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Drought Resistant Trees

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One long-term approach to dealing with tree heat and drought problems in a landscape is to plant drought resistant trees. Drought resistance requires tree leaves use water efficiently and continue to grow and make food at relatively low water potentials. Drought resistance involves characteristics like extensive root systems, thick leaf waxes and periderm, good stomatal control, and the capacity for leaf cells to function at low water contents.

Resistance

Differences among trees to tolerating heat loads and water deficits revolve around enzyme effectiveness and membrane health. The better tree cell enzymes and membranes can be protected from heat effects, the more effective a tree will be in dealing with large heat loads and associated water deficits. Protection or deactivation of enzyme systems in trees due to heat and water deficits are influenced by pH, solute levels in cells, protein concentrations, and protection mechanisms. The ability of a tree to continue functioning demonstrates resistance mechanisms which are primarily genetically controlled. Each individual usually has a wide range of plastic responses to heat and water stress, some of which involve physical and ecological attributes.

No tree-filled landscape can be made completely free of drought problems even under intensive irrigation. With more water shortages and drought periods ahead, planting trees which are drought resistant can be beneficial. Once a drought resistant tree is established it can survive drought periods for short periods during the growing season. There are many lists of drought resistant trees available. Basic characteristics of trees that use water efficiency and are somewhat drought resistant are given below. Note this list is for tree attributes which tend to confer some measure of heat and drought resistance:

1) Use natives - Native trees adapted to local soils, moisture availability, climate and pests usually perform better over the long run than exotic plantings.

2) Use early to mid-successional species - Trees which colonize old fields, new soil areas, and disturbed sites use available resources, like water, much more effectively than late successional species (climax species). Late successional species can be effectively used in partially shaded understories.

3) Select proper canopy type - Select trees for planting in full sun which will develop leaves and branches spread throughout a deep crown. These multilayered trees have

many living branches with many leaf layers. Multilayered canopy trees are more water efficient in areas with greater than 60% full sun. The other type of leaf canopy concentrates leaves in a single layer along the outside of the canopy area. These single-layer trees are good in partial shade, but are not water efficient in full sun. Examples of multilayered overstory trees include: oaks, pines, soft maples, ash, hickory, gums, walnut, poplars, and birches. Mono-layered understory trees include: beech, sugar maple, hemlock, magnolia, sassafras, sourwood, and redbud.

4) Select proper crown shape - Crown shape has a great effect on heat dissipation and water use. Ideal trees would be tall with cone or cylinder shaped crowns. Do not use flat, widely spreading species in full sun. A drought resistant tree should maintain a tall, rather than a wide appearance. Many trees which are wide-spreading when mature have narrow, upright crowns when young.

5) Select proper leaf size and shape - Select small leaved or small, deeply lobed leaved trees. These leaves are more easily cooled and have better water use efficiency than larger, rounded leaves.

6) Select proper foliage reflection - Hardwood (broad-leaved) trees reflect 25% more light than conifer trees on average. This translates into better water use efficiencies with broad-leaved trees.

7) Select upland versus bottomland species - Upland species are usually more drought resistant than bottomland species. Unfortunately, upland species can be much slower growing and do not react well to site changes and soil compaction. Tree selection must be carefully made based upon disturbance, stress, and site use expectations.

From these tree characteristics, an ideal tree for a drought-resistant landscape is a native, early to mid-successional, upland hardwood species with a multi-layered canopy, small and/or deeply lobed leaves, and a conical to cylindrical crown shape. Figure 1. Obviously you will never find an ideal drought resistant tree. Many trees do come close and have many fine features for a good landscape. Remember young trees of any species must be allowed time to become fully established in a landscape before drought resistant features will be evident. Properly fit a tree to your site and local climate to have a water efficient landscape.

scientific name	genus name	scientific name	genus name
Acer buergeranum	maple	*Ostrya virginiana*	ironwood
Acer negundo			
Acer platanoides		*Pinus echinata*	pine
Acer rubrum		*Pinus elliotti*	
Acer saccharinum		*Pinus glabra*	
		Pinus palustris	
Betula maximowicziana	birch	*Pinus sylvestris*	
Betula nigra		*Pinus taeda*	
		Pinus virginiana	
Carya glabra	hickory	*Platanus* spp.	sycamore
Carya ovata		*Populus deltoides*	cottonwood
Carya tomentosa			
Catalpa bignonioides	catalpa	*Quercus acutissima*	oak
Celtis occidentalis	hackberry	*Quercus coccinea*	
Cercis canadensis	redbud	*Quercus durandii*	
Crataegus spp.	hawthorn	*Quercus falcata*	
Cupressus spp.	cypress	*Quercus georgiana*	
		Quercus imbricaria	
Diospyros virginiana	persimmon	*Quercus laevis*	
		Quercus laurifolia	
Elaeagnus spp.	olive	*Quercus lyrata*	
		Quercus macrocarpa	
Fraxinus pennsylvanica	ash	*Quercus marilandica*	
		Quercus muehlenbergi	
Ginkgo biloba	ginkgo	*Quercus oglethorpensis*	
Gleditsia triacanthos	honeylocust	*Quercus phellos*	
Gymnocladus dioicus	coffee tree	*Quercus prinus*	
		Quercus shumardii	
Ilex decidua	holly	*Quercus stellata*	
Ilex vomitoria		*Quercus velutina*	
		Quercus virginiana	
Juglans nigra	black walnut		
Juniperus spp.	juniper	*Robinia pseudoacacia*	black locust
Maclura pomifera	Osage-orange	*Salix nigra*	willow
Morus spp.	mulberry	*Sassafras albidum*	sassafras
Nyssa spp.	tupelo	*Ulmus americana*	elm
		Ulmus parvifolia	
		Ulmus pumila	

Figure 1: A selected list of drought resistant tree species for the Southeastern United States. (once established in landscapes)

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