

Rootstocks for Kentucky Fruit Trees

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Most fruit trees that can be grown in Kentucky do not come true from seed because they are open pollinated. For example, a tree grown from a Red Delicious apple seed will be an apple tree, but the fruit will have different characteristics than Red Delicious in color, taste, and shape. This is why fruit trees are reproduced by asexual propagation, such as budding and grafting. The desired cultivar, Red Delicious in the example above, is budded or grafted onto a rootstock, a close genetic relative suitable for the graft. Rootstocks are selected to impart special traits—including dwarfing, disease resistance, and insect resistance, to the desired cultivar.

This publication describes available rootstocks for apple, cherry, peach, pear, and plum trees suitable for Kentucky fruit tree growers.

Terminology

The entire grafted tree consists of the *scion* (e.g., Red Delicious apple) and the *rootstock* (e.g., B.9). In most nursery catalogs, it would be listed as Red Delicious/B.9.

Standard trees are characterized by the absence of any dwarfing influence on the scion. They usually have a seedling rootstock and are large, full-sized trees (some are known to be 30 feet tall).

Rootstocks can be grown from seeds (Lovell seedlings) or propagated asexually or clonally.

Certified disease-free or *virus-free* indicates that the parent rootstock and offspring were subjected to intense inspection and testing and are, as the name implies, certified to be disease-free or virus-free.

EMLA indicates a virus-free rootstock of the East Malling series.

Usually, the nursery grows the rootstock for one year before grafting or budding the scion to the rootstock. The trees are then grown for another year. However, June bud peach trees are trees grown from seed and budded in June of the planting year. They are then dug in the fall for sale and planting in the spring. Thus, the scion of a June bud tree is less than 1 year old.

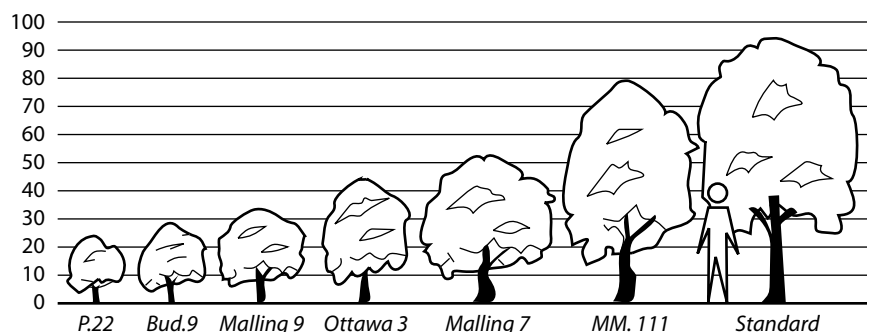
Clonal Rootstocks for Apple

Clonal rootstocks are highly recommended for the commercial apple grower and the backyard hobbyist. These rootstocks control tree size and cause the scion cultivar to begin bearing earlier and produce more heavily than trees on seedlings rootstocks (Figure 1). Rootstocks are listed in order of increasing mature tree size relative to the standard seedling.

Malling 27 (M.27)—Size 15% of standard, rarely suckers. Must be supported. Not recommended for commercial production in Kentucky because the tree is too small. Very early bearing and productive. Fruit size is reduced. Resistant to collar rot if planted in well-drained soils. Susceptible to fire blight and tomato ringspot virus. The rootstock is slow to harden off in the fall and is more susceptible to winter injury.

P.2 and P.22—From the breeding program in Poland. P.22 is 15 to 25% of standard. P.2 is 25 to 35% of standard. Trees on P.22 are less vigorous than trees on M.9. P.22 is resistant to collar rot and highly resistant to apple scab, powdery mildew, and crown gall. It is susceptible to woolly aphid and fire blight. Burrknobs and suckers are rare. P.22 has exceptional winter hardiness. Cropping efficiency of P.2 is similar to M.9. P.22 is recommended for commercial trial to replace M.27 but is considered to produce too small of a tree. P.2 is resistant to collar rot and crown gall but slightly susceptible to scab and mildew. Trees on either rootstock require a permanent trellis or post support. P.2 is recommended for commercial trial to replace M.9.

Figure 1. Comparative dwarfing by rootstocks for apples.



Budagovsky 9 (Bud.9 or B.9)—Size 20 to 30% of standard. Highly dwarfing rootstock. Compared to M.9, B.9 is more winter hardy, more resistant to dwarfing, fire blight, collar rot, and woolly aphids. Like M.9, trees on B.9 require a permanent trellis or post support. Burrknobs and suckers are rare. Graft union is smoother than that of M.9. B.9 promotes open scion growth and produces crops in two to three years with a yield efficiency comparable to M-9. Highly recommended as a dwarf rootstock in Kentucky.

