COCONUT, AN IMMINENT SOLUTION FOR SOIL POLLUTION

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I. Introduction

Coconut, one the most important crops grown in the humid tropics, is very aptly called as 'Kalpavriksha', 'Tree of Life' 'Tree of Heaven' 'Nature's Super Market' etc. as each and every part of the palm finds one or other use in everyday life. Coconut also plays an important role in the ecological landscape of the country particularly in the hilly to mountainous areas planted to coconut.

People around the world are becoming aware and highly conscious about the need of preserving the nature and an increasing number of them are opting for environment friendly products. Apart from supporting the livelihood of millions of people, directly or indirectly, in more than 90 countries in the world that cultivates coconut, the versatile palm provides essential needs in every walks of human life viz. food and beverage, medicine, cosmetics, industrial raw material, construction material, cultural and religious functions, handicrafts etc. etc. A wide range of coir and coir products including the coir yarn, ropes, mats, mattings, rubberized coir products, mattresses, pillows, cushions, coir geo textiles, coir pith, rugs, carpets and curled coir etc. are now available.

The coconut is a very unique palm having a life span of many decades and provides many services to the preservation of ecosystem and if properly managed, can be an apt example for combating soil pollution. Some of the ecosystem services are listed below.

Socio-cultural services: From time immemorial, cultivation of coconut palm has deep rooted cultural and spiritual connections in India. In every Indian ritual and auspicious occasions like child birth, wedding, housewarming etc. coconut has an important role to play. The de-husked coconut is an important offering to the deities in Hindu temples across the country and many family and social festivities are incomplete without its offering. During temple festivals in Northern Kerala, where local folk dances are performed (e.g Theyyam), tender coconut leaves are used for dressing the performers. The coconut inflorescence and the leaves are used for decorative purpose for many social and cultural celebrations in different parts of Southern India.

Carbon sequestration: This is the long-term storage of carbon in oceans, soils, vegetation and geologic formations. When more photosynthesis takes place, more CO2 gets converted into biomass, thereby reducing carbon in the

atmosphere and sequestering it in plant tissue as above and below ground biomass. In the case of coconut, the annual carbon sequestration in the above ground biomass is reported to vary from 15 to 35 Mg CO2/ha/year depending on cultivar, agro-climatic zone, soil type and management.

Soil conservation: Coconut as well as its companion crops provides sufficient ground cover, thereby, intercepting raindrops and reducing terminal velocity of raindrops to prevent loss of soil by runoff, or other removal processes. The fibrous mat of roots of coconut palms also helps in reducing soil loss through runoff.

Crop species diversity preservation: In a systematically planted coconut garden, an array of crops (vegetables, tubers, spices, fruits, medicinal and aromatic plants, ornamental plants, cereals, pulses, fodder, beverage crop etc.) could be grown with coconut depending on the growth stage of the main crop, enabling crop species diversity and ensuring year-round income.

Diversity of soil organisms: Coconut rhizosphere harbours a wide range of beneficial microorganisms which take part in improving the nutrient and fertility status of coconut gardens. The belowground microbial diversity (general as well as function specific) is found to be higher in multiple cropped coconut gardens, than mono-cropped ones.

Nutrient cycling: In some of the coconut gardens, plant parts like coconut water, husk, bunch waste, coconut frond etc. are left in the farm, though some of them are used as fuel and transformed into ashes. Coconut fronds, bunch waste etc. which are left in the garden itself undergoes slow decomposition and in turn supply back some of the nutrients removed from the soil. The understory vegetation could also provide significant biomass for nutrient recycling. Deep rooted companion crops could mine deeper soil layers and bring up nutrients.

II. Coconut- to combat pollution-the natural way

A. Use of coconut leaves

a. Mulching: Coconut leaves can be used for mulching the palm basins. This reduces the impact of falling rain drops on the ground and thereby prevents surface soil erosion. Addition of mulch can improve the organic matter status of soil as well as recycle soil nutrients. Organic matter can absorb moisture several times its weight and can serve as an effective moisture reserve for the cropping system.

b. Vermicomposting coconut leaves and other biomass: By using earthworm Eudrilus sp., all the fallen coconut leaves and other biomass in the coconut garden can be effectively converted into rich vermicompost. Vermicomposting can be done either in the coconut basin itself or cement tanks or in trenches

prepared in the coconut garden at a suitable place. Such vermicomposting helps to reduce throwing away the biomass in the coconut garden and help combat environmental pollution.

c. Plaited coconut leaf: For houses, the plaited coconut leaf furnishes an alternative thatching sheet and supplies wall screens. Within the house, coconut leaf mats form part of the necessary furnishings. A coconut leaf mat is also used to sit out doors and during certain ceremonials. A variety of baskets is made to contain foods and stored clothing.

d. Ornamentation using coconut leaf: Coconut leaf based ornamentation is an indispensible item in almost all festive and religious functions. Usually tender leaves are used for decoration. Mature leaves are used for making traditional toys, paneling pillar, roof, walls etc. The coconut leaves can be woven to make fish traps, bags, hats, hand fan, table mats, sleeping mats, as well as many decorative items.

