



## INTRODUCTION

Although there are many studies on plant growth promotion carried out using bacteria on various crops, there is scarce information on the effects of PGPR on the growth of perennial ryegrass (*Lolium perenne*) cultivated in Colombian high tropics. Ryegrass is one of the most widely cultivated grass in Colombia, and it is used as a nutritional source for livestock in intensive dual purpose, milk and meat production systems [1]. Several factors affect pasture degradation, including the following: (i) low planting density before grass initiated, (ii) forage species unsuitable for local conditions, and especially (iii) decrease in soil fertility due to inadequate use of fertilizers [2]. Therefore, the maintenance of pasture growth becomes a pivotal challenge to the sustainable management of Colombian tropical soils under livestock production.

## OBJECTIVES

To study the influence on the growth of perennial ryegrass of the bacterial inoculation isolated from silvopastoral systems of Nariño-Colombia. Additionally, to characterize molecularly the strains and its potential to plant growth promotion (PGP).

## MATERIALS AND METHODS

### Plant experiment

For the installation of greenhouse experiment, we use the ryegrass (*Lolium perenne*) var. One 50. The experimental design was a completely randomized block composed of 14 treatments: (1) chemical control with complete Hoagland solution (Hoagland & Arnon, 1950), (2) chemical control using Hoagland solution without nitrogen and phosphate rock (PR) as the only source of P (0.275 g L<sup>-1</sup>) (3-14), each strain with Hoagland solution without N and PR. Three blocks and a replica with three seedlings were established. The seeds were submerged in each inoculum for 30 minutes, and 10 mL of the strain suspension was inoculated day 0 and 6 days after of seeding (DAS). After 24 DAS under controlled conditions (18 ± 2° C, 60% humidity, 18/6 light), we evaluated the total seedlings length.

### Molecular identification

The identification was performed through the 16S rRNA partial gene sequencing. The partial sequences obtained were analyzed using the BLAST algorithm and compared with NCBI GenBank database.

### Screening for PGP properties

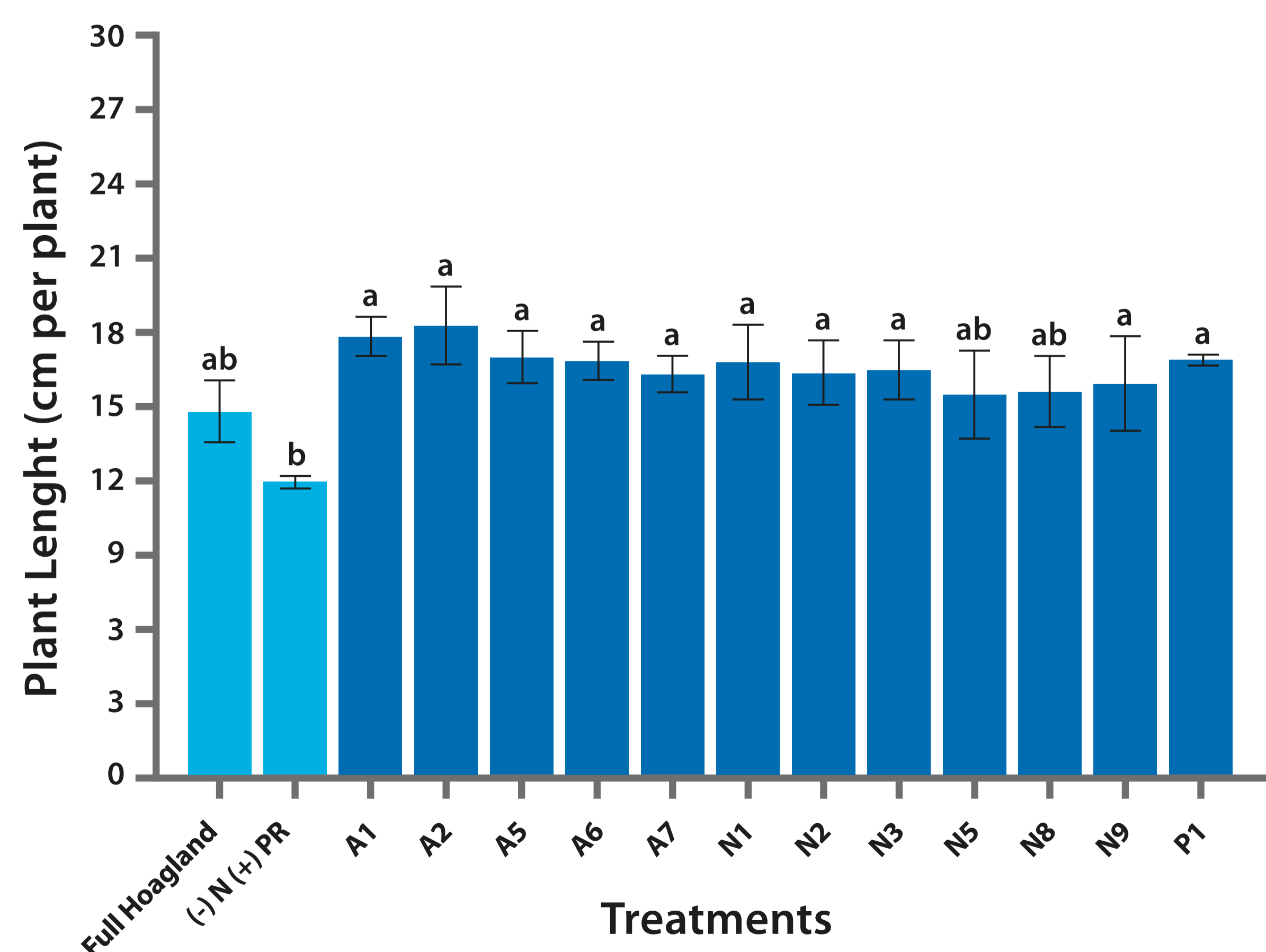
We characterize the strain's capacity to fix nitrogen; phosphate and potassium solubilization; indoles and siderophores production as reported by [3].

