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BRANCH PRUNING WOUND CLOSURE

by Dan Neely

Abstract. *Branches were pruned from 10 species of trees by the "Shigo" and the conventional methods. The branches (four per tree, five trees per species) averaged 50 to 75 mm (2 to 3 in) in diameter. Wounds from conventional cuts were 30 to 50 percent larger than wounds from Shigo cuts. There was little closure of Shigo wounds during the first year. After four years, the conventional wounds were smaller than the Shigo wounds on six species, approximately the same size on one species, and larger on three species.*

Wounds to trees are detrimental because they expose the xylem to invasion by insects or disease or decay organisms. Branch pruning wounds can be especially undesirable because wood growth after the cut, remains exposed for many years. The exposed sapwood may be invaded by borers or systemic fungi (2, 3). Infection of the sapwood and heartwood by other primary and secondary invaders may result in wood discoloration and decay (5). Bleeding from diseased heartwood following branch removal is not uncommon (1).

Yet, branch removal is a sound and often essential horticultural practice. Crossing and hazardous branches should be removed. Regulations may require that lower or obstructing tree branches be removed to accomodate pedestrian or vehicular traffic. When branch removal is necessary, rapid closure of pruning wounds is desirable. Closed wounds complete the last annual growth ring, reduce the likelihood of invasion by external agents, and increase tree stability.

The placement of the final cut in branch removal recently has been discussed by various researchers. The dialogue centers on whether rapid closure (4) or discloration and decay (7) should be the primary consideration in placement of the cut. Two criticisms of an earlier paper (4) demonstrating rapid closure from conventional branch pruning were that the data came from only three tree species and that the branches removed were quite small. They, therefore, may not have been representative of branches on larger trees. The objective of the present study was to confirm or refute the previous study by pruning much larger branches from additional species of trees.

Materials and Methods

The trees used in this study were located in the Street Tree Collection of the Morton Arboretum near Lisle, Illinois. The trees were planted in 1958 with 15 m (50 ft) between trees in a row and 15 m between rows. The trees ranged from 12 to 20 m tall in 1986. Ten cultivars within seven genera were chosen (Table 1). Four branches on each of five trees of each cultivar were selected for pruning. The branches' diameters were measured with a steel tape approximately 8 cm from the trunk. Two branches on each tree were pruned beyond the branch shoulder using the "Shigo" method (6), and two branches were pruned through the branch shoulder using the conventional method (4) on September 22, 1986. The width of xylem exposed on each wound was measured on April 27, 1987, and again in mid-October of 1987, 1988, 1989, and 1990. The amounts of closure each year on each species were analyzed using Student's test for paired samples.

Results

The average branch diameters and the average widths of wounds are given in Table 1. The widths of the wounds from conventional cuts were significantly larger than those associated with the Shigo cuts. The width of xylem exposed after a Shigo cut was sometimes even less than the branch diameter (e.g., 94 percent of branch diameter for *Liquidambar* and 96 percent for *Frax-*

inus). With conventional cuts, the wound width was often 45 percent larger than the branch diameter (e.g., 151 percent of branch diameter for *Acer* (1) and 147 percent for *Acer* (2) and *Gleditsia).*

The average closures in the widths of wounds for each of the four growing seasons are given in Table 2. Closure of the Shigo cuts was slight or nonexistent in 1987 for all 10 cultivars and averaged 3.1 mm. By contrast, only on *Quercus*

Table 1. Mean diameter of branches pruned from trees with Shigo or conventional cuts and the width of resultant xylem exposed*.

Cultivar	Cut**	Branch diameter (mm)	Xylem width (mm)	W/D†
Platanus occidentalis	S	58.2	58.5	1.01
	C	56.4	77.0	1.37
Liquidambar styraciflua	S	69.8	65.5	0.94
	C	69.9	79.7	1.14
Acer (1) *saccharum*	S	47.0	52.4	1.12
	C	46.0	67.5	1.47
Acer (2) *platanoides* 'Emerald Queen'	S	50.9	53.9	1.06
	C	47.2	65.1	1.38
Acer (3) *platanoides* 'Crimson King'	S	47.1	53.3	1.13
	C	56.7	85.6	1.51
Acer (4) *saccharinum*	S	59.9	64.2	1.07
	C	55.6	75.7	1.36
Ulmus pumila x *rubra* 'Green King'	S	42.2	46.3	1.10
	C	43.5	53.1	1.22
Fraxinus pennsylvanica	S	65.9	63.7	0.97
	C	63.7	77.1	1.21
Quercus coccinea	S	77.0	76.8	1.00
	C	64.4	85.1	1.32
Gleditsia triacanthos inermis 'Skyline'	S	69.6	74.6	1.07
	C	65.0	95.3	1.47

*Two branches of five trees of each species were pruned by each method
**S = Shigo, C = conventional
†Xylem width/branch diameter

Table 2. Average closure of the branch pruning wounds from Shigo or conventional cuts during four growing seasons, 1987-1990.

