

# PEAR DECLINE RESEARCH—

## Methods of Propagating Own-rooted Old Home and Bartlett Pears to Produce Trees Resistant to Decline

H. T. HARTMANN · W. H. GRIGGS · C. J. HANSEN

Own-rooted Bartlett pear trees and Bartlett on own-rooted Old Home rootstocks are resistant to pear decline, according to observations in Washington, Oregon, and California. These trees are also vigorous and productive. Bartlett pear, top-budded onto own-rooted Old Home stock, has the additional advantage of blight resistance in roots, trunk, and primary scaffold branches. Practical methods now available for propagating such decline-resistant and blight-resistant trees are discussed in this research report.

**S**TUDIES in the propagation of hardwood Old Home pear cuttings have been underway since 1957 and the methods used were described in detail in *California Agriculture*, October, 1961. Work has continued toward increasing the rooting percentage of the cuttings. Best rooting at Davis was obtained when cuttings were taken early in the season. A high of 72 per cent rooting was obtained with cuttings taken on October 26 as compared to complete rooting failure with cuttings taken in mid-January.

In using this method, hardwood cuttings of the previous season's growth were taken in mid-to-late October and bases were soaked in indolebutyric acid (IBA) at 200 parts per million for 24 hours. Cuttings were then stored in slightly moist peat moss for about 3 weeks (or until the first evidence of roots) before planting in the nursery. Better rooting obtained by taking the cuttings early (in October), followed by early planting (in November), probably can be attributed to the relatively high soil temperatures at that time of year, which permit some root development before the onset of lower soil temperatures later in the winter.

Applications of IBA by the concentrated-solution-dip method were as effective as the 24-hour soaking method according to 1961-62 tests. The best concentration used in these tests was 2,000 parts per million (prepared by dissolving a level  $\frac{1}{4}$  teaspoon of indolebutyric acid into  $6\frac{2}{3}$  fluid ounces of 50 per cent alco-

hol). The bases of the cuttings are dipped into this solution for about five seconds. In selecting material for Old Home cuttings, it is very important to obtain stock free of pear bark measles.

Cuttings of Bartlett pear have proven to be more difficult to root than those of Old Home. Leafy, soft-wood cuttings can be rooted under intermittent water mist sprays but the simplest method is rooting of hardwood cuttings in the nursery.

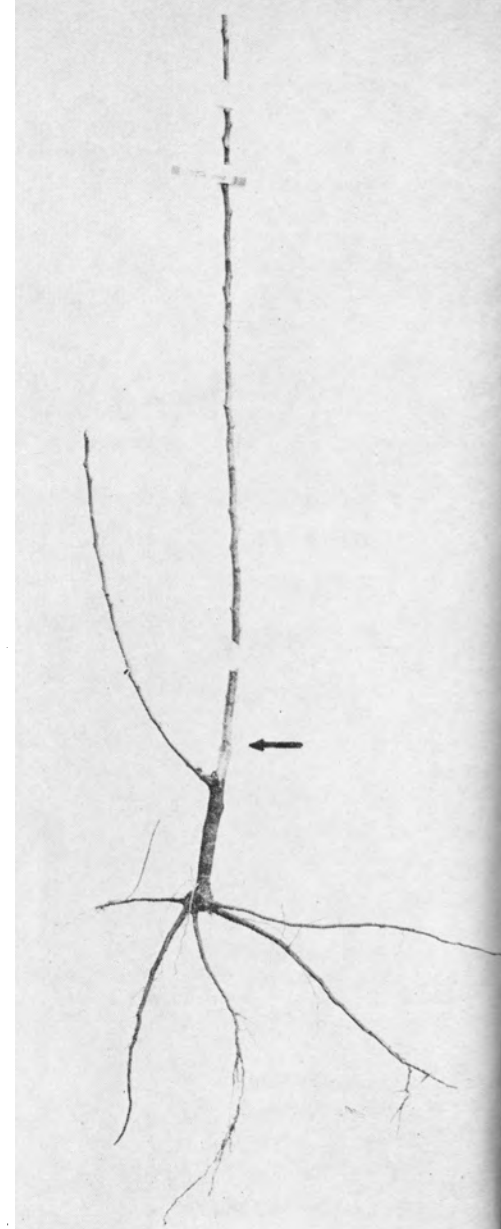
Rooting trials with softwood cuttings under intermittent mist were started in May, 1962. The table compares the use of stock material obtained from greenhouse-forced, container-grown trees with that obtained from orchard trees. Although better rooting took place when greenhouse cutting material was used, this method would be very costly for large-scale commercial propagation. Obtaining the cutting material from orchard trees would be more economical even though the rooting percentages are lower. Survival following rooting was about 60 per cent in these tests. This involved transferring the rooted cuttings into 4-inch peat pots, removal to a hardening-off mist bed (intermittent mist on 15 minutes of each hour during the day) for about 10 days, then potting into gallon containers filled with a sandy soil-peat moss mix-

