JOURNAL OF
ARBORICULTURE

November 1988
Vol. 14, No. 11

CLOSURE OF BRANCH PRUNING WOUNDS WITH CONVENTIONAL AND 'SHIGO' CUTS

by Dan Neely

Abstract. Closure rates on pruning cuts through the branch collar (conventional) and away from the branch collar ('Shigo') were compared on *Quercus palustris, Platanus occidentalis,* and *Acer platanoides* for 4 years. The severed branches (4 per tree, 10 trees per species per year) were 25 to 35 mm in diameter. Depending on species, 'Shigo'-cut wounds were 4 to 6 percent wider than the diameter of the branch; conventional-cut wounds were 32 to 51 percent wider. Wound calluses around conventional cuts grew much faster than calluses around 'Shigo' cuts (14.8 vs. 8.1 mm the first year, 17.8 vs. 12.6 mm the second year). After one growing season the amount of wood exposed on conventional and 'Shigo' branch wounds was approximately equal even though the conventional cuts were originally much larger. After the second growing season, more conventional cuts than 'Shigo' cuts were fully closed.

Natural target pruning, as defined and described by Alex Shigo (3), is a radical change from the conventional method used by arborists since the advent of the chain saw to remove branches from hardwood and coniferous trees. In natural target pruning the objective is to leave the branch collar on the primary stem while removing the remainder of the branch (4). This frequently requires the final cut to be at approximately the same angle from vertical as that formed by the branch bark ridge. This method leaves a smaller area of exposed wood, retains the branch collar, and requires an upstroke with the chain saw when the angle between the trunk and branch is acute. Conventional pruning is accomplished with a downward stroke with the chain saw on the final cut. This method creates a larger wound and removes some of the branch collar.

Following pruning, rapid production of callus is desirable in order to cover the exposed wood as quickly as possible. Closure of pruning wounds at the end of branch stubs occurs slowly if at all (1). The objective of this study was to compare closure time of wounds following natural target and conventional pruning of living branches from trees.

Materials and Methods

The trees used in this study were growing in the Illinois Natural History Survey arboretum 1 mile south of Urbana, Illinois. The trees were in 100-tree blocks spaced 4 m apart. The pin oaks *(Quercus palustris)* were planted as seedlings in 1969, the Norway maples *(Acer platanoides)* in 1970, and the sycamores *(Platanus occidentalis)* in 1977. Each year for four consecutive years (1983-1986), ten trees of each species were selected for pruning. Four living branches from each tree were removed: two by the 'Shigo' method and two by the conventional method. The 'Shigo' cuts were an upstroke of the chain saw as A-B in Figure 1. Care was taken not to leave a stub at point A. The conventional cuts were a downstroke of the chain saw beginning at A and angling out from the trunk (not flush with the trunk). Care was taken not to injure the bark on the main stem above the excised branch. A mean of tree diameters 1 m above the ground line is given in Table 1. Branch diameters 10 cm distal to the pruning cut were measured with a diameter tape. Width of exposed xylem was measured horizontally at the widest point immediately after pruning. Branches were excised the first week of May in 1983, the first week of April in 1984 and 1985, and the last week of March in 1986. The width of wood remaining exposed and tree trunk growth were measured annually in late September or early October from 1983 through 1987.

