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Rooting and Survival Potential of Hardwood Cuttings of 406 Species, Cultivars, and Hybrids of *Prunus*

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Abstract. **More than 400 genotypes of *Prunus* were evaluated for "in field" rooting and survival from fall-planted hardwood cuttings treated with 2000 ppm IBA. Cultivars of European and Japanese plums originating from species and interspecific hybrids of the section (sect.) *Prunus* had the highest survival. Cuttings from cultivars of sand cherry (sect. *Microcerasus)* and peach (sect. *Euamygdalus)* averaged 28% to 54% lower survival than European and Japanese plums. Few cultivars of almonds (sect. *Euamygdalus),* apricots (sect. *Armeniaca),* and American plums (sect. *Prunocerasus)* rooted from hardwood cuttings. Chemical name used: 1H-indole-3-butyric acid (IBA).**

Propagation of peach [*Prunus persica* (L.) Batsch] by hardwood cuttings has been studied in recent years due to the need for an inexpensive method to produce many trees for high-density orchard systems. Techniques to produce peach cultivars from semi-hardwood cuttings have been successful but costly under greenhouse conditions (Couvillon and Erez, 1980; Overcash et al., 1983; Erez, 1984; Lohnes, 1986). For rootstock, however, selecting for self-rooting has been necessary in progeny that originate from self-incompatible plum lines, interspecific crosses, and mutations because inherited traits segregate if these rootstock are seed propagated, and many interspecific hybrids are highly sterile. Much of the *Prunus* germplasm available in the United States has not been tested for its ability to root from hardwood cuttings under field and nursery conditions. This information is needed to determine the feasibility of mass clonal production of desirable genotypes of *Prunus* and to identify germplasm sources that root easily for use in breeding programs. The objective of this study was to determine the potential for vegetative propagation from hardwood cuttings of a wide range of *Prunus* genotypes, including plant introductions, numbered selections, species, cultivars, rootstock, and interspecific hybrids.

From a germplasm repository of *Prunus* at the Sandhill Research and Education Center in Pontiac, S. C., 406 genotypes of *Prunus* were selected and categorized by species composition into one of five taxonomic sections (sect.) [*Armeniaca* (Lam.) Koch, *Euamygdalus* (L.) Focke, *Microcerasus* (Spach) Schneid., *Prunocerasus* Koehne, *Prunus* Benth. and Hook] according to Rehder (1940) and Krussmann (1986). Intersectional hybrids were placed in separate categories listing all sections represented in the cross. Genotypes from the five taxonomic sections and three intersectional hybrid groups were further categorized according to one of 12 fruit types to distinguish them by fruit characteristics within and among taxonomic sections.

Twenty-five, 20-cm hardwood cuttings ≈1 cm in diameter were taken in November from current year's growth of each of 272, 341, 240, and 375 genotypes in 1984, 1985, 1986, and 1987, respectively. Cuttings were bundled, labeled, wrapped with moist paper towels, and transported in insulated coolers to Clemson, S. C., where they were treated and stuck the following day. Before treating, each cutting was wounded with two equidistant 5-cm vertical incisions through the bark and cambium at the base of the cutting. Cuttings were subsequently dipped to 1 cm above the incisions for 10 sec in 2000 ppm IBA dissolved in a solution of 50% ethanol and 50% distilled water. Following IBA treatment, cuttings were inserted through a black plastic mulch to a depth of 10 cm in a fumigated, tilled Cecil (clayey, kaolinitic, thermic, Typic Hapludults) sandy loam soil. After March budbreak, water was applied twice weekly via a trickle-irrigation system to maintain adequate soil moisture for vegetative growth.

Percent survival was recorded the following July for each set (year). of cuttings. Cultivars (= genotypes) were grouped according to fruit type within taxonomic sections, and survival data of each cultivar and fruit type were arcsin transformed for data analysis. Cultivar and fruit type data were analyzed as a randomized block design, with each year treated as a replicate. Tukey's student range test was used to separate fruit type means because of unequal numbers of cultivars per fruit type.

Survival of the hardwood cuttings differed significantly among cultivars (data not presented) and fruit types (Table 1) at the 0.1% level. Statistically, there was no strong separation among fruit types for survival, although European and Japanese plum cultivars from sect. *Prunus (P. cerasifera* Ehrh,, *P. domestics* L., *P. insititia* L., *P. salicina* Lindl., *P. simonii* Carr., *P. spinosa* L.) and intersectional hybrids involving American plum species *(P. americana* Marsh., *P. angustfolia* Marsh., *P hortulana* Bailey, *P. maritima* Marsh., *P. munsoniana* F.W. Wight & Hedr.) from sect. *Prunocerasus* generally

Table 1. Mean arcsin values and percent survival of hardwood cuttings from 12 groups of fruit types of *Prunus* field-tested for 4 consecutive years.

