Effect of dolomite application on available phosphorus status in Tea soils

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Introduction

Tea (*Camellia sinensis* L.) is an important economic crop grown on highly weathered Oxisols and Ultisols in Sri Lanka. Phosphorus (P) is one of the most important macro nutrient that influencing growth, yield and quality of tea **(**Zoysa, 1997). Phosphorus deficiency is a concern, and a problem, in most tea soils. Research shows that over 70% of tea soils are P deficient (Lin *et al*., 1991). The availability declines rapidly as the soil pH falls below 5.5 or rises above 7. Therefore, measuring the soil pH helps the tea grower to adjust soil chemical condition suitable for nutrient uptake and plant growth (Zoysa, 2008). Dolomite is recommended for amelioration of acidity in tea soils. Present investigation was carried out to identify the effect of application of Dolomite on soil available phosphorus status in Tea Growing Soils.

Methodology

Site Description: This field experiment was carried out at field No 17, Midland's Lower Division, Ratota. Midlands is an estate(s) and is located in Central Province Matale District of Sri Lanka. Long term experiment was initiated in 2009. The experiment was carried out by using tea cultivar TRI 2023.

Experimental Design: Field experiment was laid out in Randomized Complete Block Design consisting of five treatments in different rate of Dolomite (tons/ha/pruning cycle) namely T1 (Absolutely control), T2 (1), T3 (2), T4 (3), T5 (4). Each treatment replicated thrice.

Soil sampling and Analysis: Soil samples of two depths 0-15 cm and 15-30 cm were collected from the randomly selected places in each plot as a bulk and sub sample was taken from the bulk after the mixing. pH of soil suspension was determined by using pH meter(ORION 510A model, USA) with Ag/AgCl combined electrode. Soil available phosphorous was extracted by Borax solution (pH 1.5) and phosphorus was determined by vanadomolybdate blue method (Beater,1949).

Statistical Analysis

The data generated from the study was subjected to Analysis of Variance (ANOVA) and treatment means were compared least significance difference at probability $p< 0.05$ using SAS statistical package version 9.1(SAS Institute, 1999).

Result and Discussion

Effect of application of different rate of Dolomite on soil pH

The effect of different rate of dolomite on pH in soils of 0-15 cm and 15-30 cm depths are presented in Table 1.Increasing trend in pH was observed with increasing dolomite rates at 0-15cm depth but it was not significant among treatment means. The highest value of pH was observed in T5 and it

significantly varied from other treatments at 15-30 cm depth. The optimum range of pH for tea is 4.5 to 5.5 (Anon, 2000). Application of different rates of dolomite did not exceed that level. It may be due to the high buffering capacity of Ukuwela soil series (Liyanage, 2012). Some mechanisms which affect the soil pH could not be controlled under field trial such as oxidation of applied N fertilizers, exchangeable acidity, washing out of dissolved cations, leaching of Ca and Mg due to the nature of the trial in field level. Due to plant uptake of these cations can alter the pH and those affect the equilibrium of soil pH. When nitrogenous fertilizer of ammonical nature added to soil they are nitrified and nitric acid is liberated.

Table.1: Effect of application of different rate of dolomite on soil pH at 0-15 cm and 15-30 cm depths

Level of Dolomite (tons/ha/pruning cycle)	**pH (Water)**	
	0-15cm	**15-30cm**
T1-(0)	4.43[a]	4.33[b]
T2-(1)	4.42[a]	4.42[b]
T3 –(2)	4.47[a]	4.25[b]
T4-(3)	4.59[a]	4.48[b]
T5-(4)	4.63[a]	4.90[a]
LSD Value (<0.05% P)	0.25	0.408
CV %	2.97	4.84
P value	0.289	0.041

Means followed by the same letter in each column are not significantly different to LSD at 5% level.

Effect of application of different rate of dolomite on soil available phosphorus

Soil available P was significantly varied at 0-15 cm with the different rate of dolomite application (Table 2). Significant increase of plant available P (13.67mg/Kg) at 0-15cm was recorded in T4 while T5 had shown the highest available P in soil at 15-30cm depth. It is generally known that reduction of soil acidity leads to increased phosphorus availability (Gaume *et al*., 2001). Iljkic.,*et al* (2008) reported that the increasing rate of dolomite increase the pH as well as the availability of phosphorus on acid soils. Most acid soils contain low P in soil pool because that is greatly influenced by soil. Tea plants are well adapted to acid soils with high Al availability. Under this condition P availability is rapidly declined. The sufficiency range of P for tea is 15-20ppm (Zoysa and Ananthacoomaraswamy, 1995). But, the results of this study showed the highest mean value of available P as 13.63 ppm at 0-15 cm depth and 17 ppm at 15-30 cm depth . ERP is only source applied evenly to all plots to satisfy P requirement. Availability of P may be influenced by dissolution of ERP. ERP dissolution is high at optimum moisture and pH (< 5.5) level (Zoysa *et al.* 1998). Low moisture content in soil due to insufficient rainfall during experimental period to dissolve the ERP and plant uptake could be the possible reason for these declines.

Table 2: Effect of application of different rate of dolomite on soil available phosphorus

Level of Dolomite (tons/ha pruning cycle)	**P (mg/Kg)**	
	0-15cm	**15-30cm**
T1-(0)	6.00[b]	3.33[b]
T2-(1)	3.67[b]	3.33[b]
T3-(2)	3.67[b]	3.33[b]
T4-(3)	13.67[a]	4.00[b]

T5-(4)	7.67[a]	17.00[a]
LSD Value (<0.05% P)	6.163	3.47
CV %	47.21	29.74
P value	0.029	0.0001

Means followed by the same letter in each column are not significantly different to LSD at 5% level.

Conclusions

This study revealed that there was no significant difference in soil pH among different rate of dolomite applied at 0-15cm depth. Significant effect on pH with the different rate of Dolomite was found at 15-30 cm and highest soil pH was noticed with the highest dolomite applied plot. The P availability greatly influenced by soil pH. Application of 3tons dolomite/ha/pruning cycle had shown highest available P at 0-15 cm depth while application of 4tons dolomite/ha/pruning cycle had shown the highest available P in soil at 15-30 cm depth.

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