	Closure of branch pruning wounds (mm)							
	Shigo cut				Conventional cut			
Cultivar**	'87	'88	'89	'90	'87	'88	'89	'90
Platanus	-0.5	11.2	13.1	11.3	4.6	19.2*	21.9*	15.5
Liquidambar	2.9	8.6	13.8	14.7	7.1*	13.1*	21.5*	18.3
Acer (1)	1.9	7.3	10.5	10.1	8.4*	13.1*	15.6*	13.0
Acer (2)	4.5	7.4	11.0	10.6	11.6*	8.9	13.7	15.5*
Acer (3)	2.8	6.3	7.7	12.1	10.7*	13.3*	18.2*	19.3
Acer (4)	5.0	7.0	10.6	9.3	8.9*	8.7*	10.2	10.7
Ulmus	7.1	13.5	12.9	6.0	14.5*	14.4	12.0	6.2
Fraxinus	4.2	4.6	4.6	5.3	9.2	8.0	6.8	7.9
Quercus	0.4	4.6	18.6	24.8	-0.6	9.1	20.2	22.4
Gleditsia	2.4	7.5	9.5	10.9	9.5*	10.8	11.5	10.8
Average	3.1	7.8	11.2	11.5	8.4	11.9	15.2	14.0

*Significantly greater closure than Shigo cuts at P = .05 as determined by Student's t test using paired samples
**See Table 1 for species or cultivar designation

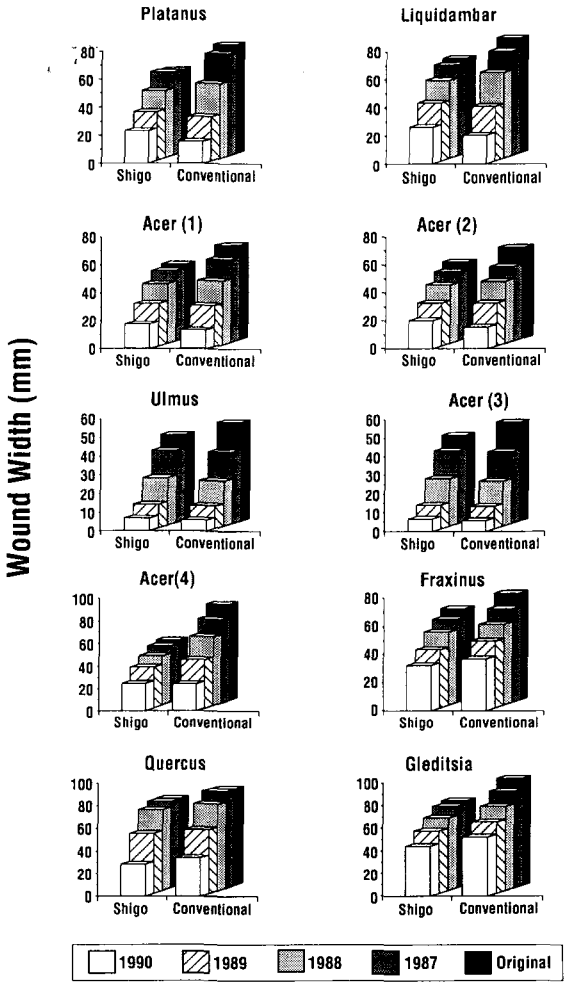

Figure 1. The widths of wounds resulting from pruning of branches by the Shigo and conventional methods and the resulting widths during four years of wound closure.

was the closure of conventional cuts limited in 1987, and closure of conventional cuts averaged 8.4 mm. With exception of *Quercus* in 1987 and 1990, the conventional cut wounds closed more each season on each cultivar than did the Shigo cut wounds.

At the end of the 1990 season, the conventional wounds were smaller than the Shigo wounds on *Acer* (1), *Acer* (2), *Acer* (3), *Liquidambar, Platanus,* and *Ulmus;* they were essentially the same size on *Acer* (4); and they were larger than the Shigo wounds on *Fraxinus, Gleditsia,* and *Quercus* (Fig. 1). Of the 100 wounds of each type on all species, 17 Shigo cuts and 12 conventional cuts were closed after four seasons.

