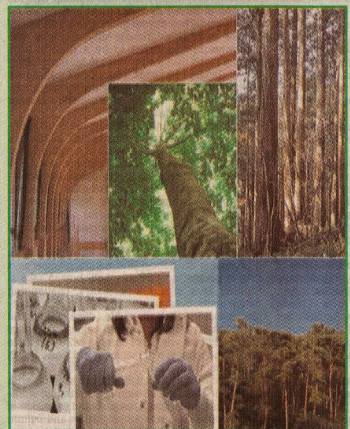




## Technologies and Package-of-Practices Developed by Indian Council of Forestry Research & Education (ICFRE) for Stakeholders' in Central India

The Indian Council of Forestry Research & Education (ICFRE) with its headquarter at Dehradun has recently initiated an innovative scheme to develop linkages by accrediting the individuals, NGOs, SHGs and farmers or any agency which agrees for the extension of technologies by going through the process. The process is to be implemented through the Tropical Forest Research Institute, Jabalpur, which is one of the regional institutes of ICFRE. The process has already begun to cover all the states under the jurisdiction of the TFRI by organizing state level meeting of the stakeholders at TFRI in which following technologies/ package-of-practices were discussed. Many individuals and NGOs have shown their keen interest in adopting the scheme of extension. The brief description of the technologies/ package-of-practices are as given below.



### 2. INTEGRATED PEST MANAGEMENT OF WHITE GRUBS IN FOREST NURSERIES

White grubs are the major group of insect pests causing large scale damage to teak and other seedlings in forest nurseries in central India, if no control measures taken. This group of insect pest is a recognized tough-to-control insect pest, inviting excessive input of chemical insecticides in forest nurseries, which further deteriorated the forest nursery sites in central India. Considering the economic importance of this group of insect pests, the Tropical Forest Research Institute has experimented and developed integrated Pest Management Model for its management with an aim to extend the know-how of the package of-

stakeholders like, State Forest Departments of Madhya Pradesh, Chhattisgarh, Maharashtra and Orissa, farmers engaged in raising and planting forestry plantation or otherwise other agricultural crops, Non Government Organizations for further extension, Self Help Groups (SHGs), etc.

The package-of-practices recommended components in the form of schedule of activities for cultural, mechanical, biological and chemical control methods in judicious combination or successive planned execution like Early seed sowing, selective retention of bushes of food plants of the adults of white grubs like ber, ghunti, khair etc. near the plots having seedlings of previous years for trap and kill method, treatment of nursery beds or agricultural farms with the soil insecticide in combination with any valid entomopathogenic fungal product (Beauveria bassiana or Metarrhizium anisopliae) available in the local market and entomopathogenic nematodes, in consultation with the entomologists of Tropical Forest Research Institute, Jabalpur, installation of light traps - Trapping of adults of white grubs trapped by installing light traps in the farms or forest nurseries, manual picking-up of white grubs from the nursery beds to be carried out and in subsequent year - deep ploughing, etc. The above methods, if executed in a planned manner under the Integrated Pest Management Programme can not only reduce and manage the white grub population below sustained level but would also minimize use of hazardous chemical insecticides. The institute can be contacted for getting the biological control agent, entomopathogenic nematodes (EPNs) and detailed IPM method for the management of white grubs in teak nurseries and agricultural farms.

### 3. BIOLOGICAL CONTROL OF INSECT PESTS IN TEAK PLANTATIONS

The insect pests like teak defoliator (*Hyblaea pueria*) and teak skeletonizer (*Ectophasia machaerota*) cause recurring damages to the teak trees in plantations and natural forests. While the insect pest damage in forest nurseries can be managed by chemical insecticides or other ecologically safer alternatives like biopesticides. However, management of these insect pests in plantations and natural forests has been a major hurdle. The Tropical Forest Research Institute, Jabalpur has developed biological method of managing these insect pests by using native natural enemies (parasitoids) of the insect pests. These naturally available parasitoids of the



pests were collected and are being mass-multiplied in the institute. They are being used to manage these insect pests by their release in the affected plantations or forest areas, which do not require any spraying. The parasitoids are released in the forest areas in the form of 'TRICHOCARD', which are pasted in the affected forests for subsequent release of the parasitoids. These Trichocards can be used for managing other insect pests also. These can be purchased from the institute by the interested stakeholders on prior intimation or order. This is one of the safest method of insect pest management.

