneur) it may be estimated that the sisal area in India will be between 1800 and 2400 ha with a production of 1080-1440 tons.

Indian Initiative for Development of Sisal Initiatives by ICAR Since 1962, Sisal Research Station of CRIJAF have been involved in development of economically viable and sustainable production technology for sisal, collection, maintenance and improvement of sisal types for higher yield and better fibre quality, transfer of technology and human resource development in relation to sisal. Number of sisal related technologies like nursery management, double row planting geometry, weed management, macro and micro nutrient management, water saving and efficient irrigation technique, concept and agro-technique of annual legume intercropping in sisal, management of zebra disease and development and commercialization of cheap, portable and energy efficient sisal decorticator have been developed and put to use for the sisal planters of the country. From 2011-12 financial year onwards, under Tribal Sub Plan (TSP), ICAR has earmarked considerable amount in each year for expansion of sisal area and dissemination of improved production technology through its establishment at Sisal Research Station (of CRIJAF) located at Sambalpur district of western Odisha. In 2011-12, about 12 ha of new sisal plantation was started by the tribal farmers following improved package of practices in the tribal dominated Sambalpur and Jharsuguda districts of Odisha. In the subsequent years, another 20.36 ha area (2012-13) and 17.11 ha (2013- 14) were brought under new sisal plantation in Odisha by the tribal farmers under the programme. At the same time about 1.32 lakh healthy sisal suckers were produced and distributed among the sisal planters for further expansion of sisal area in another 33 ha. Sisal area expansion programmes are continuing with financial support from TSP. Similar pursuit of sisal popularization and area expansion in Ranchi area of Jharkhand has been initiated with active involvement of Sisal Research Station (of CRIJAF) and Divyayan Krishi Vigyan Kendra of Ramakrishna Mission Ashram, Ranchi. Newer production technologies, such as double row planting system, use of balanced fertilizer, legume intercropping with sisal etc. were successfully transferred to the farmers' field under the TOT programmes of the research station. Several HRD programme such as trainings, awareness camps, farmers' meetings were conducted by the institute which created interest about the crop among the farming community of Odisha, Jharkhand, Madhya Pradesh and Andhra Pradesh. In the current financial year (2014-15), a more focused and mammoth scale project titled 'Enhancing indigenous availability of sisal fibre for industrial use' has been approved in principle with a budget outlay of ` 389 lakh initially for three years ending March, 2017 under Natural Fibre Platform Projects. The outcome of the project surely have greater role for increasing indigenous availability of sisal fibre in the country resulting in reduced dependency on import and thereby making sisal as one of the important natural fibres of India.

- **Initiatives by Non-Government Organizations and Private Entrepreneurs in British India:**

Sisal was a profitable venture for the private entrepreneurs. Well after independence, there was lack of initiatives as sisal plantations become uneconomic due to several technological as well as socioeconomic hurdles. However, in recent years, number of NGOs and private entrepreneurs are showing interest in sisal and started thinking and acting seriously about sisal. As for instance, Koraput Sisal Bikash Parishad grows sisal in Koraput (Sadar), Kakirguma, Nandapur and Muchkund area in Koraput district and their annual production of sisal fibre is about 100 tons at present and achieving higher production steadily. Some private enthusiastic entrepreneurs at Jaypore area also grow sisal and extract fibre using their own fibre extraction unit. A Self-Help Group operating at Kashipur area in Rayagada district of Odisha are also cultivating and producing sisal fibre. NGOs operating at Jabalpur area of Madhya Pradesh and different parts of interior Andhra Pradesh have taken initiatives to popularize scientific sisal cultivation and thereby sisal area is increasing slowly.

- **Role of Different Institutions and their Interactions for Expansion of Sisal Area and Increase in Production in India:**

In the Indian context, several component institutions are involved for expansion of sisal area and increasing production in the country. The ICAR-CRIJAF/ Sisal Research Station/ Task Force/ Core Group were in the key position for technology generation, extension of knowledge through training and demonstration to the TOT trainers from concerned line departments. Directorate of Jute Development was involved through their several extension (FLD)/ research programme like Technology Mission (Mini Missions). In this process of extension and motivation, State Department of Agriculture played major role. Krishi Vigyan Kendra (KVK) of the concerned districts developed direct linkages between the planters, State Agriculture Department and Sisal Research Station for training, motivation and extension of technical knowledge. Either directly or through Sisal Research Station, KVK also involved with the NGOs, having target of agricultural and rural development. The State Department of Soil Conservation and Department of Forest had a closer cooperation regarding expansion of sisal area and also developed contact with the State Agricultural Universities and Sisal Research Station. The KVK, Renewable Energy Department and Organic Manure Programme were involved and they played a key role in the sisal biomass utilization for the benefit of the sisal planters directly. NABARD, other Nationalized Banks and lead banks of the districts were approached by the Planters' Cooperative/ Sisal Growers' Association or by big individual planters for financing in this endeavour. There is no need to sell the produced sisal fibre by the individual grower whereas; they will sell the fibre through their cooperatives/associations to the fibre buyer or to the industry. Value addition and end product industry may have marketing and also export arrangements of their own.

## **Economics gain**

The concept of 'green' economy is supported by energy efficiency, renewable feed stocks in polymer products, encouraging industrial processes that reduce carbon emissions and producing recyclable materials. The popularity of natural fibres is undeniably based on the fact that natural fibre is not only good for skin, but it is also good for the environment. As a matter of fact, growing one ton of jute fibre requires less than 10 percent of the energy used for the production of polypropylene, a plastic polymer.

Earlier, Sisal was widely used in ropes, general cordage and twines, but product varieties gradually increased, as companies started using sisal to manufacture paper, buffing cloth, dartboards, handicrafts, Macram, carpets, geotextiles, wire rope cores and mattresses. Other sisal-inclusive products now range from steel cable yarn to twisted thread, and general yarn to knitted art crafts.

The use of sisal in non-woven textile is also of prime significance, as sisal is an environmentally friendly strengthening agent to replace asbestos and fibre glass in composite materials. This has led to increased employment of sisal fibre in the automobile industry. The use of sisal fibre depends on its grade.

Sisal is broadly categorized under three grades, which are lower, medium and high grades. Manufacturers in the paper industry use lower-grade fibre due to significant portion of hemicelluloses and cellulose found in that variety. Handled by the cordage industry, medium-grade fibre mostly is diverted to the production of binder twine, ropes and baler. These products are primarily used for agricultural, marine and general industrial purposes. The third quality, a high-grade variety of sisal, is put in the works by the carpet industry to manufacture yarns. In case of carpets, sisal is used by itself or in blends with wool and acrylic for a softer hand.

Sisal fibre is made from the process of decortications. Under this process, leaves of sisal plant are compressed and trampled by a revolving wheel set. The set contains blunt knives, so that only fibres remain. The remaining parts of the leaf are washed away by water. The decorticated fibres are also cleaned by water before drying in the natural heat or by the artificial process of hot air. The grade of fibre is decided on the basis of the moisture content so appropriate drying is imperative. Artificial drying is preferred for better grades instead of natural sun drying. After drying, the fibres are untangled via machine and categorized into grades. Another process used to separate fibre from the leaves is retting followed by scrapping. Under the retting process, a combination of bacteria action and moisture is taken into effect for rotting of plants. The process gets rid of cellular tissues and gummy substances around best-fibre bundles, helping the fibre to separate from the stem.

## **Uses/Application of Sisal Fiber:**

From ancient times sisal has been the leading material for agricultural twine because of its strength, durability, ability to stretch, affinity for certain dyestuffs, and resistance to deterioration in saltwater.

Sisal is used commonly in the shipping industry for mooring small craft, lashing, and handling cargo.

1. It is also surprisingly used as the fibre core of the steel wire cables of elevators, being used for lubrication and flexibility purposes. Traditionally sisal was the leading material for agricultural twine or baler twine. Although this has now been overtaken by polypropylene.
2. It is used in automobile industry with fiberglass in composite materials.
3. Other products developed from sisal fiber include spa products, cat scratching posts, lumbar support belts, rugs, slippers, cloths and disc buffers.
4. Sisal is used by itself in carpets or in blends with wool and acrylic for a softer hand.

