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Organic Mulch and Its Effects on Live Oaks and Urban Soil

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Current concerns regarding the need to find methods to protect and conserve soils and the increased availability of organic residues from cities are renewing an interest in the use of organic mulches, both in the traditional application of crop residues, and in the use of composted and uncomposted urban wastes[1]. Urban wood waste is the portion of the wood waste stream that can include sawn lumber, used lumber, trim, shipping pallets, pruned branches, stumps, even whole trees from street and park maintenance, and other wood debris from construction and demolition clearing and grubbing activities.

Organic mulch is made up of shredded urban wood wastes and leaf litter, a combination that can be used to provide a protective soil cover under trees and shrubs, and in planters. Mulch enriches and protects soil, helping to provide a better growing environment for plants by retaining moisture, maintaining even soil temperatures, preventing erosion, and controlling weeds. Organic mulch is decorative, and it improves the condition of the soil. As mulch decomposes, which it does slowly, it releases organic matter that helps to keep the soil loose. This improves root growth, mycorrhizae formation, and increases the infiltration of water, and the water-holding capacity of the soil. Organic mulch is a source of plant nutrients and provides an ideal environment for earthworms and other beneficial organisms. Mulch is also used to moderate soil temperature by providing an insulating barrier between the soil and the air. This means that in the hot summer, mulched soil stays cooler than soil that is not mulched; and in the cold winter, mulched soil stays warmer than soil that is not mulched. In summary, the benefits of mulching include: protects soil from erosion caused by winds and the washing effects of rain; reduces compaction caused by short, heavy rains; conserves moisture, reducing the need for frequent and expensive watering; maintains an even soil temperature, which is preferred by most plant life; prevents weed growth that competes with desired plants for water and nutrients; improves root growth and mycorrhizae formation; and provides an aesthetically pleasing "finished" look to landscape trees.

Live Oaks, common urban trees in the South, were used in this study[2]. Organic mulch of 50% sand, 25% hardwood (urban tree residue) and 25% horse manure was applied up to 4 inches thick. An additional layer of hardwood chip was used as mulch and was applied at the depth of 3-4 inches. Every season, an additional mulch (hardwood chip) was applied. Tree leaf and soil were analyzed for nutrient levels, pH, cation exchange capacity (CEC), and organic matter (OM). Soil respiration was measured using a portable respiration system (PP System). Soil was also sampled for macro-organism determination. Root growth was measured and the presence and relative abundance of mycohrrizae was determined. For mycohrrizae study, both light and electron microscopes were used. Root samples were collected from roots of the experimental plants. For light microscopy, samples were directly put on a SMZ-U Nikon stereoscope. For scanning electron microscopy, samples were sectioned and fixed over night at $4C^{0}$ in 4% glutaraldehyde buffered with a phosphate buffer at a pH of 7.2. After rinsing three times in the buffer, samples were dehydrated in a graded ethanol series and dried in a DCP-1 Critical Point Dryer, then coated in a Hummer II Sputter Coater. A Hitachi S-405A Scanning Electron Microscope was used for observations.

The research results shows that the soil physical properties were improved; soil nutrient content was increased; leaf nutrient content was higher; soil macro-organisms were greater in number and diversity; mycorrhizae density was improved (Fig 1 and 2); and root growth rate was higher.

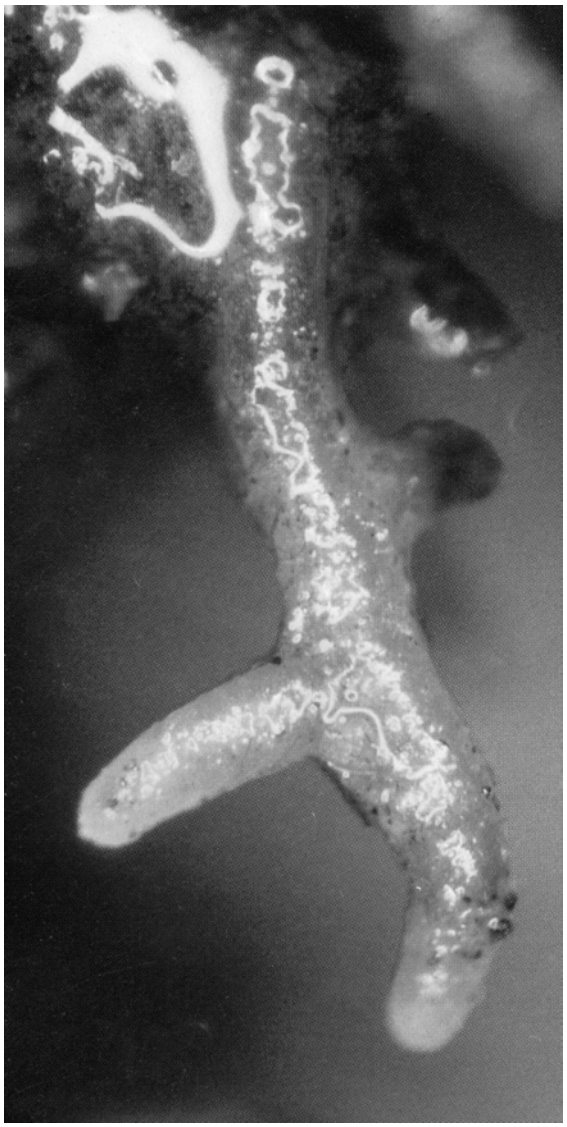

FIG 1. Close up of a newly formed mycorrhiza after mulching treatment. x200

FIG 2. Mycorrhizae clusters formed after mulching treatment. x100

References

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