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Effect of coir pith compost in agriculture

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Abstract
In India, the Coconut is one of the oldest crops and presently covers 1.5 million hectares in this country with a total production of more than 10,000 million nuts. Coconut (*Cocos nucifera*) plays an important role in the agrarian economy of India. The coconut consists the rich sources of raw material and also used as the variety of products. The coconut is used as domestic dietary needs, mostly as coconut oil and coconut milk/cream, in daily household food preparations. The by-product of coconut husk is coir pith and it is difficult to decompose due to its high lignin and cellulose content. The porosity of coir pith is high and moisture holds up to 500%, that makes it a unique input as soil amendment. In this studies coir pith waste is obtained from the coir processing industries and hence it can be used as composted manure for the agriculture purposes.

Keywords: nutritive value of composted coir pith, soil amendment

Introduction
In India, 81 thousand hectares of land is cultivated the coconut, according to a data provide by Coconut Development Board, in the year 2014-2015. The coconuts contribute nutritional security, food security, poverty alleviation, employment security and social security in the major coconut growing countries. The growth of coconut is considered to be environmentally sustainable and Eco friendly. In south Indian states particularly Kerala, Karnataka and Tamil Nadu occupy the largest area of coconut production and cultivation is among 10345 nuts/ha in the year 2014-2015. The kernel and husk is separated from once harvested the whole coconut, whether the kernel is used either directly as food or processed further into food products or oil. The endosperm of coconut is used for human consumption, and hence the raw materials and other value added products is obtained from the coconut. The inorganic fertilizers or other costly input is replaced by the application of coconut by-products, these by-products is processed into more productive form. The most of the coconut growing countries are taken coir pith as agricultural waste and accumulates as a waste product.

The heaps of coconut dust are productively used in agriculture. The coir pith is decomposed as very slow because of highly content of lignin (28.25%) is present, and hence it is used as raw organic manures for the crop. Coir pith is defined as an agro-waste produced during coir fibre extraction, constituting about 70% of coconut husk (Pazhanivel *et al.*, 2011) [17]. Coir pith compost have various beneficial characteristics, and it is productive resource for use in agriculture.

Area and Production of Coconut:- 2015-16

Serial No.	States /Union Territories	AREA (1000 Hectares)	Production (Million nuts)	Productivity (Nuts/ha)
1.	Kerala	770.62	7429.39	9641
2.	Tamil Nadu	459.74	6171.06	13423
3.	Karnataka	526.38	5128.84	9744
4.	Andhra Pradesh	103.95	1427.46	13732
5.	West Bengal	29.51	373.58	12658
6.	Odisha	50.91	328.38	6451
7.	Gujarat	22.81	312.68	13706
8.	Maharashtra	22.75	271.24	9775
9.	Bihar	14.90	141.38	9489
10.	Assam	19.73	132.59	6720
11.	Chhattisgarh	1.85	30.54	16508
12.	Tripura	7.20	29.51	4097
13.	Nagaland	0.33	2.67	8091
14.	Others	52.80	388.13	7351
	All India	2088.47	22167.45	10614

Source: Horticulture Division, Dept. of Agriculture & Cooperation, Ministry of Agriculture & Farmers Welfare, Government of India.

Materials and Methods

The Chemical Composition of Coir Fibre

Sl. No	Item	Percentage
1.	Water soluble	5.25
2.	Pectin & Related compounds	3.30
3.	Hemi-cellulose	0.25
4.	Lignin	45.84
5.	Cellulose	43.44
6.	Ash	2.22
Total		100.00

Source: "About Coir", Technical Brochure on Coir, Coir Board, Kochi, 2001, P.3

pH of Coir Pith at Washing

The pH of the graded coir pith was moderately acidic in nature in first wash and it reached near alkaline after the final wash. Similar results had been reported by several authors who stated that; pH plays an important role in the availability of nutrients especially micronutrients to the cultured plants (Krishnasamy *et al.*, 2002; Pardo *et al.*, 2003) [10, 16]. Pennisi and Thomas (2005) [18] reported that if pH is too low (<4), micronutrients become more mobile and are absorbed in excess by the plant, resulting in a state of potential toxicity. If it is too high (>9), micronutrients are less mobile and the plant cannot absorb enough that result in deficiencies. Rippy *et al.* (2004) [22] also suggested the same concept with respect to the plant growth and yield. Ross and Paul Raj (2010) [24] revealed the same parameter after sequential washing, which reached alkaline and stated that the pH of the graded coir pith indicated a mild inverse relationship with the size of the particles.