### **Tensile strength**

Sisal fibre in cross-section consists of about hundreds of fibre cells, which are smooth, straight and yellow in colour. The main feature of sisal fibre is its strength, which gives it a rough and rigid appearance. Properties like strength, durability, ability to stretch and resistance to deteriorate in saltwater, are some of the reasons that sisal is used in making ropes and similar stuff.

The texture of the fibre ensures that it absorbs dyes easily and offers the widest range of dyed colours among all the other natural fibres. In comparison to pineapple and banana fibre, sisal fibre-polyester composites are likely to give high work of fracture because of high toughness.

The fibre is extremely tough and is low on maintenance with minimal wear and tear. However, sisal fibre is still not used by the garment industry and is also not apt for wet areas. The sisal leaves are also often treated with natural borax for fire resistance properties. Sisal is used commonly in the marine industry for fastening small craft, lashing, and handling cargo. It is also surprisingly used as the core fibre of the steel wire cables of elevators.

In rare cases, sisal fibre replaces silk during summer. However, the process to soften the rugged fibre is lengthy and expensive. It requires a high degree of beating and pulping that gives a fabric that is light enough to be worn in the hottest weather. The amount of work to process the sisal into this sheer fabric implies that the cost of the resultant fabric is extremely high.

### **Sisal Fiber:**

- Sisal Fiber is one of the most widely used natural fiber and is very easily cultivated. It is obtain from sisal plant. The plant is known formally as *Agave sisalana*. These plants produce rosettes of sword-shaped leaves which start out toothed, and gradually lose their teeth with maturity. Each leaf contains a number of long, straight fibers which can be removed in a process known as decortications. During decortications, the leaves are beaten to remove the pulp and plant material, leaving the tough fibers behind. The fibers can be spun into thread for twine and textile production, or pulped to make paper products.
- Sisal fiber is fully biodegradable, green composites were fabricated with soy protein resin modified with gelatin. Sisal fiber, modified soy protein resins, and composites were

characterized for their mechanical and thermal properties. It is highly renewable resource of energy. Sisal fibre is exceptionally durable and a low maintenance with minimal wear and tear. Its fibre is too tough for textiles and fabrics. It is not suitable for a smooth wall finish and also not recommended for wet areas.

- The fine texture of Sisal takes dyes easily and offers the largest range of dyed colours of all natural fibres. Zero pesticides or chemical fertilizers used in sisal agriculture. It is a stiff fiber traditionally used in making twine, rope and also dartboards Sisal fiber is manufactured from the vascular tissue from the sisal plant (*Agave sisalana*). It is used in automotive friction parts (brakes, clutches), where it imparts green strength to performs, and for enhancing texture in coatings application.
- A sisal plant produces about 200 -250 leaves and each leaf contains 1000-1200 fibre bundles which is composed of 4% fibre, 0.75% cuticle, 8% dry matter and 87.25% water. So normally a leaf weighing about 600 g will yield about 3% by weight of fibre. [3,16]. These plants produce rosettes of sword-shaped leaves which start out toothed, and gradually lose their teeth with maturity. ...
- Wilson indicated that sisal fibre contains 78% cellulose, 8% lignin, 10% hemi-celluloses, 2% waxes and about 1% ash by weight; but Rowell found that sisal contains 43-56% cellulose, 7-9% lignin, 21-24% pentose and 0.6-1.1% ash. More recently, Joseph et al. reported that sisal contains 85-88% cellulose. These large variations in chemical compositions of sisal fibre are a result of its different source, age, measurement methods, etc.

### **Taxonomy of Sisal**

**Sisal** is a semi-perennial, leaf fibre producing plant. It belongs to *Asparagaceae* family. Different species of *Agave* (*Asparagaceae* family) namely, *Agave sisalana*, *A. cantala*, *A. vera-cruz*, *A. amaniensis*, *A. angustifolia* and *A. fourcroydes* can produce hard fibre from its leaf. However, among the different species, *A. sisalana* contributes nearly 85% of the total sisal fibre production of the world (381.43×10<sup>3</sup> t). *A. sisalana* is a native of the Yucatan area of Mexico where the fibre had been used by the native Mexican people for centuries. Later, around 1836, sisal was introduced to Florida. Other than Mexico, wide cultivation of sisal was started in Tanzania, where it was introduced by Dr. Richard Hindorf, an Agronomist from Germany. In the present world, major sisal producing countries are Brazil, Kenya, Tanzania, Madagascar, China, Mexico and Haiti. In the modern world, sisal/ agave was extensively studied by Howard Scott Gentry (1903-1993), who was an American botanist recognized as the world's leading authority on the agaves. Sisal fibre is very commonly used in the shipping industry for mooring small craft, lashing, and handling cargo. Besides, it has several other domestic to industrial uses including high strength requiring long-lasting geo textile and speciality composites. In the present world, the main sisal producer and exporter is Brazil and main importer is China.

**As Indian sisal fibre production is negligible**, so it imports virtually the whole requirement. Not being a traditional food crop, research on sisal is not very exhaustive not only in India but globally also. Even then, some useful research and transfer-of-technology on planting geometry, nursery management, macro and micro nutrient management, micro irrigation techniques, weed and disease management, agro-techniques for intercropping with annual

legumes, cheap, portable and energy efficient sisal decorticator have taken place in the country. There is no single standard for quality classification of sisal fibre in the world. Different sisal fibre producing countries/region/association follow their own method of grading/classification primarily based on length of the fibre, tenacity, colour/ lustre etc. India follows BIS standard for sisal (commercially known as 'Aloe' fibre) for grading and marking. For expanding sisal area and increasing production in the country, initiatives taken by ICAR, State Governments, Non-Government Organizations and private entrepreneurs have been categorically mentioned.

### **Fibre Composition, Quality and Grading:**

Fibre Composition, Quality and Grading Sisal fibre varies widely in quality. The variation in chemical composition is because of its different sources, age, extraction methods etc. It was indicated that sisal fibre contains 78% cellulose, 10% hemicellulose, 8% lignin, 2% waxes and about 1% ash by weight. But others found that sisal contains 43- 56% cellulose, 7-9% lignin, 21-24% pentosan and 0.6-1.1% ash. It was also reported that the cellulose and lignin contents of sisal vary from 49.62-60.95% and 3.75-4.40%, respectively, depending on the age of the plant. From India, it was mentioned that the sisal fibre is composed of cellulose (78%), hemicellulose (10%), lignin (8-10%), wax (2%) and 1% ash.

In general, the physical properties of sisal are, 0.6-1.2 m length, 0.05-0.2 mm diameter, 1.35 g/cm<sup>3</sup> density; the mechanical properties are tensile strength 500-660 MPa, tensile module 30-40 GPa and 2-3% elongation. There is no universal standard of grading sisal fibre in different countries in which it is produced. Different countries have their own system of fibre grading. Brazil, the major producer of sisal classifies fibre based on fibre length; the classification is Extra-long (>110 cm), Long (90-110 cm), Medium (70-90 cm) and Short (60-70 cm). In India, the BIS authority follows 'Aloe Fibre Grading and Marking Rules, 1975' as in the country fibre obtained from the botanical species of *Agave cantala*, *A. sisalana* and *A. Vera-cruz* are commercially called 'Aloe' fibre.

### **Mechanical extraction through Raspador machine:**

The mechanical extraction is done with the help of Raspador machine, suitable for small scale operation, Raspador machine and extracted fibre is given without damage and best quality fibres. After sisal fibre extraction and rope making, including value added products. Sisal fibre is Chemical composition, Physical properties and mechanical properties of sisal fibres are shown in following.

#### **Properties of Sisal Fiber:**

1. Sisal Fiber is exceptionally durable with a low maintenance with minimal wear and tear.
2. It is Recyclable.
3. Sisal fibers are obtained from the outer leaf skin, removing the inner pulp.
4. It is available as plaid, herringbone and twill.
5. Sisal fibers are Anti static, does not attract or trap dust particles and do not absorb moisture or water easily.

6. The fine texture takes dyes easily and offers the largest range of dyed colours of all-natural fibers.
7. It exhibits good sound and impact absorbing properties.
8. Its leaves can be treated with natural borax for fire resistance properties.

