Impact of lime application on soilborne pests and diseases in acidic soils of coffee plantations in the Central Highlands in Vietnam

CMBP Common Microbial Biotechnology Platform

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Introduction

- Vietnam is world largest Robusta coffee producer.
- Intensive practices have resulted in decreased soil and plant health and soil acidification as well as increased pest and pathogen pressures (SBPDs).
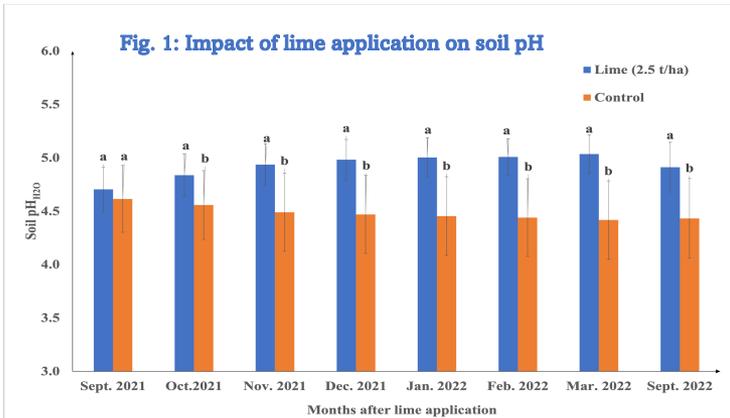
Methods

- Lime application: 2.5 t/ha
- 10 coffee plantations in Gia Lai province
- Soil pH monitored monthly
- Soil characteristics, AMF colonization and SBPDs measured one year after lime application

Results

One year after application:
- Increased soil pH by 0.5 unit
- Significantly enhanced soil OM, K, Ca^{2+}, Mg^{2+}, decreased Al^{3+}
- Significantly enhanced AMF colonization (frequency and intensity)
- No effect on SBPDs in both soil and roots

Table 1: Soil characteristics and AMF colonization one year after lime application

Treatment	pH_{H2O}	OM%	NH_4^+ (mg/100g)	NO_3^- (mg/100g)	P (mg/100g)	K (mg/100g)
Lime	4.91±0.23[a]	5.37±1.53[a]	0.61±0.08[a]	16.70±2.94[a]	25.11±18.16[a]	14.04±7.15[a]
Control	4.43±0.37[b]	4.60±1.19[b]	0.61±0.09[a]	16.24±2.90[a]	21.47±14.12[a]	11.10±5.58[b]

Treatment	Ca^{2+} (meq/100g)	Mg^{2+} (meq/100g)	Fe^{3+} (meq/100g)	Al^{3+} (meq/100g)	AMF colonization Frequency %	AMF colonization Intensity %
Lime	2.50±1.46[a]	0.48±0.55[a]	2.04±0.76[a]	0.94±0.48[b]	91.87±9.74[a]	23.86±10.70[a]
Control	1.23±0.59[b]	0.14±0.13[b]	2.26±0.77[a]	1.36±0.53[a]	79.35±14.09[b]	18.42±10.06[b]

Average values of ten farms ± standard deviation. For each parameter, values followed by different letters are significantly different at P≤0.05

Table 2: Influence of liming on SBPDs one year after lime application

Treatment	Fusarium FOC (%)	Fusarium MPD (cfu/g)	Rhizoctonia FOC (%)	Rhizoctonia MPD (cfu/g)	Plant parasitic nematodes (*Meloidogyne* and *Pratylenchus*) Soil FOC (%)	Plant parasitic nematodes Soil MPD (individuals)	Plant parasitic nematodes Roots FOC (%)	Plant parasitic nematodes Roots MPD (individuals)
Lime	100	9.4x10² (2.0x10²-1.7x10³)	90	2.0 x10² (0-6.5x10²)	70%	138 (0-1.2x10³)	76%	126 (0-7.6x10²)
Control	100	1.1x10³ (4.0x10²- 2.3x10³)	90	2.1x10² (0-7.0x10²)	74%	152 (0-2.7x10³)	86%	177 (0-7.5x10²)

Average values of ten farms. One way ANOVA did not show any significant difference at P≤0.05.
FOC: Frequency of occurrence. MPD: Mean population density. Data in bracket rank from the lowest to highest values.

Fig. 1: Impact of lime application on soil pH

The soil pH was an average value of ten farms. Error bar referred as standard deviation. Values followed by the different letter for each month are significantly different according to Pair comparisons of the mean using Tukey (HSD) test.

Conclusion and perspectives

- Lime application (2.5 t/ha) increased soil pH, soil nutrients and AMF colonization but had no significant impact on SBPDs.
- Agroecological practices such as bioinoculant application or intercropping will be investigated.

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