Paper Number: 1352 (Poster Number: 224)

The Effect of Planting Date on N2 Fixation and C Accumulation of 30 Cowpea Genotypes Planted at Two Locations in Mozambique.

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The grains of cowpea (Vigna unguiculata) contains 25% protein and 64% carbohydrates (Bressani, 1985), and can potentially alleviate malnutrition among children of resource-poor African households. Additionally, it contributes huge amount of symbiotically fixed-N (up to 201 kg N ha-1) to improve soil fertility and sustains system productivity (Dakora, 2010). The growth, N2 fixation, and grain yield of cowpea is largely affected by changes in rainfall pattern, and the lack of information on optimum planting dates. To alleviate these constraints, decisions on appropriate planting date need greater attention. The symbiotic N contribution in 30 cowpea genotypes planted at two different planting dates (15th January and 30th February, 2011) were assessed under field conditions in Mozambique, using the 15N natural abundance technique. C assimilation was assessed analyzing shoot samples for 13C/12C isotopes. The results showed marked variations among the genotypes in terms of the amounts of N-fixed and C accumulation. The genotypes IT97K-1069-6, IT98K-128-3, IT97K-390-2, IT98K-412-3, IT03K-324-9, IT04K-221-1, IT99K-494-6, IT04K-227-4 recorded higher amounts of N-fixed at all three locations. Grain yield was higher in the genotypes IT04K-321-2, IT04K-227- 4, IT00K-126-3, IT-18 and IT97K-390-2 at Muriaze. Genotypes sown in the second week of January produced greater grain yield than those planted in the last week of February. The findings of this study could be used to improve the cultivation of cowpea in Mozambique and other areas with similar soil and climate.

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Characterization of Twenty-One Common Bean Genotypes for Biological Nitrogen Fixation Under Drought Stress.

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Research Abstract
Nitrogen fixation in common beans is usually low yet the nutrient derived through this process, Nitrogen, is a major element required in large quantities. The nitrogen fixation of twenty-one common beans genotypes was assessed under drought and well-watered conditions and inoculated and non-inoculated conditions. Total nitrogen in plant tissue and soil was analyzed and the results were used for calculating nitrogen fixation using the nitrogen difference method. Maize was used as the control or reference crop. A uniform dose of fertilizer (23:21:0 4S) was also applied to all plots to boost shoot growth. The twenty-one genotypes had four different growth habits. There were six type IIIa; five type IIIb; five type IVa; and five type IVb. As for type IIIa genotypes, total plant nitrogen was significant for water regime*genotype at flowering (<.001) and at mid-pod fill (0.001) with BCB2 having the highest nitrogen content under drought (mid-pod fill) followed by VTTT925/9-1-2 then DRK 57. Type IIIb, had total plant nitrogen significant for water regime*genotype at <.001 both at flowering and at mid-pod fill with AFR703 highest followed by A344 under drought. The genotypes that performed better under drought for total plant nitrogen in type IVa were CIM-Climb01-03-04, MAC 109 and 12D/2. The genotypes that performed better under drought for total plant nitrogen in type IVb were CIM-Climb01-03-34, CIM-RWV1040-5-1-2 and MBC41. The total number of seeds for type IIIa were highest from BCB2, followed by DRK 57 and then Sugar 131 variety. There were also significant values for number of nodules for genotypes and inoculation (P <. 001 and P 0.011). All growth habits exhibited differential contributions of yield, nodule number, nodule color, and %Nitrogen. The results show that there are potential nitrogen fixers under drought stress in each growth habit which may be used for selection for drought tolerance.

Paper Number: 1354 (Poster Number: 226)

The Influence of Rhizobia Inoculation and Phosphorus Fertilizer on Yield and Quality of Cowpea Fodder in Northern Ghana.

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The influence of rhizobia inoculation and phosphorus fertilizer on yield and quality of cowpea fodder in northern Ghana
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ABSTRACT
Cowpea (Vigna unguiculata L. Walp.) is one of the key legumes for smallholder farmers in West Africa. Cowpea production is a major source food, feed and income for many smallholders and their animals. Cowpea haulm is noted to increase microbial nitrogen supply in ruminants when used as supplement to other low quality feed. However, the grain and fodder yield of cowpea is currently low in Ghana.

