Cariniana pyriformis Miers growth in two light environments in Antioquia, Colombia

John Alexander Pulgarin Díaz[1,2], Lucas Esteban Cano Gallego[1,3], Juan pablo Gil Restrepo[1,4]

[1]Corporación colombiana de investigación agropecuaria - AGROSAVIA. Centro de Investigación El Nus – Vereda ICA, Corregimiento San José del Nus, San Roque, Antioquia, Colombia.
[2] jpulgarin@agrosavia.co ORCID https://orcid.org/0000-0003-0554-8254, [3] lcanog@agrosavia.co ORCID https://orcid.org/0000-0002-2819-9694,
[4] jpgil@agrosavia.co ORCID https://orcid.org/0000-0003-4666-7356

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Introduction

Cariniana pyriformis is a valuable forest species in South America wood market. Its wood is appreciated for its durability and versatility and used for sawn timber, veneer, light and heavy construction and furniture manufacture. Very few plantations of the species are established in Colombia. The species is harvested in natural forests, in spite of being in critical danger of extinction (Cardenas & Salinas, 2006). There is a substantial lack of information about the growth of Neotropical forest species, which constitutes the first steps to develop the forestry sector.

Figure 1. Cariniana pyriformis *Miers* in Antioquia Colombia.

Goal

We compared the growth in total height (H) and diameter at breast height (DBH) of *Cariniana pyriformis* in two light environments and relate it to climate variables.

Materials and Methods

In October 2013 plots of *C. pyriformis* were established, three with 109 individuals at full sunlight in an ex-grassland for cattle and six plots with 59 individuals at partial sunlight, 35– 43% of shade provided by vegetation naturally growing in the site, mainly composed for shrubs typical of a recovering forest after many years of grassland for cattle. Plots were established in a tropical humid forest (N 06°28`48.18" W 074°39`28.80") at 850 m of elevation, mean annual precipitation of 2223.32 mm and temperature of 23°C, in the Research Center El Nus (AGROSAVIA), San Roque (Antioquia, Colombia). 15 dasometric evaluations were done until 5.17 years old.

Mean annual increment (MAI) was calculated for H and DBH, based on a completely random design with a 2x15 factorial arrangement, with light environment (partial shading and full sunlight) and measurements (15 measurements) as factors. MAI in H and DBH were related to monthly average (Ta), minimum (Tn) and maximum (Tm) temperatures in °C, precipitation (P) in mm, evapotranspiration (E) in mm, average (RHa), minimum, (RHn) and maximum (RHm) relative humidity in % (Figure 1). In addition, H and DBH at 5.17 years old were compared between systems with 95% confidence intervals. Analysis was done with the aov function of the "stats" package of R (R Core Team, 2019). Two tailed intervals with a 95% confidence are presented.

Results and discussion

Survival was 81% in full sunlight and 89.8% in partial sunlight. For MAI in H the two light environments and consecutive measurement interacted (Table 1). Since the first assessment at 0.5 years to 1.42 years old, full sunlight individuals showed a greater MAI in H than the ones in shade (pairwise comparisons: 1.58 ±0.08 and 1.35 ±0.13, respectively at 1.42 years). But in the period of 1.42 - 5.17 years no differences were detected. No differences were found for MAI in DBH in pairwise comparisons for the 1.42 - 5.17 period.

At 5.17 years no differences in mean H between systems were found (7.1 ±0.63 m full sunlight, 6.97 ±0.41 m shade); but DBH was greater in full sunlight than in shade (8.46 ±0.60 cm, 6.03 ±0.73 cm, respectively). Light environment showed a significant effect on DBH, but there was no effect of measurements over time (Table 1). Relation between climate variables and MAI were not found. Insects damage (mainly foliage feeding) were only present until 2.31 years in partial shading.

The differences found in DBH could be due to differences in light incidence or competence with other species in the site. It is common to increase DBH growth decreasing competence with other individuals (Pretzsch, 2009).

Table 1. *Analysis of variance for the mean annual increment (MAI) in height (H) and diameter at breast height (DBH) of* Cariniana pyriformis.

