

SELECTING TREES FOR THEIR RESPONSE TO WOUNDING'

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This will not be a report on a single study - rather it will be a preliminary report on a series of investigations we have begun on a number of species of trees in several parts of the country. Detailed information will be published in a series of technical reports later, but I do want to tell you about the methods we are using and what the results of these investigations might mean to you.

While we didn't bother to locate recent figures that we could quote to you, I suspect the cost of replacing trees in residential areas and on city streets runs into many thousands of dollars annually. A few of these trees might actually be dying of old age as suggested by Tom Perry, but many of them are going prematurely because they are badly decayed - and decay usually starts with wounds of one form or another.

The thought that all of those trees need to be replaced may appeal to some nurserymen, but it probably has the opposite effect on urban and municipal foresters - or at least the people who control the purse strings and the taxpayer. The ideal tree from their point of view would be one that you could run cars into, carve initials on, and generally abuse - and have the tree seal off the injury and continue to grow normally.

Finding injured trees in any major city is not a problem, as Ruth Foster has shown us, but many of these are of seed origin. If they have been vegetatively propagated, the clonal identification has long since been lost. It is impossible to do much with this type of material except to say that certain species are able to survive the collective abuses encountered in cities.

We became interested and involved in the problem of wound response when an older stand of hybrid poplar was cut for a lumber grade study. It was obvious in looking at the ends of logs stacked at the sawmill that large differences in the diameter of discoloration columns were present. Fortunately,

¹ Metro. Tree Impr. Alliance (METRIA) Proc. 1: 69-72, 1978.

we had recorded clone numbers on each log and with some quick measurements, we were able to show that the variation was between clones and not between trees (Garrett, Shigo, and Carter 1976).

Discoloration between clones ranged from 56% to 85% of the total stem diameter. Only six clones were involved in this operation and the clones were of mixed parentage. The exact cause of discoloration was not determined and the time of wounding which apparently is an important factor could not be determined. Wounding by our definition includes everything from bulldozer blades to natural pruning of branches. With all of these unknowns, we decided to try a more systematic approach and see what happened.

Most studies of wound healing in trees have concentrated on callous formation and wound closure. Wound closure was almost synonymous with wound healing. Wound healing is more than that. Large wounds may never completely close, but they may heal - from the inside. It appears that we are working with at least two internal defense mechanisms in trees. First there are the chemical barriers that keep out most wood-destroying microorganisms and to combat those organisms that get by the first line defenses, trees have evolved a system for walling off or confining the area of infection. Our next study confirmed just how effective the second defense mechanism is in some trees.

The only genetically uniform material in our area of a size suitable for wounding was another planting of hybrid poplar. We took brace-and-bit in hand and attacked. Sixty trees representing 9 different clones of Populus deltoides Marsh x P. trichocarpa Hook. were wounded. The program was complicated just a bit by the number of wounds inflicted (14), height of wounds (4) and time of year (3). The wounds were all 1.5 cm in diameter and 5 cm deep.

Closure of wounds was measured in July and the results were exactly what we were expecting. Trees in some clones had open wounds while wounds in other clones were completely closed. In October the trees were cut and dissected to record internal discoloration patterns. The ability of some clones to isolate infected tissue was striking while trees in other clones developed large columns of discolored wood. Again, the degree of column formation among clones was significantly different (Shigo, Shortle, and Garrett 1976).

The results of this study suggested that wound healing - closure and isolation of infected tissue - might be under genetic control. If this is in fact the case, then effective selection for resistance to wound diseases, a major cause of damage to trees, would be a distinct possibility.

The next phase of this research was to try to determine the heritability of closure and compartmentalization. To find trees large enough we went to Mississippi. Cooperating with the Genetics Project of the Southern Station we wounded fifty-nine clones of P. deltoides to confirm our earlier work and because they were available in a replicated test. The important part of the southern work involves 81 families of sweetgum (Liquidambar styraciflua L.). Wound closure was measured in mid-June and indications are that there is a strong clonal response. Trees will be cut in early October and dissected to measure internal compartmentalization.

A follow-up study in black walnut (Juglans nigra L.) half-sib families will be made next spring and evaluated in the fall. The tree breeding project at Carbondale, Illinois will provide the material and cooperate with us on this study. When the walnut response has been evaluated, we will review the overall project. If all three species have responded in a similar manner - and we expect they may - then we will be in a position to recommend action programs. If we do find individuals that are capable of responding to wounding in a positive way, it will be necessary to maintain these trees in a healthy condition for breeding purposes or as sources of scion material for rooting or grafting programs. Until recently, it has been necessary to cut the tree to examine and evaluate internal wound response (i.e., compartmentalization of infected tissue). The "Shigometer" which requires only a very small hole (3/32" diameter) in the tree trunk near the wound may be a solution to this problem.

