

They had roots of Old Home and they had roots of the original seedling; where trees were well-rooted above the union there appeared to be a tolerance to this disorder, pear decline. The trees were healthy, where those — in many cases — on susceptible rootstocks, where no rooting of the Old Home had occurred, the trees were dying. That leads us then to the topic of how to get production of rooted cuttings or vegetative propagation of a rootstock which is highly resistant to pear decline and which also has other desirable characteristics.

### PROPAGATION OF HARDWOOD PEAR CUTTINGS

M. N. WESTWOOD, *Oregon State University, Corvallis*  
and  
LYLE A. BROOKS, *Daybreak Nursery*  
*Forest Grove, Oregon*

Old Home pear (*Pyrus communis*) has been used for about 40 years as a blight-resistant trunkstock and as a compatible interstock for quince. If the graft-union is placed below ground, the Old Home stem will root above the union. Such trees, with a predominance of Old Home scion roots, are resistant to pear decline disease, a disorder which causes tissue injury at the union when the rootstock is a susceptible type. Seedlings of domestic and imported French pear (*P. communis*) and those of *P. calleryana* are more or less resistant to decline. However, 10 to 20 percent of the seedlings will be susceptible and are thus unsatisfactory. Trees propagated on self-rooted Old Home or self-rooted varieties do not develop decline and are thus superior in that respect.

In 1958, Dr. H. T. Hartmann and Prof. C. J. Hansen at the University of California, Davis, reported that cuttings of Old Home rooted quite well if taken in November, the bases soaked 24 hours in 200 ppm indolebutyric acid (IBA), callused in moist peat for 4 weeks at 65° F., then planted immediately in the nursery. But, if after callusing, the cuttings were stored for 10 weeks at 40° F. before planting, only about 1/3 as many survived. Further work by Hartmann and co-workers indicated that late October was the best time to collect Old Home cuttings for rooting, and that 100 ppm IBA soak was better than 200 ppm.

Extensive tests have been made in Oregon during the past 4 seasons to determine the best methods for rooting hardwood pear cuttings under Oregon conditions.

In addition to work done with Old Home, one of us (Lyle Brooks) has, for 8 years, rooted hardwood cuttings of Old Home x Farmingdale seedlings on a commercial basis. Such cuttings are much easier to root than Old Home, but in general, the same treatments can be used for both types. We have rooted Bartlett, Anjou, Bosc, and Seckel pear by the same methods, but generally only about 15 to 30 percent of them rooted. At this time we do

not feel that these varieties can be rooted in commercial quantities by the methods outlined below for Old Home and other easy-to-root types.

## EXPERIMENTAL PROPAGATION OF OLD HOME PEAR AT O.S.U.

### *Type of Cuttings*

The condition of the mother trees prior to taking the cuttings is important. The following factors were found to enhance rooting:

1. Use of non-fruiting mother trees.
2. Use of quince-rooted mother trees.
3. Ringing trunks or leaders of mother trees with a single knife cut in August.
4. Use of mature shoots of about  $\frac{1}{4}$  inch diameter in which terminal buds have set prior to the time cuttings are taken. (Very large cuttings root poorly.)
5. Use of horizontally-growing shoots in preference to upright ones.
6. Use of shoots devoid of flower buds.
7. Use of juvenile mother plants.

### *Time of Taking Cuttings*

Cuttings can be taken any time from late October to November 15th in Oregon. Leaves may not have fallen, but they can be stripped off. Cuttings should be placed in cold storage at about 35° F. and kept moist until one gets time to treat them with IBA. The IBA treatment should not be delayed more than a week after the cuttings are taken from the field.

### *Treatment of Cuttings*

1. Cut shoots into 6 to 8 inch lengths just before treating with IBA. Better results are obtained by sawing the cuttings rather than using pruning clippers. A small circular power saw works very well.
2. Soak the basal ends of cuttings for 24 hours in a 200 ppm IBA solution, made by dissolving 750 milligrams of IBA in a small amount of ethyl alcohol, then diluting it to one gallon with water.
3. After cuttings are removed from the IBA soak, place them in moist (not wet) peat or sphagnum moss and hold at 65°-70° F. for about 3 weeks. Do not allow roots to elongate during this callusing period.
4. When cuttings are well-callused and showing an occasional small root, either plant them directly in well-prepared nursery rows or rooting beds, or store them in moist peat or sphagnum at 35° - 37° F. until February or March and then plant them. We have rooted 65 to 85% of cuttings in the spring following this post-callusing storage.
5. Cuttings should be planted carefully so as not to injure the callused bases. Plant them with two buds above ground. Keep soil moist (but not wet).



