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Choosing Pear Rootstocks for the Pacific Northwest

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When you establish a new pear orchard, the proper choice of rootstock is as important as the choice of variety and site. This is true because the rootstock is involved in determining two key factors: your variety's susceptibility to several serious diseases, and your tree's performance in your climate and on your orchard site.

The principal diseases of pear trees that are related to rootstocks are fire blight, pear decline, and *Pseudomonas* bacterial blight.

If the rootstock produces suckers, as many do, and if the suckers are susceptible to fire blight, the disease may enter the root system, where it is almost impossible to control.

Pear decline is a disease that causes a girdling of the tree at the graft union, which in turn causes a slow or rapid decline and death. Pear decline is transmitted by pear psylla, a common insect pest of pears. Most nurseries no longer use rootstocks susceptible to decline, so this disease is rare. (See Table 1 for susceptibility of pear rootstocks to specific problems.)

Rootstocks also vary in their tolerance of heavy soils and cold winter temperatures, their effect on tree vigor, and other factors. If a rootstock usually will be injured when the temperature falls slowly to -10°F, it's not considered cold-hardy enough for the mid-Columbia district and districts north of there. These same stocks may be injured at higher temperatures if the temperature falls from above freezing in a few hours.

The Hood River Valley is a major pear producing region of the Pacific Northwest. Climate and soil type vary from region to region and are only two of the many factors to consider when choosing pear rootstocks.

The better rootstocks provide important advantages such as earlier, heavier production than standard roots, which are considered to be Bartlett seedlings. (The majority of pear orchards are on this rootstock.)

Rootstocks that impart high vigor are needed for red pears and Asian pears, which tend to be low in vigor. Rootstocks that restrict vigor are needed for vigorous varieties like Comice and Anjou.

We can arbitrarily divide pear rootstocks into two classes: those propagated from seed, and the clonal selections propagated from cuttings. You'll find many good rootstocks in either class.

Here are the key questions to ask:

1. Is the rootstock tolerant of fire blight and pear decline?
2. Does it sucker?
3. What will be the ultimate tree size, based on the variety and site I choose?
4. Are the resulting trees uniform in size?

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Research on pear rootstocks began at Oregon State University more than 50 years ago and has progressed considerably in recent years. Out of this program have come pear rootstocks adapted to a wide variety of sites; they produce trees either larger or smaller than standard, and they're tolerant of pear decline and a number of other problems.

When you graft any tree on a rootstock that imparts especially desirable effects (such as growth control), plant it with the graft union above ground, to prevent scion rooting and the resultant loss of desirable characteristics.

European seedling types (*Pyrus communis*)

European seedling rootstocks (called "domestic seedlings") from Winter Nellis or Bartlett female parents are mostly tolerant of pear decline and cold-hardy, but they lack fire blight resistance.

The seed for the Winter Nellis or Bartlett rootstocks usually is obtained from canneries. Orchards with satisfactory uniformity and vigor have been developed on these seedlings. Some of the orchard trees with this root are weak and may have the slow form of pear decline.

P. communis types have performed poorly on heavy clay soil in Medford, Oregon, in a rotation following pears, compared with shallow-planted quince, *P. calleryana*, and *P. betulaefolia*.

Imported French and *P. caucasica* from Eastern Europe aren't suitable because they're susceptible to decline. Another seedling type from Germany, *Kirchensaller Mostbirne*, is satisfactory but has no advantage over domestic seedlings.

Trees on Nellis roots are slightly more vigorous than those on Bartlett seedlings, and they're similar in other ways. In addition to the items listed in Table 1, Bartlett and Winter Nellis seedlings are moderately susceptible to bacterial canker *(Pseudomonas)*, oak root fungus *(Armillaria)*, and fungal *(Phytophthora)* root rot.

Some have a tendency to produce suckers, which could become infected with fire blight. They're more susceptible to crown gall (bacterial) than other stocks.

Table 1.—Relative susceptibility of pear rootstocks to damage from various causes. (0=not susceptible; 4=highly susceptible)

	Cause				
Rootstock	Pear decline	Fire blight	Cold damage	Root aphid	Iron chlorosis
OHxF clones	0	1	0	1	1
Quince	0	3	4	0	3
Bartlett seedling	2	4	0	4	1
Winter Nellis seedling	1	4	0	4	1
Old Home	0	0	0	4	1
P. calleryana	2	0	4	0	3
P. betulaefolia (Reimer's)	0	0	4	0	1

Old Home x Farmingdale clones

Old Home x Farmingdale (OHxF) clonal rootstocks used by nurseries are decline-resistant, moderately fire blight-resistant, generally cold-hardy stocks that provide a range of tree sizes. The extent to which any of these stocks restricts tree size varies somewhat with site.

They're reproduced from cuttings off selected seedling trees whose parents were the two blight-resistant *P. communis* varieties, Old Home and Farmingdale (OHxF). They were selected for their resistance to blight, high productivity relative to tree size, and other characteristics. The vigor of each of these stocks usually is compared to the average Bartlett seedling as a standard.

