A Bulletin from NCRMI on Kerala Coir

COIR VOX

Issue 4

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REVOLUTIONIZING
MICROBIOLOGY RESEARCH

E-RATT
TRAINING

COIR GEOTEXTILE
AS A MULCHING MATERIAL

COIR PITH BASED
NUTRIENT RICH GROWING MEDIA
SUITABLE FOR
VEGETABLE CULTIVATION
IN TERRACES

PUBLISHED BY

NATIONAL COIR RESEARCH & MANAGEMENT INSTITUTE (NCRMI), THIRUVANANTHAPURAM

NCRMI INFRASTRUCTURE

Revolutionizing Microbiology Research: National Coir Research and Management Institute's Innovations

The Microbiology Lab at NCRMI is a leading research facility with its state-of-the-art infrastructure and advanced microbiological instruments. The lab has positioned itself at the forefront of coir-related microbiology studies with its state-of-the-art infrastructure and cutting-edge tools.

Instruments in the Lab	Purpose
VITEK-2 COMPACT	A microbial identification system that can quickly and accurately identify bacteria.
MALDI -TOF–Vitek MS	A mass spectrometry instrument that can identify microorganisms at the species level.
Previcolor gram	A rapid method for differentiating between gram-positive and gram-negative bacteria.
Lyophilizer	A machine that can freeze-dry microorganisms, making them easier to store and transport.
Fluorometer	An instrument that uses fluorescent dyes to determine the concentration of nucleic acids or proteins in a sample.
Thermal cycler for PCR	A machine that can be used to amplify DNA, a process that is often used in molecular biology research.
Microscopes	Light microscopes.
Horizontal rectangular Autoclave	A machine that can sterilise equipment and materials.
BOD Incubator	A machine that can be used to incubate samples at a specific temperature and oxygen level.
Bio-fermenter	A machine that can grow microorganisms in controlled conditions.
Hot air Oven	A machine that can heat samples to a specific temperature.
Laminar Air flow chamber	A clean room environment that prevents contamination of samples.

The Microbiology lab has developed several innovative technologies for the coir industry, including:

- PITH ACTIVATOR for composting household organic wastes.
- TRICHOPITH SPAWN for the coir pith composting.
- PEATKOL, an alternative to charcoal.
- ECOIR BAG, a replacement for plastic coir bags.

In addition to the above, the Microbiology Lab offers many training services to the coir industry, such as Training on Coir pith composting, Supplying TRICHOPITH spawn and Technical support for coir industry stakeholders. NCRMI's Microbiology Lab remains at the forefront of microbiological advancements. NCRMI paves the way for a greener and more sustainable future with their unwavering dedication to innovation

Expert Feature

COIR GEOTEXTILE
A SUSTAINABLE PAVEMENT MATERIAL

Prof.(Dr) Samson Mathew
Director, NATPAC

Coir is a natural fibre made from the husk of coconut fruit. Because of its high lignin concentration, coir is the hardest natural fibre in comparison to other natural fibres. Because of its toughness, strength, rot resistance, durability, natural resilience, porous, hygroscopic, biodegradable, renewable, recyclable, and versatile properties, coir fibre is in high demand.

Coir Geotextiles (Coir Bhoovastra) are permeable fabrics manufactured from coir fibre collected from coconut husk, either naturally or mechanically. It's a two-treadle woven fabric composed of coir yarn with the warp and weft strands separated to create a mesh (net) pattern. Surfacial erosion control on slopes through vegetation, as well as protection of river, canal, and lake banks, road and railway embankment, and reinforcement of mud wall of stream, bunds, farm, and fishponds against erosion, and other applications involving separation and filtration are all done with coir geotextiles.