Discussion

The specifications for a Shigo cut as used in this test were those recommended in 1984. The angle of the final cut was equal to that formed by the branch bark ridge and the vertical. Since then, Dr. Alex L. Shigo has stated, "Proper pruning of a living branch is a cut as close as possible to the branch collar. There is no set angle for a proper cut" (7, page 29). Had the 1989 specifications been used in this study, the results may have been different. Both Shigo and I include the warning—**do not leave branch stubs!**

The decision that must be made by the arborist or tree owner is whether to make the final cut either through or outside of the branch shoulder. A conventional cut through the shoulder will result in a more aesthetically pleasing and faster growing callus. A cut outside of the shoulder or collar will possibly reduce discloration and decay in the stem or trunk from which the branch was removed. Both objectives are desirable, but only one is obtainable.

Acknowledgment. The cooperation of the Morton Arboretum staff, especially Drs. Gary W. Watson and Thomas Green, is gratefully acknowledged.

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Résumé. Les branches de dix espèces d'arbres étaient élaguées selon les méthodes "Shigo" et conventionnelle. Les branches (quatre par arbre, cinq arbres par espèce) atteignaient, en moyenne de 50 à 75 mm (2 à 3 po) de diamètre. Les

blessures de coupes conventionnelles étaient de 30 à 50 pourcent plus larges que les blessures de coupes Shigo. Il y avait peu de cicatrisation des blessures Shigo durant la première année. Après quatre ans, les blessures conventionnelles étaient plus petites que les blessures Shigo sur six espèces, de dimensions approximativement semblables sur une espèce et plus larges sur trois espèces.

Zusammenfassung: Äste von 10 verschiendenen Baumsorten wurden mit dem "Shigo" und den üblichen Methoden ausgelaubt. Die Äste (vier per Baum, fünf Bäume per Sorte) waren durchschnittlich 50 bis 75 mm im Durchmesser. Die Wunden von den üblichen Schnitten waren 30 bis 50 Prozent grosser als die Wunden von den Shigo Schnitten. Es gab wenig Zusammenwachsen von den Shigo Wunden wahrend des ersten Jahres. Nach vier Jahren waren die üblichen Wunden bei sechs Sorten kleiner als bei den Shigo Wunden, ungefähr die gleiche Grosse bei einer Sorte und grosser bei drei Sorten.

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PHYTOTOXICITY OF SUNSPRAY ULTRA-FINE SPRAY OIL® AND SAFER INSECTICIDAL CONCENTRATE® SOAP ON SELECTED ORNAMENTAL PLANTS IN SUMMER IN NORTH FLORIDA AND SOUTH GEORGIA

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Abstract. Two percent Sunspray Ultra-fine Spray® oil and Safer Insecticidal Concentrate® soap were applied 5 times in separate treatments to 30 species of trees and shrubs growing in containers under commercial nursery conditions in north Florida. A similar test was conducted on 17 species of container-grown ornamentals in south Georgia. Horticultural oil and soap were applied at 10 day intervals beginning July 16, 1990. Plants were visually rated for phytotoxicity prior to the second through fifth application and 10 days after the fifth application. A third test of only three applications of horticultural oil or soap on 9 species of plants was conducted at Monticello, Florida beginning August 28, 1990. All the treatments were applied from 9:30 - 11:00 A.M. and daily temperatures were above 35° each day. No phytotoxicity was observed on any of the plants tested.

Environmental and sociological concerns that accompany the application of conventional pesticides for pest control have shifted research attention to the evaluation of alternative methods. Traditionally, horticultural oils have been recommended for use in the dormant season for insect and mite control on a variety of plant species. Phytotoxicity caused by the older, less refined brands of horticultural oils precluded their use during the active growing season. However, many new, more refined horticultural oils and soaps reduce the risk of phytotoxicity. Thus they have much promise as effective alternatives to conventional pesticides, fitting well into integrated pest management programs that seek to reduce pesticide use (1, 2, 3).

Previous work in Maryland (2) and New York (1) discussed the results of both phytotoxicity and efficacy studies using Sunspray 6E horticultural oil under summer conditions. Discoloration was observed on 6 of 52 species tested (two species of maple, a juniper, a blue spruce, a red oak and an arborvitae) and the authors urged caution if 2% Sunspray oil was used repetitively on these plants (2). Excellent control of spider mites, scales, whiteflies, aphids, and mealybugs using 2-3% Sunspray 6E oil was documented in New York (1). Some phytotoxicity from 3% oil to several walnut (*Juglans* sp.) cultivars and some apparently permanent foliage discoloration to several juniper cultivars were reported (1).

Repellency and toxicity of horticultural oil to

1. We thank David Walker of Wright Nursery, Cairo, GA and Fred Beshears and Rex Purvis of Simpson Nursery, Monticello, FL for providing the plants and a site to conduct these tests. Florida Agricultural Experiment Station Journal Series publication.