### 4. TEAK-TURMERIC SILVI-MEDICINAL AGROFORESTRY MODEL

It is known that normally no other crop can be grown under teak plantations because of the wider leaves and deep shade under it. The condition allows growth of the crops which do not require much sun light. Turmeric is one such crop which require shade. Therefore, the institute has developed Agroforestry model which advocates the medicinal and arom-

at income for the farmers, besides their regular agricultural practices. The method is particularly useful for the teak growing farmers by intercropping teak with turmeric. The teak has average maturity period of 30-40 years, during which time the land available under it can be utilized for the above purpose and thus an extra income can be generated. The detailed methodology and specifications are available in the institute and can be obtained by contacting the institute. The turmeric crop require warm and moist environment with average rainfall of 225 to 250 cm, where no irrigation is required. Depending upon the variety of turmeric, 7-9 months are required for the crop yield.

### 5. FUEL OPERATED DRAUGHT-TYPE-DRIER FOR DRYING NON TIMBER FOREST PRODUCE



The collected Non-Timber Forest Products passes through several hand/processes before they eventually reach to the consumer or exporter. During this long period the quality and percentage of active ingredients deteriorate, resulting in fetching lesser price or total rejection. After collection, proper drying of NTFPs is an important step of processing which directly affect the quality of products. Different methods viz., sun drying, shade drying, electric oven, solar drier etc. can be used for drying of produce. But during rainy season or unavailability of electricity, drying of NTFPs is very difficult as it takes long time which affect physical as well as chemical quality severely.

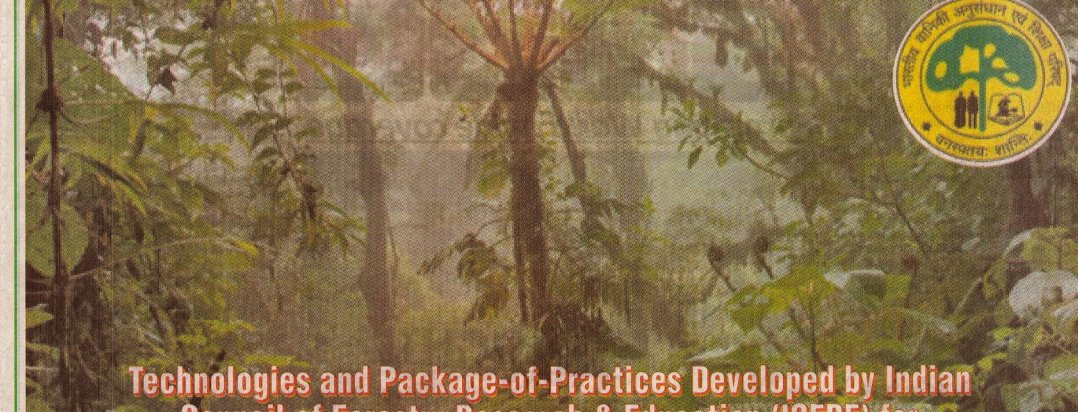
A 'Draught type fuel operated drier' has designed and constructed at Tropical Forest Research Institute, Jabalpur to dry different type of NTFPs viz., leaves, roots, tubers, fruits and stems etc. The techniques of construction and application of draught type fuel operated drier was demonstrated to trainees. The principal of operation of the drier is based on convection of heated air passing through the material kept for drying on perforated sheet. The fresh air enters through the four inlets fitted at the bottom and goes upwards, it gets heated while passing through hot stove pebbles.

The drier can be constructed with the help of two iron drums (390mm dia. and 760mm length) welded together to make a chamber with one end remaining open and the other closed with 100mm dia. hole as exit for gases emitted during burning of fuel.

Two walls made of Kachha bricks are erected on both sides of the drum on the platform upto the height of 1000mm on a rectangular platform of 1800mmx900mmx180mm using standard bricks with sand-cement. A tray of perforated sheet is placed at the top of the drier.

