Addition of Lime and Gypsum to Ethiopian Soils to Enable Lentil Growth

A.Adane[ab], J. Schoenau[b], and S. Beyene[b]
[a]Hawassa University, College of Agriculture, Ethiopia
[b] University of Saskatchewan Department of Soil Science, Canada

Introduction

Grain legumes generally are considered as salt and pH sensitive. The salinity effect on nitrogen fixation is an explanation for its salt sensitivity (Katerji et al., 2001). Soil pH is also widely accepted as a dominant factor that regulates soil nutrient bioavailability, plant primary productivity and a range of soil processes including soil microbial community structure and activity (Robson, 1989).

At present, our knowledge of the effect of pH on soil nutrient availability is poor in Ethiopia. Furthermore, there are significant regions of acidic and sodic soils that are being considered for production of grain legumes like lentil. An experiment was conducted to examine the effectiveness of lime and gypsum as amendments to improve properties of acidic and sodic soils of Ethiopia.

Materials and methods

- The study was conducted on soils of Southern Nations Nationalities and people's regional state, Ethiopia.
- Acidic soils near Hagereselam and sodic soils near Alage were collected and a pot experiment was set up. Different rates of lime 0,50%, 100%(6.5 ton/ha) and 150% were applied to acidic Hagereselam soils, while gypsum at rate of 0,50%, 100%(11.2 ton/ha) and 150% was applied to Alage soil followed by four pore volumes of water for leaching.
- Leachates were analyzed for cations and soils analyzed for pH and electrical conductivity.

Results

Table 1. Total amount of cations leached from Alage soil amended at rates of gypsum from 0 to 150% of the theoretical gypsum requirement

Treatment	Ca	Mg	K	Na
	ppm			
0 %	9.40c	0.087b	13.10b	1423.44b
50 %	94.66b	0.11a	40.22a	2655.65a
100 %	200.47a	0.05c	45.52a	2796.71a
150 %	212.51a	0.04c	45.53a	2904.39a
SE	7.95	0.0097	2.49	133.22

Table 2 Amount of cations leached in different pore volumes of water

	Ca	Mg	K	Na
	ppm			
1st PV	140.48a	0.10a	56.04a	3879.35a
2nd PV	139.35a	0.06bc	40.50b	2639.02b
3rd PV	124.24ab	0.07b	28.02c	1813.82c
4th PV	112.98b	0.04c	19.81d	1448.01c
SE	7.955	0.0097	2.49	133.22

PV= pore volume

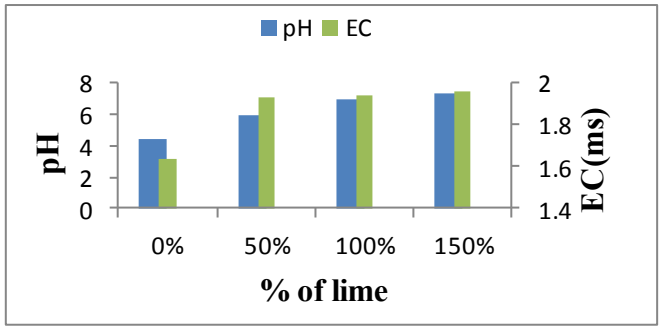

Fig. 1 Effect of lime on pH, EC of Hagereselam (acidic) soil.

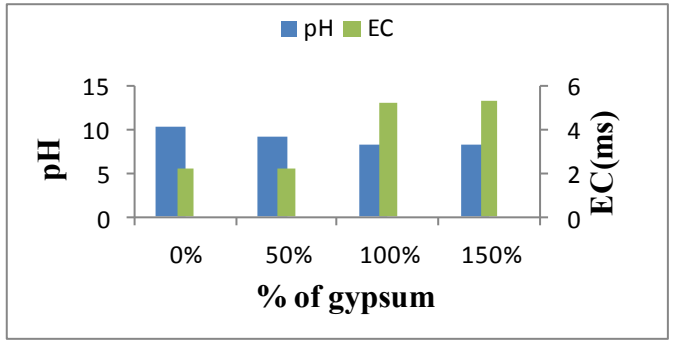

Fig. 2 Effect of gypsum on pH, EC of Alage soil (sodic) soil.

Discussion

- Gypsum amendment and leaching was effective in removing cations and reducing pH (Tables 1,2 and Fig. 1).
- As the area is dry and water limits crop production, gypsum @ 50-100% and 3 pore volumes of water is recommended. Higher rates of gypsum increased soil E.C.
- For the acid Hagereselam soil, the pH increased from 4.4 to 7.3 through the application of lime.
- 150% of the lime requirement was required to bring the soil to neutral pH value which is ideal for production of many grain legume crops.

Acknowledgement The authors are thankful to the IDRC for providing Fund.

References

Robson, A.D., 1989. Soil Acidity and Plant Growth. Academic Press, Sydney. ISBN 0125906552.

Katerji, N., Van Hoorn, J.W., Hamdy, A., Mastrorelli, M., 2001. Salt tolerance of crops according to three classifications methods and examination of some hypothesis about salt tolerance. Agric. Wat. Manage. 47, 1–8.

IDRC CRDI