### **Chemical Composition of Sisal Fiber:**

#### **a) Chemical Composition of Sisal Fibres:**

Constituent	Percentage
Cellulose	66-72
Hemicelluloses	12
Lignin	10-14
Pectin	0.9
Moisture	6-10
Ash	1-2

#### **b) Physical Properties of Sisal Fibres:**

Parameters	Dimensions
Length	0.6-1.2 m.
Diameter	0.05-0.2 mm.
Density	1.35 gm/m <sup>3</sup>

#### **c) Mechanical Properties of Sisal Fibres:**

Property	Values
Tensile strength	500-660 (MPa)
Tensile modulus	30-40 (GPa)
Elongation	2-3%

The chemical composition and cell structure of plant fibre is very interesting as each fibre is a composite in which rigid cellulose microfibrils are reinforced with soft lignin and hemicellulose matrix. Also, the microfibrils are helically wound along the fibre axis. Sisal fibre is equipped with high content of cellulose, tensile strength and modulus in comparison with other natural fibres which makes it suitable for manufacturing high strength textile and reinforcement in composites for various applications.

### **Exploring Sisal Cultivation in Madhya Pradesh**

Madhya Pradesh has a huge potential for cultivation of Sisal fibre. Sisal is a xerophytes plant and its cultivation is relatively easy and involves least water and crop management during its survival period of about 10 years. It can be raised along the bunds, hedges, forest and wastelands for soil conservation. Once established, an assured production of about 2.5 tones of fiber per hectare per annum is possible for 6-8 years. Presently sisal plantations and related activities are unorganized and localized mostly in rural and tribal areas. Sisal leaves yield quality fiber, which is utilized for conventional purposes like ropes, anchors, cordage and handicrafts. Sisal plantation activity has the annual employment potential of about 100 man-days per hectare. The tremendous potential of sisal as a resource so far has not been properly exploited

for value addition and as a source of employment generation in rural and semi-urban sectors especially in these tribal dominated areas. During Preliminary investigations of the project, it was realized that there is a great potential for the development of sisal-based technologies for engineering and rural applications.

**Therefore, it is also realized that a scientific and technical based comprehensive approach for social and economical up- liftment of Baiga Primitive Tribal Groups through formation of Self-Help Groups (SHGs) can help in elimination of rural poverty.** The SHGs, help in extending benefits to its members in creating self-awareness and feeling of self-confidence, solidarity, social security, collective decision-making risk-taking ability and financial management among the members of the groups. Therefore, it is necessary to stimulate and urge the groups by convening group meetings and discussion about the **Sisal Fibre Technology (SFT)** and create interest for further consideration of the idea, by explaining the importance and economic growth due to adoption of the technology. Then the interest becomes a desire or motivating force sufficiently strong to compel action. Keeping all these in minds, the aforesaid project was conceived submitted for financial support. The following identified objectives of the project have been implemented during two years project period from 01/04/2018 to 31/03/2020.

## **2 OBJECTIVES (AS APPROVED IN THE PROEJCT):**

The objectives of the project is to promote awareness among the identified stake holders i.e. **Baiga Tribal Community** through establishment of an **“Awareness Creation Centre”** in the village Palhera of block Mohgaon, of district Mandla and provide them training in scientific raising of Sisal plants on contour bunds and extract fiber from the leaves mechanically and help them earning additional income through value addition. **The approved project objectives are as follows:**

### **Major: The major objective is:**

Establishment of Sisal based rural livelihood generating employment and additional income for Baiga tribal community (PTG) of block **Mohgaon of Mandla District**.

### **Minor: To achieve the above major objective following minor objectives were focused during implementation of the project activities:**

- **Establishing awareness centers to demonstrate and train the stakeholders to achieve the major objective.**

Since one of the major objectives was to impart training to the stake holders so that they inherit the skill to learn the cultivation, harvesting and processing of the Sisal plants an Awareness cum Demonstration centre was established at village Palhera of block Mohagaon in consultation with village panchayat and other officials of local administration. The demonstration centre was established as per approved designs so that the required number of members of SHGs, can be comfortable accommodated. The basic infrastructural facilities e.g. sitting, arrangements, computer added facilities, power supply, Display Board, wash room etc were facilitated for effective implementation of training modules.



- Popularizing cultivation of Sisal on the forest fringes and as a live fence around tribal home gardens for growing and processing Sisal for improving Rural Livelihood. As a significant area of the project implementation site is adjacent to forest area, therefore the land lying unutilized was also preferred for cultivation of the Sisal plant, in concurrence with the permission of the Forest Department officials. The fringe area of the forest was planted with Sisal plant under the supervision of forest officials and an effective natural barrier/fence of Sisal plant was developed which not only helped in protecting the forests to some extent from the invaders but also helped in production of Sisal plants for commercial purpose which in turn helped the stake holders in sustaining livelihood. A few photographs showing the details of the activities are shown **below**:



- Develop environment friendly and cost-effective Sisal fibre extraction and proper implementation of Sisal Fibre Technology (SFT).  
After cultivation and harvestation of the Sisal plants, extraction of fibre was the key issue. As cost-effective technologies are available now a days, therefore efforts were made to train the stakeholders with the new technology available, their proper use, maintenance and also to manufacture different innovative and market demand products for commercial viabilities. Raspador machine was purchased and donated to the Gram Panchayat for providing training and also use it for extraction of the Sisal fibre.



Experts were involved for training of the stakeholders, up-keeping of the Raspador machine.



- Create economic support systems through **Sisal based Rural Agro-Industries**. This was an important component relating to sustenance of the innovative programme. For this NABARD and other lending agencies were consulted to provide loan as part of MSME so that these needy trained people can get an opportunity to establish their own enterprise. The stakeholders were also apprised of the various schemes available for starting this business. For product selling, potential business entrepreneurs were consulted to extend support in sell.
- Empower economically weak dry land farmers and women and develop skills on multiple uses of Sisal.

Most of the Baiga tribal are below poverty line and struggling hard for their livelihood. A majority of the people living in Mahgaon are land less and if few own land are not able to sustain agricultural activities due to lack of adequate resources. Therefore, one of the aspects of the project was to provide them a sustainable livelihood through this income generation activity. It was started with selecting people for forming SHG for which cooperation of Village Panchayat was sought. After formation of SHGs, a well-designed training module was prepared with the help of experts from university, CSIR & forest department. Training programme of 5 days duration for each designated SHG was organized and the participants were apprised of production, harvestation and preparation of various Sisal based market driven products for income generation. Basic objective was to develop the skill required for sustainable Sisal industry.



- Promote **Sisal Growers Associations** for sustainable implementation of Sisal based rural livelihood. Farmers/SHGs were linked with Sisal Growers Associations for marketing their product and timely payment.

### 3. PROJECT AREA (VILLAGE, BLOCK, TOTAL AREA COVERED etc.)

Mandla is a district of Madhya Pradesh, and the town is the administrative headquarter of the district. It is a part of Jabalpur division. The district has an area of 8771 km<sup>2</sup>, and a Total population (2011) of 10,53,522. It has 9 development blocks, 4 thesils, and 1214 villages. Much of the populations are adivasis (tribal people), including Baiga and Gond. The district lies in the Mahakoshal region, and most of the district areas lie in the basin of the Narmada River. The study was carried out in the Baiga dominated area of the district. The Baiga area is spread out in more than 39 villages of Mohgaon block. **Total eight villages were selected purposely from Mohgaon**



**blocks for this study and considering its accessibility in each village two SHGs (in each SHGs, 25-person total beneficiaries number 400) were formed. "The Awareness Creation Centre" is located at village Palhera of block Mohgaon in the midst of the project area.**

### 4. COMMUNITY BACKGROUND (CASTE, OCCUPATION):

The beneficiaries are from Baiga's economy which is still highly depended on agricultural pursuits and collection of minor forest produces. The tribal areas where Baiga population lives contain huge sisal plantations, which are forest, based. Baigas are one of the oldest aboriginal tribes and classified as one of the primitive tribal group (PTG) of block Mohgaon of Madhya Pradesh on the basis of pre-agricultural technology, low literacy and stagnant and diminishing population. Sisal growers / Farmers / Farm Women are not aware of the improvements that they can make use of the result of scientific research and successful experience of the other farmers. Therefore, the first task is to direct the attention of the rural people to the new idea of new fibre technology process and prospects. Creating attention is the starting point of interest. It will help in extension for transfer of Sisal Fibre Technology to improve rural livelihood in tribal areas.