FUNCTIONS OF COIR GEOTEXTILE IN PAVEMENTS

A properly designed coir geotextile should be able to perform the following functions (IRC SP: 59 (2002)), usually in tandem, in a variety of civil engineering applications:

Separation

When laid beneath the aggregate layer of an unpaved road, coir geotextile serves this purpose. As demonstrated in Figure 1, the coir geotextile prevents aggregate and underlying subgrade soil intermixing. A geotextile's separation role maintains the subgrade soils and aggregate layer intact, allowing the aggregate layer to maintain its intended thickness for the life of the road. The coir geotextile causes the entire layer to operate as if it were a flexible beam, spreading the load across a greater region. This isolation and confinement, as well as the additional strength generated by frictional interlock between the aggregate and coir geotextile, help to keep stress on the subgrade low and hence improve the structural section's load bearing capability.

Filtration and Drainage

In the presence of moist or saturated soils, the coir geotextile will also serve as a filtration and drainage medium. High pore pressure causes soil slurry, which pumps upward against the fabric during dynamic stress. The coir geotextile acts as a filter, preventing fines from contaminating the aggregate layer while allowing water to freely drain through the aggregate or through the plain of the coir geotextile. As a result, it aids in the rapid consolidation of the subgrade. Figures 2 and 3 depict the filtration and drainage capabilities of a coir geotextile.

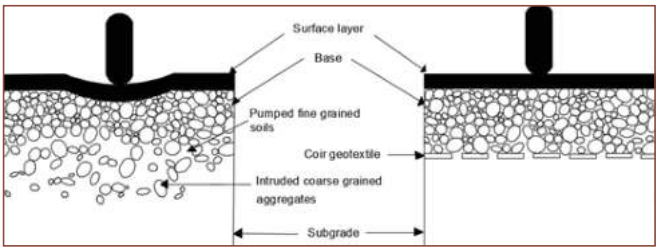


Fig. 1 Pavement Section with Coir as Separation Layer and without Coir Separation Layer

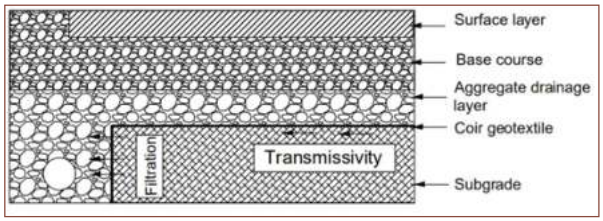


Fig. 2 Filtration Function of Coir Geotextile

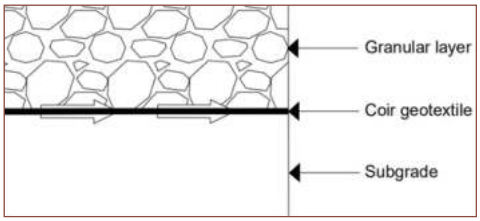


Fig. 3 Drainage Function of Coir Geotextile

Reinforcement

The two main mechanisms of the coir geotextiles are to restrict and restrain the movement of the granular layer, and to generate a vertical tension upward through the so-called membrane effect, which occurs when a geotextile achieves high tensile strength under traffic load. This helps the granular layer to support the vehicular loads by lowering the amount of stress imposed on the sub-grade. The use of a coir geotextile at this level will prevent intermixing and maintain the pavement's effective depth.

Subgrade Improvement by Application of CGT

The regions of extremely low load bearing capacity soil are reliant on reinforcement above it to avoid failure of the constructed facilities due to the anticipated loads. Improvement of subgrade has to be done for weak soils. In this context, placing the geotextile over the subgrade (Fig. 4) could improve the performance of the pavement by mobilizing its strength through improved load bearing capacity by the membrane effect and lateral restraint behaviour. Embedding coir geotextile reinforcement at the interface of subgrade and granular layers of a pavement can increase the lateral restraint by confining the local soil underneath and aggregates overlying, with a consequent gain in restricting both vertical and lateral deformations. It helps in arresting the lateral movement of the local soil and the granular materials by friction and interlocking, thereby increasing the modulus of the structural layers of the pavement. The magnitude of vertical stresses underneath the pavement diminishes with increase in the modulus of the pavement layers. As a result, significant reduction in thickness of granular layers of a pavement is possible. In addition, the functions of the geotextiles like separation, filtration and drainage helps in prolonging the service life of the pavement.

