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Pruning effects on cocoa yield depend on the size of the pruned and neighbouring trees

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Introduction

- Realized cocoa yields are typically about 20% of potential and pruning is recommended to farmers to enhance yield.
- Previous studies reported contradicting effects of pruning on cocoa yield. However, those studies looked at pruning effects at plot level, expecting trees in the same plot to respond in a similar way.
- Cocoa trees in the same field differ in size and competition with their neighbours.

Research questions

- To what extent does pruning affect cocoa tree **light interception**, **vegetative growth** and **pod production**?
- To what extent do these effects depend on **tree size** and the level of **competition with neighbours**?

Methods

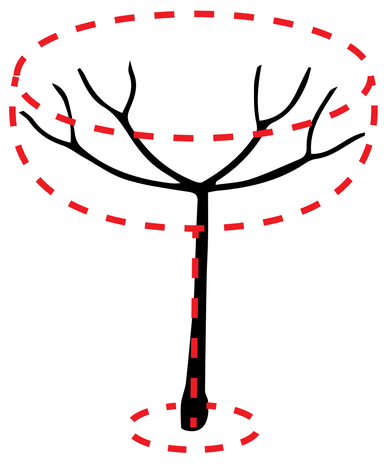

Figure 1. Schematic of an open cup-shaped tree crown

- We removed 26.4% of above ground biomass and aimed to create an open cup-shaped crown of half of the trees in an 12 years old full-sun cocoa experimental field in Côte d'Ivoire.
- We evaluated the pruning impact on light interception, leaf flushing and pod production.
- Stem basal area and sum of neighbour basal areas were used as proxies for tree size and competition.
- We analysed all response variables at **tree level** as a function of pruning, tree size and tree competition using generalized linear mixed effect models

Results

Effect on light interception

- After one year, the pruned trees recovered their initial losses in whole-canopy light interception (Fig 2) but maintained a more uniform distribution of light in the canopy.

Effect on vegetative growth

- Pruning directly increased flushing activity

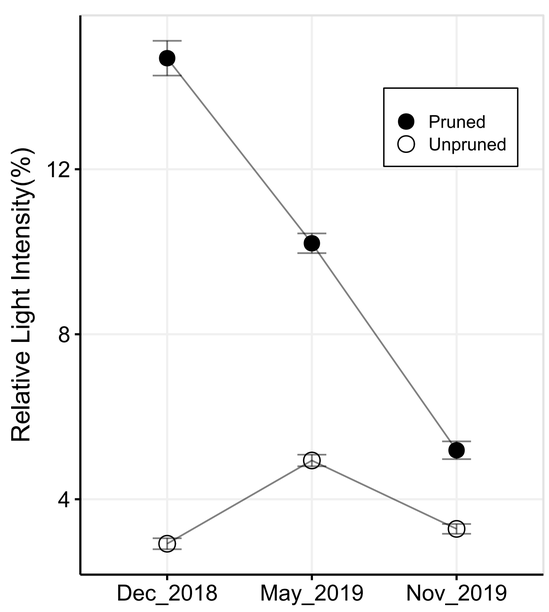

Figure 2. Mean relative light intensity below the crown for pruned and unpruned treatment at 0, 5 and 11 months after pruning.

Effect on pod production

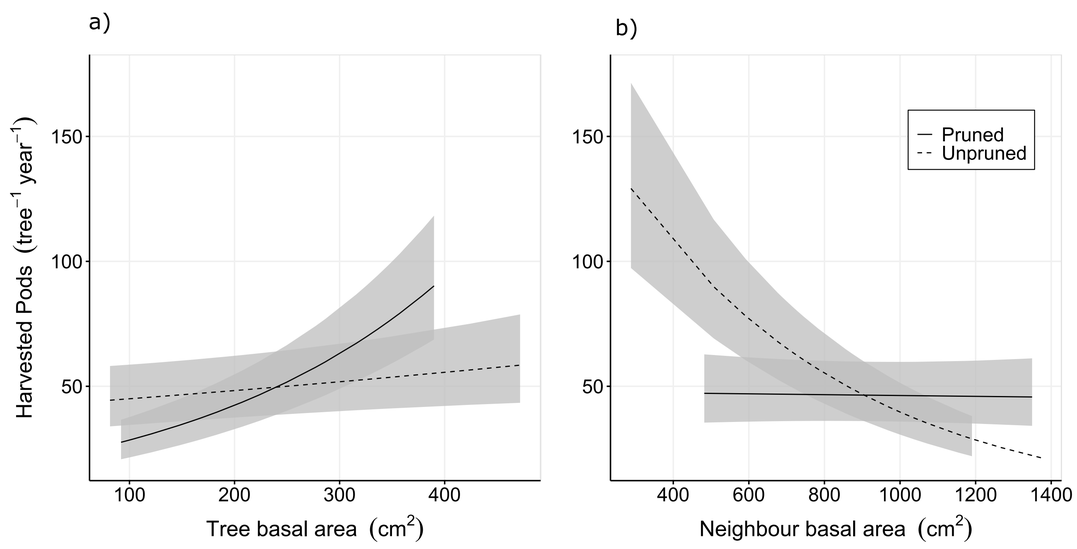

Figure 3 (a) Interactive effect on pod production of pruning and tree basal area with neighbour basal area kept at the mean value. (b) Interactive effect of pruning and summed neighbour basal area with tree basal area at mean value.

- Pruning effect on pod production was mediated by tree size and competition with neighbours
- Net pruning effect varied from negative to positive depending on the tree size - competition combination

Conclusions

- The large observed variability of responses stresses the importance of performing analysis at **tree level** rather than at plot level.
- More attention to individual tree characteristics is needed in pruning training and practice in order to have a positive effect on yield.
- The pruning mitigation effect on tree to tree competition suggests that pruning can contribute to realizing **higher-density cocoa stands**.

Read the paper:

Tosto, A., Zuidema, P.A., Goudsmit, E., Evers, J.B., Anten, N.P.R., 2022. The effect of pruning on yield of coco trees is mediated by tree size and tree competition. Sci. Hortic. (Amsterdam). 304, 111275.
https://doi.org/10.1016/j.scienta.2022.111275

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