ROOTING OF BARTLETT PEAR SOFTWOOD CUTTINGS UNDER INTERMITTENT MIST IN THE GREENHOUSE. CUTTINGS MADE MAY 16, 1962. BASES OF ALL CUTTINGS DIPPED FOR 5 SECONDS IN INDOLEBUTYRIC ACID AT CONCENTRATIONS GIVEN

Treatments	Per cent rooted		Aver. No. of roots per rooted cutting		Average root length	
	1 <sub>A</sub>	2 <sub>B</sub>	1 <sub>A</sub>	2 <sub>B</sub>	1 <sub>A</sub>	2 <sub>B</sub>
Rooting medium: Sponge Rok & vermiculite						
IBA, 8000 ppm.	10.0	5.6	7.0	3.7	1.1	2.1
Rooting medium: Sponge Rok & peat moss						
IBA, 4000 ppm.	35.0	2.2	5.4	4.0	4.3	1.5
IBA, 8000	70.0	12.2	9.3	7.8	1.7	1.7
IBA, 10,000	80.0	33.3	8.1	8.4	2.2	2.0
Difference required for significance						
—at 5% level—10.1						
—at 1% level—14.1						

1<sub>A</sub> Cuttings taken from Bartlett nursery trees forced in the greenhouse in 6 gal. containers, 30 cuttings per treatment.

2<sub>B</sub> Cuttings taken from 6-year-old Bartlett orchard trees. Three replicates of 30 cuttings each.



Typical Bartlett pear nursery tree propagated by hardwood cuttings after 12 months in the nursery. Distance from the bottom of the cutting to the arrow represents the length of the original cutting—about 8 inches.

ture. A 1:1 mixture of perlite and peat moss as the rooting medium gave better results than a 1:1 mixture of perlite and vermiculite.

Cool air temperatures are very important in rooting Bartlett pear leafy cuttings under mist. Extensive tests conducted in late spring and early summer of 1961 in partially shaded out-of-door mist beds gave quite unsatisfactory results. Although about 45 per cent rooting was obtained, a physiological breakdown of the leaves took place just as the roots became well formed and none of the cuttings survived. Abnormally high air temperatures existed during the test period, however, with 30 days of temperatures over 100° F being recorded. Similar trials conducted

during the same time of year in 1962, but in an air-conditioned greenhouse with lower air temperatures, gave much better results.

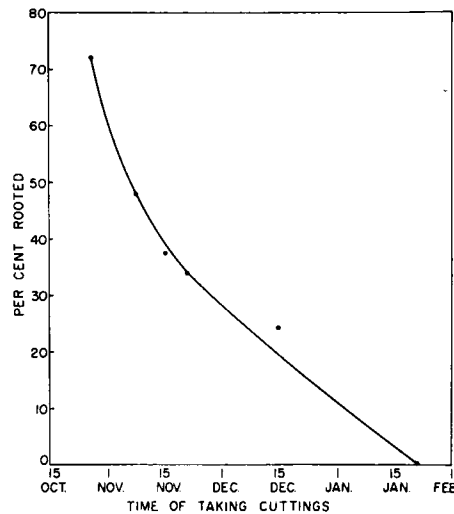
Propagation of own-rooted Bartlett pear by hardwood cuttings is a much simpler method than rooting leafy cuttings under mist and is much more likely to be adopted by nurserymen as a commercial procedure. However, the procedures mentioned above for rooting Old Home cuttings were not successful with Bartlett.

