



# 2006 GREAT SOUTHERN TREE CONFERENCE

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## RESEARCH REPORT



**November 30 – December 1, 2006**

**UNIVERSITY OF FLORIDA**  
Environmental Horticulture Department  
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**Great Southern Tree Conference Project Title:** Evaluation of landscape tree stabilization systems.

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**Objective:** Determine effectiveness of landscape tree stabilization systems when subjected to loading.

**What we did:** In the fall of 2006 we tested nine different tree stabilization systems (Table 1) through pull tests. Ten repetitions of each system were tested plus the control for a total of 100 trees. Cathedral Oak<sup>®</sup> between 2.75-3.00" in caliper and 18-22' tall grown in #45 containers were used. All trees were planted following the same protocol and were pulled within a few days to minimize the effect of rooting-in on the experiment. Soil within an 8ft x 8ft block around the tree was brought to field capacity with sprinklers to create the same soil conditions for each repetition. The trees were pulled with a winch and pulley system anchored to a concrete pillar. Data was collected through a computerized data acquisition system and the trees were instrumented with two inclinometers which measure angle and a load cell which measures force. One inclinometer was mounted to the root ball and the other was mounted on the trunk above the tie-in point on the aboveground systems. The load cell was in-line with the rope to monitor the force exerted on the tree. The trees were pulled until the inclinometer in the root ball measured 20°. Five trees were pulled for each staking system from two different directions of orientation for a total of ten trees for each staking system.

**What we found as of Dec 2006:** The direction in which each system was pulled had a major impact on force required to pull the tree to a 20° angle. The Brook's Tree Brace the 2"x 2"s on the root ball, and the Terra Toggle required the most force to pull trees over to a 20° angle (Table 1).

**Table 1.** Force to failure for landscape tree stabilization systems.

Stabilization system	Average Max. force (lbs) required to pull tree to 20° angle		
	<u>Direction 1*</u>	<u>Direction 2</u>	<u>Average</u>
<b>Root ball Anchoring</b>			
2"x 2" on root ball	477.79	339.66	408.27 a <sup>1</sup>
Dowels in root ball	135.12	109.14	122.13 c
Terra Toggle	514.21	512.12	513.16 a
Tree Staple	100.62	155.28	127.95 c
<b>Above-ground Systems</b>			
Arborbrace	205.98	115.33	160.65 b
Brook's Tree Brace	369.61	640.18	504.89 a
Duckbill	155.81	328.44	242.13 b
Rebar and Arbor Tie	180.41	407.66	294.04 b
T-stakes with Wellington tape	120.37	102.79	111.58 c
<b>Control</b>	56.18 d		

<sup>1</sup>Means followed by the same letter are not significantly different at the P<0.05 level. Means based on five trees for each staking system and direction combination.

\*Direction 1: stake or guy oriented directly toward pulling force. Direction 2: Oriented 90° or 180° from Direction 1, depending on staking system.

**Conclusion:** The systems that withstood the most amount of force were the 2"x 2"s on the root ball, the Terra Toggle, and Brook's Tree Brace. The least effective systems tested were the Tree Staple, the wood dowels, and the T-stakes with Wellington tape.



A home-made root ball anchoring system that worked well.



Trees were pulled over until they tilted 20 degrees.



Pulley system with load cell and cable to computer to measure force.



Inclinometer (with cable) measured angle of root ball as tree was pulled over.



The root ball anchoring system Terra Toggle worked well.



Brooks Tree Brace worked well to stabilize trees.