B. Use of coconut husk

a. Husk burial: The coconut is embedded in the husk, which forms 35 to 65% of the weight of the whole fruit, when ripe. The main use of coconut husk is to extract fibre and in India, only 15% of the husk is actually used for recovery of coir fibers. Burial of coconut husk can be done in coconut basins or in the interspaces to conserve soil moisture, thereby to overcome drought and button shedding due to moisture stress. The beneficial effect of husk burial will last for about 5-7 years.

b. Use of coir fibre: Coir is a 100% organic naturally occurring fiber derived from coconut husk. Coir fibers resemble the wood fibers in terms of physical properties and chemical composition. Naturally resistant to rot, moulds and moisture, it is not necessary to treat with any chemicals during its spinning process for converting it into yarn. It is very hard and the strongest among all natural fibers. The most popular uses for coir are door mats, agricultural twine and geo textiles (blankets that are laid on bare soil to control erosion and promote the growth of protective ground covers) because of its durability, eventual biodegradability, ability to hold water and hairy texture. The very strong global markets for coir fibre products and the increasing utility of coir fibre in new products – such as mattress, geo textiles and products for the automotive industry – means that coir fibre processing is an abundant activity in coir producing nations.

Novel method for retting coconut husk: The traditional method of coir fiber extraction from the coconut husk is retting, a laborious and time consuming process. This retting by soaking in backwaters requires 10-12 months. The

continued and intensive exploitation of these backwaters for retting of coconut husk has polluted made several backwaters and caused deleterious effect on the fishery resources of the state. Retting activity has also led to the large-scale reclamation of the backwaters, resulting from the accumulation of coir pith, ret liquor and other coir products, thereby converting them into foul smelling, clogged canals. In order to solve this problem, the Central Coir Research Institute (Coir Board) has developed a novel method using biotechnological approach with selected strains of microbial cultures viz., 'Coirret'. This could reduce the period of retting from 11 months to 3 months.

c. Use of coir geotextiles: There is a rapid growth in the use of bio engineered soil erosion and sedimentation control designs especially in environmentally sensitive areas. Most of these designs incorporate coir products to provide the required initial structural stability until the establishment of sustainable vegetation. Coir Geotextiles protect land surface and promote quick vegetation. Geotextiles are a wonderful treasure of natural eco-friendly, erosion control blankets in woven and non-woven preparations. Being totally biodegradable, geotextiles help soil stabilization and renew vegetation in varying slopes.

C. Use of coir pith

a. Use of coir pith (cocopeat): It is the lignocellulosic agro-waste produced during coir fibre extraction, constituting about 70% of coconut husk. Coir pith degrades very slowly and it remains in the soil for a very long period of time. Coir pith is recalcitrant and accumulates in the environment forming hillocks posing environmental pollution in the areas close to coir fiber extracting units. As a result of its fluffy nature, its transportation will not be cost effective. Coir fiber extraction units contribute considerably to the problems of environmental pollution, both land and water pollution. In order to convert coir pith into a natural organic resource, it is processed and utilized as an economical input in agriculture as well as in horticulture. Processed coir pith is used as an excellent soil amendment due to its favourable physical properties in maintaining soil health.

It is used as a replacement for traditional peat in soil mixtures, or, as a soil-less substrate for plant cultivation. Coir waste from coir fiber industries is washed, heat treated, screened and graded before being processed into coco peat products of various granularity and denseness, which are then used for horticultural and agricultural applications and as industrial absorbent. Coir pith has very high moisture retention capacity of 600- 800 per cent and can be as high as 1100 per cent of dry weight. This eco-friendly material is said to be replacing peat moss (dug from the swampy area) and rock wool (used as cultivation medium in the developed countries) as an effective soil bed under green house conditions.