Fig. 4 Laying of Coir Geotextile

Limitations of Coir Geotextile

1. Biodegradability is often considered as a disadvantage of coir geotextile for utilizing it as subgrade reinforcement. Even though the pavement becomes less dependent on geotextile in the long term due to consolidation, treatment of coir geotextiles with suitable chemical agent would help in reduction of the loss in reinforcement effect.
2. Use of coir geotextile over subgrade with high organic content and pH level of 6-8 accelerates the degradation process.
3. The production of coir geotextiles is limited to the coconut producing states of the country.
4. Coir geotextiles are hygroscopic in nature, hence proper packing should be ensured during transportation and storage.

The design and construction aspects of roads using coir geotextiles are available in **IRC:SP:129-2022 Guidelines for the Design and Construction of Roads Using Coir Geotextiles.**

Conclusion

The Government of India created the Pradhan Mantri Gram Sadak Yojana (PMGSY) to give all-weather access to eligible unconnected habitations as a tool for poverty eradication with the goal of delivering rural connection. As a part of this scheme, an inventory of local and marginal materials for road building is established in order to encourage the usage of such resources in order to make construction more cost-effective. Despite the limited success of natural geotextiles, there are certain benefits in terms of eco-friendliness and economy which have led to reinforcement using coir geotextile to be considered as a promising technique.

COIR GEOTEXTILE AS A MULCHING MATERIAL

Mulching, a major soil management method, is the practice of covering the soil around the plants to make the conditions favourable for growth and to conserve the available soil moisture. It is thus essentially a soil barrier that prevents the evaporation loss of moisture from the soil in addition to checking weed growth, reducing competition for available nutrients. Though a variety of mulching materials are available such as polythene sheets, straw, crop residue etc., polythene sheets are most common among them.

The usage of non-biodegradable materials, such as polythene sheets, deteriorates the environment. After their application as mulching material, they are usually discarded. Though other mulching materials such as straw, and crop residue have no such detrimental issues, the acceptance of such material is rudimentary for such materials could act as a source for infestation which further affect the crops. Coir could bridge the gap between the need to have a sustainable mulching material without affecting the crop under cultivation. Various coir materials such as panama matting, rubberised coir, coir geotextile and panama matting with latex backing could be employed for the mulching application. Coir being organic in nature, does not tamper with the ecological balance during its degradation. Supplemental irrigation is also lowered during the application of coir based mulches because of their water retention ability, simultaneously reducing the runoff of soil profile.