Coir Pith Compost

It is obtained from the raw material of the coconut. In the drought season it can be act as mulching material for young plantations and conserves the soil moisture. The coir pith retained high moisture capacity of about 500-600% and high cation exchange capacity (CEC), and it is enable the large amounts of nitrogen and the high content of exchangeable K, Na, Ca and Mg. The coir pith compost is used as the soil medium for better yield in agriculture sector. The coir pith compost is an alternate source of soil medium for growth of plants. Therefore the coir pith compost is preferred as a rooting medium and consider as a better alternate for soil medium. And hence the water is absorbs up to eight time of its weight.

Coir pith hillock in the state of Kerala.

Coir pith compost heap

Uses of Coir Pith Compost

Among various by-products, the coir pith is conventionally used in land fillings and manuring purposes, because which is the inadequacy in the availability and accessibility of other organic manures such as compost, FYM, green manure etc. The dumping of the coir pith itself in water bodies may increase the concentration of hydrogen sulphide, methane and carbon dioxide that are toxic gases (Paramanandham and Ross, 2015) [14]. The all plant nutrient elements is present in Composted coir pith and it can also provide a supplemental effect with inorganic fertilizers. The application of Coir pith compost is used to increased the soil native micro flora. The coir dust is applied continuously, it influenced a reduction in bulk density and improved the water holding capacity and organic carbon status of the soil. And hence the high level of water holding capacity is occur due to the pore space available by the coir pith applied in the soil.

Nutritive Value of Composted Coir Pith

The mechanical process is done in coir pith for high nutrients. Whether compared to other major nutrients, the compost coir pith is used as a source of plant nutrition. The higher quantity of potassium is present in the coir pith. In horticulture, the Coir pith is used as an important growth media for growing plants, because, of wider carbon and nitrogen ratio and lower biodegradability due to high lignin content. Coir pith is composted to increase the manorial value of pith, to reduce the wider C:N ratio, and also to reduce the lignin and cellulose content. Composting coir pith is used to converts plant nutrients to the available form and reduces its bulkiness. The composted coir pith application is used to increased the soil fertility particularly the available K status of the soil.

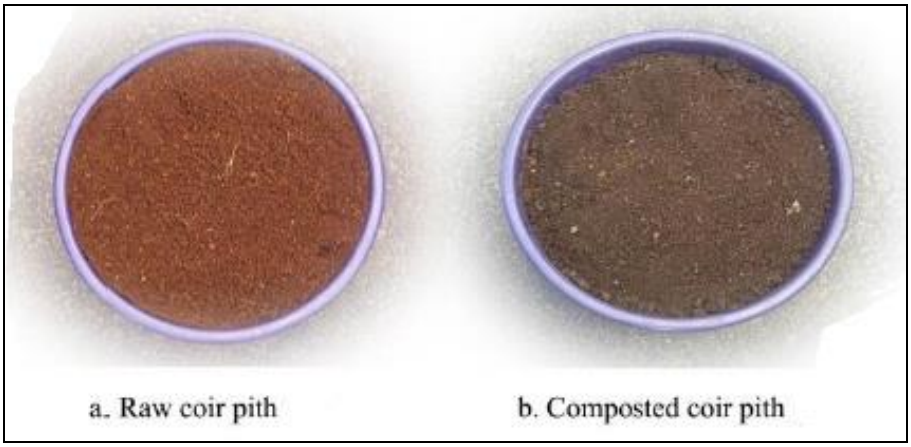

Diagram: Raw and composted coir pith compost

Nutritive value of raw and composted coir pith compost

Parameters	Raw coir pith (%)	Composted coir pith (%)
Lignin	30.00	4.80
Cellulose	26.52	10.10
Carbon	26.00	24.00
Nitrogen	0.26	1.24
Phosphorous	0.01	0.06
Potassium	0.78	1.20
Calcium	0.40	0.50
Magnesium	0.36	0.48
Iron(ppm)	0.07	0.09
Manganese(ppm)	12.50	25.00
Zinc(ppm)	7.50	15.80
Copper(ppm)	3.10	6.20
C:N ratio	112.1	24:1

Sources: TNAU Agritech portal.

