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COLOR IN SWEETGUM WOOD

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Color In Sweetgum Wood[1]

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SWEETGUM ranks as one of the most important native hardwoods in the U.S., where it grows on a wide variety of sites. In Alabama, it is common and abundant on both alluvial and moist upland soils. Sweetgum self-prunes well in closed stands, forming a clear bole; therefore, a high percentage of knot-free lumber or veneer is produced.

Wood of sweetgum is used primarily as pulpwood in the round form, as lumber for furniture, and as veneer for the manufacture of hardwood plywood for the furniture industry. Single-ply veneer is used for wire-bound boxes and crates. Other uses include railroad ties and pallets. Color variation is more important in sweetgum wood used for furniture and pulp than for other products.

Color is the primary visual characteristic chosen to describe sweetgum, and most other commercial woods, even though it is common knowledge that extreme variations of wood color occur among trees of a given species or within the same tree. Therefore, color terms chosen to describe wood in various publications are seldom explicit, but suggest ranges of color (yellow-white, greenish-yellow, purplish-brown, *etc.*), degrees of color (pale, light, dark, rich, *etc.*), and shade/color combinations (straw-buff, greenish tinge, purplish cast, *etc.*). Wood color of sweetgum is described by Brown, Panshin, and Forsaith *(2)* as follows:

[1] Research supported by McIntire-Stennis Research Funds as Project No. 916.

[2] Assistant Professor of Forestry and Forest Pathology and Associate Professor of Wood Technology, respectively.

"Sapwood (called 'sap-gum' in the trade) white, frequently with a pinkish tinge, often discolored with blue sapstain; heartwood (called 'red-gum' in the trade) carneous gray to varying shades of reddish brown, the darker grades frequently with darker streaks of pigment figure (called 'figured redgum' in the trade)."

In addition to natural colors within sweetgum wood, discolorations also occur. Many types of fungal discoloration within living sweetgums have been described *(4,6)* but are considered less important than discolorations initiated upon and within logs and lumber *(4)*. Although mineral stains might occur in sweetgum wood, specific examples are lacking *(5)*.

Discolored heartwood and sapwood cause production and post-production difficulties within the wood industry *(7)*. Sapwood is preferred for exposed parts in the furniture industry, but both sapwood and heartwood cause problems in finishing, particularly when the wood is streaked or exhibits irregular patches of color. These irregularities usually limit use of large amounts of either type wood to backing material or require heavy glazing to make the color uniform for normal uses.

Although the normal reddish-colored heartwood is not particularly dark, it does require bleaching to ensure an acceptable degree of whiteness in the manufacture of white pulp *(1)*. Colors that are darker than normal compound this problem. The amount of bleach required to produce white pulp increases with increasingly dark shades and/or intensities.

Scheffer and Hansbrough *(5)* investigated discoloration in sweetgum veneer to determine its effect upon strength characteristics that might render it undesirable for use in aircraft. Figured heartwood and pathologic heartwood exhibited normal strength; however, mineral streak, blue stain, and incipient decay lowered toughness. These conclusions were confirmed in a later study by Harrar *(3)*.

Most studies involving wood coloration have been devoted to basic considerations of wood color *(7)* and color characterization of specific wood, with any colorations caused by microorganisms eliminated by design *(8)*. None of these studies included sweetgum.

One particular problem associated with studies of coloration within sweetgum is the lack of any description of normal or abnormal colorations in standard color terms. Different physical characteristics of wood are associated with variations in color, and a key illustrating all types of coloration in standard color

terms would be useful in research involving both the lumber and pulp industries. Since very little specific information is available concerning normal and abnormal color of sweetgum wood, the objective of this study was to describe various types of coloration within wood of sweetgum in standard color terms.

MATERIALS AND METHODS

Veneer and lumber samples from eight locations in Alabama were selected on several different occasions to represent the wide range of color in sweetgum. Several hundred sections (one-inch squares, ⅛ inch thickness) with their tangential surfaces exposed were cut from this material and freeze dried to maintain the original coloration. Surfaces were left unsanded to avoid roughing the surface, which was found to cause an increase in light absorption. All measurements were made from smooth, blade-cut surfaces. A total of 222 samples were processed, but 20 of these were eliminated due to various causes (suspected misidentification, defect, extreme variation, *etc.*). Samples were analyzed with a Beckman DBG spectrophotometer equipped with a reflector apparatus. The standard was barium sulphate.

