PHYSIOLOGICAL, PRODUCTIVE AND HEALTH PERFORMANCE OF REGIONAL COCOA GENOTYPES WITH TROPICAL FINE WOODS, AGROSAVIA MODEL.

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INTRODUCTION

In Colombia there are about 189,185 ha of cocoa cultivated in association with fruit and timber species, with a production of 63,416 t yr^{-1} and an average yield of 0.45 t ha^{-1} (MADR, 2021). The department of Santander is the leading producer with a 41% share (MADR, 2021; Fedecacao, 2022). Low crop yields are attributed to poor agronomic management, inadequate planting designs and the presence of pests and diseases that significantly affect production (Carvajal *et al*., 2022). Due to its growth habit, cocoa is grown in agroforestry systems, in association with other plant species, which provide shade and allow the farmer to obtain other alternative income (Agudelo *et al*., 2018).

OBJECTIVE

To evaluate the physiological, sanitary and productive behavior of cocoa genotypes TCS (Theobroma Corpoica La Suiza) 13, 19, SCC (Colombia Corpoica Selection) 53, 82, 83, CCS (Corpoica La Suiza Collection) 73, 77, 80 and ICS (Imperial College Selection) 95; associated in planting designs with Abarco (*Cariniana Piryformis*), Teca (*Tectona grandis*) and Caucho (*Hevea brasiliensis*), in the localities of El Carmen and Rionegro in Santander, Colombia.

METHODOLOGY

The variables were recorded from experimental cocoa plots previously established in the field in agroforestry systems (Figure 1). The net photosynthesis rate by cocoa genotype under the agroforestry arrangements (Abarco - Caucho in El Carmen and Abarco - Teca in Rionegro) was recorded with the ADC Lc Pro photosynthesis measuring equipment, Hoddesdon, England, at two times of the year; the light saturation curves (A/Q) were recorded with the IRGA LI-6400 equipment, Lincoln, Nebraska USA, at the time of the highest rainfall. As for productive and sanitary yields, they were recorded throughout the year in full production.

Figure 1. Experimental cocoa plots established in agroforestry systems in Santander Colombia.

RESULTS

The results showed no significant effects of the shading systems on the net photosynthetic rates exhibited by the cocoa genotypes. However, the wet season showed higher photosynthetic activity with average values of 4.94 µmol CO_2 m^{-2} s^{-1} than the dry season with 4.3 µmol CO_2 m^{-2} s^{-1}. Genotype TCS 19 showed the highest photosynthetic rate with average values of 5.63 µmol CO_2 m^{-2} s^{-1} at the time of highest rainfall (Figure 2).

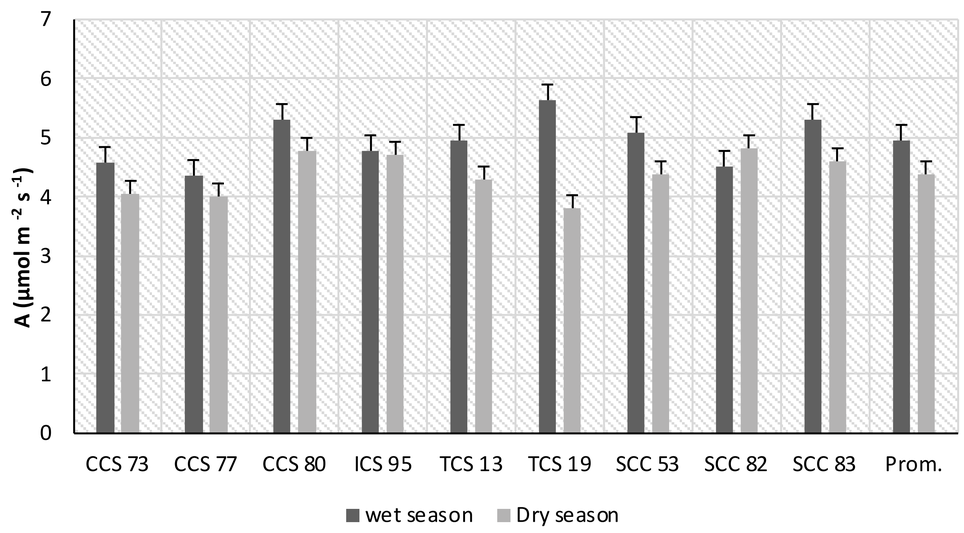

Figure 2. Net photosynthesis in nine cocoa genotypes evaluated in two periods of higher and lower rainfall intensity in Santander, Colombia.