Soil amendment

Soil amendments are those materials when added to soil, it must modify the soil properties in a positive way so as to make the soil healthy. Coir pith is especially of high demand in dry areas due to its high moisture retaining capacity around 40% (Paramanandham *et al.*, 2014) [15]. Paramanandham and Ross (2015) [14] studied the microstructure of coir pith compounds and observed the presence of numerous open cells forming large empty cavities, forming as capillaries for water and nutrient adsorption. In clay soil the coir pith added, it modifies the clay soil into stickiness and enhances the drainage properties of the soil.

Some other organic sources such vermicompost, FYM, coir pith compost, and pressmud improved the chemical and biological fertility of soil. The optimum C: N ratio of organic amendments is attributed which resulted in faster disintegration and release of nutrients in the soil. Whether the composted coir pith is applied, its improve the cation exchange capacity of soils.

Application of coir pith as soil amendment in long term basis could reduce the bulk density, increase the water holding capacity and improve the organic carbon content of soil (Muthurayar and Dhanarajan, 2013) [12]. The low particle density of coir pith itself is due to its high specific surface that results in high cation exchange capacity of around 38.9-60 meq/l00g, which is favourable for adsorption of sufficient amount of nutrients for the plants (Jeyaseeli and Raj, 2010) [7]. The physical, chemical and biological properties of the tea soil including the infection by VAM is improved by the application of digested coirpith compost and biofertilizers.

Coir pith

Coir processing factories in India produce roughly 0.50 million tonnes of coir pith waste every year that accumulates in the vicinity and creates an environmental hazard. At present about 10 million tonnes is available in south India (Ghosh *et al*., 2007) [5]. Coir pith has many beneficial characteristics, making it a potentially productive resource for use in agriculture if used after proper composting (Prabhu *et al*., 2002) [19]. Composted coir pith significantly increased the growth parameters and nodule numbers in the cowpea plants, indicating its use as an organic input (George *et al.*, 2013) [4]. Nishad *et al*. (2008) [13] observed that coir pith undergoes slow decomposition because of its low pentosan to lignin ratio of less than 0.50 per cent which is minimum required for the slow decomposition of organic matter in the soil. Composting of coir pith with earthworm or microorganisms itself may degrade the lignin. N-fixing bacteria are excellent and eco-friendly substitute for urea for composting of coir pith with P. *sajorcaju*. Composted coir pith based potting medium for cultivation of medicinal plants suggested that this compost can be used in reclamation of soils for its enhanced production, and also possibly other crops (Abesh Reghuvaran and Anita Das Ravindranath, 2010) [1].

Coir Pith Compost

Kadirvelu *et al*. (2001) [8] observed that use of coirpith compost can be done to reclaim alkaline salt-affected waste lands.

The coir waste is a by-product from the coir industry and it has a potential wealth and can be converted into valuable organic manure using omposting methods (Savithri and Hamed Khan, 2004) [26].

Ros *et al*. (2006) [23] stated that addition of coirpith compost

stimulated microbial growth through increased microbial biomass carbon (MBC) due to increased availability of substrate carbon. Raghuvaran and Ravindranath (2010) [21] confirmed that composted coirpith can be used for reclamation of soils for enhanced production.

Coirpith compost on growth attributes

Prience *et al.* (2000) [20] opined that addition of coir pith compost increase the plant height and number of leaves in maize.