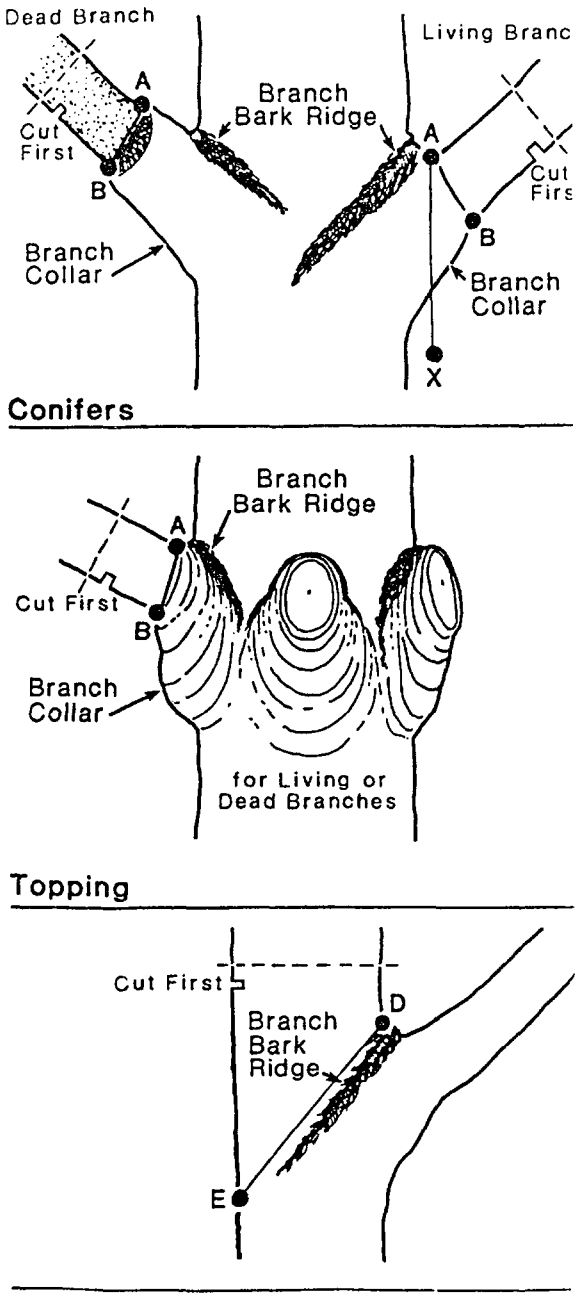

Figure 1. Natural target pruning. Excerpted from: Shigo, Alex L. 1984. Homeowners guide for beautiful, safe, and healthy trees. USDA Forest Service NE-INF-58-84.

Results

The severed branches on the trees averaged 2.5 to 3.4 cm (1 to 1.5 inches) in diameter (range 2.0 to 4.8 cm) and were uniform between treatments within a species (Table 2). The width of wood exposed following pruning was minimally greater than branch diameter on 'Shigo'-cut wounds but substantially greater with conventional pruning (Table 2). Depending on species, the percentage increase was 4 to 6 percent on 'Shigo'-cut wounds, and 32 to 51 percent on conventional-cut wounds. The branch collar was larger on maple than on oak and sycamore.

Wound calluses around conventional cuts grew much faster than calluses around 'Shigo' cuts, especially the first year (Table 3). After one growing season, the amount of wood exposed on the conventional and the 'Shigo' branch wounds were approximately equal even though the conventional cuts were originally much larger. During the second growing season, the callus growth continued to be greater on the conventional cuts. After two growing seasons, more of the conventional cuts than the 'Shigo' cuts were fully closed on oak and sycamore and almost as many were closed on maple (Table 3).

On both 'Shigo' cuts and conventional cuts on all three species, the amount of wound closure was positively correlated with wound width. The larger wounds contained more callus than the smaller wounds. This was especially evident the second growing season (data not shown, correlation coefficient (R) 0.39 to 0.81). Wound closure was also positively correlated with trunk growth (correlation coefficients (R) 0.02 to 0.34). Wound closure was greater on the faster growing trees.

Discussion

Shigo presents convincing pictorial evidence to support his thesis that natural target pruning will result in reduced discoloration, decay, and inter-

Table 1. Average diameters of the ten trees of each species pruned each year.

Species	*Spacing*	*Tree diameters (cm)*			
	(m)	*1983*	*1984*	*1985*	*1986*
Quercus palustris	4	17.0	19.8	21.8	21.4
Acer platanoides	4	12.7	13.0	15.2	16.5
Platanus occidentalis	4	10.2	10.2	10.8	12.0

nal defects within xylem tissues (5). He also warns the chain saw operator to use great care in the final upstroke cut, especially on large branches. Chain saw kick-back can cause serious injury if the operator does not maintain control at all times.

The conventional cut used in this study is not a flush cut. It is a downstroke with a chain saw that begins outside the branch bark ridge (point A in Figure 1) and proceeds slightly outward (**not** A to X in Figure 1) but without injury to the stem above the branch (approximately from A to the arrow identifying the branch collar in Fig. 1). In removing a dead branch with a callus collar with the conventional method, much of the callus tissue would be excised to avoid leaving a projection on the trunk.

Table 2. Average diameters of the branches pruned from 40 trees (10 per year) and the average widths of xylem exposed after pruning.