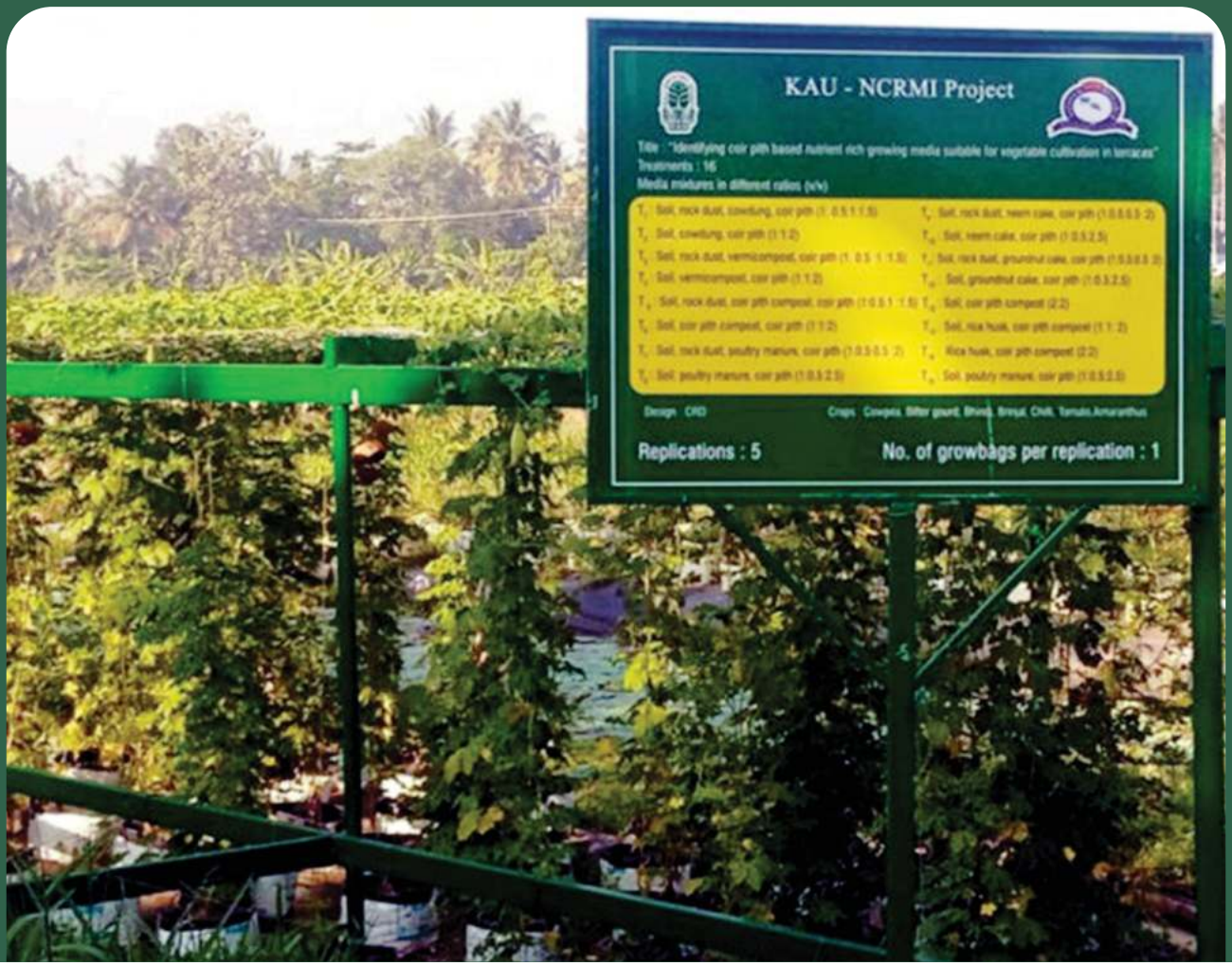
The extreme temperature condition under the early growth stages of plants may cause the plants to go under stress conditions as newly established roots are not able to uptake the proper amount of water and essential plant nutrients. Therefore, the judicious maintenance and regulation of soil temperature is a very critical factor for optimum plant growth. Coir based mulching material could ameliorate the temperature variations making the condition suitable for the growth of plants. The mulching could effectively solve the salinity problem by enhancing water retention in soil and reducing evapotranspiration.

The evaluation of various field studies using coir based mulching materials depicted that, the performance of coir based mulching media were superior to the conventional mulching materials. There was a significant difference in the growth parameters of the crop cultivated within coir based mulching media and a marked difference in the production in terms of yield from crops of those cultivated in coir based mulches than others.

Thus coir based materials provide a sustainable means for mulching application without tormenting the environment at the same time, improving the productivity of the crop through weed control, water retention and protection from soil erosion.

TERRACE FARMING

COIR PITH BASED NUTRIENT RICH GROWING MEDIA SUITABLE FOR VEGETABLE CULTIVATION IN TERRACES



Vegetables, rich in vitamins and minerals are protective and immunity building foods. However, the vegetables available in the market are often loaded with chemicals including insecticides and fungicides and are unsafe for consumption. This necessitates the maintenance of a vegetable garden in every homestead to obtain clean and fresh vegetables. However, for urban farmers, cultivable land is a major limitation in maintaining a home garden. Especially for such urban residents, rooftops/ terraces can be productively utilized for farming. Good quality lightweight growing media, which reduces the weight load on terraces therefore become a major requirement for urban farmers inclined to terrace cultivation.