### Statistical data analysis

The data were subjected to an analysis of variance (ANOVA) and the means compared by the Tukey HSD Test with 95% confidence (SPSS software, Version 19).

## RESULTS

### Bacterial inoculation improves growth ryegrass (*Lolium perenne*) var. One 50 under limited nutritional conditions (Figure 1).



**Figure 1.** Effect of promoting growth plant under limited nutritional conditions of nitrogen (absence) and phosphorus (phosphate rock as sole P source). Similar letters for treatments did not differ among themselves by the Tukey test at 5% probability.

### The strains exhibit numerous attributes of PGP (Table 1)

**Table 1.** Characterization of the strains about of their potential to plant promote growth

Strains	16S rRNA	Nitrogen fixation	Solubilization		Production	
		Growth in NFB medium (+/-)	P Tricalcium phosphate (+/-)	K Muscovite (+/-)	Indolic compounds (µg mL <sup>-1</sup> )	Siderophores (+/-)
A1	<i>Pseudomonas sp.</i>	+	-	+	546,504	+
A2	<i>Stenotrophomonas sp.</i>	+	-	-	0	+
A5	<i>Raoultella sp.</i>	+	+	+	221,184	+
A6	<i>Pseudomonas sp.</i>	+	-	+	822,94	+
A7	<i>Pseudomonas sp.</i>	+	-	+	636,69	-
N1	<i>Pseudomonas sp.</i>	+	-	-	307,96	-
N2	<i>Rhizobium sp.</i>	+	+	-	793,6	-
N3	<i>Pseudomonas sp.</i>	+	+	+	130,82	+
N5	<i>Pseudomonas sp.</i>	+	-	-	449,87	-
N8	<i>Pseudomonas sp.</i>	+	-	-	0	-
N9	<i>Pseudomonas sp.</i>	+	+	-	276,03	+
P1	<i>Rahnella sp.</i>	+	+	+	0	+

## CONCLUSIONS

The bacteria exhibited diverse PGP activities as nitrogen fixation, phosphate and potassium solubilization, and production of indoles and siderophores. Moreover, we observed that the bacterial inoculation significantly promotes the total length of the ryegrass under limited nutritional conditions (absence of N and insoluble P). The strains *Stenotrophomonas sp.* A2, *Raoultella sp.* A5, *Rahnella sp.* P1, *Pseudomonas sp.* A6 and *Pseudomonas sp.* N1 were selected for future studies in greenhouse and field conditions to optimize the mineral fertilization.

## REFERENCES

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- [2] Hungria M, Nogueira MA, Araujo RS. Inoculation of *Brachiaria spp.* with the plant growth-promoting bacterium *Azospirillum brasilense*: An environment-friendly component in the reclamation of degraded pastures in the tropics. *Agric Ecosyst Environ* 2016;221:125-31. doi:10.1016/j.agee.2016.01.024.
- [3] Romero-Perdomo, F., Abril, J., Camelo, M., Moreno-Galván, A., Pastrana, I., Rojas-Tapias, D., & Bonilla, R. (2017). *Azotobacter chroococcum* as a potentially useful bacterial biofertilizer for cotton (*Gossypium hirsutum*): Effect in reducing N fertilization. *Revista Argentina de microbiología*, 49(4), 377-383.