The space surrounding the fuel duct is filled up with stone pebbles of round shape. The dried leaves, twigs, stem etc. of the trees can be utilized as fuel in drier. The cost of construction of drier is approximately Rs.10,000 -15,000/-.

The NTFPs (tubers/rhizomes/fruits-Musti, Mahua, Amla, Satawar etc.) which have very high moisture contents, ranging between 60-80%, can be dried successfully and the moisture contents can be brought down to the levels ranging between 8-15% in 5-7 hours while other products (leaves-Kalmegh, neem etc.) could be dried within 1.5-3.00 hours.



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### 6. HAND MADE PAPER

Handmade papers play an increasingly important role in the modern society and these are being utilized in every field viz., drawing papers, visiting cards, greeting cards, invitation cards, filter paper, dry pulp, file covers, album papers etc. It offers considerable potential to meet the increasing demand of paper products in an environmentally sound way. The technique of preparation of hand made paper from waste paper, leaf fibers, non woody annual or biennial



plants/weeds viz., Lantana camara etc. was demonstrated to trainees.

The hand made paper can be made by digestion, washing and refining of cut small pieces of waste paper. The sizing chemicals and colour may be added to improve the pulp quality as per requirement. The beaten pulp is taken to wooden vats and diluted to the desired consistency for lifting paper sheet. The paper so formed is dried and the sheet is cut into the desired size for use. The detailed technology is available with the Tropical Forest Research Institute, Jabalpur. Handmade paper production has low capital investment.

### 7. SELECTION OF TREE SPECIES FOR OVER-BURDENED AND MINED OVER AREAS

Out of the approx. 175 crore hectare barren land area, 3.6 crore hect. is forest land and remaining 9.30 crore hect. under other uses. Development of forests on such barren or overburdened lands is known as afforestation and such forests are called artificial forests.



The Tropical Forest Research Institute, Jabalpur has experimented and developed site-specific technical information on species which are best suited for such barren, mined overburdened or waste logged stressed sites. It requires specific recommendations for skeletal soil (available mostly in hilly or stony areas with shallow soil, water logged soil where roots are always submerged, degraded soil which are deficient in nutrition, bhata soil which is completely oxidized soil due to high temperature in open areas and is deficient in nutrition).

Such specific information for mined-overburdened, lands with degraded and bhata soil, coal, copper and iron mines is of immense use in afforestation programmes and amelioration of the sites not only from the socioeconomic perspectives of the local inhabitants but also considering the long term goals of ecosystem manage-

ment. The details can be had from the Tropical Forest Research Institute, Jabalpur.

### 8. WATER CONSERVATION TECHNIQUE FOR AFFORESTATION IN DRIER AREAS



In drier parts of the country with lesser rainfall, conservation of water becomes a task, which hampers the afforestation programmes, thereby affecting local ecological conditions. The institutes under the Indian Council of Forestry Research & Education have investigated very simple but useful methods through development of micro-waterbeds for conservation of water during drier periods for facilitating afforestation programmes. These include preparation of saucer-type pits around the planted seedlings for conserving and allowing more percolation of water during the rainy season, ring pits of 1 meter diameter around the planted seedlings, long trenches alternating with the high bunds; etc. The methods investigated are suitable not only for the forestry operations but also the horticultural and agricultural purposes in the areas requiring intensive water conservation.