Malling 9 T337 (M.9 T337, M.9 NAKBT337)—Size 25 to 35% of standard. Certified selection of M.9 tested by the General Netherlands Inspection Service for Woody Nursery Stock (NAKB) for viruses. Usually referred to in nursery catalogs as M.9 T337. It makes a dwarf tree that commences fruiting early and is productive for its size. Trees on M.9 NAKBT337 should be supported by a wire trellis or posts. The rootstock is susceptible to nematodes, woolly aphid, and fire blight but is resistant to Phytophthora root rot (crown or collar rot). Requires irrigation on sandy soils; responds well to mulching on most soils. Unusually attractive to mice. Suitable for high-density plantings. In Kentucky, M.9 T337 could be susceptible to winter injury like M.9 in extreme cold winters.

Mark (MAC.9)—Size 25 to 35% of standard. Mark rootstock has brittle roots that need support. It is hardy early on but susceptible to freeze injury in late winter. It works best in well-drained soils and is drought tolerant. It is moderately resistant to collar rot but susceptible to fire blight. It is also prone to abnormal swelling at the ground line that can stunt the growth of the tree. It is an early bearing and productive rootstock. Mark is susceptible to fire blight and woolly aphid. Serious burrknob problems have been encountered by some growers, especially in the South. More winter hardy than the Malling rootstocks. Kentucky has experienced difficulty with this rootstock, including loss of vigor of the tree, burrknobs, and brittle grafts. We do not recommend this rootstock in Kentucky.

Malling 9 (M.9L or M.9)—Size 30 to 40% of standard. Classical M.9 received from East Malling in 1931. Somewhat less dwarfing than M.9 NAKBT337 but otherwise similar. Infected with common latent viruses. A replacement clone was prepared at East Malling by heat treatment to eliminate the common latent virus. The rootstock is susceptible to nematodes, woolly aphid, and fire blight but is resistant to Phytophthora root rot (crown or collar rot). The replacement clone is designated EMLA 9. Shows winter injury occasionally in Kentucky.

Geneva 16 (G.16)—Size 30 to 40% of standard. It is highly sensitive to common latent viruses, and only virus-free scion wood may be used. It is tolerant to crown rot, immune to fire blight and scab. G.16 is nonbrittle and well anchored. Suckers and burrknobs are rare. Some union breakage at the graft union has been observed in one of our plantings.

Ottawa 3 (O.3)—Size 40 to 50% of standard. Very productive and early bearing. Susceptible to fire blight, woolly aphids, and

tomato ringspot virus but resistant to collar rot. It is sensitive to extremely acidic soils but is free of suckers and burrknobs. Support has not been required in Kentucky, possibly in early years due to poor rooting. Recommended for commercial trial.

Malling 26 (M.26)—Provides somewhat better anchorage than M.9, but staking or other support is recommended for all but the most compact varieties. Empire and similar cultivars fruit too early on M.26, and chemical fruit thinning should be used to prevent loss of leaders. Most varieties have been quite productive on M.26, but those especially susceptible to fire blight (such as Gala and Jonathan) should be avoided. Susceptible to fire blight, woolly aphid, and crown rot. Most tolerant of low winter temperatures of all the English rootstocks. Requires a well-drained, but not droughty, soil. Under Kentucky conditions, problems with fire blight and collar rot have severely limited sites and cultivars with which it can be used.

Geneva 11 (G.11)—Size 30-40% of standard. It is less attractive to woolly apple aphid than is M.26 and moderately resistant to both fire blight and collar rot. Precocious with a high yield efficiency. Seldom has burrknobs or suckers. Comparable in vigor to M.9.

Malling 7 (M.7)—Size 55 to 65% of standard. Performs best on deep, well-drained soil and is somewhat drought tolerant. While most trees on M.7 are self-supporting, staking for the first four to five years is suggested. M.7 should be used as a rootstock for Delicious and Idared on only the most favorable sites as it produces larger than desired trees. The virus-free clone of M.7 is EMLA 7 has exceptional winter hardiness and good anchorage.

Geneva 30 (G.30)—Size 55 to 65% of standard. Support is not required and suitable for vertical axis training. More precocious and more productive than M.7, with yield efficiencies three to five times better than M.7. Less prone to suckers and burrknobs. Resistant to crown rot and fire blight. Tends to have thorns that must be cut off before planting. Recommended for trial in Kentucky. Gala is not recommended on G.30 as the graft union is brittle and prone to breakage.