Host	*Treatment**	*Branch diameter (cm)*	*Wound width (cm)*	*Percentage** increase*
Quercus	S	3.36	3.50	4
	C	3.29	4.34	32
Acer	S	3.41	3.61	6
	C	3.38	5.10	51
Platanus	S	2.55	2.65	4
	C	2.51	3.33	33

*S = Shigo, C = Conventional
**Wound width times 100 divided by branch diameter, minus 100

Aesthetics are especially important in the maintenance of amenity plants. Dead branches, broken branches, branch stubs or knobby growth on trees are not pleasing to the eye. These are also detrimental to the tree because "healing", i.e., closure of wounds through production of callus tissues, is delayed, prolonged, or slowed (2). Also, minor defects in the interior of the tree have little or no effect on tree vigor, and as long as they do not threaten tree stability should be of minor concern.

In natural target pruning, Shigo exhorts practioners to aim for the targets and try to hit them. "Do not try to 'be safe' and leave a stub. A stub gives the pathogen a food source while they grow into the branch corewood." (5) Nevertheless, with current tools the tendency for those attempting to adhere to the 'Shigo' method is to leave a stub. Branch stubs heal very slowly (1). This study provides evidence to show that the pruning wounds remaining after correctly prepared 'Shigo' cuts close more slowly than conventional cuts. The question that remains is, which is more serious: 1) the discoloration, decay, and internal defects that may occur following the use of the conventional pruning method, or 2) the aesthetic discomfort of humans and slow closure of wounds on trees resulting from the natural target pruning method?

Table 3. Average closure by callus of pruning wounds on 40 trees, number of wounds fully closed after 2 years, and the average width of exposed wood after 2 years.

Host	*Treatment**	*Original wound width (mm)*	*Closure (mm)*		*After 2nd year*	
			1st year	*2nd year*	*Fully closed (of 80)*	*Exposed xylem width (mm)*
Quercus	S	35.0	5.6	14.5	9	14.9
	C	43.4	12.9	22.0	29	8.5
Acer	S	36.1	6.6	10.4	13	19.1
	C	51.0	14.8	16.4	9	19.8
Platanus	S	26.5	12.1	13.1	65	1.3
	C	33.3	16.9	14.9	68	1.5

*S = Shigo, C = Conventional

Literature Cited

1. Neely, Dan. 1970. *Healing of wounds on trees.* J. Amer. Soc. Hort. Sci. 95:536-540.
2. Neely, Dan. 1988. *Tree wound closure.* J. Arboric. 14:148-152.
3. Shigo, Alex L. 1984. Homeowners guide for beautiful, safe, and healthy trees. USDA Forest Service NE-INF-58-84. 8 pp.
4. Shigo, Alex L. 1985. *How tree branches are attached to trunks.* Canadian J. Bot. 63:1391-1401.
5. Shigo, Alex L. 1986. A New Tree Biology. Shigo and Trees, Associates, Durham, New Hampshire. 595 pp.

Plant Pathologist
Illinois Natural History Survey
608 East Peabody Drive
Champaign, Illinois 61820

Abstracts

LAUERSDORF, J. 1987. **Shade tree apraisal and some pitfalls of the profession.** Arbor Age 7(11); 41-43.

Until recent years, tree evaluation was often considered to be a real estate concern, with trees to be evaluated only by realtors. Today the courts often demand the services of expert witnesses from professions within the green industry. The "Guide for Establishing the Value of Trees and Other Plants" and the Manual for Plant Appraisers" provide excellent guidelines for establishing plant value. There appears to be a tendency among most first-time appraisers to overrate plant value. How does one perceive value? It can be based on historic influence, aesthetics, timber and other preference. The method or accuracy of data collection, although important, is not nearly as important as how you report your findings. A neat, well written, professional report should stand on its own in a court of law.

WATSON, M.R. 1987. **Growth regulators save money for utility.** Arbor Age 7(6): 22-24.

A production tree-growth regulator program was initiated at Potomac Edison in July, 1986. Effective control without visual impacts convinced Potomac Edison that tree-growth regulators (TGRs) had a place in utility tree trimming. However, it was felt at the time that a delivery system acceptable for daily use as part of a trimming operation was not available. In 1983, a contract for the development of an injection system was awarded to Asplundh Tree Expert Co. From the project, an injection system was developed that meets the outlined criteria. A very important aspect of field injection of TRGs is the time required to place the material into the tree. Time varies with tree species. Generally, ring porous species are the slowest to inject, while diffuse porous species are the fastest. Injection times remain fairly constant regardless of crown size and diameter.