### 9. TECHNOLOGY FOR THE PRODUCTION OF AM FUNGI FOR USE AS BIOFERTILIZER FOR QUALITY TEAK STUMP PRODUCTION

Many bacteria and fungi are present in the soil and play an important role in growth of plants including teak. Till date application of arbuscular mycorrhizal (AM) fungi and N2 fixing bacteria has not been commercially utilized in stump production. However, initial works have been done on screening and application of AM fungi on teak. Presence of Azospirillum in the endorhizosphere of teak roots and other bacteria on the surface or in the cytoplasm of AM spores has been reported. The present technique is aimed to utilize AM fungi, plant nitrogen fixing bacteria, Azospirillum better teak stump production. Application of biofertilizers increase the number of stumps produced per bed as well as the diameter of stumps. An artificial profit index was calculated combining both the parameters to infer the real benefit of biofertilizers application. Based on the profit index application of biofertilizers (AM fungi + Azospirillum) was found the best to produce quality planting propagules of teak in a commercial nursery. A mixed inoculum of AM fungi isolated from teak rhizosphere (containing *Acadulopora bevis*, *A. scrobiculata*, *Glomus intraradices*, *G. etunicatum* and *Scutellospora pelliculata*) thoroughly mixed in the form of AM inoculum is available and can be obtained from Tropical Forest Research Institute, Jabalpur after prior intimation/ order. The application of AM fungi along with Azospirillum produced the maximum profit besides AM fungi has also got other beneficial effects on plant growth, like disease resistance, drought tolerance, etc. therefore this treatment is recommended for production of propagules of teak in a commercial nursery.

### 10. EQUIPMENT FOR CONSERVATION OF HARVESTED BAMBOO

Bamboo has been attracting human beings since times immemorial, in one or the other ways, particularly in India. It is also known as 'Poor Man's timber' because of cultural and economical association with one or the other kind of bamboo. The problem with bamboo lies in its strength, which lasts only 2-4 years, due to biological degradation by many kinds of pests belonging to fungi and insect groups.

The Indian Council of Forestry Research & Education has developed equipment for treatment of bamboo, which has been named as 'Pragati keep'.

ing its use in small scale industries. The bamboo treatment may enhance its life from 3 to 30 years, depending upon the species and use. The equipment works on the principle of pushing of preservative chemicals inside the bamboo using manually created air pressure, which allows flow of the preservative all through the length of the bamboo, ultimately exuding from the other end. It takes 30-45 minutes for treating 10 meter long green bamboo. The details of the equipment and specifications can be had from the Director, Tropical Forest Research Institute, Jabalpur.

### 11. DEVELOPMENT OF PESTSTAT: A METARRHIZIUM FUNGUS BASED BIOPESTICIDE

There are many foliage feeding insect pests, which cause damage to the agricultural and forestry crops. The Indian Council of Forestry Research and Education has developed a fungus (*Metarrhizium spp.*) based biopesticide named PEST-STATE. The formulation when employed on the affected crops, seedlings or trees after dissolving in 0.5% kanchi or karanj (pongam) oil can bring good control of the defoliating insect pests. It is environmentally safe, being of natural origin, despite being safer to the user.

### 12. PRODUCTION OF IMPROVED PLANTING STOCK OF MEDICINAL PLANT SARPGANDHA

The countrywide requirement of Rauwolfia root is going to be 6000 ton/annum, whereas current supply is only 850 ton/annum. This acute shortage of sarpgandha root can be met with production of quality planting materials of high reserpine yielding genotypes on mass scale. The growing requirement of Rauwolfia roots by pharmaceutical industries can be met by supplying of such high yielding planting materials which will ultimately reduce the pressure on natural stands of the species. The Tropical Forest Research Institute, Jabalpur has developed the technique of screening of superior genotypes and further micro-propagation of the above plant species for supplying quality planting materials on mass scale. The micro-shoots produced through such method can be transferred to root trainers filled with autoclaved sand. The technique shows almost 90% survival and flowered without any morphological variation within 12-13 months of their transfer to the field. The tissue culture techniques of the above species are available at reasonable rates at the institute on prior request.

### 13. VILVEKAM : A BOTANICAL BIOPESTICIDES FOR THE MANAGEMENT OF INSECT PESTS.

The teak defoliator (*Hyblaea pueria*) is a pest of teak in India and is of major economic significance. This pest is of major concern as it is involved in complete defoliation of trees during the early part of the growing season. Defoliation does not kill teak trees, but it results in less of growths and resulting timber loss.

The Indian Council of Forestry Research and Education has developed 'VILVEKAM' a botanical based biopesticides from seed oil of bel (*Aegle marmelos*). The formulation is effective in managing the young stages of teak defoliator insect pest and thus a promising biopesticide. It is an eco-friendly biopesticide having no environmental hazardous effects. The details of the biopesticides with recommendation on doses and concentrations can be obtained from the Tropical Forest Research Institute, Jabalpur.