RESULTS AND DISCUSSION

Condensed data from spectrophotometric analyses from 202 specimens are presented in Fig. 1-3. Fig. 1 shows the color distribution of these specimens as indicated by dominant wavelength; Fig. 2 indicates the color distribution with respect to hue; and Fig. 3 illustrates the distribution of samples with respect to measured color as indicated by purity (percent).

The CIE luminous reflectance and chromaticity values were converted to the Munsell color notation through graphical means. Hues exhibited by wood of sweetgum ranged from 2.5 yellow-red to 2.5 yellow with the majority of samples in the range of 5 yellow-red to 10 yellow-red (value range from 4.0 to 9.0 and chroma range from 1.0 to 5.0). Sweetgum data plotted on the 1931 CIE Mixture Diagram yielded an average dominant wave length of 583 nm (nanometers).

A guide to color in sweetgum was prepared by selection of Munsell color notations that best represent the wide range of color within sweetgum wood. This system consists of a letter sequence (21 letters – A through U) in each of 5 hues (2.5YR 5YR, 7.5YR, 10YR, and 2.5Y) shown as follows:

2.5YR: A, B, C, & D (2 specific color notations each)

5YR: E, F, G, H, & I (1, 2, 3, 3, & 2 specific color notations, respectively)

7.5YR: J, K, L, M, & N (3, 3, 3, 2, & 2 specific color notations, respectively)

10YR: O, P, Q, & R (3, 4, 2, & 2 specific color notations, respectively)

2.5Y: S, T, & U (2, 2, & 1 specific color notations, respectively).

Difficulties encountered in reproduction of the above specific color notations (because of their closeness to skin colors and tones) have precluded attempts to present a complete guide to color in sweetgum in this publication. However, several alternatives are available for those individuals and/or firms interested in securing such a guide. These are as follows:

(1) Individual glossy color chips (11/16" x 13/16") may be purchased from Munsell Color Company (presently 75¢/chip). Tables 1 through 5 in the Appendix specify the 48 specific notations in 5 hues included in the above guide. Spaces are included in these tables for attaching these specific chips. (Total cost: $36.00)

(2) A Munsell Soil Color Chart that contains 46 of the 48 specific color notations (7/2 & 7/4 in Hue 2.5YR not included) with matte color chips (1/2" x 21/32") may be purchased from Munsell Color Company (presently $32). These charts contain approximately 150 additional chips that would allow a much greater latitude in color designation. The two chips not included could be purchased separately. (Total cost: $33.50)

(3) Individual pages from the Munsell Soil Color Chart in 5 specific hues (2.5YR, 5YR, 7.5YR, 10YR, & 2.5Y) may be purchased separately from Munsell Color Company (presently $5/page). The two additional chips (7/2 & 7/4 in Hue 2.5YR) could be purchased to complete the guide. (Total cost: $26.50)

If alternative 1 were chosen to complete the guide in the Appendix, this color guide could be used to characterize color of sweetgum specimens by the letter designation of the line and the number position of the specific sample that matches in that designated line (B2, G3, L1, P4, T2, *etc.*). Munsell color notation then could be recorded directly from the bottom of the color keys (2.5YR-6/4; 5YR-6/6; 7.5YR-6/2; 10YR-6/6; 2.5Y-7/4; *etc.*).

Information concerning purchase of these color chips or color chart may be obtained by contacting: Munsell Color Co., 2441 N. Calvert St., Baltimore, Md. 21218.

