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Nissen, T.M. "Intercropping Timber with Food Crops: A Bioeconomic Assessment of Smallholder Management Options in the Philippine Uplands." Ph.D. diss., University of Georgia, Athens, 1998.

As the area under vegetable cultivation on the steep slopes of Mt. Kitanglad in the Philippines increases, so does concern about the future economic and ecological health of the farms and watershed. But vegetable farming, because of its intense management demands and returns to land, also provides farmers with distinct opportunities for moving towards profitable and lower-risk perennial-based systems. Experiments were conducted on farms to evaluate under what conditions timber farming would be attractive to small farmers, and the tradeoffs associated with different management decisions, including intercropping, species selection, planting density and geometry, and branch pruning. Tree seedlings of *Paraserianthes falcataria*, *Eucalyptus deglupta*, and *E. torelliana* were planted in 1995. Intercrops included cabbage, Chinese cabbage, cauliflower, beans, and maize. Intercrop yields and tree growth were measured over two years. A relationship between stand basal area and intercrop-yield reduction was found, which may be used to evaluate the relative competitiveness of different tree species. The stand basal area relationship and published tree-yield equations were used to estimate total returns through the length of model rotations. Because the value of crops remains much greater than the value of timber where fertility is good, intercropping gave higher returns to land only on parcels that were to be fallowed for a minimum three years or had very low productivity. Timber intercropping, however, had higher returns to labor than sole cropping. Under all conditions, timber intercropping was preferable to sole-cropping of trees because the costs of site establishment, fertilization, and weeding could be charged to the intercrop. Optimal returns to intercropping generally occurred at tree densities between 100-400 trees ha^{-1} . Low densities allow intercropping to continue long enough to confer adequate benefits to the trees while minimizing both inter- and intra-species competition. Low tree densities may eventually fully stock the site without having to thin, further improving the returns to labor. More research is needed to quantify the value of non-merchantable timber products, soil fertility effects of short-rotation timber, and the marginal gains to extended periods of intercropping.

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