UREIDES SAP CONTENT IN COMMON BEAN GENOTYPES SELECTED FOR HIGH-NODULATION EFFICIENCY

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INTRODUCTION

The ability to common bean plants establish a symbiotic interaction with N_2-fixing Proteobacteria of the Rhizobiaceae family is an important evolutionary trait that has been considered in the Embrapa common bean breeding program. In previous stages of breeding *per se*, genotypes with high efficiency in nodulation were selected to be tested in field trials carried out to evaluate a series of traits of interest, prominently related to biological nitrogen fixation (BNF). Considering that ureides comprise up to 90% of the total N transported in the xylem of N_2-fixing tropical legumes (BARAL et al., 2016), its quantification becomes an important additional parameter to select potential parents for common bean breeding programs focused on BNF. This work presents results of the field evaluation of 15 common bean genotypes previously selected in a greenhouse screening which the ureides sap contents were quantified by contrasting the performance of those genotypes under N fertilization and under *Rhizobium* inoculation.

MATERIALS AND METHODS

The goal of this study was evaluating in field conditions the ureides sap content of 15 common bean genotypes previously selected for nodulation efficiency in a greenhouse screening (KNUPP et al., 2017). A field trial was carried out in the rainy growing season of 2013 in Santo Antônio de Goiás, GO, Brazil. The 15 genotypes and the control cultivars Pérola and Ouro Negro were evaluated under two N sources: seed inoculation with 10^9 CFUs. g^{-1} peat *Rhizobium* mix (strains SEMIA 4077, 4080 and 4088) or N fertilization (80 kg N ha^{-1}). A split plot design arranged in randomized complete block was used with N sources as main plots and genotypes as sub-plots. The quantification of ureides sap content was carried out as described by Hungria & Araújo (1994). Data were submited to a variance analysis and the averages were compared by the Tukey's test at 5% of significance.

RESULTS AND DISCUSSION

The statistical differences verified for ureides sap content are influenced by genotypes, N sources and the interaction between both (Table 1). The content averages obtained by the inoculated genotypes were higher than three times those obtained by the fertilized genotypes (61.94 and 18.14 nmol mL^{-1}, respectively) (Table 2). The genotype PI 313633, in addition to be among the highest performing genotypes for ureides sap content under fertilization, was the superior under inoculation, with 142.31 nmol mL^{-1} (Table 2), suggesting a strong ability to carry N in the form of ureide in sap. The ureides, which in the nodule has its origin in "de novo" synthesis of purines, in N-fertilized plants may have been synthetized from purines derived from nucleotide metabolism (BARAL et al., 2016). Ureides sap concentration were higher in inoculated plants (Table 2), indicating that it can be associated to the BNF and the internal N remobilization in fertilized plants.

Table 1. Analysis of variance for ureide sap contents of common bean genotypes sampled at flowering stage (R6) in field trial in Santo Antônio de Goiás (GO), Brazil (rainy growing season of 2013).

Variation source	DF	Ureides sap content
Blocks	2	6.60^{ns}
N source (S)	1	5.18×10^{4}**
Residue	2	26.99
Genotype (G)	17	3.32×10^{3}**
Interation GxS	17	3.18×10^{3}**
Residue	36	26.62

*, **, ***: Significant at the levels 5, 1 e 0,1% by F Test.

Table 2. Ureide sap contentes of common bean genotypes sampled at flowering stage (R6) under N-fertilization (40+40 kg N ha^{-1}) and *Rhizobium* inoculation, in a field trial carried out in Santo Antônio de Goiás (GO), Brazil (rainy growing season of 2013).

Genotype	Ureides sap content (nmol mL^{-1})	
	N-fertilization	*Rhizobium*
01. CNF 0011234	17.80 c	126.76 b*
02. CNF 0011559	38.06 a	15.03 gh*
03. CNF 0011239	16.49 c	91.72 c*
04. PI 209491	14.24 c	121.57 b*
05. PI 387865	33.58 ab	54.84 ef*
06. CNF 0011228	9.32 c	47.70 f*
07. CNF 0011026	15.98 c	83.96 cd*
08. CNF 0011137	18.69 c	51.30 f*
09. CNF 0011075	14.65 c	128.19 ab*
10. CNF 0011095	17.48 c	27.68 g*
11. CNF 0011240	15.28 c	9.81 h
12. CNF 0011028	9.75 c	27.68 g*
13. PI 325750	16.22 c	8.47 h*
14. PI 313633	33.66 ab	142.31 a*
15. CNF 0011086	14.59 c	70.02 de*
16. Pérola	10.05 c	81.30 cd*
17. Ouro Negro	12.08 c	15.80 gh
18. NORH 54	18.52 bc	10.71 h
Average	18.14	61.94*
CV (%)	13.02	

Averages followed by the same letter in the columns don't differ from each other at the 5% level by Tukey test. * Significant difference between N sources by F Test at the 5% level.

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