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RHIZOBIAL SPECIFICITY AND NODULATION IN LEGUMES UNDER DROUGHT CONDITIONS IN THE SEMI-ARID COUNTY OF KITUI IN LOWER EASTERN KENYA

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INTRODUCTION

Low crop yields in Kenya's arid and semi-arid regions have been attributed to poor fertility and low usage of un-affordable fertilizers. Amongst mitigation measure is legume-based biological nitrogen fixation that can naturally sustain the nutrient pool of soils and thus sustainable crop yields in these drought-prone environments. Ability of rhizobial strains to survive, nodulate and fix nitrogen varies widely and thus selection of rhizobia with specific symbiotic and competitive attributes suited for drought conditions must assume precedence. Given high demand for legumes, there is a need to identify and select appropriate legume-rhizobium symbioses that can sustain production in Kenya's dry regions.

MATERIALS AND METHODS

Two-season field-based drought trials studied beans, cowpeas, dolichos lablab and green grams at Kenya's arid county of Kitui (1.4° S, 37.9° E). Data on leaf surface area, root nodules, pods, dry mass and wilting were measured and ANOVA done through GenStat. Sampled root nodules were cultured in the lab to identify rhizobial species which were then inoculated with the legumes under greenhouse to determine their specificity.

RESULTS AND DISCUSSION

Upon dissection and culturing, nodules exhibited pink coloration and formed raised, translucent and "milkish" colonies, an indication active nitrogen fixation and non-contamination. All rhizobium species identified were fast growers i.e. they took 2 – 3 days to form colonies and change BTB dye color to yellow from green. Under greenhouse, legumes exhibited species-specific nitrogen fixation. Dolichos lablab, green grams and cowpeas fixed nitrogen via *Rhizobium legumirnosarum* and beans fixed nitrogen through *Rhizobium phaseoli.*

All assessed parameters significantly varied at legume, treatment and seasonal levels enabling selection of best and least performing legumes. Green grams and dolichos lablab exhibited significantly higher yield compared to cowpeas and beans. Green grams also produced higher total root nodules than other legumes. The leaf surface area of green grams, dolichos lablab and cowpeas insignificantly varied from each other, while the leaf area of beans was substantially smaller. Based on the observed performance, green grams was considered drought tolerant, and beans drought susceptible. Coincidentally, the least and severe leaf wilting were respectively scored in green grams and beans under drought stress. Root nodules positively correlated with yield and negatively with wilting, potentially implying that nitrogen fixation might have contributed to better performance of green grams under water deficient conditions and hence drought tolerance relative to beans.

CONCLUSIONS

It can be hypothesized that *Rhizobium leguminosarum* associated with nitrogen fixation in green grams, dolichos lablab and cowpeas, contributed to better yield and performance of green grams under drought stress compared to nitrogen fixation in beans through *Rhizobium phaseoli*. Further research is however recommended to test the efficiency of nitrogen fixation by two rhizobium species.

KEYWORDS

Legumes, Rhizobium species, Nitrogen fixation, Bio-fertilizer, Drought stress, ASALs