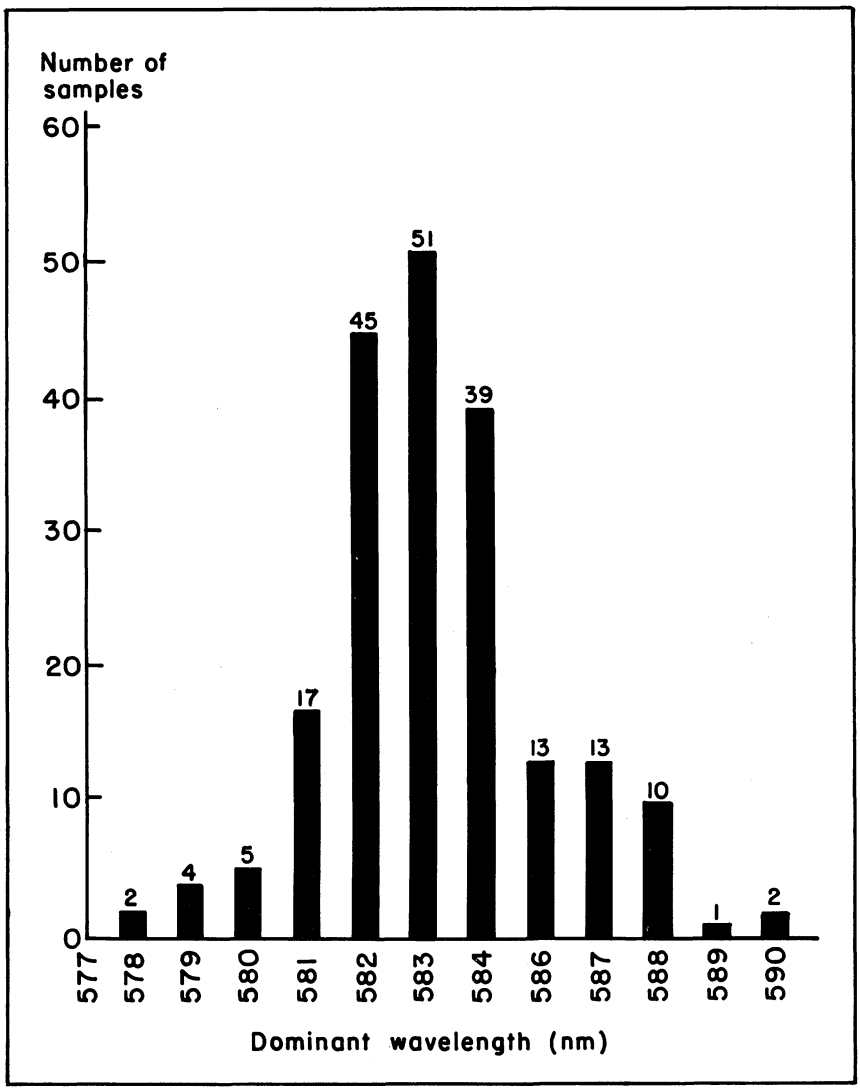


FIG. 1. Distribution of Tangential Wood Samples of Sweetgum (Liquidambar styraciflua L.) with respect to Measured Color as Indicated by Dominant Wavelength.

