EFFECTs OF COMPOST ON CHANGES OF SOIL FERTILITY PARAMETERS UNDER TEA

P.A.P. Sajeewani[1], A.K.N. Zoyza[2], W.M.S. Wijayatunga[2] and A.N. Jayakody[1]

[1]*Department of Soil Science, Faculty of Agriculture, University of Peradeniya*
[2] *Soils and Plant Nutrition Division, Tea Research Institute, Hanthana*

Introduction

Conventional Tea cultivation involves high input of costly synthetic fertilizers which may cause detrimental effects to the environment. Cost for fertilizers and chemical contamination of the environment could be reduced through measures like compost applications as compost is primarily a soil improver and secondarily a fertilizer. Hence, this study has attempted to evaluate the changes in soil fertility parameters and yield in a tea plantation under application of different amounts of compost.

Materials and Methods

This study was conducted in *Kelebokke* estate, *Madulkale* of Up Country Intermediate Zone and the soil investigated belongs to *Hunnnasgiriya* series (Mapa, 2005). Addition of compost was done to each plot with a size of 25 m^2 (30 bushes/ plot) from 2002 to 2008. The treatments were 0 (control), 10, 20 and 30 tons of compost application per hectare per year and arranged in Randomized Complete Block Design (RCBD) with three replicates as two factor factorials. Besides, 400 kg of N (Urea), 35 kg of P_2O_5 (Eppawala Rock Phosphate (ERP)) and 120 kg of K_2O (Muriate of Potash (MOP)) were applied per hectare annually. Soil samples were collected using soil augers from two depths namely 0-15 cm and 15-30 cm in 2002, 2004, 2006 and 2008. Bulk density (BD), Water retention, pH (in H_2O and $CaCl_2$), pH buffering, Exchangeable acidity, Aluminium (Al) saturation, Cation Exchange Capacity (CEC) and Effective Cation Exchange Capacity (ECEC) were determined according to procedures adopted by the Tea Research Institute, Sri Lanka. Furthermore, yields were compared with respect to different rates of compost applications.

Changes of nutrient retention ability were also examined by conducting a leaching column experiment. At the beginning, a known amount of Urea, ERP and MOP was added to each column, containing representative soil masses from each treatment and the amounts of Nitrogen (N), Phosphorus (P) and Potassium (K) leached were determined throughout one month. Data analysis was done using the Statistical Analysis System (SAS).

Results and Discussion

Quality of used compost was complied with Sri Lankan standards (pH-6.5, C:N ratio-22.6, E4/E6 ratio-1.12). There were no significant changes in BD and Water retention due to compost application. However, a slight increase in water retention was observed when the rate of compost application was increased.

No significant changes in pH of both depths were observed. With time, application of high rates of compost improved the pH buffering ability, mainly in the top soil compared to the control (Figure 1.a and 1.b). The improvement in pH buffering ability that occurred may have been probably due to weakly acidic carboxylic and phenolic functional groups produced by compost.

Overall reduction of the exchangeable acidity at higher rates of compost applications and decrease of exchangeable acidity in all treatments in 2006, may have occurred due to Al blocking ability of added compost as a result of possible chelation (Table 1). Al saturation showed a decreasing trend when high rates of compost were applied to soils. In 30 t ha^{-1} yr^{-1} of compost applied plots, there was a gradual increase in CEC with time whereas a decrease was observed in the control treatment (Table 2). CEC values did not show a significant increase in the sub soil as observed in the top soil. For CEC, block, treatment and time effects were not significant. Brady (1990) described that at low pH values, Al ions react and bind or block exchange sites in silicate clays and humus. Results of ECEC were unexplainable as variations were not in a general sequential order.

The highest leaching losses of N and K were observed in the column, containing no compost, suggesting that application of compost has increased the nutrient retention ability (Figure 2). Low CEC, poor structure and high percolation rates may also have contributed to high leaching losses of N and K from the control treatment. Amount of P leached was negligible within the experimental period, as the P source was ERP which has a very low solubility. Also, Acidic pH may have immobilized available P.

Statistical analysis showed that there was no treatment effect on yield variation. A significant yield increase was not observable throughout the experimental period, perhaps due to the adequate supply of N, P and K by the added inorganic fertilizers.

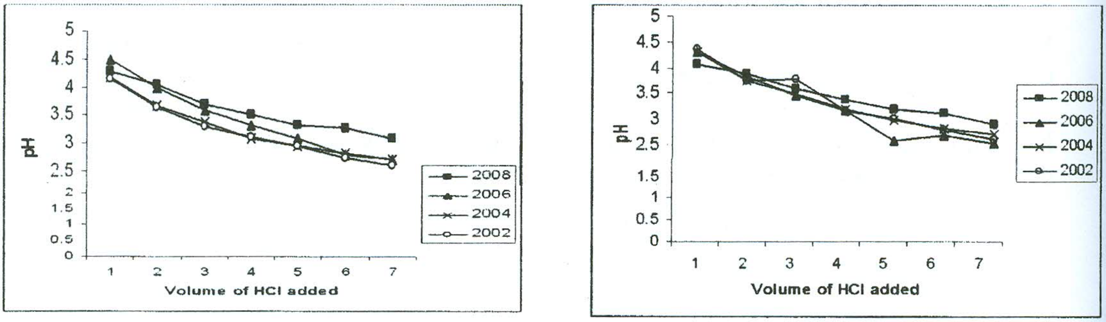
Conclusions

pH buffering ability, CEC and N, K and Water retentions were increased with increasing rates of compost applications whereas the exchangeable acidity and Al saturation were decreased considerably. However, favorable changes in fertility due to compost addition have not brought about any yield increment.

References

Brady, N.C. (1990). The nature and properties of soils, Macmillan publishing company, A division of Macmillan, Inc.

Mapa, R.B., Dasanayake, A.R. and Nayakkekorale, H., (Eds.) (2005). Soils of theIntermediate zone of Sri Lanka. Morphology and classification. Peradeniya. Soil Science Society of Sri Lanka.



(a) (b)

Figure 1. Changes of pH buffering in top soil treated with 30 tons of compost/ ha/year (a) and no compost (b)

Table 1. Variation of Exchangeable Acidity -cmol$_c$/kg of soil

Tons of compost/ha/year	2002		2004		2006		2008	
	Top soil	Sub soil	Top soil	Sub soil	Top soil	Sub soil	Top soil	Sub soil
0	1.24a	0.96a	1.77a	1.26a	0.79b	0.82a	1.65a	1.22a
10	1.37a	0.99a	1.29a	0.85a	0.79b	1.25a	1.79a	1.47a
20	1.64a	0.82a	1.57a	0.75a	0.87b	0.83a	0.88a	0.73a
30	1.77a	1.60a	2.34a	1.47a	0.56b	0.80a	0.89a	0.81a

Means with the same letter in a column are not significantly different at $p<0.05$

Table 2. Variation of CEC in top soil- cmol$_c$/kg of soil

Tons of compost/ha/year	2002	2004	2006	2008
0	26.2	18.2	19.9	18.9
30	20.2	25.6	28.1	31.9

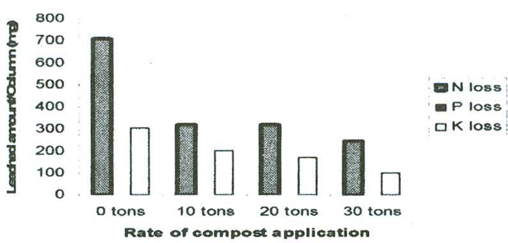


Figure 2. N, P and K leaching of treated soils with different amounts of compost (P is not appearing in the Histogram as the contents were negligible)