

## Managing Shade Trees for Coffee Can Benefit the Soil

*By Travis Idol and Adel Youkhana*

Many small coffee farms in Hawaii and around the world incorporate trees as part of the production system (e.g. fruit and nut trees), as windbreaks, for landscaping around the home, or even to protect the coffee plants from excessive sun and high temperatures. Actively managing shade trees to maintain optimal shade levels (around 40-50%) can be a lot of work, and dealing with the pruning waste also becomes an issue.

Chipping and mulching the tree pruning residues is one option to recycle and make good use of this material. Mulch is a good soil cover. It can suppress weed growth, reduce water runoff and erosion, insulate the soil from extremes of heat, reduce surface evaporation, and stimulate soil biological activity. Most tree mulch makes a poor nutrient source, though, since wood generally has a low nutrient concentration. That may not be the case with mulch from nitrogen (N) fixing trees, since they generally have a higher N concentration than other tree species. Past studies have shown that leaf and fine root litter from N-fixing trees can add over 100 kg of N per hectare (100 lb per acre), but this was without pruning or otherwise managing the shade levels.



*First-year coffee seedling under *Leucaena* KX2 shade.*



*Second-year coffee plants under managed KX2 shade (40%).*

An ongoing study at the University of Hawaii-Manoa is showing that chipping and mulching the pruning residues from an N-fixing tree can have positive benefits for the soil. We are using the *Leucaena* hybrid KX2 developed at UH-Manoa as a fast-growing and multipurpose shade tree for coffee. Because the tree fixes its own N, mulching of the pruning residues acts like a slow-release fertilizer to the soil. This may also help to build up the soil organic matter level.

Results from this study have shown exactly what we had hoped. Pruning every 6-12 months adds approx. 25 Mg per ha (25 tons per ac) of mulch to the soil every year, including over 150 kg per ha (150 lb per ac) of N! Decay of this mulch results in a release of N beginning in the first 3 months and continuing for at least one year. After only two years, soil C in the top 20 cm (8 in) also increased significantly by over 10 Mg per ha (10 tons per ac). This obviously has benefits

for improving soil quality and can support organic farming practices.

This system could be altered so that the trees are grown separately from the coffee, adding the mulch from tree pruning to open-grown coffee plants. Although this eliminates competition for resources among the trees and coffee plants, our results suggest that the trees suffer due to the loss of nutrients exported in the mulch. It is unclear how long this system could be maintained before tree growth slows to the point where there isn't enough mulch to satisfy the coffee plants.

In short, tree pruning residues are a valuable source of organic matter and potentially nutrients that can be put to good use in an agroforestry system, such as shade-grown coffee. Integrating N-fixing trees within these systems ensures the trees are able to maintain growth rates, providing a long-term source of N and organic matter to the soil.

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*Effect of mulch (left) vs no-mulch (right) on coffee growth and health.*



*Mulch generated from shade tree pruning*

Youkhana, A and TW Idol. 2009. Tree pruning mulch increases soil carbon and nitrogen in shade and full sun coffee agroecosystems in Hawaii. *Soil Biology and Biochemistry*. 41:2527-2534. doi:10.1016/j.soilbio.2009.09.011



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