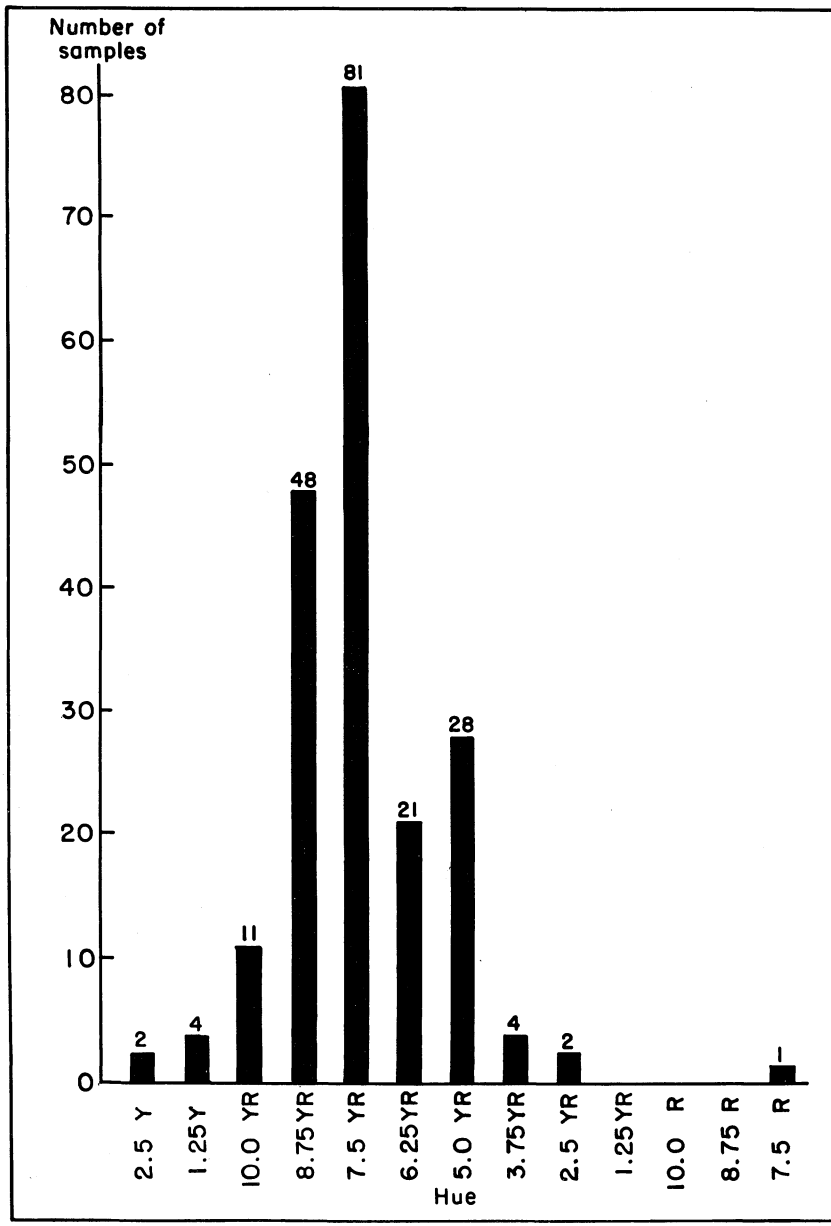


FIG. 2. Distribution of Tangential Wood Samples of Sweetgum (Liquidambar styraciflua L.) with respect to Measured Color as Indicated by Hue.

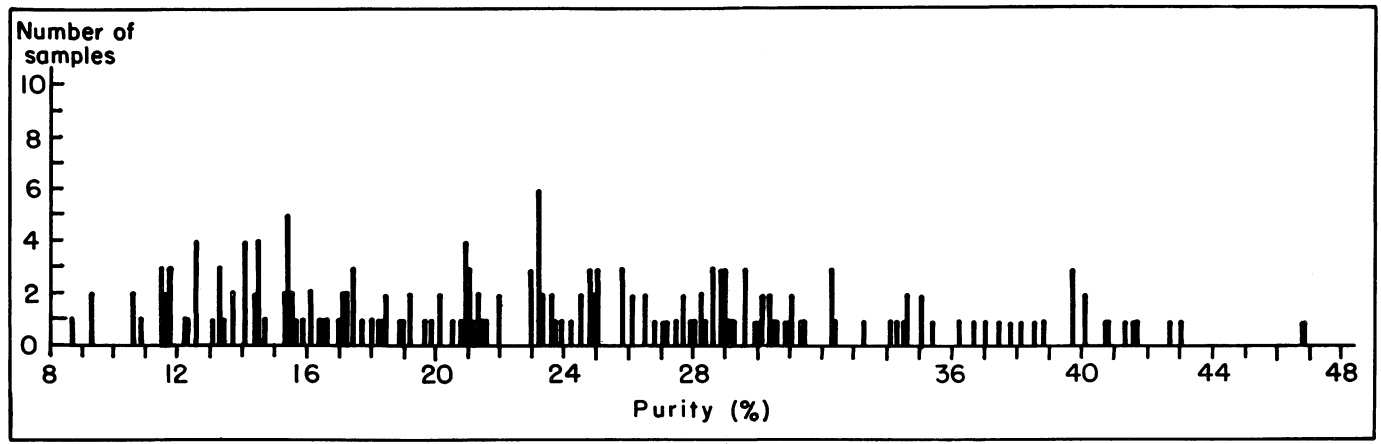


FIG. 3. Distribution of Tangential Wood Samples of Sweetgum (Liquidambar styraciflua L.) with respect to Measured Color as Indicated by Purity (percent).