I am certain that the first nursery on the market with trees guaranteed to resist some of the damages associated with wound will find a large and ready market in urban and municipal forestry programs.

LITERATURE CITED

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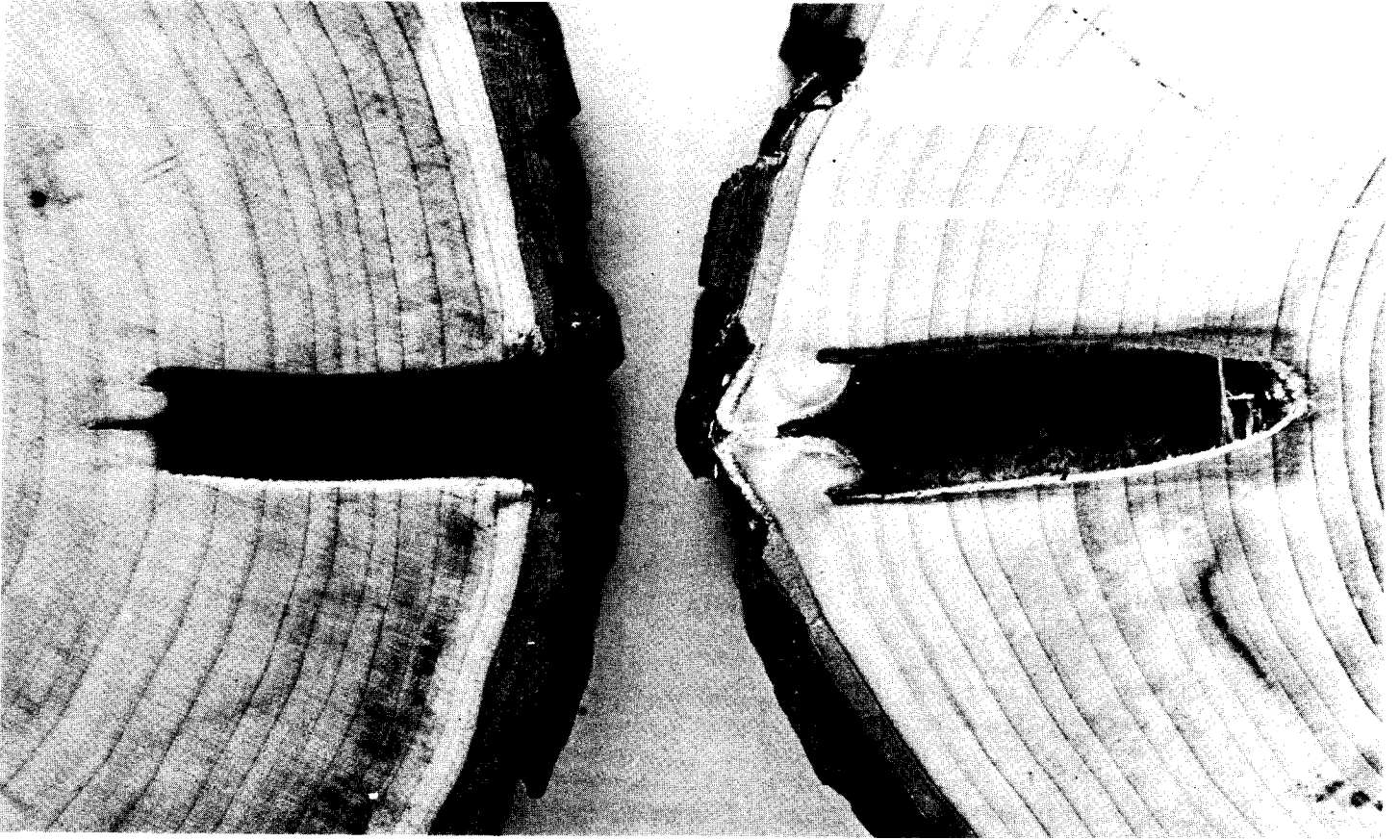


Figure 1. Clone at left showing slow wound closure and poor compartmentalization of discoloration. Clone at right closed rapidly and has practically no discolored wood associated with the wound.