

Rooting Baldcypress Stem Cuttings

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Stem cuttings of baldcypress clones were rooted under environmental conditions normally used for Douglas-fir cuttings. Rooting of cuttings in three bed areas receiving different amounts of intermittent mist were evaluated. The 23-year-old clones rooted best (58%) in the wettest area of the rooting bed (50% moisture content). Cuttings developed large tap roots that greatly exceeded the size of the aboveground portion of the plants. Tree Planters' Notes 44(3): 125-127; 1993.

In western Oregon, the search for plants to protect shores of reservoirs from water erosion led us to propagate baldcypress (*Taxodium distichum* (L.) Rich.). Reservoirs established for flood control are subject to great fluctuations in water level: they are routinely drawn down to low water levels each fall before the start of the rainy season. The drawdown can exceed 30 vertical m (100 feet) and results in exposing the bare banks to wave erosion. Trees planted on exposed banks during low water are likely to be submerged under many feet of water for several consecutive months. Baldcypress is a species from the southern United States that thrives in wet areas and can tolerate prolonged submersion (Hall et al. 1946). The species also grows along river drainages in the northern extremes of its range in southern Illinois and southwest Indiana. Baldcypress trees planted in the north-eastern United States and southern Canada withstand minimum winter temperatures of -29 to -34 °C (-20 to -29 °F) (Wilhite and Toliver 1990). Unfortunately, baldcypress in the most northern populations produce very little seed (Mattoon 1915).

In 1989 we could not locate a source of seed from cold-hardy populations of baldcypress for planting, so we decided to root stem cuttings and plant the rooted cuttings instead of seedlings. In this report, we describe the rooting environment, our rooting results, and the somewhat unusual rooting characteristics of baldcypress.

Materials and Methods

Cuttings were made from branch tips of 3-year-old rooted ramets of 20-year-old trees (ortets) that had been established from rooted branch tips collected from 10 trees growing near Corvallis, Oregon. These 10 parent trees grew from seed gathered from indigenous populations in southern Illinois

Cuttings were rooted in a vinyl chloride-covered rooting house at Corvallis, Oregon, according to rooting techniques known to work well with Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) cuttings (Copes 1983). The actual rooting bed measured $1.5 \times 15 \times 0.6$ m ($5 \times 48 \times 2$ feet). The upper 15 cm (6 inches) was filled with a 2:1 rooting mix of sphagnum peat and fine washed sand, and the lower 46 cm (18 inches) was filled with fine sand. The rooting medium was maintained at 21 °C (70 °F) with heat cables. The rooting area was kept at high humidity, and the water needs of the cuttings and media were supplied by a single line of Flora-Mist nozzles (15 l/hr) (4 GPH nozzles) down the center of the bed. Nozzles were positioned 45 cm (18 inches) above the rooting medium and spaced every 91 cm (36 inches) along the center of the bed. The nozzles produced a full circle pattern. The on/off operation for the misting was controlled jointly by a 24-hour clock and a Mist-A-Matic® moisture-detecting electric leaf. The mist control was adjusted to spray for 12 sec whenever the moisture control device opened the solenoid valve regulating the water line. Intermittent misting began each day an hour after sunrise and ceased at sunset.

Six different fungicide foliar-sprays were used—a mixture of thiophanate-methyl and ETMT (Banrot), benomyl (Benlate), chlorothalonil (Bravo and Daconil), captan, iprodione (Rovral). A different one of these was applied each week during the rooting period. Biweekly applications of 20-20-20 fertilizer (200 ppm nitrogen) were applied by injector after roots were first visible on the basal area of the cuttings. Fertilization continued until the cuttings were removed from the rooting bed in August. High temperatures for air and rooting medium temperatures were controlled by externally covering the rooting house with 50% shade-cloth.

Branch tips from rooted cuttings of 10 clones were collected in early April 1989. The branches were stored for 7 days at 1.6 °C (35 °F) in plastic bags containing moist paper towels until placement in the rooting bed. The buds were dormant at the time of collection. The cuttings were placed in the rooting chamber on April 25, 1989, after cuttings of all 10 clones were thoroughly mixed into one homogenous sample. Before placement, the 3- to 5-mm-diameter stems were trimmed to 15- to 20-cm (6- to 8-inch) lengths and submerged for 2 to 5 seconds in a 10%

solution of captan fungicide in water. The basal 2.5 to 5.1 cm (1 to 2 inches) of all cuttings were submerged for 5 seconds in 0.5% indole-3-butyric acid (5,000 ppm IBA) dissolved in 50% ethanol.

Immediately after the hormone application, the basal ends of the cuttings were stuck 5.1 cm (2 inches) deep into the rooting medium. The cuttings were positioned about 7.6 cm (3 inches) apart in three row treatments extending 13 m (42 feet). One row was 10 cm (4 inches) from the outside edge (outside row) of the bed 66 cm ((26 inches from the center), a second row (middle row) was 38 cm (15 inches) from the center and outside edge of the bed, and the third row was 2.5 cm (1 inch) from the center of the rooting bed (inside row) and also directly under the line of mist nozzles (figure 1).

The rooting bed was divided into 7 blocks; each block was 1.8 m (6 feet) long (figure 1). The experimental unit for rooting success was the percentage of 25 cuttings per row that rooted in each block. Available moisture decreased towards the exterior of the rooting bed as distance from the mist nozzles increased. At the end of the rooting period, the average moisture content of the rooting medium of each row was estimated by sampling eight locations along each row, weighing the rooting media samples before and after oven-drying, and calculating the percentage of water in the samples.