APPENDIX

TABLE 1. GUIDE TO COLOR IN SWEETGUM—HUE 2.5 YELLOW-RED

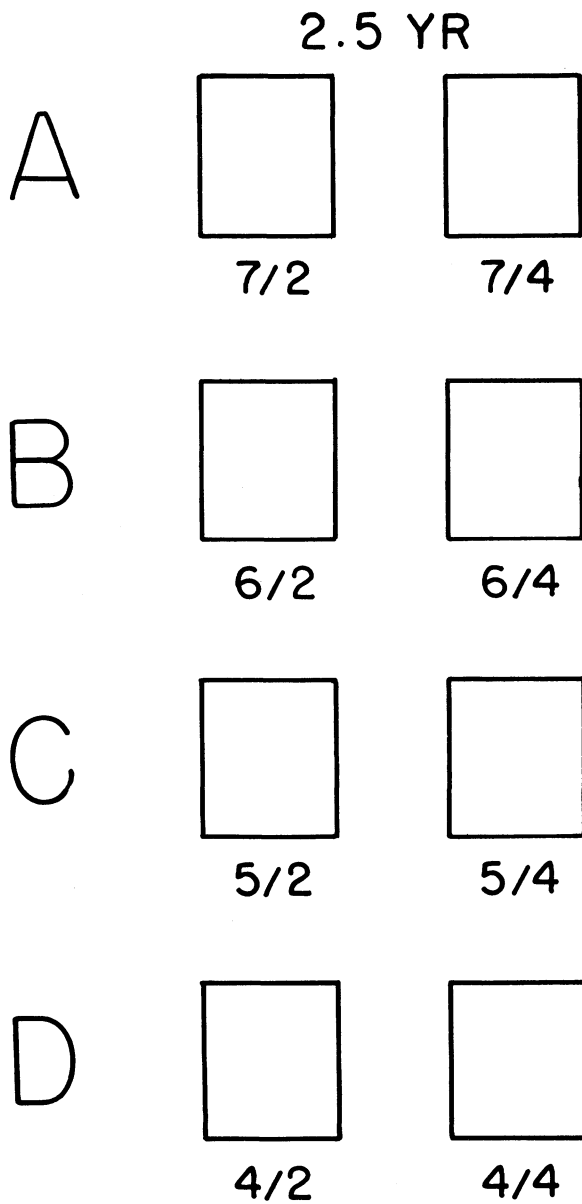


TABLE 2. GUIDE TO COLOR IN SWEETGUM—HUE 5 YELLOW-RED