Soil, sand/rock dust and cow dung are the three major ingredients of conventional potting media. However, the soil and sand fractions are heavy and are not easily available also. Use of lightweight natural resources as substitutes for the soil and sand fractions can bring down considerably, the weight of the growing media. Coir pith is one such lightweight natural resource that could be substituted for soil and sand fractions. Based on the above idea, a collaborative experiment was carried out by Kerala Agricultural University and the National Coir Research & Management Institute to identify coir pith based good quality and lightweight growing media for vegetable production. The main field experiment was carried out at the Integrated Farming System Research Station, Karamana, Thiruvananthapuram functioning under Kerala Agricultural University, the experimental results of which were confirmed in 5 farm trials conducted at different regions of Thiruvananthapuram district. The experiment lasted for two years, from 2020-2022.

As part of the experiment 16 different coir pith based growing media were generated and their physical, chemical, and biological properties were recorded. Vegetable crops viz., bitter gourd, vegetable cowpea, bhindi, tomato, chilli, and brinjal were raised as main crops on these media and their growth and yield in each media were recorded. Amaranthus was thereafter raised without any additional fertilizers, but by utilizing the residual nutrients after the main crop harvest in each of these media, the growth and yield of amaranthus were also recorded. Based on the experimental results on crop yield and also account the weight of the growing media, three of the coir pith based growing media were identified as superior for use in terrace farming.

Conclusion

1. Natural resources like coir pith can be productively utilized as component of potting media, thereby addressing the pollution problems as well.
2. Three good quality and light weight growing media were generated with coir pith as one of the media components. These media recorded weight reduction to the tune of 25 to 40 per cent compared to conventional media) and could result in similar or higher vegetable yields compared to conventional media.
3. The conventional medium (Soil, rock dust and cow dung in the ratio 1:1:1 on volume basis) recorded the highest weight per bag (13.82-13.96 kg). Maximum weight reduction was achieved with the medium comprising of rice husk and coir pith compost in the ratio 2:2 on volume basis (3.72- 3.96 kg) ; but the yield effects were not pronounced in this medium
4. With regard to yield of different vegetable crops, the medium comprising of soil, vermicompost and coir pith in thé ratio 1:1:2 (volume basis) performed in a significantly better manner and was closely followed by or else comparable to the medium comprising of soil, rock dust, vermicompost and coir pith in the ratio 1: 0.5 :1 :1.5 on volume basis.
5. The medium comprising of soil, vermicompost and coir pith in thé ratio 1:1:2 recorded crop yields to the tune of 3.45 kg fruits per plant (bitter gourd), 2.06 kg (bhindi), 1.05 kg (vegetable cowpea), 2.22 kg (tomato), 0.81 kg (chilli) and 2.99 kg (brinjal) per plant/grow bag. One crop of amaranthus was successfully raised utilizing the residual soil nutrients of the media, after the harvest of these main crops. The weight per growbag of this media was only 8.30 kg, accounting to more than 40 per cent weight reduction compared to the conventional media.
6. The medium comprising of soil, rock dust, vermicompost and coir pith in the ratio 1: 0.5 :1 :1.5 on volume basis recorded similar yields as above and had an average weight of 9.66 kg media per grow bag.
7. Farm trials (pot culture) carried out for two vegetable crops bhindi and amaranthus at 5 different locations (Nemom, Kudappanakkunnu, Nedumangad, Vamanapuram and Parassala) of Thiruvananthapuram district confirmed the superiority of the above two media.

LOOM MATS

Loom mats are coir mats that are produced in looms. The most common type of coir loom mats are – Fibre mats, Rod mats, Creel mats, Loop mats, Carnatic mats and Gymnasia mats.

FIBRE MATS

Fibre mats are manufactured by the insertion of tufts of coir fibre during the weaving process. Fibre mats have a very compact brush firmly held by the base fabric, and therefore, these mats are very much durable. It can be woven in a variety of ranges of intricate designs and pile heights, and further, it can be bevelled to give clarity to the design and shape.

