Long-Term Effects of Scalping on Organic Matter Content of Sandy Forest Soils

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The organic matter content of sandy soils continues to exhibit the effects of scalping 10 years after planting. This may have adverse effects on seedling survival and development.

Of the many forest soil characteristics, organic matter content is one of the most important, especially during the establishment of plantations. Organic matter improves soil structure, increases soil porosity and aeration, and, most important for sandy soils, increases the moisture-holding capacity and ability to hold and exchange nutrients (5). Thus, any activity that serves to maintain or increase organic matter in sandy soils is considered favorable to seedling growth and development.

Chopping and shearing--conventional site preparation methods--produce differing amounts of soil scarification, with shearing usually resulting in greater site disturbance, especially if wind-rowing is combined with the shearing. This difference has been noted for years, along with the advantages and disadvantages associated with each practice.

However, the practice of scalping during the planting process is usually given less consideration, even though it may actually have a greater effect on seedling microenvironment than site preparation activities. In this paper, *scalping* is defined as the displacement of topsoil along the planting row during machine planting operations. This displacement is accomplished by a V-blade mounted to the front of the tractor (usually a crawler-type such as a D-4). Although the principal intent of scalping is to clear the planting row of logging debris and reduce undesirable vegetation, it also creates a "planting trough" with the enriched topsoil piled well away from the planted seedling.

Forest managers agree that scalping may result in short-term unfavorable topsoil conditions, but most think that its effects on organic matter levels and moisture-holding capacity will be of an abbreviated duration. The purpose of this study was to evaluate the organic matter status in sandy soils that were scalped during planting operations. Because differences in organic matter would be obvious immediately after planting, 10-year-old plantations were used in an effort to examine the long-term effects of the scalping on this soil property.

Materials and Methods

The study was conducted in the Upper Coastal Plain region of East Texas. Only plantations located on sandy soils were considered, and textural analysis confirmed that sand content of all study sites ranged from 69 to 80 percent. Criteria for selection were: 1) the plantation was 10 years old, 2) the plantation had undergone site preparation during summer or fall and was planted by machine in the subsequent planting season, and 3) the survival rate was at least 60 percent.

Four plantations (hereafter referred to as locations) were selected. In an effort to test the effects of scalping following different site preparation, two of the plantations chosen had been chopped and burned and two had been sheared, windrowed, and burned. All locations had been scalped during planting.

Twenty 2-acre (295- x 295-foot) study sites were established, 10 in each mechanical site preparation treatment. Three circular half-acre sample plots were established within each study site, giving a total of 60 sample plots.

On each sample plot, nine composite soil samples were removed from the upper 6 inches of soil for analysis of organic matter content. Three sampling positions extended radially from each of three randomly selected trees: OM_T (1

[1] This work was completed while A.W. Ezell was on the faculty of Texas A&M University; it is approved as Texas Agricultural Experiment Station Publication TA-18806.

foot from the base of the tree), OM_M (midway between the planting row and the debris mound created by scalping), and OM_D (the center of the debris mound). A soil punch was used to collect five composite soil samples at each position. Each composite was air-dried for 48 hours, mixed thoroughly, and analyzed for organic matter content according to the wet combustion method (3).

Results and Discussion

Duncan's multiple range test defines the differences among sampling positions (fig. 1). For each location, with the exception of location 4, organic matter values for the tree and debris sampling positions differed significantly at P < or = 0.05, with the midway sampling position acting as a transition zone (table 1).

It is beyond the scope of this study to determine causes for nonsignificant differences among sampling positions at location 4, yet evidence suggests that the trend of organic matter content may be partially attributed to the quality of the planting operation. Planting at this location is exceptionally close, averaging 51 square feet per tree. With this narrow spacing, the operator of the tractor, while clearing the planting furrow with a V-blade, apparently piled some of the scalped soil onto the adjacent planting row, thereby concentrating topsoil and debris against the planted trees.

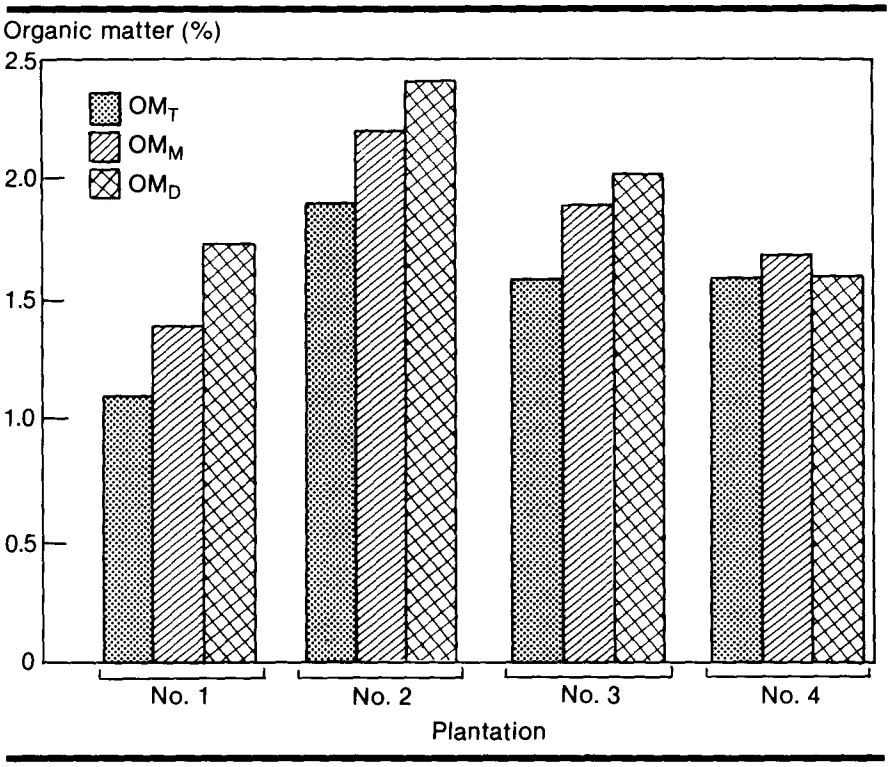

Figure 1—*Average organic matter content by sampling positions for all locations. OM_A = 1 foot from base of tree, OM_M = midway between planting row and scalping mound, and OM_D = center of scalping mound.*

Conclusions

The results of this study indicate that the organic matter content of sandy soils does not recover from the effects of scalping, even after 10 years. Although many other site factors must be considered in an evaluation of survival and growth, the organic matter content in sandy soils is of major importance. Although there are beneficial effects of scalping, there are also detrimental effects due to the reduced organic matter content of the soil. Both moisture retention and nutrient availability may be reduced for prolonged peri-

Table 1—*Organic matter content for each location*[1]

	Percent organic matter[1]		
Location	Tree	Mid	Debris
1	1.1a	1.4ab	1.7b
2	1.9a	2.2ab	2.4b
3	1.6a	1.9b	2.0b
4	1.6a	1.7a	1.6a

[1]Means within locations not followed by the same letter differ significantly at $P \leq 0.05$ (Duncan's multiple range test).

ods. This impact should be given serious consideration by plantation managers for sites subject to drought and/or low fertility in their unaltered states.

Lower intensity methods of site preparation have already been noted as preferable on sandy sites because they reduce soil disturbance (1, 2, 4). It appears that reduction or elimination of scalping on sandy sites should be added to the recommendations concerning reduced soil disturbance.

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