

## Nursery Propagation by Hardwood Cuttings: *Prunus*

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Several tests were conducted to look at the rooting of *Prunus* hardwood cuttings in the commercial nursery. The commercial propagation of plum rootstocks ('Marianna 2624' and 'Myrobaln 29C') was used as a comparison with the more difficult-to-propagate rootstocks, 'Hansen 536' and 1-82, peach/almond hybrids. A comparison between the size of the cuttings, the time of year they were cut, and the different environments in which they were grown was analyzed for two growing seasons (1994-95 and 1995-96).

Hardwood cuttings of 'Hansen 536' and 1-82 were cut in Nov. 1994 and Nov. through Feb. 1996 and either planted directly in the field or rooted in a greenhouse and then transplanted to the field. In 1995, plastic sleeves to cover the cuttings planted directly in the field greatly enhanced the survivability of the cuttings. Ninety-eight percent of the 'Hansen 536' cuttings that were covered with plastic sleeves rooted and survived in the field.

Hardwood cuttings of 'Hansen 536' were taken to the greenhouse in Feb. 1995. An overall rooting of 19% and a overall field survival of 75% was achieved that year.

In 1996, rooting of 10.2%, 4.1%, 11.1%, and 9.2% occurred with hardwood 'Hansen 536' cuttings taken in Nov., Dec., Jan., and Feb., respectively. Different planting dates affected the survivability of the rooted cuttings, the later in the winter the cuttings were planted, the better the survival. For example, only 10% of the cuttings planted in Jan. 1996 survived, whereas 20% of the cuttings planted in April 1996 survived. This was also true in 1995 when 75% of the cuttings planted in April survived and grew well.

### INTRODUCTION

Propagation of *Prunus* rootstocks in the commercial nursery has long been required to maintain certain desirable characteristics of rootstocks. Seed propagation has been the propagation method of choice, but more recently the demand for specialized rootstocks that are adapted to certain soil conditions have been in high demand. The good news is that nurserymen have at their disposal several different rootstocks for problem soils. The bad news is that propagating these rootstocks, other than from seed, has presented some challenges.

Rootstocks such as the 'Marianna 2624' and the 'Myrobaln 29C' plums are easily propagated by hardwood cuttings. Plum rootstocks are propagated in November, dipped in a rooting hormone and planted to the field. A 90% to 95% rooting in the field is consistently achieved with this method (Hartmann and Kester, 1983).

Two new rootstocks developed by the University of California at Davis are the 'Hansen 536' and Hansen 2168. Both of these rootstocks are peach/almond hybrids that are very vigorous and resistant to some soil nematodes as described in Kester and Asay (1986). Commercial nurseries recognized the importance of these charac-

teristics and the benefit of propagating true-to-type rootstocks.

'Hansen 536' was released from U.C., Davis and propagation began in 1989. Several methods were used to propagate this rootstock. In 1995 and 1996, experiments with the 'Hansen 536' and a newer experimental hybrid were conducted. Cuttings of each clone were either planted directly in the field, after a basal dip of rooting hormone, or placed in the greenhouse for rooting. The objective of this study was to obtain commercial levels of production of 'Hansen 536' and 1-82 peach/almond hybrids equal to or greater than that of the commercially propagated plum rootstocks, 'Marianna 2624' and 'Myrobaln 29C'.

Several problems were encountered when 'Hansen 536' and the 1-82 hybrid were placed in the standard plum propagation system. First, the cuttings that did not root in the field rotted and died. Second, by planting a field of 'Hansen 536' and having several die, there was suddenly an inefficient use of space. The solution to these problems is the main thrust of this project.

Propagation of plum rootstocks ('Marianna 2624' and 'Myrobaln 29C') consisted of taking 16-in.-long cuttings from mother plants maintained in a "bush" form. The reason for this form of mother plant was for ease of collection and the ability to make a close planting similar to a hedge row. These cuttings are taken in November right at or after leaf fall. If necessary, the leaves were removed and the cuttings were bundled in units of 100. The base of the bundles were cut off with a band saw to make a fresh, uniform cut. The bundles were then placed in a 1-in.-deep solution of 1H-indole-3-butyric acid (IBA) at about 100 ppm. Each bundle of plum rootstocks was held in the solution for 24 h. At the end of the 24-h soak, the bundles were placed upside down in a 3 ft<sup>3</sup> wooden bin and filled with moist sawdust so all of the bundles were covered. The bundles of cuttings were stored this way until the field was ready for planting. The bundles were then taken to the field in mid-November and the individual cuttings were planted in raised beds at a spacing of 5 to 7 in. apart and about 6 to 8 in. deep. The cuttings were firmly packed into the raised beds and watered in. Usually, winter rains provide sufficient moisture for the cuttings but occasional irrigation applications may be necessary if the winter is unusually dry. The cuttings will stay dormant in the field until early spring, about mid-February, when the buds swell and the cuttings begin to grow.