A study was conducted investigated the effects of inoculation and phosphorus fertilizer on the yield and fodder quality of three improved cultivars of cowpea. Split-plot design was used with a replicate in four different communities in Savelugu-Nanton district of Ghana. The treatments were: songotra, padituya and apagbaala varieties as main plot factor and combinations of inoculation and phosphorus fertilizer as sub-plot factors (inoculant only, phosphorus only, phosphorus and inoculant and control) The inoculant used is called BR3262 from EMBRAPA. Results indicated that rhizobia inoculation and phosphorus fertilizer increased yield significantly ($p < 0.05$) of both grain and fodder as compared with control treatments between and among varieties. Padituya produced the most biomass yield (6.04 t/ha) while songotra produced the least (3,09.t/ha). Grain yields were not significantly different. There were no significant differences in number of nodules per plant. Fodder quality factors such as crude protein (CP), neutral detergent fibre (NDF), Acid detergent fibre (ADF) and in-vitro digestibility are being conducted to determine the treatment effects on the quality of cowpea haulms as fodder for livestock.

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The Abundance of Indigenous Rhizobia Nodulating Common Bean in Uganda and the Soil Factors That Influence Them.

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Common bean is an important grain legumes in Uganda. It forms an important part of the traditional diet and provides income for the rural communities. Common bean is able to fix nitrogen through bacterial symbiosis and yields could potentially be increased through the use of rhizobial inoculants. Inoculant response depends on the abundance, competitiveness and effectiveness in N fixation of the indigenous compatible rhizobia in relation to the attributes of the inoculant strains. We therefore aim to determine the most-probable numbers (MPN) of indigenous rhizobia and the soil characteristics that influence them. Soils were sampled from the Montane and Mt Elgon Agro-ecological zones (AEZ) in Uganda. Indigenous rhizobia populations were determined using the plant infection technique and soils were subjected to physicochemical analysis. Among 29 soil samples assessed, the highest MPN was found in the bean-banana/ coffee intercrop and the lowest in grasslands under sterile conditions using growth pouches supplied with sterile water and N-free nutrient solution. This data showed that the land use management system and cropping history determine the abundance of indigenous rhizobia but this is influenced by soil characteristics such as pH, organic matter and phosphorus content. Notably the organic matter ranged from 1.3-5.0%, pH 3.7-6.6, phosphorus content 2-69 ppm mg/kg and N content from 0.1-0.3%. Our next steps will be to isolate, characterise and test potential strains as inoculants that can be used to enhance common bean yields.

Key words: nitrogen fixation, MPN, physicochemical analysis

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Policing the Gate: Can Pea Plants Stop Rhizobial Cheats from Entering?.

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Legumes form symbioses with nitrogen-fixing soil bacteria called rhizobia. An intricate signalling process allows rhizobia to infect plant roots and form nodules. Inside nodules, rhizobia fix atmospheric nitrogen into ammonia and provide it to the plant. Rhizobial strains vary widely in how much nitrogen they provide and this influences crop yields. Despite some evidence to the contrary, there have been recent claims that legumes exert 'partner choice' and selectively form symbioses with rhizobia that provide more nitrogen. We tested whether peas exert such partner choice. As many traits influence the ability of rhizobia to form nodules, the only unbiased test of partner choice requires the use of strains that differ in their ability to fix nitrogen, but nothing else. We developed sets of wild-type nitrogen-fixing strains and their respective nifH mutant non-fixing strains. Strains were distinguished using chromosomal gusA and celB marker genes and were otherwise completely isogenic. Peas were inoculated with different ratios of wild type to mutant strains. We found that the percentage of nodules containing the wild type strain exactly reflected the percentage of the wild type strain in the inoculum. We therefore found no evidence for partner choice. Our results demonstrate that pea plants cannot exercise partner choice. This emphasizes the essential role of plant sanctions for plant and rhizobial fitness. In sanctioning, plants allocate fewer resources to established nodules providing little nitrogen. Ongoing work will focus on how such sanctions affect crop yields and populations of effective and less effective rhizobia in the soil.