### 5. METHODOLOGY FOLLOWED (SURVEY; MOBILIZATION; TECHNOLOGY IDENTIFICATION; TRANSFER & ADOPTION; DEMONSTRATION & TRAINING COMPONENT, ETC.):

#### SURVEY:

The project was started from **March 2018** and as proposed in the **First Phase** of the project work plan, meetings were organized for consultations with the resource persons for finalizing

the training schedule, contents of the literature to be provided, modalities for formation of SHGs in accordance with the activities as per the sanction given by DST.

Consultations with local Government officials and NGOs were done several times to select the community under this project. Consultations with the Target community were also carried out for field visits and following methodology was adopted to mobilize the target community.

**Preliminary survey of village:**

In the initial stage of the project, preliminary survey of Baiga (PTG) village community of blocks Mohgaon, district Mandla in Madhya Pradesh was conducted.

**PRA Exercise:** PRA approach was adopted to mobilize the Baiga (PTG) Community for conducting the training and capacity development programme.

**Field visit for Interaction with target group:** In March 2018, first interactive visit was organized in Mohgaon block of Mandla district. Our organization (Society for Environmental Conservation) was in close contact with **16 Baiga (PTG) Tribal Self- Help Groups of Mohgaon block of Mandla district** and helped them in starting Sisal growing activities. During the visit, they were consulted to take up Sisal plantation activities. A rapid rural assessment exercise was carried out during the visit.



**Initial workshop with target group:**

To initiate a dialogue with the target group who are new to the projects, an initial workshop was organized in Mohgaon block of Mandla district to take up the project activities at beneficiaries' level.



Baiga tribal selected to be engaged in Sisal plants growing and cultivation activities were invited to attend it. Officials from Forest Department of Mandla district was also involved in the activity. About 250 Baiga tribes associated with Sisal plant growing and cultivation related activities attended the workshop. In this workshop, the experts of the different organizations told them about Sisal cultivation, its importance and its benefits. They have also mentioned how they can use the scientific techniques for Sisal plants growing and cultivation.

**Group formation:**

The initial workshop was conducted by the Society of Environmental Conservation to form **16 Baiga Tribal Self-Help Groups (SHGs)** in 8 villages in Mohgaon block of Mandla district and out of this 8 groups were selected for **Sisal Growing Association (SGA)**.

**Activity selection:**

As per the interest of the beneficiaries' group and the local need, different activities related to Sisal growing and cultivation and sisal fibre extraction, rope making, Sisal fibre handicraft items making were conducted.

**Training:** As proposed, 16 SHGs were constituted. Each SHGs consist of 25 beneficiaries.

**BAIGA BENEFICIARIES:****GROUP-I: VILLAGE MOHGAON RAIYAT**

S. No.	Name	S. No	Name	S. No	Name
1	Pusia Bai Baiga	11	Keharwati Baiga	21	Pahal Singh Baiga
2	Buddu Singh Baiga	12	Putty Lal Baiga	22	Parbatiya Baiga
3	Gomati Bai	13	Rajesh kumarBaiga	23	Premvati Baiga
4	Gulab Baiga	14	Dhola Singh Baiga	24	Pinky Bai Baiga
5	Hirondi	15	SukaratiBaiga	25	Santi Bai Baiga
6	SadanBaiga	16	Sukchain Baiga		
7	Suman Bai Baiga	17	Sukhmaniya Baiga		
8	Durga Prasad Baiga	18	Jagat Lal Baiga		
9	Ram Pyari Baiga	19	Basant Baiga		
10	Chatty Baiga	20	Shankari		

**GROUP-II: VILLAGE MOHGAON MALL**

S. No	Name	S.No	Name	S .No	Name
1	Chander Singh Baiga	11	Sampa Bai	21	Sonkali
2	Gyanvati	12	Mukesh	22	Sonsay
3	Kamalsingh	13	Nisha	23	Brihaspati
4	Guddi Bai	14	Bisah	24	Vishram
5	Saraswati	15	Meena Bai	25	Ramkali
6	Dassu	16	Dhanesh		
7	Umreth	17	Rekha Bai		
8	Kamli	18	Virendra		
9	Bhuri Bai	19	Sitaram		
10	Biriya Bai	20	Sukhvariya		

**GROUP-III: VILLAGE BODASILLY**

S. No.	Name	S. No.	Name	S. No.	Name
1	Ratan Singh Baiga	11	Raj Kumari Baiga	21	Savitri Bai Baiga
2	Sita Bai	12	Bhagrati Bai Baiga	22	Budhiya Baiga
3	Sukmania Baiga	13	Teejo Baiga	23	Dujiya Bai Baiga
4	Ram Prasad Baiga	14	Gyanwati Baiga	24	Bhoori Bai Baiga
5	Guddy Bai Baiga	15	Ratto Baiga	25	Chain VatiBaiga
6	Gilaso Baiga	16	Veer Singh Baiga		
7	Suresh Baiga	17	Prem Vati Baiga		
8	Meena bai Baiga	18	Rajjo Bai Baiga		
9	Sangeeta Bai Baiga	19	Sumarniya Baiga		
10	Pahalvati Bai Baiga	20	Chameli Bai Baiga		

**GROUP-IV: VILLAGE BODASILLY**

S.No.	Name	S. No.	Name	S. No.	Name
1	Jagdeesh Baiga	11	Bela Kali	21	Mangliya
2	Guddu Baiga	12	Basanti Bai	22	Pahelvati Bai
3	Dhania Baiga	13	Bisto Bai	23	Krishna Kumar
4	Rajesh Baiga	14	Champa Bai Baiga	24	Rajesh
5	Kubriya Baiga	15	Bilso Bai	25	Dhan Raj
6	Gyanwati Bai Baiga	16	Usha Bai		
7	Beena Bai	17	Sita Bai		
8	Malti Bai	18	Ram Pyari Bai		
9	Kranti Bai	19	Keharvati Bai		
10	Lalita Bai	20	Ganga Bai		

**GROUP-V: VILLAGE PIPARIA RAIYAT**

S. No.	Name	S. No.	Name	S. No.	Name
1	Pahel Singh Baiga	11	Santosi Baiga	21	Shanti Bai
2	Memvati Bai	12	Sundari Bai	22	Hemant Baiga
3	Ram Kumar Baiga	13	Panna Lal Baiga	23	Dharmi Bai
4	SukalVati Baiga	14	Than Singh Baiga	24	Laxmi Bai
5	Yashoda Bai	15	Jathiya Baiga	25	Raju Baiga
6	Sam VatiBaiga	16	Dharam Chandra Baiga		
7	Samar Vati Baiga	17	Dhanesh Baiga		
8	Muniya Bai Baiga	18	Chammu Baiga		
9	RajjuBaiga	19	Mahavati Bai		
10	Dhaniya Bai	20	Devanti Bai Baiga		

**GROUP-VI: VILLAGE PIPARIA RAIYAT**

S. No.	Name	S. No.	Name	S. No.	Name
1	Gita Bai Baiga	11	Jitedra Baiga	21	Bhag Chand
2	Raju	12	Saroj Bai	22	Kamal Vati
3	Jagdeesh Baiga	13	Rukmaniya Bai	23	Shanti Bai
4	Dinesh Baiga	14	Dilip Singh Baiga	24	Sushila Bai
5	Maneesh Baiga	15	Sant Ram Baiga	25	Sukal Vati Baiga
6	Phool Kali Bai	16	Ramhiya Baiga		
7	Lamiya Bai	17	Jay Ram Baiga		
8	Aayto Baia	18	Maha Vati Baiga		
9	Meera Bai	19	Samni Bai		
10	Naresh	20	Amar Vati Baiga		

**GROUP-VII: VILLAGE PALHERA**

S. No.	Name	S. No.	Name	S. No.	Name
1	Mohan Lal Baiga	11	Bisso Bai	21	Narbadiya Bai
2	Meena Bai	12	Rajvati Bai	22	Kutriya Bai
3	Samarto Bai	13	Bhuri Bai	23	Suk Vati Bai
4	ShyamVati Bai	14	Dasso Bai	24	Rajkumari Bai
5	Rajo Bai	15	Ram Vati Bai	25	Paheli Bai
6	Ganga Bai	16	Lalita Bai		
7	Titri Bai	17	Meena Bai		
8	Somvati Bai	18	Samarto Bai		
9	Sonvati Bai	19	Lamiya Bai		
10	Chando Bai	20	Kaushalya Bai		

