

The level of competition between cocoa trees depends on the average diameter of the trees and their genetic origin

Context and justification

The genetic improvement of cocoa in Côte d'Ivoire is based on the selection of clone hybrids in comparative hybrid trials. The selection criteria have always been production, bean quality and resistance to diseases and insects. Competition between trees for resources, although having an effect on the selective value of individuals, has never been taken into account in this program. The aim of this study was to understand the dynamics of intraspecific competition over time in two cocoa populations planted in Côte d'Ivoire.



Photo 1: Highly competitive cocoa tree influencing the diameter of its neighbours.



Fig 1: Comparison of diameter of control families present on the 2 plots.

No significant difference between plots ($P=0,42$)

Plant material

- ◆ Two cocoa population of Côte d'Ivoire Reciprocal Recurrent Selection Scheme
- ◆ First population : UA cocoa population originating from the Upper Amazon (E61)
- ◆ Second population : LAT mixed population derived from crosses between Lower Amazonian and Trinitario (E64)
- ◆ Three common control families planted in each of the plots

Methods

- ◆ Two contiguous plots planted in total randomization
- ◆ Spacing of 2.5 x 3 m, in full sun, without fertilizer
- ◆ A mixed model implemented with BreedR with genetic, spatial and competition effects (TrebiSSou *et al.*, 2021)
- ◆ Multivariate analysis for diameter and cumulated production at each date

Dynamic of competition for diameter

- ◆ The effects of competition appeared later in the LAT population than in the UA population.
- ◆ A competition effect that accounts for between 8 and 10% of the variance explained by the model, depending on the population



Fig 2: Dynamic of percentage * of competition per population and year

* Percentage of competition is expressed as the diameter variance explained by competition related to the variance explained by the model

Genetic effect of competition for diameter

- ◆ the level of competition on the diameter of neighbours increased linearly with the mean annual diameter of the two populations.
- ◆ High level of competition for the same diameter in the UA population compared to the LAT population (non-significant interaction $p=0.80$)

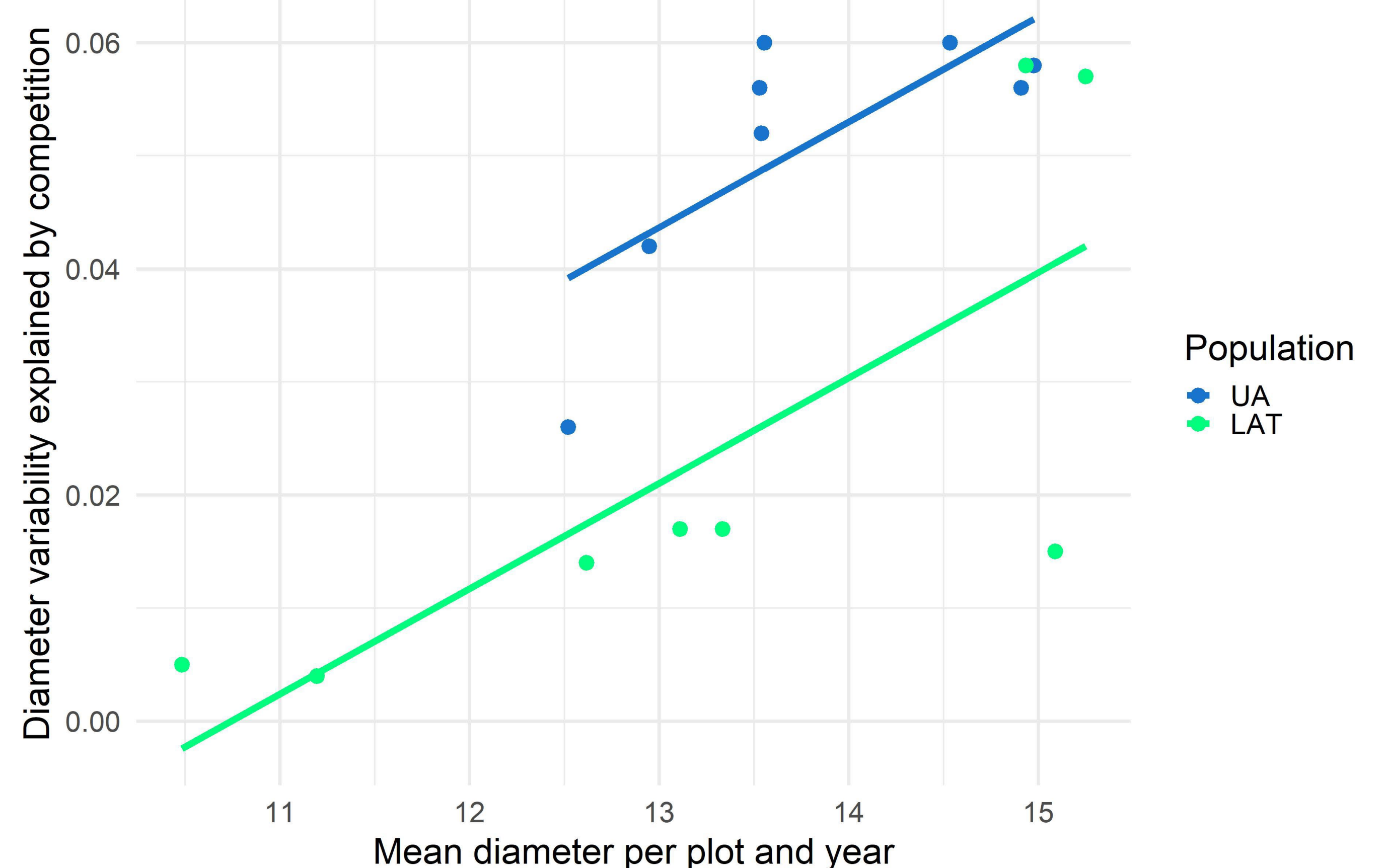


Fig 3: Increase of the competition effect with the diameter for 2 populations

Conclusion

- ◆ managing competition should enable the producer to increase production and make it more sustainable

References

TrebiSSou, C.I., Tah, M.G., Munoz, F., Sanchez, L., N'Guetta, S.P.A., Cilas, C., Ribeyre, F., 2021. Cocoa breeding must take into account the competitive value of cocoa trees. *Eur. J. Agron.* 128, 126288