Agroforestry and yield

Reference 3

Background and objective

Together, coffee and cocoa represent an important component of the international commodity trade volume , providing income for over 30 million smallholders, predominantly in developing countries. There is a strong tendency worldwide to intensify these traditional shaded systems by reducing or eliminating shade trees, planting higher densities of new coffee and cocoa varieties, and using agrochemical inputs. All these efforts are aimed at increasing production and short-term income. Evidence of the trade-offs between biodiversity performance and socio-economic benefits or their potential double dividend is lacking, as there are only few multidisciplinary studies that quantify both. The central question addressed is if the financial and biodiversity performances of small-scale shaded coffee and cocoa systems are similar or higher than those of conventional systems.

Search strategy and selection criteria

Systematically searched for scientific and grey literature using the following search terms in Google Scholar: "Biodiversity AND shade AND agroforestry AND (tropics OR tropical) AND (product OR productivity OR profit OR profitability OR yield OR financial OR finance)" Studies were selected if they included (i) coffee or cocoa systems; (ii) an intensified conventional systemand a shaded system, and there ismentioning of difference in shade between the two systems in the paper; (iii) quantitative information on yield (kg ha−1) and/or costs and benefits (monetary currency), in terms of e.g. input costs, net revenue, labour time and costs, or Benefit-Cost Ratios (BCR); and (iv) quantitative information on biodiversity performance in terms of species richness

Data and analysis

Differences in mean indicator value (yield, productivity per tree) between shaded and conventional systems were tested by conducting one-sided, paired sample t-tests (R, version 3.0.2, R Core Team 2014). This analysis allowed for comparison of means between groups while taking the paired cases into account and p-values, t-test values and degrees of freedom(df) are reported. One-way ANOVA testswere conducted to test for differences in variance in indicator value (yield) among the characterized low, medium and high shade tree densities, for which p-values, F-values and degrees of freedom (df) are reported.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
23	Cocoa and coffee cultivation in tropical lands	Tree-shaded coffee and cocoa.	Monocropping (Cocoa and Cofee)	Differences in mean 1) yields of the main cashcrop (coffee or cacao) (kg ha−1) and 2) productivity per shrub-tree of the main cashcrop (kg shrub−1, kg tree−1) between shaded crops and conventional crops.	56%

Results

- The average cocoa-tree and coffee-shrub density was 32% higher for conventional systems, a difference which was significant.

- Productivity per hectare for shaded systems decreased 26% compared to conventional systems. This difference in yield is reflected by the higher coffee and cocoa tree density and higher per plant productivity for conventional systems.

- Data showed a trend towards higher average productivity for conventional systems per coffee shrub of cocoa tree by 18%.

- No significant difference in yield was found among low, medium and high shade tree densities.

- NA

Factors influencing effect sizes

No factor was analyzed.

Conclusion

Lower average yield of the main cash crop (−26%) was found for shaded systems in comparison to conventional systems. Yields don't account for other products obtainable by co-crops in shaded systems.