

Evaluation of the effect of *Azospirillum brasilense* inoculation on arabic coffee seedlings

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ABSTRACT

In fabaceae, *Azospirillum* is used in association with *Rhizobium* bacteria to promote biological nitrogen fixation, making the plant tolerant to water stress and resulting in better nutrient utilization, obtaining a plant more productive and vigorous and increase roots for better nutrient uptake by the plant. However, there are no studies using coinoculation in Coffee. The objective of the study was to evaluate the effect of different doses of *A. brasilense* on the development of coffee seedlings. The experiment was carried out in Machado, southern Minas Gerais. The experimental design was completely randomized (DIC), with five treatments and nine replications, totaling 45 experimental plots. The experimental unit consisted of pots of 12 liters of capacity with a substrate composed of 70% soil and 30% of tanned manure and a coffee seedling of cultivar Catuaí Vermelho IAC 144. Treatments were composed with different doses (0, 0.75, 1.5, 2.25 and 3.0 mL) of *Azospirillum brasilense* inoculant from the Micro-Chemistry laboratory, Azofix[®], having Ab-V5 strains, 1×10^8 cfu. mL⁻¹ viable cells per mL. From stage V7, the seedlings received eight applications with a seven-day interval. The applying was done in the late afternoon, under favorable environmental conditions, using a hand sprayer. Evaluations were performed 150 days after the first application. The variables evaluated were shoot height (ALT) (cm); shoot fresh matter (MFPA) (g); root fresh matter (MFR) (g); leaf fresh matter (MFF) (g); stem diameter (DIA)(mm) and pivoting root length (CRP) (cm). It is concluded that the inoculation of coffee seedlings with bacteria of the species *Azospirillum brasilense* promotes greater growth of the pivoting root as well as the fresh matter of the whole root system of coffee seedlings.

Key words: *Coffea arabica*; Seedlings production; Symbiosis.

1 INTRODUCTION

Brazil is currently the world's coffee producer leader. Coffee production began in the mid-eighteenth century, making several regions of Brazil producing coffee, increasing jobs and wealth in the country (Vilela, 2010). Minas Gerais was responsible this year for the estimated production of 27.3 million bags of coffee (CONAB, 2019).

Due to the socio-economic importance of the crop, all stages of the coffee production chain are thoroughly researched, from seedling production to beverage processing.

Bacteria of the genus *Azospirillum*, are commonly inoculated in Poaceae of economic interest, aiming at the biological nitrogen fixation provided by this microorganism in symbiosis with plants. However, in other species, mainly Fabaceae, *Azospirillum* is used in association with *Rhizobium* bacteria to promote biological nitrogen fixation and increase roots for better nutrient uptake by the plant, this practice is called co-inoculation (Hungria; Nogueira; Araujo, 2015). Reis Júnior et al. (2011), emphasize that these organisms can stimulate the production of phytohormones that result in root development. Also, according to Itzigsohn et al. (2000), inoculation with these microorganisms in pastures does not impact the environment.

Studies conducted using the inoculant in Fabaceae showed an increase in the biological nitrogen fixation rate, enhanced by the greater formation of nodules in a deep root

system, making the plant tolerant to water stress and resulting in better nutrient utilization, obtaining a plant more productive and vigorous.

The objective of the study was to evaluate the effect of different doses of *A. brasilense* on the development of coffee seedlings.

2 MATERIAL AND METHODS

The experiment was carried out in the city of Machado, south region of Minas Gerais, located at latitude 21°41'02" S, longitude 45°55'29" W and 819 meters above sea level. The region has a hot and temperate climate according to the Koppen classification with a defined season, the annual average temperature is 20.6 °C with a minimum of 14.7 °C.

A completely randomized experimental design (DIC) was used, with 5 treatments and 9 repetitions, totaling 45 experimental plots. Each experimental unit consisted of a 12-liter pot filled with 70% soil and 30% tanned manure. In each experimental plot, there was a seedling of coffee cultivar Catuaí Vermelho IAC 144, obtained in a commercial nursery properly registered in MAPA (Ministry of Agriculture, Livestock and Supply).