**GROUP-VIII: VILLAGE PALHERA**

S. No.	Name	S. No.	Name	S. No.	Name
1	Guddi Bai	11	Jathiya Bai	21	Bodho Bai
2	Dharam Vati Bai	12	Munni Bai	22	Basanti Bai
3	Rubina Bai	13	Sukoo Bai	23	Rammo Bai
4	Sampatiya Bai	14	Prem Vati Bai	24	Sonkali Bai
5	Sumantra Bai	15	Munni Bai	25	Soma Bai
6	Budhiya Bai	16	Premkali Bai		
7	Sukhmaniya Bai	17	Ansuiya Bai		
8	Sona Bai	18	Sumitra Bai		
9	Geeta Bai	19	Sita Bai		
10	Ramkali Bai	20	Lamiya Bai		

**Group- IX: VILLAGE CHOUGAN, MOHGAON, MANDLA**

S. No.	Name	S. No	Name	S. No	Name
1	Ram Prasad Baiga	11	Kamalvati Baiga	21	Nainvati Baiga
2	Ayto Bai Baiga	12	Lamina Bai Baiga	22	Kamaliya Baiga
3	Puniya BaiBaiga	13	Kaushaliya Baiga	23	Tulsa Bai Baiga
4	Sunila BaiBaiga	14	Rajkumari Baiga	24	Ram Bai Baiga
5	Lamiya Bai Baiga	15	Sukarati Baiga	25	Rammo Bai Baiga
6	Ramety Bai Baiga	16	Sampatiya Baiga		
7	Sabni Bai Baiga	17	MatiyaBai Baiga		
8	Sukhvati Bai Baiga	18	Budhiya Bai Baiga		
9	Sahmatia Bai Baiga	19	Basanti Bai Baiga		
10	Samaro BaiBaiga	20	Gansho Bai Baiga		

**Group- X: VILLAGE CHOUGAN, MOHGAON, MANDLA**

S. No	Name	S. No	Name	S. No	Name
1	Ram Kishan Baiga	11	Rampyari Bai Baiga	21	Sunita Bai Baiga
2	Mangalvati Bai Baiga	12	Harikali Bai Baiga	22	Fagany Bai Baiga
3	Kallo Bai Baiga	13	Chandvati Bai Baiga	23	Murli Bai Baiga
4	Leelavati Bai Baiga	14	Komli Bai Baiga	24	Jurli Bai Baiga
5	Ravita Bai Baiga	15	Pahelvati Bai Baiga	25	Titari Bai Baiga
6	Khamiya Bai Baiga	16	Munni Bai Baiga		
7	Muliya Bai Baiga	17	Siyavati Bai Baiga		
8	Sukhmaniya Bai Baiga	18	Gidiya Bai Baiga		
9	Jagoti Bai Baiga	19	Guddi Bai Baiga		
10	Aaradhna Bai Baiga	20	Bilsho Bai Baiga		

**Group- XI: VILLAGE JHEENA, MOHGAON, MANDLA**

S. No.	Name	S. No.	Name	S. No.	Name
1	Geeta Lal Baiga	11	Bilsiya Bai Baiga	21	Kaklo Bai Baiga
2	Chaity Lal Baiga	12	Jamuna Bai Baiga	22	Ramvati Baiga
3	Laxmi Bai Baiga	13	Dharmo Bai Baiga	23	Sumantri Bai Baiga
4	Sukhmati Bai Baiga	14	Aayto Bai Baiga	24	Manglo Bai Baiga
5	Sumantra Bai Baiga	15	Vaishakhiya Baiga	25	Nainsi Bai Baiga
6	Meena Bai Baiga	16	Sunita Bai Baiga		
7	Kota Bai Baiga	17	Kaliya Bai Baiga		
8	Radhiya bai Baiga	18	Munny Bai Baiga		
9	Sukko Bai Baiga	19	Sundri BaiBaiga		
10	Lamno Bai Baiga	20	BartoBai Baiga		

**Group- XII: VILLAGE JHEENA, MOHGAON, MANDLA**

S. No.	Name	S. No.	Name	S. No.	Name
1	Amarat Lal Baiga	11	Jamuna Bai Baiga	21	Dayavati Bai Baiga
2	Sakko Bai Baiga	12	Kola Bai Baiga	22	Nain Bai Baiga
3	Ganga Bai Baiga	13	Manglo Bai Baiga	23	Sona Bai Baiga
4	Vaishakhiya Bai Baiga	14	Meena Bai Baiga	24	Phoolvati Bai Baiga
5	Ramoti Bai Baiga	15	Neha Bai Baiga	25	Naina Bai Baiga
6	Kamalwati Bai Baiga	16	Budhiya Bai Baiga		
7	Ramvati Bai Baiga	17	Bhuri Bai Baiga		
8	Munni Bai Baiga	18	Dallo Bai Baiga		
9	Kota Bai Baiga	19	Diblo Bai Baiga		
10	Aeto Bai Baiga	20	Parvati Bai Baiga		

**Group- XIII: VILLAGE RAMKHIRIA, MOHGAON, MANDLA**

S. No.	Name	S. No.	Name	S. No.	Name
1	Indrajeet Baiga	11	Sunita Bai Baiga	21	Janiya Bai
2	Ramvati Bai Baiga	12	Bodho Bai Baiga	22	Sumiya Baiga
3	Sukko Bai Baiga	13	Kaushaliya Bai Baiga	23	Dassi Bai
4	Manna Bai Baiga	14	Manki Bai Baiga	24	Teeko Bai
5	Munni Bai Baiga	15	Shiv Kumari Baiga	25	Sonkali Baiga
6	Ram Vati Baiga	16	Sukhmaniya Bai Baiga		
7	Samaro Bai Baiga	17	Seeta Bai Baiga		
8	Mangli Bai Baiga	18	Batasho Bai Baiga		
9	Sail Kumari Baiga	19	Reovati Bai Baiga		
10	Sita Bai Baiga	20	Gulvasiya Bai Baiga		

**Group- XIV: VILLAGE RAMKHIRIYA, MOHGAON, MANDLA**

S. No.	Name	S. No.	Name	S. No.	Name
1	Brahaspati Baiga	11	Yashoda Baiga	21	Sundari Bai
2	Chaity Baiga	12	Ram Kumari Bai	22	Mahavati
3	Kalsho Bai	13	Samvati Bai	23	Puniya Bai
4	Lamiya Baiga	14	Muniya Baiga	24	Ramkali Bai
5	Tilshi Bai Baiga	15	Dhaniya Baiga	25	Anokhi Baiga
6	PremLal Bai	16	Jathiya Bai Baiga		
7	Guddy Bai	17	Shanti Bai Baiga		
8	Jashomati Bai	18	Dharmi Bai Baiga		
9	Samarto Bai	19	Laxmi Bai Baiga		
10	Sunita Bai Baiga	20	Geeta Bai Baiga		

**Group- XV: VILLAGE BILGAON, MOHGAON, MANDLA**

S. No.	Name	S. No.	Name	S. No.	Name
1	Jagdeesh Baiga	11	Rama Baiga	21	Punia Bai
2	Mukesh Baiga	12	Kamla Bai	22	Kala Bai
3	Malti Bai Baiga	13	Anguri Bai	23	Dullo Bai
4	Malati Bai Baiga	14	Ramko Bai	24	Malti Bai
5	Lalita Bai Baiga	15	Janka Bai	25	Hina Bai
6	Basanti Bai Baiga	16	Saroori Bai		
7	Usha Bai Baiga	17	Gomti Bai		
8	Billo Bai Baiga	18	Rukkho Bai		
9	Ganga Bai Baiga	19	Narayani Bai		
10	Puja Bai Baiga	20	Vaijanti Bai		