Rooting data were subjected to analysis of variance (ANOVA) by using the SAS procedures for general linear models (SAS Institute Inc. 1985). The experimental design had row position or moisture content of the rooting medium as the independent variable and rooting percentage the dependent variable. Blocking was done along the length of the rooting bed to reduce microsite variation. Such variation resulted from differences in soil history, misting application, air movement, etc. Data were transformed to angular values before ANOVA to correct for departures from normality. Significance was achieved when $P < 0.05$.

Results

Rooting of cuttings of baldcypress was greatest when cuttings were stuck in the wettest area (inside row) of the rooting bed (table 1; figure 1). Rooting averaged 58% for cuttings placed in the inside row, immediately below the mist nozzles. Increasingly poorer rooting occurred in the drier areas of the bed (33 and 6% for the middle and outside rows, respectively). Row difference (bed position) in rooting success was highly significant ($P < 0.0001$). Only block 4 had greater rooting in the midpoint row than in the wetter inside row (table 1). Block differences were not statistically significant.

Table 1—Percentage of baldcypress cuttings that rooted and moisture in the rooting medium for cuttings grown in the outside, midpoint, and inside rows

Block number	Outside row	Midpoint row	Inside row	Ave. rooting % \pm SD
Rooting %				
1	8	16	56	27 \pm 26
2	4	36	68	36 \pm 32
3	0	40	80	40 \pm 40
4	4	4	60	23 \pm 32
5	4	44	60	36 \pm 29
6	12	44	32	29 \pm 16
7	8	48	52	36 \pm 24
Average rooting % \pm SD				
	6 \pm 4	33 \pm 17	58 \pm 15	32 \pm 6
% Moisture in rooting medium				
	29	40	50	

Correlation coefficient for rooting percentage and moisture content ($r = 0.995$, $P > t = 0.0665$). SD = standard deviation.

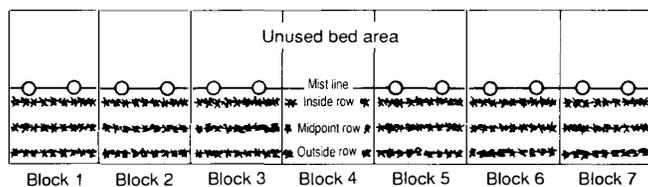


Figure 1—Diagram of the rooting bed showing the relationship of the three treatment rows to blocking, mist nozzles, and edge of rooting bed.

Available moisture declined as distance from the mist line increased. The inside row closest to the mist nozzles averaged 50% water content, and the midpoint row and outside rows averaged just 40 and 29%, respectively (table 1). The regression of rooting percentage on average moisture content was linear ($Y = -29.35 + 0.899X$), as indicated by the correlation between mean rooting percentage and moisture content of the rooting medium ($r = 0.995$). The probability of a larger T value occurring by chance was 0.0665.

Cuttings developed large tap roots at the base of each stem. The weight of the belowground biomass exceeded the aboveground component.

Discussion

We rooted baldcypress cuttings by using techniques and conditions that have worked well for Douglas-fir cuttings because we did not know the conditions that would promote greatest rooting of baldcypress stem-cuttings. Intermittent misting prevents desiccation of

unrooted cuttings, but high humidity, moisture on the surface of the foliage, and warm temperature produce an ideal environment for the growth of pathogens. By not misting at night, we were able to keep the surface of the cutting dry during that time.

Optimum rooting conditions for baldcypress cuttings appeared to be wetter than for Douglas-fir (Copes 1992). Baldcypress rooted best in the wettest (50% moisture content) area of the rooting bed, while that area of the rooting bed, based upon prior experience, is the poorest location for rooting Douglas-fir cuttings. The driest area along the outside edge of the rooting bed (29% moisture content) was the poorest area for rooting baldcypress. Interestingly, the preferred rooting environments of baldcypress and Douglas-fir are similar to their general requirements as seedlings. Baldcypress germination requires a soil that is saturated, but not flooded, for 1 to 3 months; seedlings can survive flooding if they grow fast enough to keep at least part of their crowns above water for most of the growing season (Wilhite and Toliver 1990). Douglas-fir seedlings are intolerant of excessively wet soils and die when subjected to more than 2 weeks of anaerobic conditions (McCaughey and Weaver 1991).

Baldcypress cuttings formed roots that were not characteristic of other conifers with which we have experience. A typical cutting developed a long, thick tap root that was 1 or 2 feet in length and literally grew out the bottom of the rooting bed. We have not seen similar root systems when rooting other conifer species. The characteristic root system may be an adaptive trait enabling baldcypress trees to anchor themselves in very wet sites.

Recommendations

Satisfactory rooting can be achieved with branch tips of 20-year-old baldcypress trees and the rooting procedures described here, but we feel that better rooting might have resulted if wetter conditions than those producing 50% moisture content in the medium had been used. Even greater rooting would probably have occurred if branch tips of more-juvenile trees had been used. In the future, propagators should test even wetter rooting conditions with 24 hours of intermittent or continuous mist. Care should be used in attempting to root or grow baldcypress cuttings in small containers as the large tap-root formed by the cuttings may not be well suited to shallow or small containers.

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