Characterization of Soil Properties under Legume and Non-Legume Tree Canopies Occurring in Signal Grass (*Brachiaria decumbens*Stapf.) Pastures

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Key words: agroforestry, nutrient cycling, shade, soil fertility, soil organic matter

Introduction Trees improve the soil by numerous processes, mainly when used in agroforestry systems, where different species are cultivated in the same area. Legume trees influence nutrient availability within the root zone of the intercropped species by different processes such as: i) N biologic fixation; ii) nutrient recovery from deeper soil layers; iii) reduction in soil erosion and runoff; and iv) increasing nutrient bioavailability by increasing soil organic matter (SOM) mineralization. The objective of this research was to evaluate the total soil organic matter and soil Mehlich-I P at different points underneath the tree crown, according to a shade gradient of legume and non-legume trees occurring on signalgrass (*Brachiaria decumbens* Stapf.) pastures.

Material and methods The experiment was carried out in the coastal region of Pernambuco State, in Itambe Agricultural Research Station from IPA. Geographical coordinates are 7°25′0″S lat. and 35°6′0″W longitude with 190 m above sea level. Average annual rainfall in this area is 1,300 mm and the soil is classified as an oxisol. Soil samples were taken according to the crown projection of two legume trees (*Mimosa caesalpiniifolia* Benth. and *Machaerium aculeatum* raddi.) and two non-legume trees (*Anacardium occidentale* L. and *Artocarpus integrifolia L.*). Samples were taken at 10%, 50%, 100%, and 150% of shade projection at the 0-10 cm soil layer. Soil analyses of these samples were accomplished at UFRPE, determining total SOM and soil Mehlich-I P (EMBRAPA, 1999). Data was analyzed as complete randomized design (proc mixed SAS) and non-linear and linear models were used (proc nonlin SAS) to fit the data whenever the shade gradient was significant.

Results Soil fertility was greater under the crown projection as shown by SOM (Table 1) and Mehlich-I P (Table 2) for all evaluated tree species. Total SOM showed a negative exponential pattern ($P<0.01$), with greater SOM concentration closer to the tree trunk. Legume trees showed less SOM accumulation than non-legume trees. This might be related to tree age and crown projection. Non-legume trees had a wider and denser crown than the legume ones. Shade may affect soil temperature and soil microbe activity, modifying decomposition rates. In addition to that, residue deposition likely differs among evaluated species, affecting SOM accumulation. Available P (Mehlich-I) showed a linear decrease, with sun-exposed areas showing less soil P. Considering that these trees occur in a pasture area, cattle manure deposition may contribute to increase soil P under the crown projection (Dubeux et al, 2007).

Table 1 *Total SOM (g/kg) according to a shade gradient under legume and non-legume trees occurring on signalgrass pastures, Itambé-PE, Brazil.*

	Crown projection (%)			
Species	10	50	100	150
	g OM/kg soil			
A. occidentale L.	67.4	53.6	48.8	46.6
M. aculeatum Raddi.	35.9	34.8	28.8	28.6
A. integrifolia L.	73.3	60.9	48.2	41.4
M. caesalpiniifolia Benth.	35.6	35.2	38.0	30.0
Shade vs. Sun				P < 0.0002
Legume tree vs. Non-legume tree				P < 0.0001

Standard error = 4.6 g of O.M./kg of soil

Table 2 *Mehlich-I P (mg/dm³) according to a shade gradient under legume and non-legume trees occurring on signalgrass pastures, Itambé-PE, Brazil.*

Crown projection (%)	Soil Mehlich-I P (mg/dm³)
10	23.4
50	15.9
100	17.0
150	9.7
S.E.	6.3
Linear effect	P < 0.0173
Shade vs. Sun	P < 0.0350

Conclusions Soil fertility was greater under the crown projection than under full-sun exposed areas. Greater residue deposition and cattle manure deposition on shaded areas likely contributed to increasing soil fertility levels under trees. Non-legume trees had denser and wider crowns, which likely contributed to greater SOM accumulation under the crowns compared to legume trees.

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