ORGANIC MATTER - HOW MUCH IS ENOUGH? –

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ABSTRACT: Confusion exists with regard to organic matter levels that should be maintained in forest nurseries. Factors influencing organic matter depletion are discussed. A method of setting realistic goals is presented and explained using a case study from the Placerville Forest Nursery.

INTRODUCTION

The importance of organic matter is generally accepted by the majority of nursery managers. There is, however, considerable confusion concerning the level of organic matter that should be maintained in the soil. Results of the OSU Nursery Survey (Davey 1984) showed that 86% of the nursery managers responding felt that their organic matter levels were not as high as they should be. They reported levels ranging from 1 to 7% (average 3.6%) but felt that levels should range from 2 to 10% (average 5%). Sixty-two percent rated organic matter maintenance among the top five management problems.

It would appear that there is no clear idea of how much is enough. Forest nursery management is basically a mining operation with regard to organic matter. The removal of whole seedlings plus the numerous cultural activities that accelerate the organic matter decomposition process hasten the depletion of soil organic matter.

FACTORS INFLUENCING ORGANIC MATTER LEVELS

The level of organic matter that can be maintained in a forest nursery is influenced by the same factors that determine the amount of native organic matter present in an "undisturbed" forest soil plus the cultural practices used in the nursery.

The amount of organic matter in an "undisturbed" forest soil is a function of the decomposition of forest litter and the synthesis of humus or soil organic matter. The rate at which this process proceeds and the amount of humus formed is influenced by moisture, temperature, and soil texture. Moisture and temperature influence the rate of decomposition. The specific surface that will complex organic matter is a function of soil texture. Under similar climatic conditions higher levels of organic matter will occur in fine-textured soils than in coarse-textured soils.

It is unrealistic to set a level or range in levels that should be maintained in all nurseries regardless of location. What then is realistic or practical? This should be determined for each individual nursery. In practice this has not been done.

A SUGGESTED APPROACH

A logical approach to determining a realistic level of organic matter to be maintained would be to ascertain the level in a soil similar to the nursery soil that is supporting a relatively undisturbed forest stand. This level would need to be discounted to account for cultural practices. Jenny (1941) reported that 38% of the native organic matter was lost over a period of 50 years of cultivation. Nursery cultural practices including land leveling, frequent cultivation, and whole plant lifting also influence loss of organic matter. A total loss of 40% would be a conservative estimate.

PLACERVILLE NURSERY - A CASE STUDY

In the course of making an intensive soil survey and developing a soil management plan for the U.S. Forest Service Placerville Nursery, an Aiken loam similar to the nursery soil, but supporting a well-stocked stand of ponderosa and sugar pine and white fir was sampled. Elevation and rainfall are the same as at the nursery. Undecomposed litter was removed and the mineral soil was sampled to a 7-inch depth, the same depth as used for routine nursery soil sampling. Organic matter was determined by the Oregon State University Soil Testing Laboratory. The average soil organic matter in the stand sampled was 10.3%. It would be unrealistic to assume that this level could or should be maintained at the nursery.

Much of the land in the Placerville area was cleared in the early 1900's, put into grain production and eventually into orchards. All of the nursery acreage was in orchard production at the time of acquisition. If it is assumed that at the time of clearing the native organic matter was 10 percent and that 38% was lost through cultivation the resulting level would be 6.2%.

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The average level for all of the nursery blocks sampled was 4.9% and ranged from 3.6 to 6.6%. The difference between 6.2 and 4.9% percent may have resulted from erosion losses during orchard production, orchard clearing, and land leveling for nursery production and from whole tree lifting. A level of 5.5 to 6.0% would probably be an attainable goal.

Organic Matter Management -- In the parcels having 5.0% or more organic matter, a large biomass green manure crop in each rotation would help to maintain current levels.

In parcels below the 5.0% level, additions of organic materials such as sawdust could be utilized. A 2-inch layer of sawdust per acre is approximately 20 tons or 40,000 pounds. Assuming 2,000,000 pounds for the weight of an acre furrow slice (7 inches) of soil this would be an addition of 2% organic matter. During a three-year rotation approximately 90% of the sawdust will decompose resulting in an increase of 0.2 percent organic matter. On areas having low organic matter levels this would increase the rate of attaining the desired level. When adding sawdust, 10 pounds of nitrogen should be added per ton of sawdust, half of it when the sawdust is turned under and the second half at a time that fits into the management schedule.

Sawdust or other highly carbonaceous materials should not be applied just prior to seedbed preparation and seeding a new crop. After lifting and just prior to establishing a green manure crop is probably the best time. The application of other nutrients and lime, if needed for the next seedling crop, would enhance the decomposition process and produce a heavier green manure crop.

Although the addition of sawdust has been used as an example for increasing soil organic matter there are other materials that can be used. Materials which have not been used previously should not be used on a large scale without some small area applications for testing their quality. It is strongly suggested that steps be taken to establish realistic goals for maintenance of soil organic matter.

REFERENCES

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