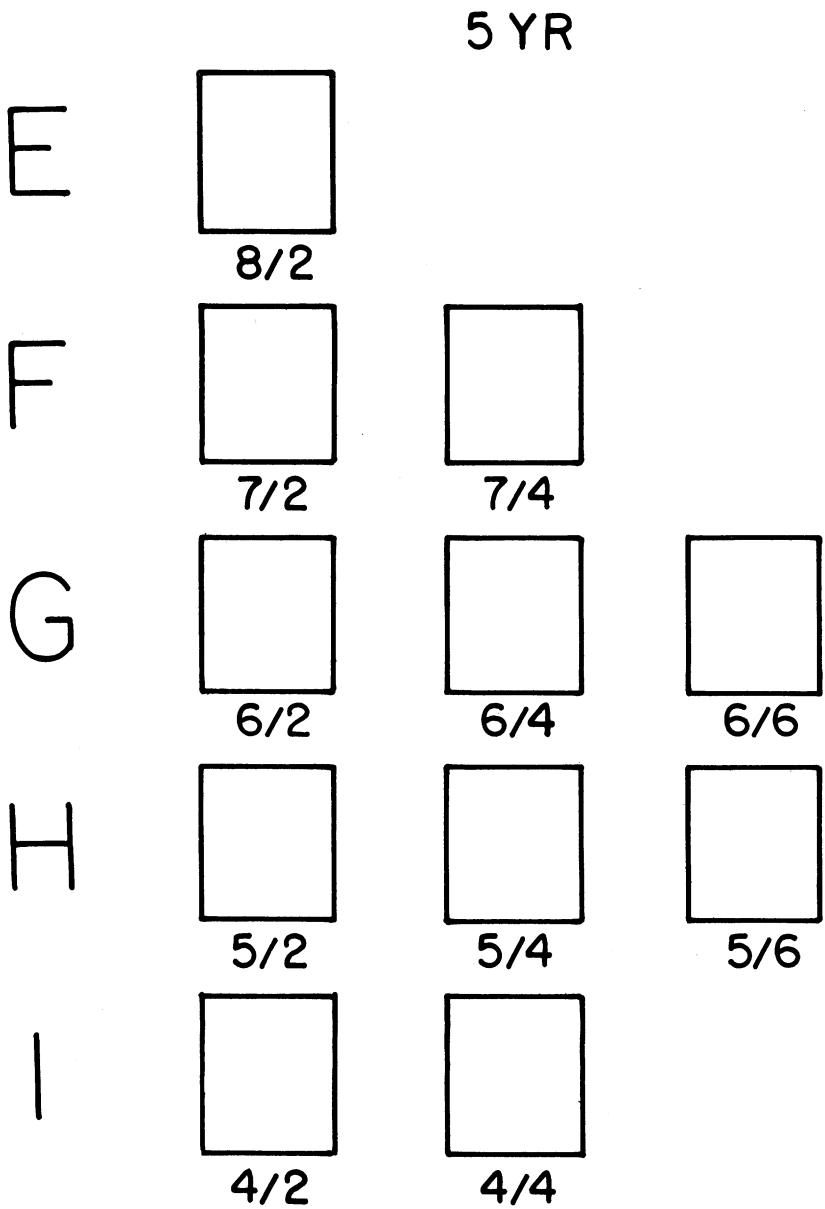


TABLE 3. GUIDE TO COLOR IN SWEETGUM—HUE 7:5 YELLOW-RED

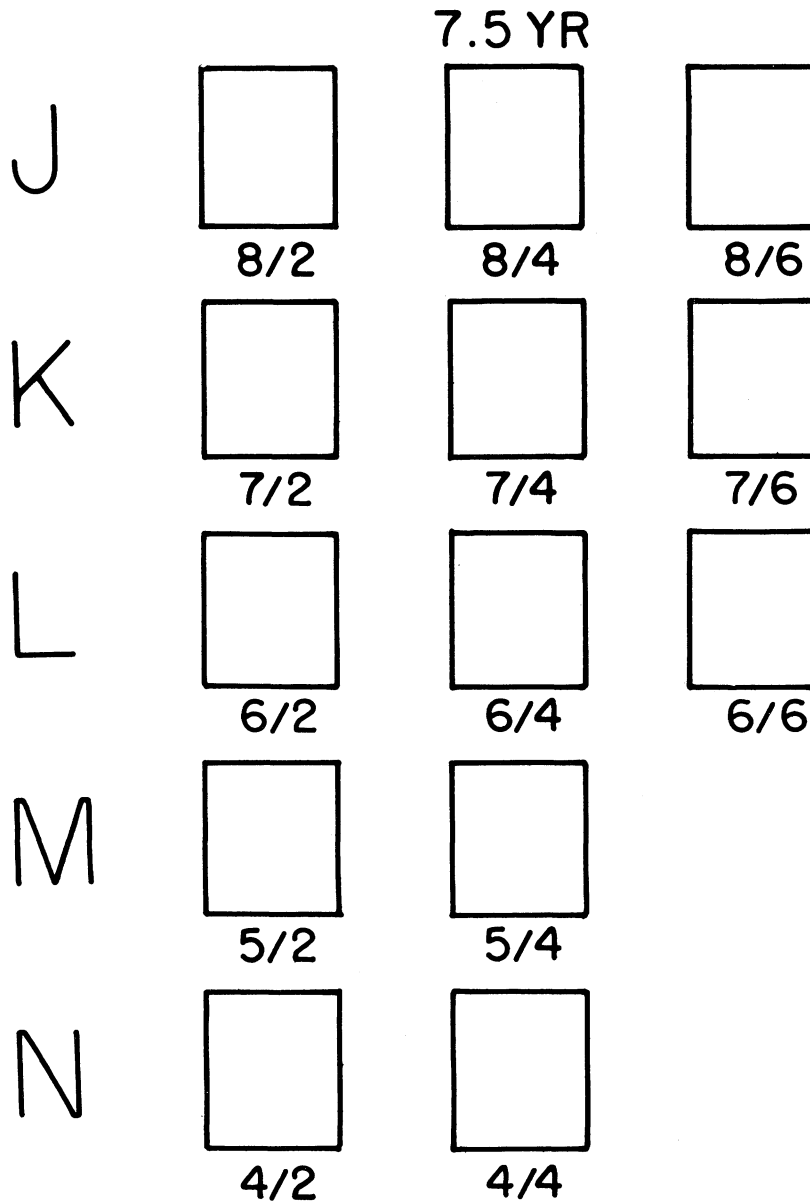