After trying numerous techniques used for rooting cuttings of "difficult" plants, the procedure described below resulted in rooting of 47 per cent of the Bartlett cuttings planted. These rooted cuttings

**ROOTING OF BARTLETT PEAR HARDWOOD CUTTINGS, STORED FOR THREE WEEKS OVER BOTTOM HEAT BUT WITH TOPS EXPOSED TO OUT-OF-DOORS WINTER TEMPERATURES. CUTTINGS TAKEN NOVEMBER 20, 1961. THREE REPLICATES OF 25 CUTTINGS EACH**

Treatment	Bottom heat temperature	Planting date	Percentage of cuttings which produced vigorous nursery trees
IBA, 100	55° F	Jan. 5	9.3
IBA, 150	55°	"	10.6
IBA, 200	55°	"	30.7
IBA, 150	65°	"	28.0
IBA, 150	75°	Dec. 20	46.7
Difference required for significance—5% level—6.5			
—1% level—9.5			

Bartlett pear softwood cuttings rooted under intermittent mist in the greenhouse. Cuttings were taken May 16 and treated for 5 seconds with indolebutyric acid at 10,000 ppm. Cuttings to left were taken from orchard trees. Cuttings on right were from greenhouse-forced container-grown trees. Rule is 6" long. Cuttings were dug July 2, 1962.



**Relation of time of taking Old Home hardwood cuttings to per cent rooting obtained. All cuttings were treated with indolebutyric acid at 100 ppm, followed by storage for 3 weeks at 70° F in moist peat moss before planting.**

also produced strong nursery trees large enough to plant directly into the orchard, thereby producing a pear nursery tree in 12 months.

### Rooting procedure

Bartlett cuttings 8 inches in length and  $\frac{1}{4}$  to  $\frac{5}{16}$  inch in diameter, from the previous summer's growth, were made in

mid-November. The bases of these cuttings were soaked for 24 hours in a 150 part per million solution of indolebutyric acid ( $\frac{1}{4}$  teaspoon IBA dissolved in a small amount of alcohol then added to 3 quarts of water). The cuttings were then set upright in orchard lug boxes three-fourths filled with slightly moist peat moss so that the lower two-thirds of the cuttings were in the peat moss and the upper one-third was exposed to the air.

These boxes were then placed in a bed with bottom heat supplied by thermostatically controlled hot water heating pipes so that a temperature of 75° F was maintained at the base of the cuttings. (Experimentally, two lower levels were also used—65° and 55° F but with poorer results.) The cuttings at 75° F bottom heat were maintained under these conditions for 31 days (from November 20 to December 20, 1961)—during which time the mean maximum out-of-door temperature at Davis was 53° F and the mean minimum was 38° F.

At the end of this period there was evidence of roots appearing at the base of the cuttings. The cuttings were removed and planted leaving one inch exposed. Planting was done by placing the cuttings in a trench dug into previously roto-tilled soil and carefully pulling the loose soil in around them so as not to disturb the tissues at the base of the cuttings. It is important to get cuttings planted before any appreciable root growth starts. During inclement weather they can be held for a short time in cold storage at 35° to 40° F which will retard root development.

In rooting Bartlett hardwood cuttings it seems important to obtain some chilling of the buds while maintaining the base of the cuttings at a sufficiently high temperature level to stimulate development of adventitious root initials. Holding the entire cutting at a warm temperature of about 70° F after treatment with IBA (which gives good rooting with Old Home pears) is ineffective with Bartlett. As shown in the table on hardwood cuttings, in the series held over 55° F bottom heat, IBA at 200 ppm was much more effective than 100 or 150 ppm. Likewise, 75° F bottom heat was better than 55° or 65° F. It seems probable, therefore, that using IBA at 200 ppm and bottom heat at 75° F would give good results in rooting Bartlett hardwood cuttings.

*Hudson T. Hartmann is Professor of Pomology; William H. Griggs is Professor of Pomology, and Carl J. Hansen is Professor of Pomology, University of California, Davis.*