Some of the application fields of coir pith are: mulching to preserve the moisture and soil conditioning, organic manure (compost), briquetted fuel for chulas and furnaces, bricks and roofing sheets for building purposes etc., production of particle board, activated carbon, erosion control, bio-gas production, mushroom cultivation, potting mixture for seedling growth, extracting lignosulphonates, wetting agent, dispersing agent and adhesion compounds in pesticides, fertilizers etc.

b. Composting coir pith: Large scale composting can be done by the heap method in a shaded place by treating coir pith obtained from coir processing units with poultry manure, lime and rock phosphate. Spread it evenly after proper mixing. Keep the heap moist by regular watering and cover it using dry grass or other suitable material to prevent moisture loss. Turn the whole heap once in two weeks to enhance the speed of decomposition. The composting will be completed in 1½ to 2 months.

D. Use of coconut timber

a. Use of coconut timber: One of primary uses of coconut timber is for building construction. It is suitable for housing components like trusses, purlins, walls, joists, doors, window frames and jalousies. Coconut wood can be a promising material for the manufacture of furniture, novelties and other handicrafts due to its beautiful spotted grain pattern and attractive natural appearance. Use low density coconut wood materials (from the centre of the stem) only in non-load structures like walls and panels while high density coconut wood (from the perimeter of the stem) can be used as posts, power and telecommunication poles, for load-bearing structures like floor tiles (parquet), trusses and joints etc. Medium density boards can be effectively used for walling, horizontal studs, ceiling joists and door/window frames.

E. Use of other coconut parts

a. Value addition of tender coconut husks: Tender coconut husk becomes a waste material after consuming the tender coconut water and the soft kernel. Composting tender coconut husk is an environmentally sound and economically advantageous way to utilize waste for soil organic amendment. This Involves complete or partial degradation of variety of chemical compounds by consortium of microorganisms. This can be used as a natural soil conditioner.

b. Use as pulp for paper making: The waste husk of green / dry tender coconuts is to be chopped in to uniform size and made in to powder form which contains fibre, pith and outer skin. It is then pulped after mixing with the waste paper by organo-solv treatment using an organic solvent in the presence of mineral acid catalyst .This pulp from tender coconut husk is an excellent wood substitute in making paper.

j. Use of coconut water for value addition: Sizeable quantity of coconut water will be produced from various industries such as Desiccated powder, coconut milk, coconut oil etc. and if left un-utilized near the factory premises, will definitely cause environmental pollution. There are now technologies available for effective utilization of such coconut water to make coconut vinegar, soft drink etc.

k. Use of coconut shell: Every year billions of coconut shells are discarded as waste after their meat has been extracted. These discarded coconut shells can be used for making decorative items and eco friendly utensils (bowls, cutlery and tea sets etc.). These are 100% natural, lightweight, food safe and reusable.

Crushed coconut shells are suitable as substitute for conventional aggregates in lightweight concrete production. It is cost effective, eco friendly and resolves the issues related to shortage of conventional material. Coconut shell is hard in nature and does not deteriorate easily once bound in concrete and therefore, it does not contaminate or leach to produce toxic substances.

Coconut shells can be converted into charcoal and activated carbon and increase value to the product. Biochar from coconut byproducts like shell and pith, can improve carbon sequestration potential of soil, promotes microbial activity and improves physical properties and soil health, enabling ability to withstand erosion.

Preparation of COCOLAWN

COCOLAWN is a lush green instant lawn of grass developed by CCRI based on coir products viz coir geotextiles, coir fibre, coir pith and (C-POM) Coir Pith Organic Manure. The lawn is encased in a composite comprising a single layer of coir fibre embedded in coir netting or coir geotextiles. A layer of coir pith is placed on the fibre. Grass slips are planted on the coir pith bed so made and Coir Pith Organic Manure [CPOM] is applied on it to form a thin layer. The coir based lawn is lighter in weight and therefore, easy to handle in comparison to the grass turfs. It is easy to shift the material from one place to another and it can be rolled for transportation.

Gardening without Plastic

Coconut fibre, shells and wood can be used as containers for growing plants, especially for hanging purpose, replacing conventional plastic pots. Pots made of coconut fibre, which are bio degradable, can be used widely in gardening. Fibres from the coconut husk together are blended with a biodegradable plastic to produce a biodegradable plastic product that can be further made into other items. Plastics, thus, made from coconut husk fine fibre powder will return to the environment after disposal much more rapidly than those without coconut husk

fine fibre powder.

Replacing plastics with coir-based products

Advantages of coir based containers are:

- Provides adequate aeration and drainage to the potted plants due to higher porosity
- Roots can easily pierce into the container walls avoiding root compression
- Enables direct planting of seedlings raised
- Avoids transplanting shock and provides better seedling vigour
- Holds moisture and hence higher water use efficiency
- Improved nutrient retention capacity
- Regulates the soil temperature