ROD MATS

Rod Mats are manufactured from topping yarn made from 2, 3 or 4 soft twisted strands. It is a mat with a pile formed by cutting two or more strands of yarn folded together and wound around a flat grooved steel bar along with alternate ends of the warp. Using rods of different thicknesses can vary the pile height, and the proportion of topping yarn and weft can be varied for desired quality.

CREEL MATS

In Creel mats, there is more than one kind of warp, which is always held at the maximum tension that interlaces with the weft and produces the base fabric. On the base fabric, so formed loops of pile structure, either cut or uncut, are projected by the yarn slack warp. The pile structure is obtained by suitable positioning of the coir yarn in the fabric structure with the use of grooved rods and cutting the yarn passing over the rods with a sharp knife.

LOOP MATS

A loop mat is type of creel mat where the pile is in the form of loops of yarn and not cut as in creel mat. This is made up by three chains, one tight and the other two slack working as pile/binding. The piles are formed by loops which in-turn is formed out of a slack chain.

CARNATIC MATS

It is a type of creel mat with base fabric composed of jute twines and pile structure formed by thin vycome yarn of soft twist. Carnatic mats have a special appeal due to low pile height, lightness and its structure. It is a 3 chain creel mat with double thw number of ends & picks whereas the pile height and weight of mat are half when compared with two chain creel mats.

GYMNASIA MAT

It is a mat with pile formed by cutting three or more yarns folded together and wound around a grooved iron rod along with alternate ends of warp. The pile height is generally two and a half inches and is made thicker to meet the specific requirements.

Special feature

DRONA ENGINEERING

DRONA Engineering was established in 2011 and began manufacturing European shuttle looms spare parts for weaving sisal, coir, wool and jute fabric. DRONA production area today extends over 10,000 sq. ft. DRONA looms are developed and designed by experienced engineers and technicians specialized for the research of technological improvements of always new, customized solutions. The looms are manufactured by skilled craftsmanship in way to meet highest quality expectations.

Coir Jute Matting Loom

DRONA machines for weaving include Geo textile Shuttle Loom 1 meter & 2 meter width, Wool Carpet Rapier Looms, Carpets with natural fibres, Hand spun Jute Loop wire looms up to 3m width. DRONA also manufactures Coir Brush mat (BC20) loom up to 2mtr width and Coir mat 4 shaft loom.

In addition DRONA manufacturers equipment related to weaving industry such as Edge scaling machine for latex backed door mat, Spooling machine for Bobbin winding, Shuttle cops winding machine, Roll passing machine, Electronic dobby, Coir spinning machine, and Singing machine for jute mattings.

4 Shaft Matting Loom – 2 Mtr Width

Hand Spun Jute/ Coir Loop Wire Loom

Geotextile Loom For Jute /Coir

FRAME MATS WORKSHOP AT NCRMI

A three-day workshop for master trainers on the production of frame mats was conducted at NCRMI.

KERALA STATE COIR MACHINERY MANUFACTURING COMPANY LIMITED (KSCMMC):

THE GAME CHANGER OF THE COIR INDUSTRY

The Government of Kerala incorporated "The Kerala State Coir Machinery Manufacturing Company" (KSCMMC) at Alappuzha in Kerala as part of its vision of modernization and mechanization of the coir industry. KSCMMC produces a variety of machines that lead to value addition in the coir value chain. Some of the major types of machinery manufactured by KSCMMC are:

- **Defibering machines** extract coir fibre from coconut husk. Presently the company is manufacturing three types of Defibering machines, which are of 46.5 HP Capacity, 65 HP Capacity, and 80 HP Capacity. These machines are having the capacity to process 800 to 3000 husks per hour.
- **Defibering machines** The rotary crusher in the system crushes husks, the defibering machine separates coir fibre and pith, the willowing machine cleans fibre, and screeners separate coir fibre and pith from impurities.
- **Dehusking machine**, capable of Dehusking over 400 coconuts per hour.
- **Electronic ratt** that consume negligible power and offers the facility for coir yarn spinning at households. The output of electronic ratts is nearly 18 kilograms per day.
- **Bailing Press** fabricated and distributed by the company is useful for bailing coir fibre suitable for long distance transportation.
- **Automatic Spinning Machine (ASM)** offered by the company has the capacity to spin up to 100 KG of coir yarn per shift.
- The company produce machine for making garden articles and garden pots using plastic waste and short coir fibers. The company offers manual, semi-automatic and fully automatic looms for making Geo-Textiles, four-shaft mattings, other mattings etc.