Kannan *et al* . (2005) [9] reported that plant height, LAI and dry matter production of maize was higher under coir pith compost applied plot compared to control. Boateng *et al.* (2006) [2] have shown that application of nutrients from composted coirpith and inorganic sources significantly improved the yield of maize. Ramesh *et al.* (2006) stated that application of composted coir pith significantly increased LAI and CGR of the crop.

Coirpith compost on yield and yield attributes.

Saraswathy *et al.* (2004) [25] opined that the higher grain yield and nutrient uptake of grain was with the application of composted coirpith. Boateng *et al.* (2006) [2] have shown that application of nutrients both from composted coirpith and inorganic sources significantly improved the yield of maize. The increasing doses of coirpith compost along with inorganic fertilizers significantly increased the yield of maize and dry matter content as also reported in the findings of Maria Kmetova *et al.* (2013) [11]. Application of LFA @ 6 t ha^{-1} along with recommended level of urea and 10 t ha^{-1} of composted coir pith gave the maximum grain yield (Elavalagan, 2014) [3]. Application of coirpith compost along with nitrogen fertilizer produced higher yield than organics alone which might be due to optimum release of NH4-N from urea. (Husan, *et al.*, 2014) [6].

Coirpith compost on nutrient uptake

Solaimalai *et al.* (2001) noticed that application of coir pith reduced pH and EC and increased the organic carbon resulted in increased nutrient availabiliy in the soil which made the maize plant to absorb more nutrients and increased yield.

Parasuraman *et al.* (2003) reported that combined use of organics like coirpith compost was essential for sustaining crop yields in dry lands owing to the addition of nutrients and improvements in soil conditions.

Velmurugan *et al*. (2007) stated that application of digested coirpith compost + Azospirillum + phosphobacteria + VAM exhibited greater potassium uptake in maize. Addition of coirpith compost increased the uptake of NPK and micronutrients in maize (Sandhyarani, 2010). The uptake of nutrient and antioxidant activity in the maize plant was higher with coir pith compost application (Saikia and Upadhyaya, 2011).

Discussion

The optimum physical, chemical and biological properties in addition rich nutrients by the composted coir pith to the soil. In agro-industrial waste the coir pith can be bioconverted into compost, and it will obtained productive yield besides quality of produce.

The composted coir pith is one of the important organic sources for the agriculture crops, because of using the inorganic sources such as fertilizer, herbicides etc, is degraded the soil surface and destroyed the soil amendments. The coir pith is provide the sufficient nutrient for the growth of the plants. Even "Coir pith" (coco peat or processed coir pith) is used as the plant growing medium, and hence the coir pith is exported in the form brick and also used as soil conditioner for plant growth in indoor gardens and nurseries. It increased the ammonification, nitrification, and nitrogen fixation, due to improved microbiological activity. The coir pith helps to increase the growth of soil micro organism, and maintain the soil healthy, reduce the soil erosion.