Following this same procedure for the 'Hansen 536' peach/almond hybrid, 23,145 16-in.-long cuttings were cut from 'Hansen 536' mother plants on 14 Nov. 1994. These mother plants were maintained in much the same way as the plum mother plants (bush type). The source of 'Hansen 536' mother plants came from trees that were budded onto certified 'Nemaguard' peach in the spring of 1993. The 'Hansen 536' budwood that was used in 1993 came from the Foundation Plant Material Service in Davis as certified budwood.

The 'Hansen 536' cuttings were divided into small-, medium-, and large-caliper sizes. All of the cuttings were dipped in 4000 ppm IBA for 10 sec. The cuttings were planted in the field on 19 Nov. 1994. The cuttings were not callused when they were planted. The soil was a very light, sandy loam with good drainage.

On 20 Dec. 1994, one month after planting, several 'Hansen 536' cuttings had callused. Two months after planting, over 80% of the cuttings had callused. By the Spring of 1995, very few cuttings leafed out and less than half survived (Table 1).



**Table 1.** Propagation of hardwood 'Hansen 536' cuttings in 1994-95. Direct planting in nursery row.

'Hansen 536'	Number cut	IBA in ppm	Date cut	Date planted	Survival	Survival (%)
Small	18,610	4000	11/14/94	11/19/94	6141	33
Medium	2838	4000	11/14/94	11/19/94	1050	37
Large	1697	4000	11/14/94	11/19/94	670	39
Total	23,145				7861	34

During that same time, 100 1-82 peach/almond hybrids and 500 'Marianna 2624' were planted in the same field. The 1-82 hybrids and the 'Marianna 2624' were treated the same as the 'Hansen 536'. The 1-82 hybrids and the 'Marianna 2624' were planted on 19 Nov. 1994 and carefully watched during the winter and the following spring.

On 23 Jan. 1995, 67,200 'Hansen 536' were cut from the same mother plants as before. These Hansen were cut to 8 in. long and dipped for 10 sec in 4000 ppm IBA in 50% alcohol. The cuttings were then taken to a greenhouse on 4 Feb. 1995 where they were put into small, individual plugs measuring about 2 in. wide and 4 in. deep. These plugs were then placed in styrofoam trays of 200 cuttings per tray and placed on a bench with bottom heat and overhead mist. The mist came on for 5 sec every 15 min and the bottom heat was maintained between 75 to 78F. After about 10 days, callusing was noted around the base of the cuttings.

On 3 April 1995, 13,070 cuttings had rooted. These cuttings were then taken to the field on 16 April 1995 and planted. Out of the original 13,070 cuttings that had rooted, 9862 survived in the field (Table 2).

**Table 2.** Propagation 1994-95 greenhouse grown 'Hansen 536' peach/almond hybrid.

Date cut	Number cut	Date to greenhouse	Date rooted	Number rooted	Rooted (%)	Date planted	Number survived	Survived (%)
1/23/95	67,200	2/4/95	4/3/95	13,070	19.4	4/6/95	9862	75

In Nov. 1995 another test was conducted with 'Hansen 536' and 1-82 hybrid. Sixteen-inch-long cuttings were taken from mother trees of 'Hansen 536' and 1-82. A total of 250 'Hansen 536' and 500 1-82 were cut on 1 Dec. and dipped in 4000 ppm IBA for 10 sec. The cuttings were then planted in the field on 9 Dec. along with plum cuttings of 'Marianna 2624'. Small plastic "jackets" were placed around 150 of the 'Hansen 536' cuttings. These jackets were a white, thin sleeve of plastic about 2 in. in diameter and 12 in. long. The jackets were open on both ends so they were able to be slipped over the top of the cuttings. The cuttings remained in the field all winter and were scored for survival in the spring.

On 28 Nov. 1995, 106,800 8-in.-long cuttings of 'Hansen 536' were cut from the

same 'Hansen 536' mother plants as in 1994. The cuttings were bundled into bunches of 100 and then dipped for ten sec. into a 4000 ppm IBA solution. These cuttings were placed upside-down in a 3 ft<sup>3</sup> wooden bin and covered with moist sawdust. The wooden bins of cuttings were then taken to a greenhouse on 1 Dec. At the greenhouse, the bundles were cut open and each cutting was placed in an individual growing plug. The plugs were then placed in a styrofoam tray that held 200 plugs per tray. These were the same plugs and trays that were used the previous year. The trays were placed under a mist system in the greenhouse and misted for 5 sec every 15 min. The trays of cuttings were on benches that had bottom heat supplied to them by hot water pipes. The temperature of the benches measured between 75 to 78 F. After 30 days, rooting was noted in the growing plugs on the base of the cuttings.