### *General Comments*

As noted later, one of the big problems in callusing or storage of cuttings is infection of the bases with mold. Once started, it spreads rapidly in the container. For that reason, it is best to place the cuttings in several containers rather than all in one large one.

Moisture loss from cuttings may reduce the percentage survival. We have found that dipping the cuttings in "Wilt-Purf" (polyvinyl chloride) just after the IBA dries, increases the survival rate.

A quick-dip of 5 seconds in high concentration IBA in 50% alcohol has not been as satisfactory as the 24-hour soak of 200 ppm. If a quick-dip is used, it should be at 2,000 ppm. Results were very poor in 1963 when we used a quick-dip of 1,000 ppm IBA. (See Table 1.)

Partial shading of the rooting beds until mid-summer may aid in survival of cuttings, but is not a necessity under the relatively cool summers in the Willamette Valley of Oregon.

As long as the cuttings are mature and about pencil size, it is unnecessary to girdle mother trees or use quince root although both practices increase rooting.

## COMMERCIAL PROPAGATION OF OLD HOME X FARMINGDALE PEAR AT DAYBREAK NURSERY

First, let's say the Willamette Valley probably is a poor location for open field planting of hardwood cuttings because it is subject to a wide range of weather conditions during the months of February through May. Rainfall, changing soil conditions, and off-season heat waves can raise havoc with a well-planned planting venture. To be successful in rooting cuttings on a commercial basis, where a competitive price limit is involved, production costs show that it is necessary to obtain over a 50% stand of saleable plants. One should have 70%. Survival of Old Home x Farmingdale (OH x F), in the better years, has been around 65%, and down to 30% when weather conditions delayed planting until May.

### *Type of Cuttings*

To obtain a high percentage of rooting, one must have an ample supply of cutting wood available. Medium-sized cuttings, around pencil size, are best. Large sizes ( $\frac{3}{8}$ " up), which are usually from vertical terminal growth, should be discarded. Small sizes, especially if from mature lateral side limbs, will grow quite well and should be used if large scale production is desired. These we grade as medium-small size, discarding all below  $\frac{3}{16}$ " diameter.

### *Method of Rooting*

Two distinctly different methods for rooting hardwood cuttings are being used. Either fall cuttings taken in late October, leaves stripped, and with a 24-hour soak using 100 or 200

ppm IBA, — or dormant cuttings taken in late January using the quick-dip, 5-second immersion, of 1,000 to 2,000 ppm (4 to 8 gm of IBA per gallon of 50% alcohol). All OH x F cuttings rooted to date have been with the quick-dip method. Old Home cuttings tried with quick-dip in Oregon, both in October and in January have resulted in only 10 to 15% survival of poorly-rooted plants. It is quite likely that OH x F, using the full 24-hour soak, could be rooted up to 90%. Such a test will be run this fall (1963). However, OH x F, being in a juvenile state, will develop spur thorns on the lower section of the limb, which is the most desirable for cuttings. Weaker-growing limbs will spur almost the entire length. Since leaves cannot be stripped, it would be necessary to pick them off one at a time. Thorn removal is a necessary procedure, and in doing so, one must not injure the two dormant buds on each side. This will result in wounding the cutting and allow slow dehydration during the 3 to 5-months storage necessary here in the Northwest, unless steps are taken to seal off the wound. Dipping the two top buds in "Wilt-Pruf" will seal off the top of the cutting along with the two buds that are normally exposed after planting.

#### *Length of Cutting*

Here again, one has to decide what is best for each variety. Old Home, which does not grow spur thorns, and produces new growth on the cuttings which has the tendency to grow out on 45° angle, should be cut to 8 to 10 inches long. This will allow space for the fruiting variety bud to be set below the top growth in the nursery row after transplanting. OH x F will produce upright top growth, and since spur thorns develop at each bud, we find it difficult to bud into the original cutting scion. We have gradually reduced the length of cutting to 5½ inches. This type of plant will allow budding into new top growth.

This short cutting will have less food storage and could result in a lower percentage of rooting. This we have been unable to determine, since, over a period of 8 years, our percentage of rooting has never twice been the same. Also, short cuttings usually produce only one bud shoot and could result in root development on only one side of the cutting, especially with hard-to-root varieties, such as Old Home. With OH x F this has not been too much of a problem. Losses from these one-sided cripples has not exceeded 5 to 7%. Longer cuttings, where 2 or 3 bud shoots develop, could eliminate this loss, but again the greater the number of shoots the sooner the cutting would develop water stress, unless weather conditions were favorable for early rooting.

### COMMERCIAL ROOTING OF OLD HOME PEAR AT DAYBREAK NURSERY

Results of storage and rooting of Old Home hardwood cuttings (treated with IBA and callused at 70° F. in late October, 1962) are shown in Table 1.