Reference

1. Abesh Reghuvaran, Anita Das Ravindranath. Efficacy of biodegraded coir pith for cultivation of medicinal plants. J. Scientific and Industrial Res 2010;69(7):554-559.
2. Boateng SA, Zickermann J, Kornaharens M. Effect of poultry manure on growth and yield of maize. West Africa J Appl. Eco 2006;9:1-11.
3. Elavalagan VA. Effect of Lignite Fly Ash and Composted Coir Pith on Cultivable Soils. Biosci. Biotech. Res. Asia 2014;11(1):109-113.
4. George V Thomas, Palaniswami C, Prabhu SR, Murali Gopal, Alka Gupta. Co-composting of coconut coir pith with solid poultry manure. Current Sci 2013;104(2):245-250.
5. Ghosh PK, Sarma VS, Ravindranath AD, Radhakrishnan S, Ghosh P. A novel method for accelerated composting of coir pith. Energy fuels 2007;21:822-827.
6. Husan MR, Islam MR, Faried K, Mian MH. Nitrogen use efficiency and rice yield as influenced by the application of prilled urea and urea super granule with or without organic manure. J. Bangladesh Agril. Univ 2014;12(1):37-43.
7. Jeyaseeli DM, Raj SP. Chemical characteristics of coir pith as a function of its particle size to be used as soilless medium. Ecoscan 2010;4(2, 3):163-169.
8. Kadirvelu K, Thamaraiselvi K, Namasivayam C. Removal of heavymetals from industrial waste waters by adsorption onto activated carbon prepared from an agricultural solid waste. Bioresour. Technol 2001;42:745-752.
9. Kannan P, Saravanan A, Krishnakumar S, Natarajan SK. Biological properties of soil as influenced by different organic manures. Res. J Agric. Biol. Sci 2005;1(2):181-183.
10. Krishnasamy R, Somasundram J, Savithiri P. Sewage sludge-coir pith pellets: A source of organic manure. 17th World Congress of Soil Science. 14-21 August, Bangkok, Thailand 2002;344:1-11.
11. Maria Kmetova M, Kovacik P, Renco M. The effect of different doses application of dry coirpith compost on yield parameters of maize and potatoes. Acta fytotechnica et zootechnica 2013;16(1):5-11.
12. Muthurayar T, Dhanarajan MS. Biochemical changes during composting of coir pith waste as influenced by different agro industrial wastes. Agri. Sci 2013;4(5B):28-30.
13. Nishad VM, Parameswaran M, Kadeeja Beevi. Role of microorganisms in coir pith degradation "*In vitro*" and "*In vivo*" studies, 2008, 03-44.
14. Paramanandham J, Ronald Ross P. Scanning electron microscopic analysis of coir pith after subjected to different treatments. Recent Trends in Physical Chem.: An Int. J 2015;2(1):1-3.
15. Paramanandham J, Ronald Ross P, Abbiramy KS, Muthulingam M. Studies on the moisture retention capacity of coir pith, as a function of time. Int. J. Chem.

Tech. Res 2014;6(12):5049-5052.
16. Pardo A, Juan JAD, Pardo JE. Characterisation of different substrates for possible use as casing in mushroom cultivation. Food Agri. Environ. 2003;1:107-114.
17. Pazhanivel G, Chandrasekaran P, Prabha DS, Bhuvaneswari B, Malliga P, Chellapandi P. Effect of coir pith based cyanobacterial biofertilizer for improving fatty acid contents in *Arachis hypogaea* L. (Groundnut) oil seeds. J. Adv. Develop. Res 2011;2(1):38-41.
18. Pennisi BV, Thomas PA. Essential pH management in greenhouse crops. Bulletin 1256. Issued in furtherance of co-operative Extension work, Acts of May 8 and June 30, 1914, The University of Georgia College of Agricultural and Environmental Sciences and the U.S Department of Agriculture Co-operating 2005.
19. Prabhu T, Narwadkar PR, Sajindranath AK, Rathod NG. Effect of integrated nutrient management on growth and yield of coriander. South Indian Hortic 2002;50:680-684.
20. Prience SPM, Sivakumar WS, Ravi V, Subburam V. The effects of coir pith compost on the growth and yield of leaves of the mulberry plant. J Indian Soc. Sci 2000;57(1):118-122.
21. Raghuvaran A, Ravindranath AD. Efficacy of biological coirpith for cultivation of medicinalplant. J. Sci. Industrial Res 2010;69:554-559.
22. Rippy JFM, Peet MM, Louws FJ, Nelson PV. Plant development and Harvest yields of greenhouse tomatoes in six Organic growing systems. Hort. Sci 2004;39:1-7.
23. Ros M, Klammer S, Knapp B, Aichberger K, Insam H. Long-term effect of compost amendment of soil on functional and structural diversity and microbial activity. Soil Use Manage 2006;22:209-218.
24. Ross PR, Paul Raj S. Utilization of coir waste as a soilless medium. Adv. Biol. Res 2010;4:198-200.
25. Saraswathy R, Singaramand P, Krishnasamy R. Response of rainfed blackgram in phosphorous and potassium nutrient with composted coir pith. Madras agric. J 2004;91(1-3):45-53.
26. Savithri G, Hamed Khan S. Industrial application of coir waste. Plant physiol 2004;23(8):13-30.
27. TNAU- Tamil Nadu agriculture university, Coimbatore, agritech portal