

## Effectiveness of Bradyrhizobia and lime on yield of groundnuts and maize under intercrop system in acids soils of western Kenya

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### Abstract

Bradyrhizobia is the rhizobia species that fixes nitrogen in the groundnut crop. Soil acidity is a constraint to effective bradyrhizobia activity. Western Kenya is characterised by acid soils and thus uncondusive for bradyrhizobia activity. The aim of this study was to select the best liming material to bring the pH to optimum levels for effective bradyrhizobia activity and to establish the best bradyrhizobia inoculants that fix the highest amount of nitrogen for enhanced groundnut and maize yields. Dolomitic lime raised pH to optimum levels and bradyrhizobia A6w and V2w performed best in increasing both groundnut and maize yields. This package, i.e., Dolomitic lime with either bradyrhizobia strain A6w and V2w should be promoted in acidic soils of western Kenya for ground nut and maize production.

**Key words:** Acid soils, BNF, bradyrhizobia, dolomitic lime, groundnut

### Résumé

Bradyrhizobium est l'espèce de rhizobium qui fixe l'azote dans la culture de l'arachide. L'acidité du sol est une contrainte à l'activité efficace des bradyrhizobiums. L'Ouest du Kenya se caractérise par des sols acides et donc peu propices à l'activité des bradyrhizobiums. Le but de cette étude était de sélectionner le meilleur matériau de chaulage pour amener le pH à un niveau optimal pour l'activité efficace des bradyrhizobiums et d'établir les meilleurs inoculants des Bradyrhizobiums qui fixent la plus grande quantité d'azote pour les rendements améliorés de l'arachide et du maïs. La chaux dolomitique a élevé le pH à des niveaux optimums et les bradyrhizobiums A6W et V2W ont accompli les meilleurs résultats dans l'augmentation à la fois du rendement de l'arachide et celui du maïs. Cet ensemble de la chaux dolomitique avec l'une ou l'autre souche des bradyrhizobiums A6W et V2W devrait être encouragé dans les sols acides de l'Ouest du Kenya pour la production de l'arachide et du maïs.

**Mots clés:** Sols acides, BNF, bradyrhizobium, chaux dolomitique, arachide

## Background

Groundnut is one of the major crops in Western Kenya. However, soil acidity is a constraint to groundnut productivity as it results in low soil fertility. In Kenya, groundnut yields have been reported to be about 200 kg ha<sup>-1</sup> (Nekesa *et al.*, 1999), yet the crop has a yield potential of 1700 kg ha<sup>-1</sup> (Bullen *et al.*, 2008). Groundnut is capable of biological nitrogen fixation (BNF) and yields higher if conditions for biological nitrogen fixation are right. Groundnut can fix 134 kg N ha<sup>-1</sup> year<sup>-1</sup> (Giller, 2001) depending on soil conditions. Soil acidity negatively affects this process by hindering the effectiveness of bradyrhizobia (Dommergues, 1995). Lime has been reported to raise soil pH (Okalebo and Woomer, 1996). Different liming materials exist and they differ in their effectiveness to correct soil acidity. Calcitic and dolomitic limestone are such materials with potential of raising soil pH and making it more conducive for biological nitrogen fixation to take place. However, the effectiveness of bradyrhizobia for BNF varies with strain. It is therefore important to screen them to find the most effective for the crop in question. Calcitic and dolomitic limestones can raise soil pH and used in combination with appropriate bradyrhizobia could potentially increase groundnut yields. Hence the rationale for this study.

## Study Description

A field study was conducted in two sites in Western Kenya. Groundnut and maize were intercropped using the MBILI system in 5 m x 4.5 m plots. A blanket application of P and K was applied at 26 kg ha<sup>-1</sup> and 50 kg ha<sup>-1</sup> respectively. A randomised complete block design with split plots replicated three times was used. Lime was in the main plot at three levels (L0, L1, L2). Bradyrhizobia (strains A6, W1, V2 and biofix), N (34 Kg ha<sup>-1</sup>) and the control were sub-plot treatments. Data on soil chemical changes and yield parameters were recorded.

## Research Findings

The results showed that groundnut and maize yields varied by site and treatment. Bradyrhizobia strain A6w significantly increased groundnut yield in both sites. Yield increased by 56.7% and 69.9% above the control at Ligala and Koyonzo, respectively. Maize yields were significantly increased above the control by 32.4% and 24.4% at Ligala and Koyonzo sites, respectively. However there was no significant effect of bradyrhizobia A6w and on maize yields at both sites. Dolomitic lime increased groundnut yield by 17.8% and 12.7% better than calcitic lime at Koyonzo and Ligala sites, respectively. Soil pH at Koyonzo increased up to 6.5 at 60 DAS (days after sowing). This correlated well with the N data whereby at 60DAS the soil N was 0.19% and 0.21% at Ligala and Koyonzo respectively.

This study has generated useful findings that will support the improvement of groundnut and maize yields in acid soils of western Kenya if adopted by farmers.

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