Table 1 Rooting of Old Home pear cuttings on a commercial scale. (Cut in late October, treated with IBA, callused 3-4 weeks in November, stored over winter 34° to 38° F and planted March 13, 1963)

Kind of wood	Size <sup>1</sup>	IBA treatment	Number counted	Percent rooted
Mature	Medium	200 ppm-1 day	1900	78
Mature	Small	200 ppm-1 day	2350	55
Mature	Medium	1000 ppm-5 sec.	3300	15
Mature	Small	1000 ppm-5 sec.	960	10
Soft	Medium	200 ppm-1 day	1680	30
Soft	Small	200 ppm-1 day	3300	14
Soft	Small	1000 pmm-5 sec.	1950	3

<sup>1</sup>/Medium = pencil size (about 1/4 inch diameter)

Small = smaller than 1/4 but at least 3/16 inch diameter

No girdling of trees was done and no "Wilt Pruf" was used on this lot. Packing material used was sphagnum moss in the live state, direct from moss beds. After IBA treatment, cuttings were packed in crates, 2,000 per crate, standing in a vertical position with a layer of sphagnum under and over cuttings. Boxes were lined with polyethylene-coated paper. Post callusing storage temperature was from 34° to 38° F. Length of storage time was 3 1/2 months.

Of the 7 different treatments (Table 1) only 2 gave good enough rooting to be of commercial value. Mature, medium-sized cuttings rooted very well (78%) when treated with 200 ppm IBA, 1-day soak. Mature, small-sized cuttings rooted fairly (55%) with the similar IBA soak. Soft-wood cuttings, with active terminals and cuttings treated with a quick-dip of 1,000 ppm IBA, did not root well.

#### *Notes at Planting time*

Very little mold showed on mature wood. Nursery side limbs, in some cases, were badly infected, resulting in some bundles of 100 cuttings being entirely discarded. Others were opened and infected cuttings discarded. All material had been sprayed with Bordeaux 8-8-100 previous to being cut from the trees.

Wilt Pruf has not been used on Old Home cuttings. It has been used on OH x F and various plum cuttings and found to be beneficial in reducing mold infection. Complete immersion is not advisable. Dip the basal 1/2" and the top portion to the ground planting level. Allow to dry before packing. Callus action will break the seal and it *could be* beneficial to re-dip the basal end before over-winter storage with as little light exposure as possible. This experiment should be tried. Care should be taken in handling to avoid bruising the callus.

MODERATOR MELOTT: Thank you, Dr. Westwood. Are there any questions?

MR. DAN SCHMIDT: Would it be advisable to plant the cuttings directly in the nursery row so that they could be budded the same year.

DR. MEL WESTWOOD: We do that in research work because we like to gain all the time that we can. It is quite successful in our plots where we pay attention to what needs to be done and we force them along. We allow at least two sprouts to grow, though, so that the root system will be symmetrical and grow on both sides of the base. Where we don't do that, and the root system isn't well-formed it should be transplanted one season to form an acceptable nursery tree for the trade. We use the dogleg trees and that sort of thing in research because we know that it does not make any difference in the ultimate performance of the tree in the orchard.

VOICE: If you only have a 30% stand, then what? You would have a pretty bare field.

DR. MEL WESTWOOD: That is correct. That would be one of the risks. If one worked his system out so he knew how thickly to plant to get a stand and if one could predict the weather, he could probably do it. I think perhaps a satisfactory method would be, as Lyle Brooks has done, to plant the cuttings close together — two or three inches apart — in rooting beds, cover them with sawdust, or mulch them with sawdust and furnish partial shade during the first part of the summer. Then, by giving the cuttings fertilizer through the season and irrigating frequently, a good growth is obtained. Then the rooted cuttings are transplanted to the nursery. If the roots need a little trimming to get a good root system you can do that in the transfer.

MR. FRANK SMITH: Is there any difference between saw-cutting in making the cuttings and cutting them with pruning shears?

DR. MEL WESTWOOD: Cutting with a saw does less tearing damage to the bases and usually results in a more symmetrical, more well-balanced root system than when pruning shears are used. This is, I think, true in every test where we have made the comparison. Perhaps Dr. Hartmann or some of the others might have had some other experience.

DR. H. T. HARTMANN: We did make such a comparison one year — cutting with a power band saw versus cutting with pruning shears. The rooting percentage was just the same, but the saw was much faster in preparing the cuttings so that is what we have used since then.

DR. C. J. ALLEY: When you are callusing the hardwood cuttings in boxes to develop the root primordia do you ever experience any development of mold in these boxes?