TABLE 4. GUIDE TO COLOR IN SWEETGUM—HUE 10 YELLOW-RED

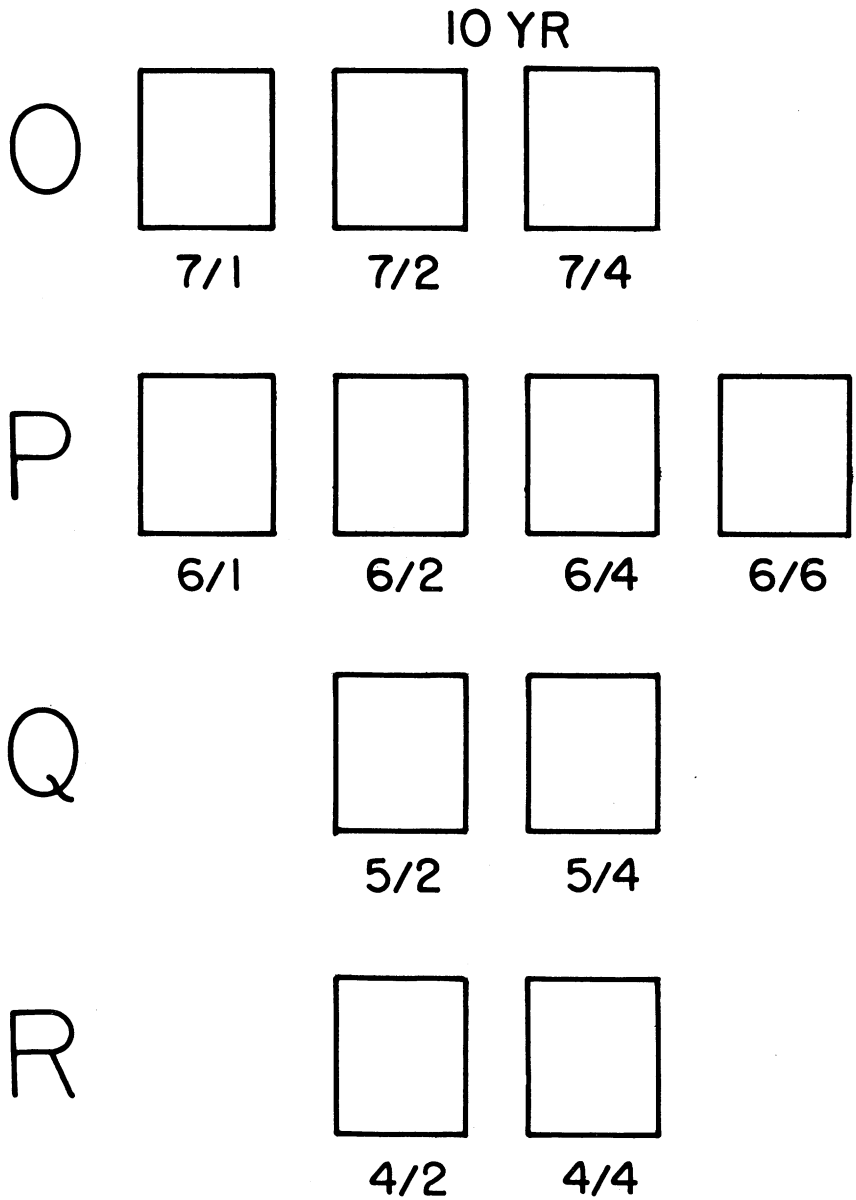
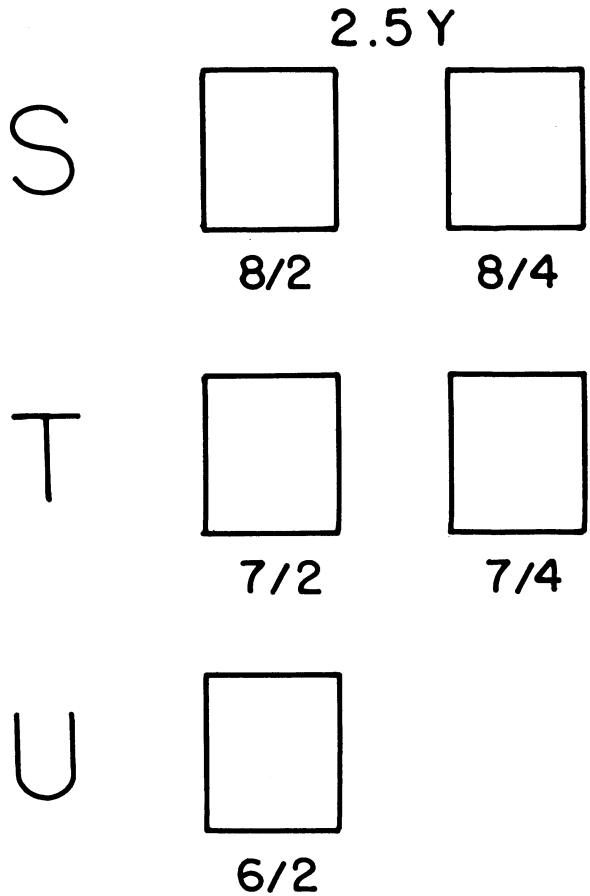


