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Utilization of Coconut Coir Dust Mulch in the Tropics

Whether economical or ecological motives are the driven force, in Low External Input Agriculture (L.E.I.A.) systems in the tropics, farmers often utilize biowaste for soil conservation and sustainable land use. In order to evaluate the effects of any kind of organic mulch, different -mostly well studied- aspects need to be considered, as each mulch has its specific characteristics. The one discussed below is coconut coir dust, a biowaste product obtained after coconut processing. The dust is the left over after the fibre fraction has been removed from the husk. As it has some good characteristics and potentials, a résumé has been made of literature and recent studies carried out by students of the University of Gent and the College of Gent, Belgium at the Coconut Research Institute of Sri Lanka.

One of the most important characteristics of coir dust mulch (C.D.M.) is the high water retention capacity. Coir dust can store up to 8 times its dry weight on water. By applying a 15 cm thick C.D.M. layer around coconut seedlings in Sri Lanka, irrigation could be reduced by 40-55 % during the dry season. In a pineapple coconut intercrop during the dry season, the top soil layer had a moisture content of 49 % under C.D.M., compared to 10 % under a sandy ridge of the same height (see pictures). The retention of water is not too strong as plant available water stored in coir dust is about 50 %, compared to 10 % in organic sandy soils and 23 % in organic sandloamy soils.

Next important characteristic is its low biodegradation. Coir dust consists mainly of lignine, cellulose and hemicellulose. About 90 % is organic matter and the C/N ratio is extremely high (> 130). The low pH of 4.5 - 5.5 offers an extra protection against biodegradation, as many micro organisms do not survive once the pH drops below 4. Slow biodegradation of organic mulches has been recently more and more looked for, especially in the humid and sub-humid tropics, where fast mineralization of the humic substances and outwash are big problems. Coir dust can therefore be applied as a mulch or incorporated in the soil to improve soil structure.

Concerning the nutritional aspects, different considerations can be made, firstly as a source of nutrients, and secondly as a cation supporting medium, which, together with the clay minerals, determines the so called cation exchange capacity (CEC) of the soil. From the first point of view, one can state that in coir dust, the amount of N, P, Ca and Mg are negligeable, making coir dust a poor source of nutrients. When mulch is applied for salt sensitive plants care has to be taken that the concentration of K, Na and Cl are not too high. Ec values are mostly low (< 1 mS/cm). Highest salt concentrations, though still low, are mainly observed in coir dust which is fresh and from coastal coconut trees.This salt concentration can be reduced by flushing down these elements by rain, before applying the mulch in the field or nursery. From the second point of view, coir dust has a good CEC value of approximately 50 meq/100g dry matter. Addition of coir dust to the weakly (Ultisols) or strongly (Oxisols) leached ferallitic soils of the humid and sub-humid tropics thus improves the nutrient binding capacity of these soils. Up to 70 % of the nitrogen applied is often lossed through leaching. Application of a mixture of coir dust and ureum strongly reduces these losses by slowly releasing ureum-N.

Besides the above mentioned properties, coir dust has proven to have beneficial effects on crop production and weed suppression. In India, different tree species performed better on

saline soils after coir dust was applied. In a commercial tree nursery in Kenya, germination of cashew seeds (*Anacardium occidentale*) has improved, after C.D.M. application. Besides, roots are not damaged after transplanting thanks to the loose structure of the coir dust. Weeds in cashew plantations in India are suppressed to an extent of almost 75 % by C.D.M., which is applied around the trees in circles with 1.5 m radius and a thickness of 7.5 cm. In Sri Lanka, this kind of mulch is mainly used in semi-perennial crops like pineapple (*Ananas comosus*) and ginger (*Zingiber officinale*). In a pineapple intercrop under coconut, weed flora changes were observed with the use of C.D.M., in that there was a clear tendency towards moist loving weed species as *Borreria latifolia* and *Commelina nudiflora*. Coir dust, on the other hand, suppressed weeds which are defined as some of the world's worst weeds, namely goatweed (*Ageratum conyzoides*), purple nutsedge (*Cyperus rotundus*) and the sensitive plant *Mimosa pudica*. Therefore, coir dust promotes the growth of some (weed) species on the other hand, while suppressing other species.

A final point related to this, is the positive effect on the establishment of cover crops. As such, the high incidence of *Pueraria phaseoloides* coincides with the cover cropping practices under coconut in Sri Lanka. This herbaceous legume is, however, suppressed by weeds under dry weather conditions. The application of coir dust tackles this problem and positively influences the leguminous cover crop during the dry season. The easy establishment of cover crops on pits and trenches filled with coir dust has also previously been reported.

Coir dust, besides of being important to control weeds, improve soil physical conditions and increase water retention capacity, therefore has a direct effect on the sustainability of cover crops during the dry season, and an indirect effect on the soil N-level. C.D.M., therefore, should be regarded as an important tool for soil conservation and sustainable land use in many integrated cropping systems. Future use of coir dust for mulching purposes in the tropics is, however, seriously threatened by its increasing application as horticulture substrate in Europe.

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