DR. MEL WESTWOOD: Yes, I think that this is perhaps one of the things that anyone going into hardwood cutting propagation will very soon realize — that molds are there all the time.



The whole business is inoculated with mold spores. We find that mature wood will go through this callusing period much better than the softer wood. Many times the low percentage rooting of softer hardwood cuttings is the result of heavy infection of molds in the storage room, either in the callusing room or in the storage following, if one has to over-winter them in storage. So that one should probably put only a few hundred cuttings per box so that if mold should get started — and it spreads very rapidly from bundle to bundle, then you won't lose so many.

DR. C. J. ALLEY: Do you ever use any treatments to prevent the mold from developing on the cuttings?

DR. MEL WESTWOOD: No, we have not.

DR. H. T. HARTMANN: Development of mold on the cuttings during the callusing period is certainly a problem in this method of hardwood cutting propagation. This hazard can be greatly reduced by keeping the medium the cuttings are stored in — we use peat moss — just barely damp, just wet enough to keep the cuttings from drying out. Excessive moisture will most likely cause mold problems.

DR. C. J. ALLEY: On the girdling of your large leaders to get a harder type wood, is this a single ring, or is it a double ring that you use?

DR. MEL WESTWOOD: We use a single cut with a sharp, thin-bladed knife. We remove no bark and make no treatment of the wound. It heals quite quickly. That is, it forms callus. The callus later develops and differentiates into the conducting tissue so that a single cut appears to be satisfactory in our work.

MR. DAVID A. LAWYER: I would like to ask if you ever tried or thought of using etiolation as a means of preparing more favorable wood?

DR. MEL WESTWOOD: Of course, layerage is generally a matter of etiolation followed by rooting. That is where one covers the bases of the stems with sawdust or soil or some other thing that excludes the light. Lyle Brooks has done some of this with cuttings. The Old Home pear does not seem to root readily as layers, but it does etiolate well. He had fairly good success by taking these etiolated cuttings off the layering bed and treating them with hormones, just as he would the cuttings. He had better success initially than he did with the hardwood cuttings. This was with a different timing than we have now found to be the best for the Old Home cuttings.

MR. DAN BANA: In connection with pear decline, I have often heard that Old Home pear is susceptible to measles. Would you elaborate on that.

DR. MEL WESTWOOD: Well, I am not a plant pathologist and I don't want to get too deep into this subject. Old Home pear itself does not develop any bark measles condition, but in many cases Old Home, somehow or another, has picked up this

conditions, although it is latent and cannot be seen in the Old Home. When you graft Bartlett on top of infected Old Home then Measles show up in the Bartlett. This trouble causes poor growth, inadequate fruiting, etc. As I understand it, this is supposed to be a virus which the Old Home could carry and which affects the scion variety. Now we have propagated several hundred trees from what we call the parent tree — the original tree of Old Home from Medford which Frank Reimer made from the cuttings he got from Illinois. These rooted cuttings, having been top-worked to Bartlett, have never shown a measles condition. I don't know a single instance where one could say that it has. In some cases where Old Home has been on quince, either as a holding tree, in a scion block or budwood block, or whether they took their budwood from Old Home that had been on quince at one time or another, some of those trees of scion-rooted Old Home have developed the bark measles on the Bartlett tops.

MODERATOR MELOTT: To clarify this a little more, is it not true that this tree you referred to is known as "Talent Old Home"?

DR. MEL WESTWOOD: Yes, the Talent Agricultural Experiment Station, which is in a suburb of Medford, Oregon, is where the tree grew. It has now been moved to the new Station. It's quite a job to move a 46-year-old pear tree, but we moved it. It is growing now for the third season after moving, at the new Handley Farm at Medford. But it is the so-called "Talent" sources of Old Home pear.

MR. BILL CURTIS: I was just wondering why not wrap these individual bundles of cuttings in polyethylene then you wouldn't have any trouble with infection problems in bundling them up. Is it impractical because its too much trouble?

DR. MEL WESTWOOD: It can be done. We have kept the moisture around our cuttings by putting them in polyethylene in our small-lot research work. It is up to the nurserymen to decide whether this sort of thing is practical.

MR. IVAN ARNERSON: Just one comment about Myro 29-C and Marianna 2624 hardwood cuttings. We have been putting about 1000 or 1500 cuttings in polyethylene with a little fine shingle tow. They callus very nicely. They have no mold. The moisture content is very good. It's perfect for that.

MODERATOR MELOTT: Our next speaker is affectionately known here in Oregon as just plain "Al." Dr. Roberts from Oregon State University, Professor of Horticulture, is going to talk to us on the subject, Propagation of Cherry Rootstocks. Dr. Roberts!