Edaphic Relationships of Spicebush *Lindera benzoin* (L.) Blume

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Introduction

The research was performed in Ginn Woods, a 67.5 h beech-maple climax community located approximately ten miles north of Muncie and 0.5 mile southwest of the Missisinewa River. The stand is in Section 18, T22 N, Rio E in Union Twp. of Delaware County, Indiana. The predominant soil types in the woods are a Blount silt loam and a Pewamo silty clay loam, both developed from Late, Late Wisconsin glacial till (3). The woods is presently owned by Ball State University and is primarily utilized for field research by the Department of Biology. Since the purchase of the woods in 1972 there has been no disturbance by cutting, grazing or fire. The only logging since the mid-1800's was the removal of 16 mature black walnuts in 1967.

In east central Indiana, spicebush, *Lindera benzoin* is most commonly found in the highest densities on upland moist depressional sites in Mixed Mesophytic and Beech-Maple Forest types. These sites are poorly drained but not normally ponded for extended periods of time. The spicebush occurs in essentially pure stands within the shrub stratum.

Methods

Three spicebush study sites were selected within Ginn Woods for evaluation. The selection was based on the amount of soil surface area covered by the shrubs related to the density of same. The three subcommunities with the highest coverage and density were used. The three communities averaged 20 plants per site and an average area of 136 m^2 per site. East-west transects were oriented through each of the study areas and stations established on the transects at one m intervals. The transects extended through fingers of Pewamo silty clay loam and onto adjacent higher areas of Blount silt loam. Bouyoucos moisture blocks and Y.S.I. temperature thermisters were buried at each station at 5 and 20 cm depths to monitor available soil moisture and soil temperature daily through the growing season of 1977. Air temperature at 25 cm above the soil surface was also recorded daily for each station. Soil samples were removed at each point for lab analysis of texture and nutrient levels.

Also at each station samples of spicebush plant tissues were made at various phenological stages. The stages of development and organs sampled were as follows: dormancy (shoot), mature bud (bud and shoot), anthesis (flower, shoot and immature leaf) and at leaf abscission (shoot and freshly fallen leaf).

Soil cores were oven dried at 50° C for 24 hours and ground with a Waring blender prior to nutrient analysis. Plant tissue samples were dried at 65° C for two hours and ground with a Wiley mill with a 20 mesh screen. Nitrate nitrogen for both plant tissues and soils was determined by the modified Kjeldahl method

(2). Total phosphorous in plant tissues was analyzed by the Molybdenum Blue Method (2). Soil phosphorus values were obtained using the Sodium Bicarbonate Method of Olson (2). Eight trace minerals, Cd, Cr, Cu, Fe, Mn, Ni, Pb and Zn were analyzed for both soil and plant organ samples following the Acid Digestion Procedure of Perkin-Elmer (4). Processed samples were filtered and diluted with de-ionized water for determinations in ppm with Atomic Absorption Spectrophotometer. Textural analysis of the soil samples followed the standard hydrometric methods of Bouyoucos.

Results

Tree density and canopy cover (1) were similar at all three study sites therefore insignificant differences prevailed between sites for available soil moisture. Spicebush density was also similar with 22 plants at the 144 m^2 Site I, 19 for 132 m^2 at Site II and 19 for 132 m^2 at Site III. Fluctuations in moisture were correlated with precipitation; the greatest differences at the 5 cm depth. A direct relationship between available moisture and station location was also evident with the most depressional and higher clay content stations with the highest available soil moisture levels. Soil temperature corresponded as anticipated with air temperature. Lower growing season soil temperatures occurred at the 20 cm depth and at the more depressional stations on the Pewamo soil type.

Consideration of the data on trace mineral levels in the soil at each station or in plant organ tissues at the phenological stages indicated no correlation. Wide variations occurred in mineral levels between stations on the same soil types and at the same time period. The two macronutrient soil analyses however gave several positive correlations. All three sites were remarkably similar in these correlations. Nitrate levels varied from an average of 0.20% by weight on the Blount to 0.27 on the Pewamo. Total phosphate, though at lower levels, ranged from an average of 0.09% on the Blount to 0.16 on the Pewamo. Tissue sample analyses for the two macronutrients gave the highest nitrate values, a mean of 0.31%, for shoot samples and the lowest, 0.23% for leaves. These values remained relatively unchanged through the growing season. Phosphate levels were inversed in that the highest levels, 0.16%, were in the leaves and the lowest, 0.09%, in the shoots.

The highest spicebush densities did occur on the Pewamo silty clay loams. The higher densities appeared to be related to available soil moisture through the growing season due to drainage and higher clay contents. Soil phosphate levels also seemed to have a positive effect on the distribution of spicebush in Ginn Woods.

Literature Cited

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