On 16 Jan. 1996, 10,890 of the 106,800 cuttings (10.2%) had rooted and were taken to the field and planted. This same procedure was repeated for 'Hansen 536' cuttings on 28 Dec., 15 Jan., and 1 Feb. The layout and results of the experiment are detailed in Table 3.

**Table 3.** Layout and results of 1995-96 hardwood propagation of two peach/almond hybrid rootstocks.

Rootstock	Date cut	IBA	Number cut	Date to greenhouse	Date to field	No. planted	Planted (%)
'Hansen 536'	11/28/95	4000 ppm	106800	12/1/95	1/16/96	10890	10.2
1-82 Hybrid	11/28/95	4000 ppm	1400	12/1/95	1/16/96	186	13.3
'Hansen 536'	12/28/95	4000 ppm	99250	1/2/96	4/10/96	2142	2.2
'Hansen 536'	12/28/95	4000 ppm	2100	1/9/96	4/10/96	203	9.7
'Hansen 536'	1/15/96	4000 ppm	65000	1/16/96	4/10/96	7200	11.1
'Hansen 536'	2/1/96	4000 ppm	53000	2/26/96	4/10/96	4898	9.2

A comparison between the two propagation tests in 1994 revealed that 7861 (34%) of the 'Hansen 536' cuttings had survived out of 23,145 original cuttings that were planted directly to the field in November of 1994. The results of the 'Hansen 536' that were rooted in the greenhouse before planting revealed 13,070 (20%) of the cuttings rooted out of the 67,200 originally cut.

Out of the 100 1-82 hybrids that were planted directly to the field in November of 1994, 20 cuttings (20%) survived.

In 1995, of the 500 1-82 hybrid cuttings that were directly planted in the field on 9 Dec. 246 survived (49.2%). Of the 250 'Hansen 536' cuttings that were directly planted in the field on 9 Dec. 1995, 148 survived (59.2%). Of the 150 'Hansen 536' cuttings that were planted with the plastic sleeve, 148 survived (98%).

In 1995-96, 326,150 'Hansen 536' cuttings were taken to the greenhouse to root. Out of that, 27,130 cuttings rooted (8.3%) (Table 4).



**Table 4.** Results of the 1995-96 'Hansen 536' hardwood rooting trial in a greenhouse.

Date cut	Number cut	Number planted	Percent planted
11/28/95	106,800	10,890	10.2
12/28/95	101,350	4142	4.1
1/15/96	65,000	7200	11.1
2/1/96	53,000	4898	9.2
Total	326,150	27,130	8.3

Reighard et al. (1990) suggested that hardwood cuttings are a potential means to propagate *Prunus* selections. The commercial availabilities of 'Marianna 2624' and 'Myrobaln 29C' plum are examples of successful hardwood propagation in a commercial nursery.

This was the first greenhouse propagation test on a large commercial scale of peach/almond hybrid rootstocks. It is possible to achieve at least 30% rooting by directly planting peach/almond hybrids in the field (Hansen and Hartmann, 1968). For commercial purposes and cost of production in a commercial nursery, 30% survival is not adequate. Thus, cuttings of 'Hansen 536' were taken to the greenhouse to root before they were planted in the field. In 1994-95, 19.4% of the cuttings taken to the greenhouse rooted. Out of that, 9,862 cuttings (75%) were planted to the field. This might sound like a very low number, but the benefit to transplanting only rooted cuttings is that the nursery field is 75% utilized compared to 30% utilization of the field that is directly planted in the fall. The loss of cuttings occurs in the greenhouse before they are planted, not in the field.

**Table 5.** Percent survival of 1995-96 'Hansen 536' cut on different dates and rooted in the greenhouse.

Date cut	Percent survival
11/28/95	10.2
12/28/95	4.1
1/15/96	11.1
2/1/96	9.2

Greenhouse grown 'Hansen 536' in 1995-96 produced 27,130 rooted cuttings out of 326,150 (8.3%). It didn't seem to matter when the cuttings were taken to the greenhouse.

When the rooted cuttings of 'Hansen 536' were planted in the field in April 1995, 75% of the cuttings survived. In 1996, cuttings were planted on Jan. 16 and only 10% of them survived. 'Hansen 536' cuttings planted in April of 1996 had over a 20% survival in the field.

It was noted that the rooting and survival percentages for 'Hansen 536' grown in

the greenhouse in 1996 were lower than that of field grown 'Hansen 536' the same year (8.3% rooting in the greenhouse compared to 59% rooting for those directly planted in the field). However, many environmental factors need to be taken into consideration when working with hardwood cuttings of *Prunus* in the field. The goal of this continuing research is to help eliminate some of the variables encountered in this preliminary study and to create a propagation system for difficult-to-root *Prunus* species that would be as successful as the system used for commercially propagated plum rootstock.

#### LITERATURE CITED

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