Trees on Old Home x Farmingdale clone 51 are about 80 percent of standard (Bartlett seedling) size, depending on soil type. They're more dwarfing on heavy clay soils. They haven't been as productive as trees on the other OHxF clones mentioned. In British Columbia, they've shown an unsatisfactory degree of cold-hardiness.

Trees on 40 may be as small as on 51, but they're more productive. Trees on clones 69 and 217 are similar in size to 51 and slightly smaller than trees on 282 and 97, which produce trees of about standard size but are more precocious than Bartlett seedlings.

Trees on clone 333 have been healthy and productive in several locations, but they've been less productive than standard-sized trees at the Mid-Columbia Agricultural Research and Extension Center, Hood River, Oregon.

The Oregon nursery that has specialized in these stocks plans to use clones 40, 69, 217, and 282 for most varieties, and 277 or 97 for some slow-growing red pears and Asian pears.

All the major pear varieties are graft-compatible with Old Home x Farmingdale clones. These clones have performed less well on the unusually fine-textured clay soils in the Medford district. Most have performed well in other pear districts of the Pacific Northwest on lighter textured soils.

The clones recently selected for propagation in large quantities are cold-hardy, aren't prone to suckering or lime-induced chlorosis, and aren't unusually susceptible to fire blight or *Pseudomonas*.

Other pear species

Pyrus calleryana. Although it's resistant to fire blight, mostly tolerant of pear decline, and vigorous, this stock is cold-hardy only to about -10°F, depending on how quickly the temperature falls. It's used in regions that have warm winters.

Trees on seedlings from a pure source of *P. calleryana* have shown about 10 percent weak trees, which is similar to trees on Winter Nellis or Bartlett seedlings. These weak trees may be partially susceptible to pear decline disease. Because those seedlings that come from crosses with the highly decline-susceptible *P. serotina* or with *P. ussuriensis* are susceptible to pear decline, it's important to isolate nursery seed sources from those species.

Trees on *P. calleryana* are of about standard vigor; but in contrast to most vigorous stocks, they begin bearing at an early age. Fruit sizes generally are larger than on standard roots. The mature trees are slightly smaller than those on *P. communis* seedlings.

P. calleryana is resistant to oak root fungus, *Phytophthora* root rot, and crown gall. It tolerates wet soil better than OHxF stocks and as well as quince and Bartlett seedlings. It is subject to lime-induced chlorosis.

Seedling *P. calleryana* often is a good choice for any pear variety, but particularly for Comice, Bosc, and Seckel. Although there's little experience in this country with Asian pears on *P. calleryana,* they've been grown on it in China and Japan.

***Pyrus betulaefolia* ("betch").** "Betch" seedling rootstocks are tolerant of pear decline, more vigorous than standard, and at least moderately cold-hardy. They aren't resistant to fire blight. Because of the high vigor imparted, trees on "betch" may be more susceptible to fire blight.

Trees on "betch" tend to be slow to begin bearing. With pear varieties that tend to overset and to require extensive hand thinning, such as Bartlett and Seckel, "betch" may be the favored rootstock in some situations because trees on this stock produce larger-sized fruit.

Seedlings from trees of OSU selection Nos. 1, 2, 3, and 5 *P. betulaefolia* are true to type. The four OSU trees are from stock brought directly from China and are thought to be pure species types, not hybrids.

P. betulaefolia seed from most other sources appears to contain a mixture of hybrid types. These hybrids could introduce an undesirable degree of variability in the orchard trees and the "black end" physiological disorder of fruit. ("Black end" occurs with European pears on certain Oriental rootstocks, and it appears to be related to a rootstock's inability to supply enough calcium to the fruit.)

Confusion between true *P. betulaefolia* rootstock and seedlings that probably were hybrids of *P. serotina* x *P. betulaefolia* has led to the mistaken belief that fruit from trees on *P. betulaefolia* are susceptible to "hard end" or "black end." Isolate nursery seed sources at least 300 yards from other species of pear.

P. betulaefolia seedling rootstocks are more resistant to pear decline than any other seedling type. The trees are more vigorous than trees on *P. communis* seedlings, which makes *P. betulaefolia* a good choice where soils are heavy or poor, or in replant situations where low tree vigor may become a problem.

Although "betch" rootstocks might be good for red varieties where insufficient tree vigor is a problem, this hasn't yet been established. Red Comice or red Anjou on "betch" may be slow to begin producing. Since the fruit of Anjou grown on *P. betulaefolia* often has cork spot, grow Anjou on other stocks.