Fruit type grouping	Taxonomic section	No. of cultivars	Mean survival for 4 years (%)	Arcsin value[z,y]
European and Japanese plum	*Prunus*	41	42.5	39.0 a
European and Japanese plum x American plum	*Prunus* x *Prunocerasus*	27	40.3	37.4 a
European and Japanese plum x sand cherry	*Prunus* x *Microcerasus*	7	36.2	33.6 ab
Sand cherry	*Microcerasus*	10	30.7	30.3 ab
European and Japanese plum x peach	*Prunus* x *Euamygdalus*	7	28.1	29.1 abc
Peach-like[x]	*Euamygdalus*	14	23.9	24.1 abcd
Peach x almond	*Euamygdalus*	18	23.3	24.0 abcd
Peach	*Euamygdalus*	220	22.5	24.0 abcd
Nectarine	*Euamygdalus*	22	19.6	20.6 abcd
American plum	*Prunocerasus*	11	8.5	11.4 bcd
Apricot	*Armeniaca*	16	3.5	5.5 cd
Almond	*Euamygdalus*	13	1.5	3.6 d

[z]Values represent percent survival data that were arcsin transformed to degrees for analysis of variance. Data are 4-year means.
[y]Mean separation by Tukey's student range test, $P = 0.05$.
[x]Peach-like includes the species *P. davidiana, P. kansuensis,* and *P. triloba.*

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Table 2. Top 10 surviving cultivars of peach and plum tested for at least 3 of 4 years.

Cultivar of plum	Mean survival (%)	Cultivar of peach	Mean survival (%)
Early Crimea	96	Rheingold	60
St. Julian	91	Chico 11-12	60
WA 1236	90	PI 146137 (USSR)	55
Marianna 2624	88	ARK 7768	50
SJ 53-7	82	Chu Hun Tao	46
WA 1230	81	Hangchow	44
Damas 1869	74	Nectar	44
Ohio 2	73	Yennoh	43
Myrobalan B	73	Tenn. Nat. IR 282-2-6	42
FL 1-2 Plum	72	Heath Cling	41

had higher survival rates. Some cultivars of European plums had excellent survival, especially when compared with the best cultivars of peach (Table 2).

Sand cherry cultivars from *P. besseyi* Bailey and *P. pumila* L. (sect. *Microcerasus)* had lower survival rates (31%) than those of the European and Japanese plums. Likewise, peach, nectarine, and related peach-like species *[P. davidiana* (Carr.) Franch., *P. kansuensis* Rehd., *P. triloba* Lindl.] from sect. *Euamygdalus* also had lower survival rates (20% to 24% vs. 40% to 43%) than the European and Japanese plums, but these differences were not statistically different. Survival in the almonds *[P. dulcis* (Mill.) D.A. Webb (= *P. amygdalus* Batsch), *P. fenzliana* Fritsch], apricots *(P. armeniaca* L., *P. mume* Sieb. and Zucc.), and American plums (sect. *Prunocerasus),* in contrast, was poor (2% to 9%) and significantly lower than any fruit type from the *Prunus* and *Microcerasus* sections. Mean survival of each intersectional hybrid group was intermediate to their two parent groups.

Cutting survival was also significantly influenced by year. Cuttings stuck in Nov. 1986 had significantly higher survival (33%) than those stuck in 1984 (20%), 1985 (23%), or 1987 (18%). Mean soil temperatures at the 10-cm depth, however, did not differ more than 2.5C among years for the first 4 weeks after the cuttings were stuck. In addition, 1986 had neither the warmest nor the coldest soil temperatures for the critical 4-week post-planting period. Increased survival of 1986 cuttings may have been due to chance, since the smallest number of cultivars sampled was in 1986. Thereby, a disproportionate number of good-rooting genotypes may have been sampled in 1986, which would inflate the overall survival rate, as compared to the other years. Other factors that were not quantitatively measured, such as mother-tree vigor and winter rainfall, also may have influenced rooting and survival of the 1986 cuttings.

Data suggest hardwood cuttings are a potential means to propagate many selections of *Prunus* from sects. *Prunus* and *Microcerasus,* since 18 of the 20 cultivars with > 60% survival were plum and sand cherry cultivars and hybrids. Results are less encouraging for hardwood propagation of selections from the sect. *Euamygdahs.* Propagation success for peach, nectarine, and intrasectional hybrids varied widely among and within species. Cultivars derived from *P. persica* generally propagated more successfully from hardwood cuttings than those from lineages containing *P. davidiana, P. dulcis,* and *P. triloba.* However, only 3% of the peach and nectarine cultivars had greater than 50% survival. Similar low-survival rates of field-propagated peach cultivars were reported by Sen and Couvillon (1983) and Matta and Vadhwa (1987). Despite the low propagation success under field conditions, sufficient variation in rooting ability still exists within peach germplasm to suggest that progress could be made toward increasing rooting potential using current breeding techniques. This approach has been successful in plums, as eight of the top 10 surviving cultivars in this study were plum rootstock that were screened by breeders for self-rooting potential. Other means, such as incorporating genes of plums from sect. *Prunus* into peach by hybridization, might increase rooting and survival of hardwood cuttings. Once genetic barriers to self-rooting in peach are overcome and vegetative propagation techniques improve, production of peach cultivars from hardwood cuttings may become commercially viable in the nursery industry.

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