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Manurial effect of wood ash and refuse tea on nutrient status and yield of tea (*Camellia sinensis* L.)

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Abstract

A field experiment was carried out to determine the effects of wood ash and refuse tea with urea on yield and nutrient status of tea. Experimental plots were located in the St Coombs Estate, Tea Research Institute, Talawakelle, Sri Lanka. Six treatments (1 ton wood ash plus 20 ton refuse tea ha^{-1} $year^{-1}${T_1}, 2 ton wood ash plus 20 ton refuse tea ha^{-1} $year^{-1}${T_2}, 1 ton wood ash plus 20 ton refuse tea plus 587 kg urea ha^{-1} $year^{-1}${T_3}, 2 ton wood ash plus 20 ton refuse tea plus 587 kg urea ha^{-1} $year^{-1}${T_3}, present TRI fertilizer mixture{T_3}, and control{T_3}, without any fertilization) were arranged according to Randomized Complete Block Design with three replicates. Macro and micro nutrient contents in soil and leaf were analyzed5 months after applying treatments and yield was recorded in weekly intervals.T_2 applied plots indicated significant positive effect ($p<0.05$) on the yield and significantly ($p<0.05$) higher Potassium and Calcium content in the soil. Significant effect ($p<0.05$) of Nitrogen and Carbon content in the soil was given by T_1. Electrical conductivity and pH changes in soil were not any significantly different among all the treatments whilst higher macro and micro-nutrient concentration was observed in the soil, treated with T_1,T_2,$T_3$and T_4. It is evident from results that wood ash, refuse tea with urea can be successfully used to promote sustainable tea cultivation in the Mattakelle soil series (Rhodudults/Tropudults;USDA classification) which having high buffering capacity.

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Keywords:Buffering capacity, Soil nutrient, Sustainable tea production

1. Introduction

Tea (Camellia sinensis (L) O Kuntze) is very important plantation crop in Sri Lanka. The immature shoots of tea are plucked at regular intervals and removed a certain amount of various elements from the plant-soil system1.

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Therefore, fertilization acts as a major role in tea sector to enrich its economical yield factors such as vigor, flush yield, and growth.

Production cost of tea was highest in Sri Lanka in compare to other competitive tea producing countries. Syntheticfertilizer is affecting the natural environment harmfully by many ways. Then, throughout the world, there is an increasing demand for organic tea, which is free of pesticide and other chemical residues2.

The use of solid waste such as wood ash and refuse tea has enabled an alternative form of fertilization and a way to replace nutrients in the soil, consequently affecting the crop. Tea industry, also has waste product such as refuse tea coming from made tea production while ash coming from fire wood. This residue contains varying concentrations of minerals and, once in the soil, works as a corrective fertilizer improving the soil fertility.

Several researches had publicized that when synthetic fertilizers were not applied, the use of wood ash produced significant effects on the growth and yield of many crops, but dearth of information of effect of application of wood ash on tea plant growth and yield. This study was initiated to find out and recommend wood ash more rationally to the tea plantation stakeholders in eco-friendly and cost-efficient way.

2. Methodology

The experimental plots were located at the Tea Research Institute of Sri Lanka (latitude 6o80' N, longitude 80o 40'E; and altitude 1382 m AMSL) of the Mattakelle series which belongs to the great soil groups Red Yellow Podsolic (Rhodudults/Tropudults; USDA classification) in up-country wet zone;WU2. Average annual rainfall of the area is about 2250 mm and annual average minimum, maximum temperatures were 14.2oC and 22.8oC, respectively.

The field trial was carried out trench planted spacing of 4x 2 feet in1965. Each individual plots contained 40 bushes. The following six treatments (Table 1) were arranged in the Randomized Complete Block Design with three replicates (n=3). Eighteen plots were marked out and each plot was surrounded by a guard raw which separated the treated area in order to prevent treatment effect in any adjacent plots.

The initial nutrient content (%) available in wood ash and refuse tea were analyzed by using following stranded methods. Soil (0-6 and 6-12cm depth) and leaf sampling was undertaken before the 1st treatment application and after 5 months. Electrical conductivity and pH were determined using pH meter (ORION 510A model, USA) and Conductivity meter (model CDM 83), respectively.

Soil and leaf nutrients content, including C, N, P, K, Mg, Ca, Mn, Fe, Zn and Cu measured by analysis of soil and fresh leaves using Walkley- Black method, Kjldal method3, Determination of Borax [Na2B4O7.12H2O] extractable phosphorous4, Determination of total potassium, magnesium, calcium in soil, and determination of D.T.P.A extractable (Zn, Cu, Mn, Fe)Trace element in Soil respectively. Total yieldin each plot also obtained from sum of ten times plucking.

Data were analyzed using the Statistical Analysis System and Microsoft Excel version 6 package. Mean comparison of treatments were performed using Least Significant Difference (LSD) test at 0.05 probability level ($p<0.05$).