Increasing cowpea productivity by combining rock phosphate and arbuscular mycorrhizal fungus inoculation in sub-Saharan Africa

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Introduction

• The P deficiency negatively affects the formation of nodule (L, 2) and the symbiotic fixation of N₂, gas by limiting growth and survival of rhizobia (1, 3) in legume crops.
• According to our previous study, P and N uptake by cowpea are significantly correlated.
• The P deficiency negatively affects the formation of nodule (1, 2) and the symbiotic activity of rhizobia (6).

Materials and Methods

- Pot test 1 was conducted to verify the effect of AMF inoculation on cowpea shoot dry weight with 0 and 30 mg P kg⁻¹ as K₂HPO₄.
- Pot test 2 was conducted to verify the effect of co-application of rock P (60 mg P kg⁻¹) and AMF inoculation.
- Pot test 3 was conducted to identify the optimum amount of rock P application for AMF inoculation using 20, 40, and 60 mg P kg⁻¹.
- Pot test 4 was conducted to identify the effect of co-application of rock P (40 mg P kg⁻¹) and AMF inoculation on cowpea drought tolerance.

Nutrients, AMF and irrigation

- Rock P from Togo was used with AMF strain, Glomus intraradices.
- In all pot tests, basal application of 50 K (KCl), 50 Mg (MgSO₄, 7H₂O), 5 Zn (ZnSO₄, 7H₂O), 10 Mn (MnCl₂, 4H₂O), 5 Cu (CuSO₄, 5H₂O), 5 Mo (NH₄)MoO₄.2H₂O, 4.0 H₂O mg kg⁻¹ (soil) was used.
- De-ionized water was used for irrigation to keep the soil water content at approx. 50% of field capacity in pot tests 1, 2, and 3.
- In pot test 4 (normal irrigation treatment), soil water content was kept at approx. 50% of field capacity. Drought treatment was irrigated 50 ml once per week from 3 WAP to 7 WAP. Water content under drought condition was less than 25% of field capacity.

Test 1: Can AMF inoculation help increase SDW in cowpea?

- Infection rate of AMF under zero P application was approx. 30-50% in all cowpea genotypes and maize, but under 30 mg P kg⁻¹ was almost 0%.
- Focusing on zero P application, the SDW of cowpea genotypes with AMF inoculation were higher than without AMF inoculation (Fig. 1).
- AMF inoculation does not work if there is high available P in soil. But under low P condition, AMF can help to increase SDWs of cowpea.

Conclusions

1. Inoculation of AMF such as Glomus intraradices can increase SDW at 8 WAP of cowpea under low P condition. Therefore, it can contribute to increase P uptake by young cowpea plant.
2. For AMF inoculation to work, we need to apply at least 20 mg P kg⁻¹ as rock P.
3. Co-application of rock P and AMF inoculation has high possibility of inducing drought tolerance in cowpea.

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References