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Effects of canopy management of of umbrella tree (*Terminalia brownii* Fres.) on microclimate and maize (*Zea mays* L.) yield in agroforestry parkland of South Ari District, Southern Ethiopia

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Abstract

Smallholder farmers manage trees on crop fields in the South Ari District of southern Ethiopia through pruning and pollarding. Among those trees, *Terminalia brownii* is one of the preferred and dominant tree species, with numerous multipurpose uses such as tools, firewood, charcoal, medicine, shade, and soil improvement. However, the effects of their canopy management on microclimate and maize yield have not been scientifically quantified; even the results of other tree studies have been contradictory. Hence, this study investigated how *Terminalia brownii* canopy management affects microclimate and maize yield in parkland agroforestry. As part of the study, data were collected on microclimate and maize yield at three different distances from the tree trunks to the open field: D1 (0–4.1 m), D2 (4.1–8.2 m), and D3 (15 m outside the tree canopy cover). The study also included three different tree canopy management treatments (pollarding, pruning, and control), which were replicated three times in a randomised complete block design with a factorial arrangement. The study results revealed that canopy management of the tree influenced the microclimate, which in turn influenced yield. Statistically significant differences ($p < 0.05$) were observed in the yield and yield components of maize when grown under tree canopies compared to open fields under either canopy-managed trees or control. The highest grain yields (3,717 kg ha⁻¹ and 3,718 kg ha⁻¹, respectively) were observed in plots with pruned and pollarded trees, while the lowest yield (2,642 kg ha⁻¹) was obtained from the control plot. The observed differences in yield might be due to the highly concentrated soil nutrients, modified microclimate under the tree canopies, and reduced shading effects under canopy-managed trees. It is therefore recommended that either pruning or pollarding of *Terminalia brownii* trees be adopted to enhance yield by modifying the microclimate and improving soil nutrients.

Keywords: Agroforestry, maize productivity, microclimate, open field, shading effects, tree management