**Group- XVI: VILLAGE BILGAON, MOHGAON, MANDLA**

S. No.	Name	S. No.	Name	S. No.	Name
1	Mahesh Baiga	11	Shimla Bai	21	Chanda Bai
2	Phool Singh	12	Mona Bai	22	Sukalvati Bai
3	Sarju Bai	13	Suman Bai	23	Aandhi Bai
4	Parvati Bai	14	Meenakshi Bai	24	Chameli Bai
5	Ramkali Bai	15	Sikha Bai	25	Ganga Bai
6	Aanandi Bai	16	Sobha Bai		
7	Mahavati Bai	17	Kiran Bai		
8	Maya Bai	18	Sona Bai		
9	Daya Bai	19	Jyoti Bai		
10	Lata Bai	20	Jagrati Bai		

**SEC, conducted 20 trainings for 16 Self-Help Groups of Sisal growing and cultivation of Sisal Fibre Extraction, rope making, yarn making, Sisal fibre handicraft items making and Vermi-composing and Bio-gas uses for domestic purpose. Forest boundary Sisal leaves was harvested by the Baiga communities/ forest villagers for sustainable livelihood.**

**Training Manual is enclosed as Annexure-I for ready reference:**

Date /Days	Time	Activity	Name of Participants	Training Officer
From 09/04/2018 To 11/04/2018	10:45 AM	Trainings for SHGs/SGA and skill development/awareness programmes / workshop. 2 training programmes (3, days).	08, SHGs members,	M. S. Viridi. Ex. Director, CSIR, Bhopal, Kalpana Sharma & Dr. P. Ashokan (AMPRI) Bhopal.
From 15/05/2018 To 17/05/2018	10:50 AM	Training programmes on Sisal plant growing, sisal leaves cutting / cultivation Sisal fibre extraction Rope making and Bio-gas, Vermi-composting. 4 training programmes (3, days).	08, SHGs members	M. S. Viridi. Ex. Director, CSIR, Bhopal. Dr. E. Peter (AMPRI) Bhopal. Dr. Brijesh Sharma., SEC, Bhopal.
From 04/06/2018 To 06/06/2018	10:30 AM	Handicraft items making and learning Programmes for women. 2 training programmes (3, days).	08, SHGs members	Dr. Brijesh Sharma, SEC, Bhopal. Dr. S. K. S. Rathore (AMPRI) Bhopal. P.I. Kalpana Sharma.
From 05/07/2018 To 07/07/2018	10:00 AM	Sisal fiber product making and learning programmes for youth. 2 training programmes (3, days).	08, SHGs, members	M. S. Viridi. Ex. Director, CSIR, Bhopal & P.I. Kalpana Sharma.
From 24/07/2018 To 27/07/2018	10:00 AM	Fields preparation and growing of Sisal plants. Sisal plantation in the fields. Sisal plants care and managements (4, days).	08, SHGs, members	M. S. Viridi. Ex. Director, CSIR, Bhopal P.I. Kalpana Sharma
From 15/04/2019 To 17/04/2019	10:00 AM	Trainings for SHGs/SGA and skill development/awareness programmes/workshop. 2 training programmes (3, days).	08, SHGs, members	M. S. Viridi. Ex. Director, CSIR, Bhopal. P.I. Kalpana Sharma
From 25/05/2019 To 27/05/2019	10:30 AM	Training programmes on Sisal plant growing, sisal leaves cutting / cultivation Sisal fibre extraction Rope making and Bio-gas, Vermi-composting. 4 training programmes (3, days).	08, SHGs, members	P.I. Kalpana Sharma, Co-I. Dr. Anita Verma, Dr. Brijesh Sharma & Dr. P. Ashokan (AMPRI) Bhopal.
From 07/06/2019 To 09/06/2019	10:30 AM	Handicraft items making and learning Programmes for women. 2 training programmes (3, days).	SHGs, women	P.I. Kalpana Sharma, Co-I. Dr. Anita Verma & M. S. Viridi. Ex. Director, CSIR, Bhopal.
From 27/08/2019 To 29/08/2019	10:30 AM	Sisal fiber product making and learning programmes for youth. 2 training programmes (3, days).	SHGs, youth	P.I. Kalpana Sharma, Co-I. Dr. Anita Verma & Dr. P. Ashokan (AMPRI) Bhopal.
From 26/09/2019 To 29/09/2019	10:30 AM	Fields preparation and growing of Sisal plants. Sisal plantation in the fields. Sisal plants care and managements (4, days).	08, SHGs, members	Dr. Brijesh Sharma, P.I. Kalpana Sharma & M. S. Viridi. Ex. Director, CSIR, Bhopal.

**Exposure visit:** SEC conducted exposure visit for the Self-Help Groups. One exposure visit was organized at Advance Material Processing & Research Institute (**AMPRI**), Bhopal, Madhya Pradesh for demonstration of Sisal plant leaf cutting and Sisal fibre extraction through **Raspador** machine for beneficiaries.

**Demonstration unit:** The Setting of demonstration Units like shed, purchase of machine Raspador, Rope making and Vermi-Compost pits, Bio-gas plants, water tanks etc. have been done to conduct further experiment. Field experiment was carried out at **Palhera village of Mohgaon** block of Mandla district. A shed was constructed with 25 X 40 ft area and two Vermi-compost pits and one Bio-gas unit were buildup for training purpose to the beneficiaries.

#### 6. TECHNICAL BACK-UP SUPPORT AND LINKAGES ESTABLISHED WITH S&T INSTITUTIONS:

**SEC, established strong linkages for** Technical Collaboration with Advanced Material Processing Research Institute (**AMPRI**), Bhopal (formerly known as RRL) of **CSIR** as ready reference which has vast experiences and technical resources for Sisal programme. **SEC**, utilize the resources of AMPRI while providing training and capacity development programme to SHGs, members. Experts from Department of Zoology, Barkatullah University, Bhopal were also utilized for implementation of identified activities.

S. NO.	Name of institution	Technical back up
1.	Department of Zoology, Barkatullah University, Bhopal.	Provided experimental laboratory set up for necessary requirement.
2.	Technical Collaboration: Letter from Advanced Material Processing Research Institute ( <b>AMPRI</b> ), Bhopal (formerly known as RRL) of <b>CSIR</b> as ready reference	As ready reference from the AMPRI, Dr. P. Ashokan and Dr. E. Peter and Dr. S. K. S. Rathore, scientist of AMPRI, Bhopal.

#### 7. SCIENCE & TECHNOLOGY COMPONENT:

A work shed has been established to organize training and capacity development programme for the target groups. Experts from CSIR and Forests department of Madhya Pradesh have been involved in providing the training to the trainees and training materials prepared by the experts were distributed to the participants.

#### 8. PEOPLE'S PARTICIPATION FROM PLANNING TO IMPLEMENTATION STAGE (WITH EMPHASIS ON EXTENT AND NATURE OF THEIR INVOLVEMENT IN TECHNOLOGY GENERATION/MODIFICATION/TRANSFER/ADOPTION; CO-OPERATIVE FORMATIONS):

As stated earlier, SEC has involved the target population in various phases of the project:

- **Initial phase:** Before starting the project, SEC organized PRA exercise to get the input of the participants.

- **Implementation phase:** During implementation phase also SEC, conducted all the activities in consultation with the target groups. In this phase demonstration unit was constructed with active participation of the group. They contributed for the entire labor work.
- **Group formation:** Almost all the beneficiaries involved in the project have been organized in the form of Self-Help Groups and they have been linked with banks.



**9. IMPACT ANALYSIS WITH INDICATORS (QUALITATIVE & QUANTITATIVE DETAILS; TECHNO ECONOMIC VIABILITY; IMPROVEMENT IN PRODUCTIVITY: QUALITY & QUANTITY/INCOME GENERATION/LIVING STANDARD/SKILL UPGRADATION & MANAGERIAL CAPABILITY/ENVIRONMENTAL CONDITIONS/PERSONNEL TRAINED AS THE CASE MAY BE):**

The monitoring agencies like representative from village Panchayat and **Officers from Forest Department of Madhya Pradesh and Scientist from AMPRI, CSIR** were involved to supervise the implementation of the proposed activities and their suggestion were incorporated from time to time for effective implementation of the project.