Treatments were composed with different doses (0, 0.75, 1.5, 2.25 and 3.0 mL) of *Azospirillum brasilense* inoculant from the Micro-Chemistry laboratory, Azofix[®], having Ab-V5 strains, 1×10^8 cfu. mL⁻¹ viable cells per mL.

From the emission of the 7th pair of true leaves, the seedlings received eight applications with a seven-day interval. The applying was done in the late afternoon under favorable environmental conditions, using a hand sprayer. Irrigations were performed via sprinkling so that the soil remains close to field capacity.

Evaluations were performed 150 days after the first application. The variables evaluated were shoot height (ALT) (cm); shoot fresh matter (MFPA) (g); root fresh matter (MFR) (g); leaf fresh matter (MFF) (g); stem diameter (DIA)(mm) and pivoting root length (CRP) (cm).

Data were submitted to analysis of variance and regression using the statistical program Sisvar®, the chosen model that best fits the data (Ferreira, 2014).

3 RESULTS AND DISCUSSION

According to the analysis of variance, there was no difference between treatments for the parameters of plant height, stem diameter and fresh matter of leaf and shoot. Statistical differences were observed for the variables of fresh root matter (Figure 1) and pivoting root length (Figure 2).

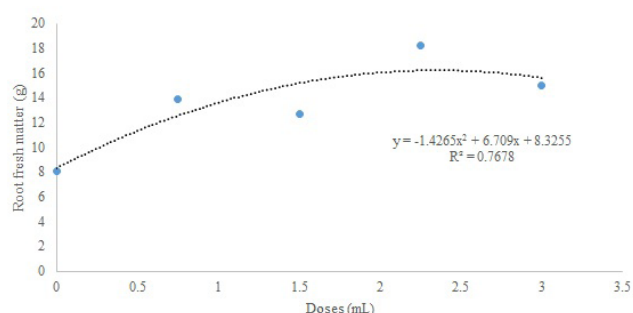


Figure 1: Fresh root matter (g) of coffee seedlings submitted to different doses of *A. brasilense*. Machado, MG.

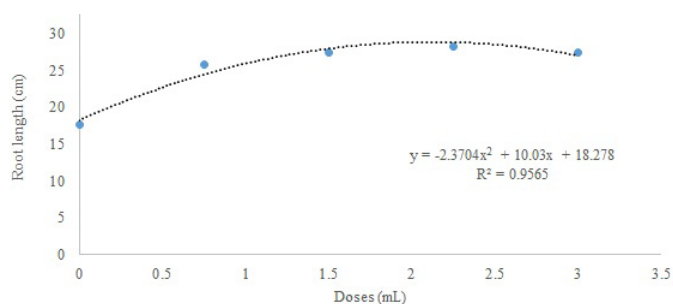


Figure 2: Root length (cm) of coffee seedlings submitted to different doses of *A. brasilense*. Machado, MG.

The results corroborate with Dobbelaere et al. (2001), where the fresh matter of corn seedling roots presented an average of 54.80 grams for the treatments inoculated with *A.*

brasilense, differing statistically from the control. The authors concluded that there was a contribution of the microorganism in the development of the corn root system.

According to Cotrim, Alvarez and Seron (2016), inoculation with different doses in the corn crop did not differ to the control, obtaining the average length of 12.71 cm for the control and 12.27 cm for the plants inoculated with *Azospirillum brasilense*.

According to Bashan, Holguin and De Bashan (2004) and Hungria et al. (2010), the effect of inoculation with bacteria of the genus *Azospirillum* on plant growth is related to the synthesis of plant hormones, responsible for the communication between plant cells, tissues and organs, which stimulate the development of the inoculated plants root system, resulting in a higher absorption of water and nutrients, obtaining a more productive and vigorous plant.

Cavallet et al. (2000) and Reis Júnior et al. (2011), affirm that the inoculation with *A. brasilense* alters the seedling radicle, increasing the lateral and adventitious roots. This process is due to the production of phytohormones, which are growth-stimulating substances (auxins, cytokines, and gibberellins) and not exclusively by biological nitrogen fixation.

4 CONCLUSION

The inoculation of coffee seedlings with bacteria of the species *Azospirillum brasilense* promotes greater growth of the pivoting root as well as the fresh matter of the whole root system of coffee seedlings

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