TABLE 5. GUIDE TO COLOR IN SWEETGUM—HUE 2.5 YELLOW



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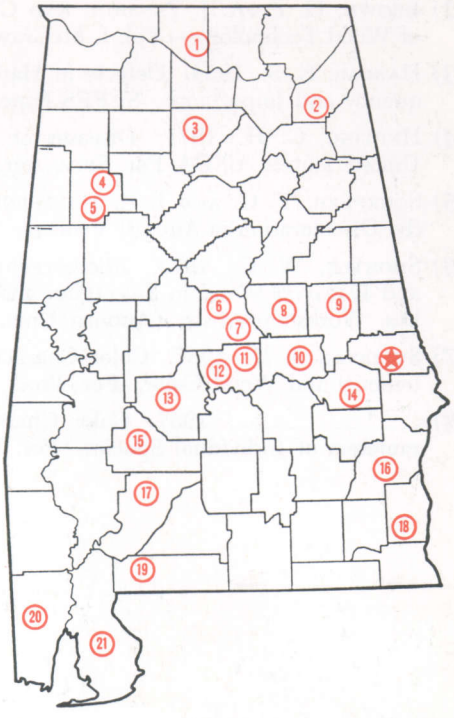

Research Unit Identification

★ Main Agricultural Experiment Station, Auburn.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Thorsby Foundation Seed Stocks Farm, Thorsby.
7. Chilton Area Horticulture Substation, Clanton.
8. Forestry Unit, Coosa County.
9. Piedmont Substation, Camp Hill.
10. Plant Breeding Unit, Tallassee.
11. Forestry Unit, Autauga County.
12. Prattville Experiment Field, Prattville.
13. Black Belt Substation, Marion Junction.
14. Tuskegee Experiment Field, Tuskegee.
15. Lower Coastal Plain Substation, Camden.
16. Forestry Unit, Barbour County.
17. Monroeville Experiment Field, Monroeville.
18. Wiregrass Substation, Headland.
19. Brewton Experiment Field, Brewton.
20. Ornamental Horticulture Field Station, Spring Hill.
21. Gulf Coast Substation, Fairhope.