**First year: OBJECTIVES ACHIEVED:**

**FIRST PHASE: 1st YEAR**

**In first year following activities as envisaged in the work plan have been completed:**

- Creation of Infrastructure facilities- leasing of building land with shed with all facilities of water and power.
- Recruitment of Project Staff and their sensitization.
- Setting up of Demonstration Units- Machine Fibre extraction units, Biogas unit, Vermi-composting pits, Rope making, Mat making, Handicrafts items.
- Development of linkages with State Government line departments.
- Development of literature and exhibits on Sisal based livelihood.
- Implementation of Sisal Fibre Technology (SFT).

- Organization of Village level awareness meetings.
- Formation of Village level Sisal Growers Association (SGA) /SHGs.
- Selection of 25 participants for each SGA for training and skill development programme.
- Organizing Training to Stake holders (Participants).

**The participants underwent trainings and skill development in the following areas.**

- Sisal cultivation in the forest lands and boundaries.
- Mechanical extraction of fiber and grading of fiber.
- Rope making and yarn making.
- Biogas production and its use with Sisal biomass.
- Handicrafts making with fiber.
- Making of mats, bags, brushes.
- Encouraging women to organize into Baiga Tribal Self-Help Groups and introduce them to small savings scheme through micro financing (Credit) scheme.

**SECOND PHASE: II nd YEAR**

The remaining activities as approved in the project were implemented in second year.

**These are:**

- Organizing trainings and skill development programme for selected participants.
- Strengthening of micro financing system with (PTG) Baiga Tribal through SHGs.
- Follow up of village meetings.
- Strengthening of marketing networks, exploration of demand in domestic and international markets.
- Participation in natural fiber trade fairs and seminars.
- Establishing the awareness creation centre as a model centre for popularizing Sisal based livelihood in the tribal areas.
- Establishing a sustainable marketing network for various sisal fiber products.
- Continuation of trainings and skill development programme or the beneficiaries from remaining areas of the district.



**10. SPECIAL FEATURES (NEW TECHNOLOGY GENERATION/ INNOVATIVENESS IN TERMS OF LOW COST/DESIGN/ENVIRONMENTAL FRIENDLY ETC; REPLICABILITY POTENTIAL & MULTIPLIER EFFECT IN NEARBY AREAS):**

Sisal is a strong fibre, which is traditionally used for making ropes, cordages, and twines. It is also being used to manufacture coarse fabrics, rugs carpets, handicrafts, mats, fishing nets etc. The sisal pulp left after fibre extraction is used for making paper/ paper boards, hecogenin, wax, biodegradable polymer etc. biogas and vermin-compost.

**Vermi-composting:** In vermin-composting degradation of bio-residues is done with the help of earthworms (*Eisenia foetida*). Sisal leaves contain about 95% of green pulp, which is utilized in the preparation of vermicompost. This ecofriendly organic manure is rich in nitrogen, phosphorous, potassium and organic matter.



**Biogas:** Sisal leaves wastes have great potential in catering for energy demand, especially in small-scale local energy sector. Bio-methane from sisal fibre wastes, a waste product of the sisal industry, is of great importance as a renewable energy carrier that could be used for cooking and power generation. Sisal waste has proved a good feed for an aerobic reactor to produce biogas and this biogas could be used for the generation of electricity.



### Degumming and Softness of Sisal Fibres:

For handicraft, textiles and other applications, multi cellular fibres are widely used. Degumming with alkaline agents not only removes the non-cellulosic materials like hemi cellulose, pectins and lignin but help to soften them substantially. Research studies indicated that at higher concentration and at elevated temperatures, with sodium hydroxide (NaOH) treatment, non-cellulosic parts have been substantially removed. Further crystallinity % is also got affected as given below:

S. No.	Constituents	Raw Fibre	NaOH Treated 100g/lit.30 mt. Room Temp.	NaOH 180g/lit. 30mt. At Room Temp.	NaOH Treated 100g/lit.30 mt. At 75 C.
1	Cellulose	56.50%	65.50%	73.20%	81.50%
2	Hemicellulose	15.30%	12.00%	8.50%	5.50%
3	Lignin	22.50%	18.50%	14.50%	10.23%
4	Pectin	5.50%	4.00%	3.80%	2.75%

The studies have indicated that while treating with **NaOH** at different temperature and concentrations, the tenacity of the fibres had also shown in significant decline with corresponding improvement in the elongation % as given below:

S. No.	Constituents	Raw Fibre	NaOH Treated 100g/lit.30 mt. Room Temp.	NaOH 180g/lit. 30mt. At Room Temp.	NaOH Treated 100g/lit.30 mt. At 75 C.
1	Tenacity cN/Tex.	0.572	0.280	0.244	0.231
2	Elongation %	3.00%	20.20%	22.15 %	21.50%

### 11. APPLYING FOR PATENT, IF ANY:

The proposed programme was related to training and capacity development on Sisal Cultivation, harvesting, manufacturing marketable products for livelihood generation of the people living below poverty line so that they become economically self sustainable. Hence no effort has been made for obtaining patent.

## 12 INDICATORS APPLIED FOR MONITORING:

### Pre and post intervention:

A general survey was conducted to understand the economical background of the Baiga community in the project area. Questionnaires were prepared in consultation with the experts to have an input of the community structure, social status, livelihood conditions, work profile, agricultural activities, educational status etc.

After implementation of the project activities a post monitoring study is proposed to understand the effectiveness of the project activities with the involvement of SHG members, Sarpanch of village Panchayat, forest officials, local bodies and marketing representatives.

### 13. FOLLOW UP ACTION (POST PROJECT):

The assets created under the project like work shed, raspador machine etc. have been handed over to local Panchayat for sustaining the project activities. Modalities for financial support for continuing the sisal cultivation is being explored with the NABARD and district administration.

### Income improvement

Presently sisal and their allied activities is an unorganized sector localized mostly in rural and tribal areas. The sisal fibre and its allied activities like cultivation; fibre extraction, processing and making value added products could augment the employment opportunities for income generation in rural sector. The engineering applications of sisal fibre like buildings, automotive, railways etc. are the prospective areas where it can generate enormous employment potential in semi urban and urban areas. Sisal plantation activity alone has an annual employment potential of about 113 man-days per hectare. For instance, the state of Madhya Pradesh has 14.17 lakh ha. Barren and uncultivated wastelands, out of which 3.00 lakh ha (20%) can be targeted for sisal plantations, which can generate enormous employment potential (339 Million Man Days) for exclusively cultivation and fibre extraction. Apart this fibre is an input material for various rural applications involving cordage, mats, handicrafts and other utility items, which can augment the employment opportunities for income generation in rural sector.

### Employment potential from sisal cultivation.

Scenario	Sisal Cultivation Area (ha).	Production (Tons/Yr.)	Man-days (per Year)
Unit area	1.00	2.5	113
Current Status-India (Unorganized Sector)	10.100	25,250	11,41,300
Potential (Madhya Pradesh)	3,00,000/-	7,50,000/-	3,39,000/-

## 14. CONSTRAINTS & SUGGESTIONS:

### SWOT ANALYSIS FOR SISAL

#### Strength

- Agave, in general, is well adapted to arid environment as the species is xerophytic in nature.
- The crop of sisal is well suited under the changing climatic situation characterized by elevated mean temperature, erratic and insufficient rainfall.
- The blue water footprint (surface and ground water consumed) of sisal is only 9 m<sup>3</sup> /t of sisal fibre produced which is much lower than other vegetable fibre crops such as jute (33 m<sup>3</sup> /t) and ramie (201 m<sup>3</sup> /t).
- Moderate waste lands can also be utilized for growing sisal with economic benefits provided adequate crop care is taken by adopting improved package of practices
- Recommended double row planting of sisal checks soil. Erosion, restrict runoff loss of rain water, improves absorption of rain water in the soil layer.
- Being a perennial crop, it requires less agro-activities and thereby minimum soil disturbances occur.
- Fortunately, sisal is not heavily infested by many diseases and insect pests beyond certain degree causing economic loss. Therefore, sisal plantation does not add pesticide load to the environment.
- A number of value-added uses has been identified and documented.
- Sisal cultivation and fibre production in the poor socioeconomic regions of the country may act as elixir for the social malady arising out of sense of neglect or deprivation resulting in separatist/out of the mainstream movements.

