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Trade-Off Analysis and Economic Valuation of Intercropping Teak (*Tectona grandis*) – Maize under Different Silvicultural Management

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Abstract

With decreasing forest area and the recent logging moratorium in Indonesia, timber production increasingly comes from smallholder systems within which laissez faire tree management has often led to low quality timber and hence low revenues for farmers. We carried out *ex-ante* analysis to explore the effect of different management practices on growth and production of teak and maize when they are intercropping using the tree-crop interactions model (WaNuLCAS). We considered a three-treatment factorial: the initial teak density (1600 trees ha^{-1} (2.5 m x 2.5 m), 1111 trees ha^{-1} (3 m × 3 m) and 625 trees ha^{-1} (4 m × 4 m)), the thinning (light (25 %), moderate (50 %) and heavy (75 %) of tree density), and pruning (40 % and 60 % of crown biomass). We compared intercropping with both teak and maize monoculture to show the trade-offs amongst different management options. As expected, cumulative maize yield in the first years of teak growth was negatively correlated with tree density and 10 % – 38 % higher when the tree density was reduced. All intercropping practices produced higher wood volume when compared with monoculture, as trees benefit from crop management and fertilisation. Maximum wood volume (m^3 ha^{-1}) was provided by the system with initial tree density 625 trees ha^{-1}, 25 % of it was thinned at year 5 and another 25 % of it was thinned at year 15 and 40 % of crown pruned at year 4, 10 and 15. However, greater stem diameter per tree was provided by 50% of thinning at year 5 rather than 25 % of thinning at year 5. Although greater stem diameter is rewarded with higher market price per volume of wood, an economic evaluation taking into account the cost of labour (for thinning and pruning) and its effect on additional timber revenue showed that the highest Net Present Value and return to labour was provided by the system with the second 25 % thinning done in year 20 instead of year 15.

Keywords: Agroforestry systems, ex-ante analysis, silviculture, smallholder teak, trade-off!analysis

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