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The World's Tropical Rainforests as source of high potency Biochar

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Introduction

Tropical rainforests are characterised by the high rate of extraction of mineral cations from depth and their deposition on the forest floor in biomass, where the process is augmented by composting which is activated and supplemented by animal excretion. Nowhere is this more effective than in volcanic regions, where the mineral source constitutes that upon which all life on earth has developed. The rapidity with which these processes operate in the world's tropical rainforests generates a vast untapped nutrient resource in the form of runoff which presently flows to the oceans.

Correctly trapped and converted to transportable form, this can be a major component of future world agriculture.

Results and Discussions

A means of trapping, harvesting and concentrating nutrient from this source in the form of biochar and augmenting it for increased potency is described, using bamboo as a trap crop.

The procedure mimics the way in which farm crops extract applied fertilizer nutrient and export it in the form of produce, and will involve the establishment of bamboo forestry plantations along the lower slopes of rainforest where, during the four year maturation period the culms become charged with nutrient extracted from runoff and constitute an excellent biochar feedstock.

By implementing a system of village level agroforestry programs based on this concept, endangered rainforests would be conferred with economic value far beyond the transitory cash returns derived from logging of their timber, and the way opened for a true partnership between world agriculture and rainforest village communities which will benefit both. Village latrines located above the plantations offer further sources of enrichment while the bamboo root mass functions as an effective filter against stream pollution.

A permanent root system which facilitates nutrient take-up and holds future benefiits viv a vis carbon credits, culm by culm harvest which preserves canopy, rapid four year maturation cycle, and carbon dioxide absorption almost three times greater than that of other forest species, make bamboo a preferred feedstock. Location of highly CO_2 absorbent plantations at base of valley slopes, where atmospheric CO_2 concentrations are highest, is advantageous. Bamboo also secretes within it's culm tissue 5% silica in fine crystalline state.

Pyrolysis of mature biomass from such plantations will yield biochar of high silica and fullerene content. The latter being molecular-sized structures of crystalline carbon which resemble those of zeolites in the capacity to act as molecular sponges which store cations, microbes and water. Biochar possessing these structures is of greatly enhanced value to agriculture, and such value may be further augmented by including seaweed and fish waste in the pyrolysis.

In the kiln seaweed halogens react with silica to form insoluble halides and are retained in the resulting biochar. Likewise, dried fish waste releases valuable nutrient cations, in particular phosphorus, to the mix. Phosphorus is normally lost as the pentoxide in traditional charcoal production because of inadequate kiln sealing but this does not occur with modern biochar plant.

Concerns over future supplies of phosphorus for world agriculture appear to be poorly founded in the light of the growing awareness that superphosphate is a wasteful means of application and much more is either fixed or leached from agricultural soils than had previously been supposed. Estimations of phosphorus actually available to crop plants are now as low as 5%, and experience with biomineral fertilization in South Australia has achieved credible response from as little as 2% applied in a form which is insoluble and converted only in answer to plant demand as outlined in the abstract titled Nature's Smorgasbord. There are in addition, strong indications that appropriate mineral/microbial balance in the rhizone promotes a synergy which greatly increases the efficiency of metabolic utilization of phosphorus, and that

high application rates may no longer be necessary.

A first season response of wheat crop under biomineral management resulted in harvest levels of only 10% less than those under diammonium phosphate, and experience has shown that the first-use crop depression is corrected in the second season. It is of interest to note that protein content of wheat was increased by 20% under biomineral fertilization, confirmed by University of Adelaide analysis. These results were obtained using biomineral fertilizer with a carbon agent much inferor to biochar, which at the time was unavailable.

A project with the goal of establishing proof-of-concept for biochar production on the lines discussed is proposed for the Indonesian archipelago, which constitutes a sustainable nutrient source for the Australasian region. In Mexico, Dr Mario de la Pena of Project Ihuita Siyonami is assessing a similar program in the southern provinces and hopes to extend to Central America. The aim of these programs is to integrate village communities with world agriculture so as to protect rainforest and create sustainable village income streams.

Conclusions

Biochar technology offers the means to harness the vast untapped nutrient resource of tropical rainforests for world agriculture in partnership with village communities. In doing so it will endow rainforest with powerful economic leverage against destructive logging practice.