#### Weakness

- Comparatively larger area (say >1 ha) is needed for economically viable plantation of sisal
- Unlike several other fibre crops, extraction process involves mechanical extractor called decorticator which is often beyond the affordability of small and marginal farmers.
- Propagated through vegetative means, so availability of planting materials (bulbils and suckers) for larger area is inadequate. Moreover, it involves transport cost and possibility of physical damage to the living plantlets reduce survival rate.
- Initial longer harvest holiday (for 3 years or so) disinterest common resource-poor farmers/ planters.
- Lack of sufficient number of high yielding varieties/ types to choose for specific situations.
- Comparatively narrow genetic base for improvement in fibre productivity and quality.
- Low or negligible credit flow in sisal plantation sector.
- No well-known Indian Farming August 2015, quality standard, so farmers are forced to sell at lower price offered by the middlemen/ fixed by the mills.
- Unorganized marketing facilities and non-existent extension networks

**Threat**

- Global competition from China and Brazil, producer of quality sisal fibre.
- Steep competition from cheap man-made fibres in general and synthetic based composites in particular.

**15. CONCLUSION:****Livelihood generation:**

India's villages are dependent on agriculture for much of their sustenance. Drought is a common occurrence across much of India. As a result, villagers, for the most part, remain a poor lot-the per capita income of India's villages is perhaps not more than Rs. 10,000 per annum. The country needs creative solutions and technological innovations to start a revolution which can take its villages fast forward in time by creating them economically viable units and growth engines, harnessing the power of the villagers, and opening up new horizons with the promise of a better tomorrow. As identified from the study, food insecurity in the state of Madhya Pradesh can be attributed to factor such as fluctuating weather conditions leading to server drought, undulating terrain with little or no capacity of conserving water, steep slopes with high surface runoff, unavailability of drought resistance variety of quality seeds, agricultural practice etc.

**In Madhya Pradesh** an average family is secured for 6-7 months in a year from the agricultural produce such as wheat, maize, rice, millet, and gram. The earning from cash crops such as oilseeds, groundnuts, etc. enhances the food purchase power of these cultivators. For the rest of the years these families depend upon purchase from the open market or the public distribution system. During the crisis the animals are often set free, as they become unable to feed the live-stock.

Landless families and communities living near the forest, however largely depend upon forest produce during a crisis. The forest provides fruits, mushrooms, tubers, roots, etc. for house hold consumption. Since Madhya Pradesh is primarily an agricultural state, the indigenous sources of livelihood for the communities are agricultural. A majority of the households are dependent upon agriculture.

At times landless families earn their livelihood by working as wage labourers. To find an alternate source of income, families migrate to relatively well-off districts nearby as well as others states. Within a household, people reduce the size of meal during scarcity. They adapt towards eating foods for the less preferred (small millets, kodo and kutki tubers, roots, leafy vegetables, etc.). Sometimes, reducing the meal size is not enough and so they even skip meals.

**SUMMARY** Sisal fibre has a bright prospect for its versatile nature encompassing ecofriendliness, suitability for moderate wastelands, apt for changing climatic situation due to low water requirement, high water use efficiency (CAM plant), survival and economic output even in very high ambient temperature; it puts minimum pesticide load to the environment through its cultivation process, being semi-perennial and with lower agro-activity it conserves soil. Sisal is the most viable option for employment opportunity and rural development in the tribal dominated and socio-economically less developed parts of the country; vast arena of sisal-based composites with targeted characteristics, sisal based geo-textiles have edge over

others due to presence of higher strength and impregnated waxy material and a bunch of engineering applications, etc.

### Opportunity

- Due to several desirable inherent qualities, sisal has ample scope for product diversification and value addition. The broad classification of such diversified products includes, sisal-based geotextiles, coir and sisal blended yarn, biodegradable natural fibre composites, sisal/glass fibre reinforced hybrid composites, sisal fibre reinforced thermostats, sisal fibre reinforced thermoplastics, sisal fibre reinforced rubbers, sisal fibre reinforced cement and gypsum.
- Fortunately, in recent years, appropriate agro-technology to grow annual legumes namely cowpea, pigeon pea, black gram and green gram as intercrops in sisal for initial 3 years has been standardized. Therefore, even the resource poor sisal farmers will get economic return from the piece of land for initial 3 years harvest holiday phase of sisal. This practice also contributes in minimizing soil erosion due to thick foliage cover; improve soil health by increased rhizospheric soil microbial activity and positive nutrient balance.
- Sisal responds to precision placement of water through drip method. This system of precision irrigation not only saves amount of water but also increases water use efficiency. The same has been proved in number of field experiments in double rowed sisal plantation where limited drip irrigation during the summer months (April-June) increased the sisal fibre yield from 33 to 47%.
- Portable sisal decorticator was designed, developed and tested successfully by CRIJAF. The new decorticator provides improved processing of sisal fibre with less energy input and able to provide 55-60% more fibre than the existing one. The Decorticator has already been commercialized through a MOU between the inventing institute (CRIJAF) and the large-scale manufacturer operational from Odisha. So the long felt need of cheap, portable and energy efficient sisal decorticator has been fulfilled.
- Sisal waste can be used as good mulching material in other crop to conserve soil moisture in different cropping situation. It can also improve soil conditions and other characteristics of the soil.
- Sisal can save trees as this leaf fibre crop produces huge amount of biomass which can be utilized for paper pulp. Bleached and unbleached sisal pulp is ideally suitable for manufacturing of different quality papers such as dielectric paper, vacuum and tea bag, filtration paper. Bleached sisal pulp can be used for cigarette paper.
- Sisal leaf decortications residue has good potential for bio-methane production (0.2 m<sup>3</sup> CH<sub>4</sub>/kg residue added) after pre-treatment by lignolytic CCHT 1 and Trichoderma reesei.
- Agricultural activity in sisal plantation requires at least 140- 160 man-days at the present level of mechanization in agriculture of peninsular India. In a state like Chhattisgarh, Odisha and Madhya Pradesh, sisal plantation can generate rural employment of not less than 4-5 lakh man-days every year.

- Sisal fibre based rural handicraft and small industry further augment the employment opportunities in those states.
- Some national financial institutions (such as NABARD) have programme through which sisal can be raised in wasteland and also has scheme for assisting rural women entrepreneur dealing with sisal-based handicrafts.
- Sisal crop can help to raise the socio-economic status of the tribals where large areas of land are lying unutilized and unproductive. It provides working opportunities in off-season in remote tribal areas of the country Sisal based product diversification (handicrafts, floor covers, carpets and low-cost composite building materials) is a distinct possibility.
- Harnessing important secondary metabolites like 'Hecoginine', etc from sisal has bright prospect in India.
- India imports about 2000 tons (1964 tonne in 2006) of sisal fibre by paying US \$ 2.33 million. So, domestic production may save valuable foreign exchange.
- In the line of 'London Sisal Association', Indian Sisal Producer and Marketers Association may be formed and activated for getting better opportunity in the global market of natural fibres.

#### Exit policy

***Although the activities defined in the project have been implemented within the prescribed time schedule however for sustainability of the Sisal cultivation and technical manpower generated with the training and capacity programme, post project monitoring should be undertaken for that future plan of activity has been submitted to the local bodies by Society of Environmental Conservation (SEC). As per the approved project period, the project duration is for two years which has been completed in March 2020.***

***However, it would be worthwhile to mention that Sisal programme usually takes at least 3-4 years since harvesting of Sisal plant is done after three years when the plant achieves maximum growth. As the project period was for two years hence the SHGs, members were demonstrated the use of fibre extraction through Raspador machine using the Sisal plants cultivated by Forest Department of Madhya Pradesh three years back. Thereafter the members of the SHGs, are in touch with the SEC for all sorts of support and technical consultation for extraction of the sisal plants planted by them after three years, even after completion of the project.***

***SEC, is also conducting various livelihood programme under financial support of DST and other government agencies. Efforts are to mobilize other agencies like NABARD for sustainability of the Sisal based industry. As Central and State Governments are also providing various support through schemes for MSME, therefore Sisal industry may also likely to emerge as one of the livelihoods based programme for upliftment of socio-economic status of Baiga Community who are traditionally very poor and needs lot of support from government and non-government organizations. Continuation of further activities may be strengthened with extension of the project duration for another two years.***

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