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INFLUENCE OF GEOGRAPHIC ORIGIN AND SOIL PROPERTIES ON COLOR OF BLACK WALNUT VENEER

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Walnut veneer from sites in Missouri, Illinois, and Indiana was analyzed for color attributes and chemical properties. Veneer color also was compared to an industry color standard. Soil chemical and physical properties were measured on selected sites in each state. In general, walnut trees grown on soils with equal proportions of sand, silt, and clay have better veneer color attributes than trees grown on soils with high clay/sand or clay/silt ratios.

Walnut veneer color is an important quality attribute and determinant of value. In the past, the study of walnut color has been done on either walnut lumber or on veneer not graded by the veneer industry. Past studies have shown that the color of veneer had a low heritability suggesting a greater environmental influence than genetic influence during formation of heartwood. The designations used for color science are set by the Commission Internationale de l'Eclairage (CIE) and include L* for lightness, a* for red-green color range, and b* for yellow-blue color range.

Color analysis was done on 239 sheets of veneer from 128 veneer quality trees in three states and six sites for our study. The color analysis showed there was no difference in lightness (L*) between states or sites within states. In the red-green color range (a*), there was a difference between the three states but not the sites within states. The veneer from Missouri was redder than the veneer from Illinois or Indiana. There was no difference in a* between Illinois and Indiana. There is, however, a difference in the yellow-blue color range (b*) between sites within states but not between states. One site in Indiana was more yellow than the other five sites.

All the veneer from each site and state was compared to a mouse gray industry standard (i.e., a walnut veneer sample which represents an "ideal" color for the walnut market) in the red-green and yellow-blue ranges. The veneer from Missouri tended to be more red and blue than the veneer standard. The veneer from Illinois and Indiana tended to be more green and blue than the standard.

From 3 to 10 trees per site (total of 30 trees) that had been harvested were chosen for wood and soil chemical analysis. The finished veneer was analyzed for nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), aluminum (Al), iron (Fe), sodium (Na), manganese (Mn), zinc (Zn), copper (Cu), boron (B), lead (Pb), nickel (Ni), chromium (Cr), and cadmium (Cd). The soil within 4 ft of each tree was analyzed for pH, N, P, K, Ca, Mg, Na, Mn, Fe, Zn, Cu, Pb, Ni, Cd, Cr, % sand, % clay, and % silt. The color variables were analyzed for their relationship with the wood and soil elements. Increasing L* values were correlated with increasing Al, decreasing N, and decreasing Mg levels in the wood and increasing Cd levels in the soil. Increasing a* values were not correlated with soil elements but were correlated with increasing Al, Ca, and Cu and decreasing Zn levels in the veneer. Increasing b* values also were not correlated with any soil elements but were correlated with decreasing K levels in the veneer.

Veneer L* (lightness) was also directly correlated with clay/sand, clay/silt, and clay levels in the soil. The red-green veneer color attribute (a*) was inversely correlated with soil texture index, defined as 270.1*((%sand/100) x (%silt/100) x (%clay/100)). No significant correlation was found between b* and soil physical properties.

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One interpretation of these correlations with soil physical characteristics is that veneer color attributes are generally poorer on sites that have high clay/sand or clay/silt ratios. Conversely, walnut veneer color should improve on soils that have more nearly equal proportions of sand, silt, and clay.

Additional study sites within and along the margins of the natural walnut range, especially sites in states other than Illinois, Indiana, Missouri, and Iowa (a state in which we have done some additional sampling and analysis), are needed to test the strength of the correlations and possible management implications. Details on materials and methods, results, and discussion for the study done in Illinois, Indiana, and Missouri are contained in Workman (1996).

LITERATURE CITED

Workman, Jr., Edward C. 1996. Influence of geographic origin and soil properties on walnut veneer color. M.S. thesis, Department of Forestry, Southern Illinois University, Carbondale, IL. 212 p.