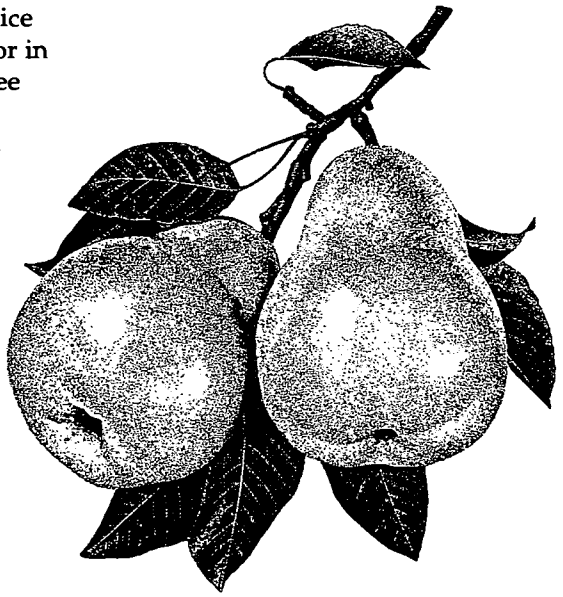
Because of the deep-rooting habit of *P. betulaefolia,* trees on this rootstock are more tolerant of drought but less tolerant of lime-induced chlorosis than most. They tolerate high water tables when the tree is dormant—but not high water tables that fluctuate during the growing season. *P. betulaefolia* is tolerant of bacterial canker and *Phytophthora* root rot.

Although not enough is known about the cold-hardiness of *P. betulaefolia* roots, they've been satisfactory for Bartlett at Othello, Washington, where -20°F temperatures during the 1968-1969 winter didn't damage the rootstocks' productivity. Seedlings of "betch" produced from hybrid seed, most of which comes from Europe, probably won't be as cold-hardy as the pure "betch" from northern China.

Quince rootstocks

Clonal quince stocks are used primarily in southern Oregon to provide growth control and earlier production for Comice.

Because it's not cold-hardy, quince is a satisfactory rootstock for pears only where winter injury isn't likely to occur. Comice, Rogue Red, Seckel, and Anjou can be worked directly on quince. The original Bartlett, Bosc, Forelle, Packhams Triumph, Winter Nellis, and Eldorado need a compatible interstock.



Bartlett on Old Home on quince has been larger than Bartlett on Hardy on quince—but less productive for the space occupied. Quality of Bartlett on Old Home on quince has been poor.

Hardy interstems may be preferred because of the susceptibility of Old Home to bacterial canker *(Pseudomonas)*. However, if shoots aren't allowed to grow on the interstem, there's no problem with *Pseudomonas*. Trees on EM quince A are about 50 percent as large as standard. On Provence quince BA29, they're 60 to 65 percent as large as standard.

French Bartlett (PI 241968) and Swiss Bartlett (PI 267940) are more compatible with quince, but they've not been as productive as Oregon (OP9) Bartlett. Compatibility with quince is best when rootstock and scion variety are free of known viruses. Incompatibility may develop when they're infected with virus. The length of interstem used as a compatibility bridge isn't important.

When you propagate Bartlett on quince, you could insert a thin piece of Old Home stem as a sandwich between the scion shield-bud and the quince stem. You can do this in a single operation, which saves both time and money.

Four clones of quince have been shown to be suitable for use in Oregon: virus-free East Malling Quince A, Provence quince, Lepage type C, and Provence type BA29. Other clones of quince may be available, but there's no assurance about their performance.

Trees on Quince A and Provence quince are about equal in productivity, but fruit size generally is larger on the latter. Because of their greater size and vigor, plant trees on Provence quince with wider spacing than trees on Quince A.

Provence quince is better than Quince A for small-fruited and high-yielding varieties such as Seckel and Bartlett. Quince A has been used extensively for Comice.

Trees on quince roots haven't performed well on some soils in the mid-Columbia region, especially in Hood River County, Oregon, and in Klikitat and Skamania counties, Washington.

Quince-rooted trees performed exceptionally well on one clay-adobe soil. They're more tolerant of "wet feet" than OHxF pear rootstocks. However, quince root does best in an open, well-drained soil.

Pears on quince roots are susceptible to lime-induced iron-deficiency chlorosis (yellowing), oak root fungus, verticillium wilt, and *Phytophthora* fungus infection. They often produce suckers, which are susceptible to fire blight, but they're moderately tolerant of bacterial canker.

Because quince root systems aren't as well anchored as pear, quince-rooted trees may require support on windy sites and those with sandy soil. All varieties that you graft directly on quince—except Comice—will need this support.

Rootstocks for Asian pear

Asian pear trees require rootstocks that impart a high state of vigor. No *Pyrus communis* rootstocks are vigorous enough for most Asian pears, with the possible exception of the most vigorous Old Home x Farmingdale clones.

Asian pears require vigorous rootstocks such as *Pyrus betulaefolia* or *P. calleryana*. Unfortunately, their cold-hardiness isn't well known. Since some Asian pear varieties will support the pear psylla that carries pear decline, it seems possible that trees on *P. ussuriensis* and *P. serotina* rootstocks may get decline.

However, if the scion variety reacts so strongly that it doesn't transmit the decline organism to the susceptible rootstock, the trees won't get decline.

Unacceptable rootstocks

For European pear, the Asian rootstocks *Pyrus serotina* and *P. ussuriensis* are unacceptable—they're very susceptible to pear decline. Few, if any, nurseries offer trees on these rootstocks.

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