For the light curves, the combined analysis shows photosynthetic activity at low radiation levels, with a light compensation point of 15.49 µmol photons m^{-2} s^{-1}. The photosynthetic rate increased at higher light intensity, up to the light saturation point of 1,000 µmol photons m^{-2} s^{-1}, which represents between 40 and 50% of the maximum total radiation in Santander (Figure 3).

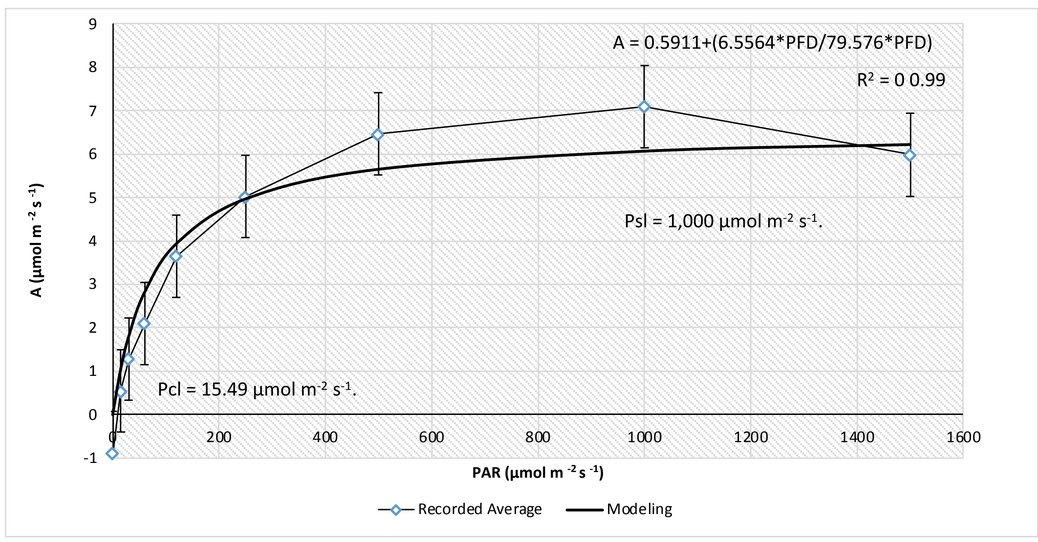

Figure 3. Light curves recorded and modeled in nine cocoa genotypes evaluated in Santander, Colombia.

Genotypes TCS 19 and TCS 13 presented higher yields with 1.8 kg ha^{-1} and 1.6 kg ha^{-1} under Abarco, Teca and Caucho shade; however, the other genotypes showed high decrease in productivity when grown under Teca and Caucho shade. The lowest Monilia losses occurred in plants grown under Abarco shade and the genotypes with the lowest disease incidence were TCS 19 and TCS13 with 5 and 8%, respectively (Figure 4 A and B). These results confirm that productivity is related to the photosynthetic rates of cocoa genotypes and shade species used in SAF agroforestry systems.

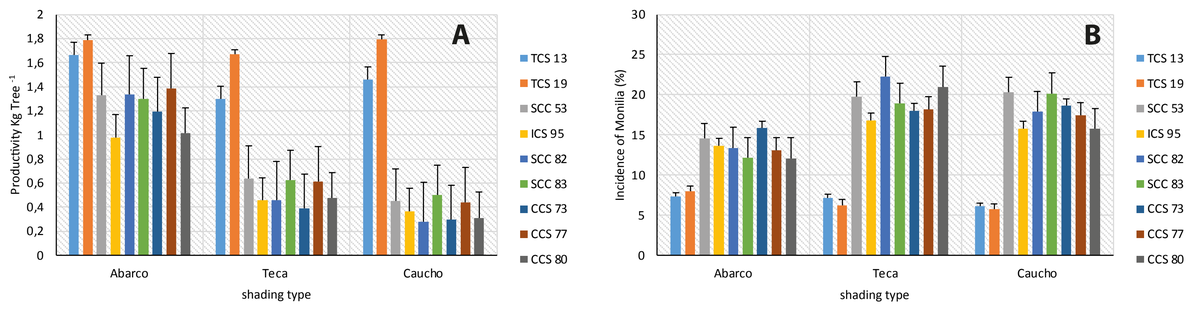

Figure 4. Productivity (A) and incidence of Monilia (B) in nine cocoa genotypes evaluated under shade of three forest species in Santander, Colombia.

CONCLUSION

The results indicate that cocoa genotypes show higher productivity and lower incidence of Monilia when grown under Abarco shade. Therefore, its use is recommended in cocoa crops with agroforestry arrangements that provide between 40 and 55% of total radiation, to increase crop productivity.

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