

ANALYSIS OF THE SYMBIOTIC SYSTEM BEAN-RHIZOBIA UNDER WATER STRESS CONDITIONS IN GREENHOUSE

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Introduction

The symbiotic system common bean-rhizobia is often influenced by the availability of water in the soil. Water stress supposes a reduction of the biomass of the plant, of P absorption, of nitrogen fixation and nodulation (Muñoz-Perea et al. 2007). The sensitivity of nitrogen fixation to drought in legumes is variable, and depends mainly on the type of nitrogen compound synthesized in the nodules. The common bean responds with an accumulation of ureides with a negative effect on the nodules and nitrogen fixation. The objective of this work was to analyze how the water stress affects the plant-rhizobia symbiotic relationship and its effect on yield traits.

Material and Methods

In this work we have used 10 common bean landraces and breeding lines, some of them tolerant to drought, that were inoculated with 10 strains of *Rhizobium* (eight local and two reference ones, *R. tropici* CIAT899 and *R. etli* CFN42) (Table 1) in controlled greenhouse in a factorial trial under two conditions: irrigated and water stress. The landraces, belonging to the germplasm collection at the MBG-CSIC, were selected from a previous experiment to see their performance under drought conditions. The breeding lines were provided by several institutions. Aerial and root dry matter of the plant, and number and dry matter of nodules were evaluated and the variation detected in these characters was analyzed by ANOVA.

Table 1. Genetic material studied

Common bean	Rhizobia
PHA-0155	SLL2
PHA-0432	CIAT899
PHA-0471	CFN42
PHA-0483	EXIC
PHA-0683	EXIB
PMB-0220	EG
PMB-0222	EF
PMB-0244	EPOB
PMB-0285	APAFI
PMB-0286	LTMF

Results and Discussion

There were significant differences between the different genotypes for all variables. No significant differences in treatment-strain interaction and treatment-strain-genotype interaction were observed, due to the specificity of binding strain-genotype. Thus, they are strains that increase the yield of certain genotypes, but do not have the same effect on other genotypes (Rodiño et al.

2011). In the non-water stress trial and within each genotype, the values of aerial dry matter vary significantly between different strains used, highlighting the landraces PHA-0155, PHA-0483 and the breeding line PMB-0222 and the local strain APAFI. This specificity strain-genotype is important to find the strain that optimize the yield of improved landraces (Hungria et al. 2006). The water stress suppose generally a 32% of aerial dry matter reduction, but PHA-0471 and PMB-0220 increase their aerial dry matter in this conditions, when were inoculated with strain *R. tropici* CIAT 899. The nodule number and nodule dry matter showed high variability and PMB-0285 and PMB-0286 were the genotypes with high nodule number. They are strain-genotype combinations that have a high number of nodules, multiplying for six the average values of the variety. The nodular dry matter vary depending on the genotype, the inoculated strain and the environment, and can be observed different groups: 1) plants with large nodules and no correlation with aerial biomass; 2 and 3)(with different nodulation performance) when the nodular and aerial biomass is correlated and 4) plants with low nodulation and no correlated with the aerial biomass (Figure 1).The water stress causes in the plants a reduction in the number of root hairs, thereby reducing the number of nodules per plant. In this work, the reduction in the number of nodules was 57%. The combination strain EPOB-PHA-0471 achieved the maximal nodulation in these conditions. The nodule dry matter increases significantly under conditions of water stress. The genotypes with a high nodular biomass were PHA-0683 and PHA-0483 and the local strains that induce a greater nodule biomass were EF and EPOB. PHA-0683 presents a great uniformity in the caliber of your nodules, regardless of the nodule number and with a significant correlation with aerial biomass (Figure 1).

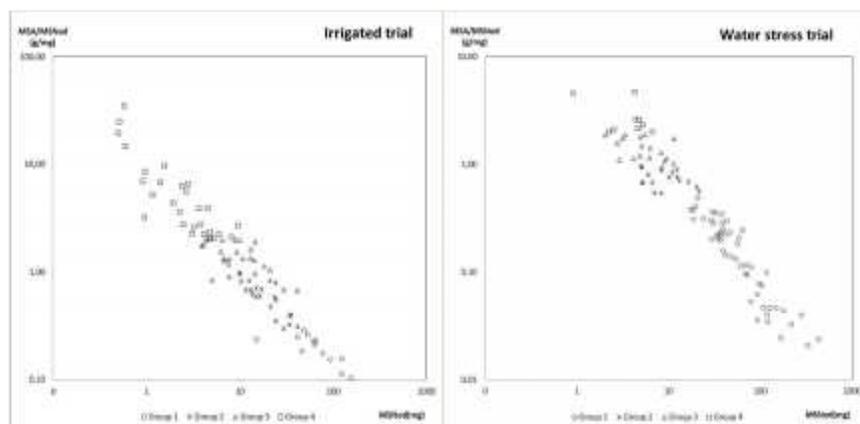


Figure 1. Nodule dry matter in relation to the aerial dry matter under irrigated and drought stress conditions

References

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