In the last five years, the company has produced and distributed 96,76,00,000 (Ninety-six crores, seventy-six lakhs) Rupees worth of coir machinery and the machines were distributed among beneficiaries in Kerala, and this was beneficial for over 600 cooperative societies operating in the coir industry.

E-RATT TRAINING

Electronic ratt, commonly known as "e-ratt", is a novel finding for the Coir Industry's spinning sector. It is a simple instrument working on a 12-40V DC motor, which can produce coir yarn of runnage 140-180. The production capacity of eratt is 13- 18 Kg of Coir yarn in an 8 hr Shift. The women workers of coir industry has wholeheartedly accepted this equipment for its ease of use and convenience in installation and dismantling. It could be installed anywhere and everywhere in a bare minimum space.

NCRMI has already conducted 54 batches of e-ratt training during 2018-23 for women workers of various coir cooperative societies throughout Kerala under all ten project offices. The e-ratt training activity attracted the newer generation to the Coir industry due to its ease of work and lesser drudgery and the option of it being used at one's own house premises. NCRMI has trained around 1080 women workers of various Coir Cooperative Societies selected by respective Coir project offices and approved by Coir Development Department.

Exporter Profile

PALM FIBRE (INDIA) PVT LTD

Palm Fibre (India) Pvt Ltd started its journey in coir with Coconut Farming in the early 1900s. Palm Fibre diversified to processing coir fibre into yarn and was producing yarn for European Companies based in India. Later in 1945, Palm Fibre (India) Pvt Ltd evolved into an exporter of yarn to its customers in Europe and over time, understanding the possibilities of exports and further value addition, Palm Fibre further expanded its range of products and services to become a manufacturer exporter of a variety of Natural Fibres and materials for floorcovering and home décor.

Palm Fibre, through its focus on quality and structured processes, now manufactures and exports to customers worldwide from its various facilities audited for Social, Legal, and Environmental Compliances in Kerala and Tamil Nadu. Palm Fibre dedicates its efforts to put customers first by giving them the best quality by having in-house facilities for Dyeing, Weaving, Tufting, Moulding, Printing, and other value-added processes.

At Palm Fibre, the foundation is built upon the unwavering commitment to delivering the best to its customers. Rather than resting on its laurels, Palm Fibre (India) Pvt Ltd embraces change and progress to provide its customers with the best solutions. Through its commitment to quality, experience and innovation, Palm Fibre aims to forge long-standing partnerships with its customers

SOCIETY: GUNDU ISLAND CO-OPERATIVE SOCIETY

Gundu Dweep has a rich history in the coir industry, dating back to the British colonial era. What we know today as the collective was originally a coir factory under the ownership of John H. Aspinwall, and later his business partner W N Black. Gundu “Saip” later established the factory in 1944-45. The island reportedly gets its name from him. Mr. Gundu managed the rope factory until 1960, producing a special rope product called “Chakiri Thaduk”. Famous for its colourful designs and superior quality, this rope earned the nickname ‘Deluxe’. In 1960, Mr. Gund stepped down. The cooperative started functioning on 16 June 1960 and started by using traditional machines. Managed by the cooperative, the factory began producing rope fences which gained pan-Indian popularity with the support of the Coir Board. Today, the firm employs 52 workers, many of whom are over 60 years of age. The scenic island and industrious factory have risen as a prominent attraction for tourists and foreigners from across the globe.

Department of Coir Development
Government of Kerala, India

National Coir Research
& Management Institute

Kerala COIR
Golden Yarn of God's Own Country

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