Source of variation	Analyzed Variable	df	Sum of squares	Mean square	F value	Pr(>F)
Light environment	H	1	23.9	23.91	53.57	3.42E-13
Consecutive measurement		1	292	291.97	653.99	< 2e-16
Light environment* consecutive measurement		1	66.1	66.15	148.17	< 2e-16
Residuals		2334	1042	0.45		
Light environment	DBH	1	72.2	72.2	235.429	<2e-16
Measurement in time		1	68.1	68.08	222.008	<2e-16
Light environment *consecutive measurement		1	0.2	0.25	0.807	0.369
Residuals		1895	581.1	0.31		

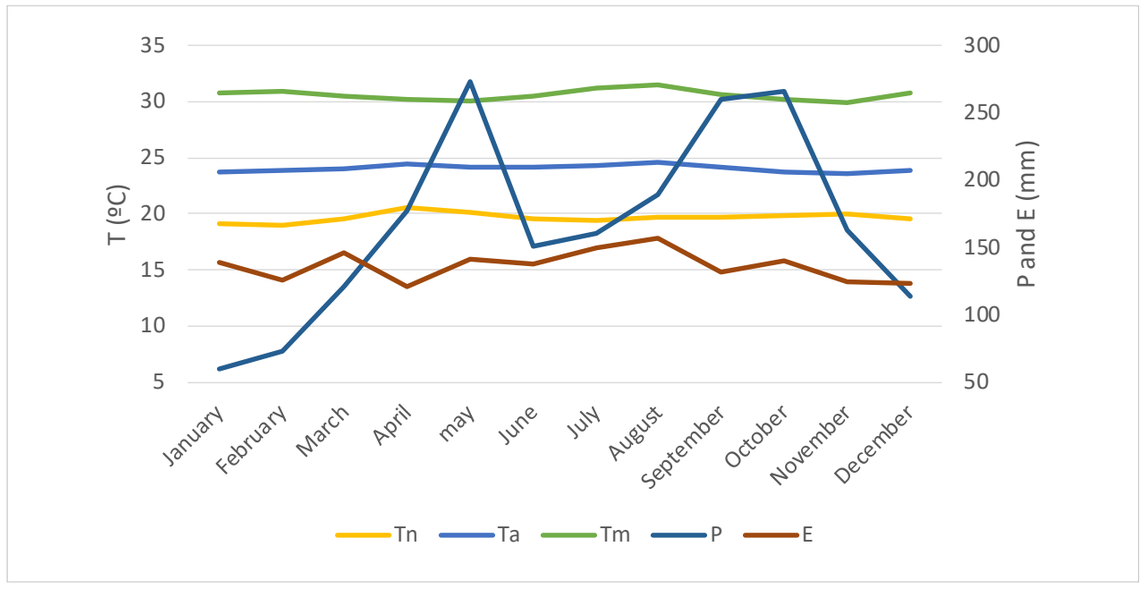

Figure 2. *Climate variables for the period 2014 – 2018. Monthly average (Ta), minimum (Tn) and maximum (Tm) temperatures in °C, precipitation (P) in mm and evapotranspiration (E) in mm in the study area.*

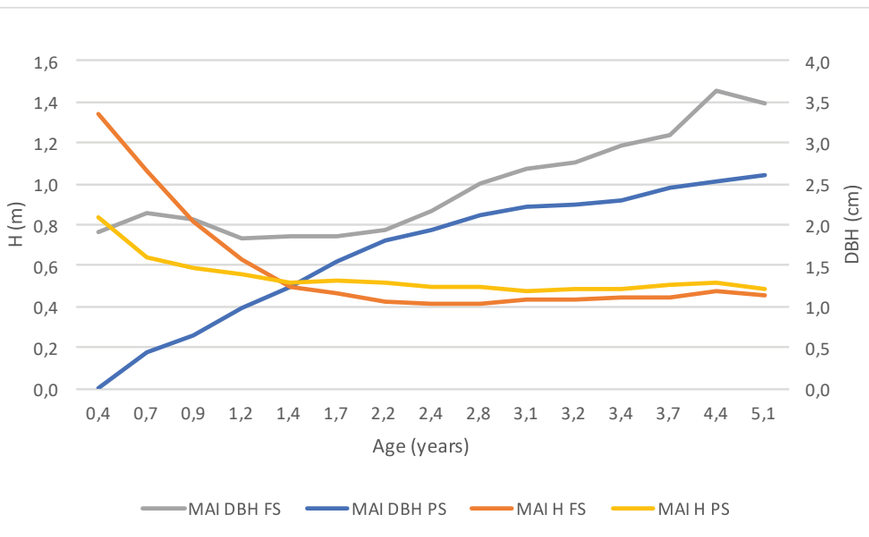

Figure 3. *Mean annual increment (MAI) for height (H) and diameter at breast height (DBH) in partial shading (PS) and full sunlight (FS) for* Cariniana pyriformis.

References

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