Malling-Merton 106 (MM.106)—Size 65 to 75% of standard. Consistently a highly productive rootstock, second only to M.9 in efficiency. Much better anchored and substantially more productive than trees on M.7, but it hardens off late in the fall and can be damaged by early freezes. Early bearing with few suckers. Its susceptibility to collar rot and early winter freeze restricts its usefulness in Kentucky. Resistant to woolly aphid. Should not be planted on sites that tend to have poorly drained soil. Trees of Red Delicious and some other varieties on MM.106 are susceptible to union necrosis and decline, caused by tomato ringspot virus.

Malling-Merton 111 (MM.111)—Size 80 to 85% of standard. Moderately slow bearing with medium productivity. More drought tolerant, somewhat better anchored, and slightly more productive than other rootstocks. Resistant to woolly aphid. MM.111 has been an outstanding rootstock for

Idared, spur-type Red Delicious, spur-type McIntosh, Jonathan and Rome Beauty. Best adapted clonal stock for survival in Kentucky, particularly on heavy soil. However, its large tree size is too large for most plantings.

Interstem M.9/MM.111—Made by interposing a 6- to 10-inch stem piece of M.9 between the MM.111 rootstock and the scion variety. Dwarfing effect of the M.9 interstem is less than if used directly as a rootstock. Staking can usually be avoided. More tolerant of drought than M.9 alone. Plant with soil level halfway up on the M.9 interstem.

Cherry Rootstocks

Mazzard—Standard rootstock for cherry. The preferred rootstock for both tart and sweet cherries in Kentucky.

Peach Rootstocks

Bailey—Survived better than Lovell and Halford in Illinois trials and yielded similarly to these rootstocks.

Citation—This dwarfing rootstock for peaches and plums is a complex peach x plum hybrid bred by Floyd Zaiger of California. Peach trees on Citation are about half of standard size; Redhaven/Citation have not performed well in two different trials in Kentucky. Not recommended. Patented.

Guardian—Nematode resistant. Used extensively in the South but has not survived well in Kentucky.

Halford—Peach seedling rootstock that performs similarly to Lovell in Kentucky.

Harrow Blood—Has not performed well in Kentucky.

Lovell—Peach seedling rootstock that has been outstanding in most NC-140 trials and survives well in Kentucky. Trees of peach and nectarine are available on this traditional *Prunus* rootstock. Most common peach rootstock in Kentucky.

Mariana 2624—Will produce a semidwarf tree 10 to 15 feet tall. It does well on wet soils and tolerates a variety of soils. It is compatible as a rootstock for plums and peaches.

St. Julian GF 655-2—Clonal rootstock for peaches and plums. Produces moderately vigorous, productive trees. Does well on heavy, wet soils. Resistance to *Phytophthora* and bacterial canker is fair.

Nemaguard—Chinese rootstock that induces late blooming and is being tested in the Southeast. It is Nematode-resistant rootstock that apparently is not winter hardy in Kentucky.

Pear Rootstocks

Old Home—Hardy, fire-blight-resistant cultivar primarily used as a rootstock, producing full-size trees.

OHxF 97—Vigorous, disease-resistant rootstock; sibling of OHxF 333. Bartlett and Bosc cultivars grafted on OHxF 97 have produced standard-size trees that are more productive and precocious than trees on seedling rootstock. OHxF 97 works well under ornamental pears and Asian pears.

OHxF 217—Like all other OHxF pear rootstocks. OHxF 217 is resistant to fire blight, *Phytophthora* root rot and woolly aphid. Its vigor appears to be between OHxF 333 and standard pear seedling. Suggested for trial.

OHxF 333—Size is 50 to 65% standard size. Semidwarfing pear rootstock recently introduced in Oregon. In limited tests at Geneva, Bartlett trees on OHxF 333 rootstock are about half standard size, while Bosc trees on OHxF 333 rootstock are about two-thirds standard size. Resistant to fire blight, collar rot, woolly pear aphid, and pear decline. Trees are productive, precocious, and well-anchored. Some report that fruit size is reduced. Does not dwarf Asian pear. We think OHxF 333 is worthy of commercial planting.

Pyrodwarf—A new rootstock which produces trees that are 50% of standard without reducing fruit size. A cross of Old Home and Bonnie Luise. Pyrodwarf is precocious, has moderate resistance to fire blight, and does not root sucker. Recommended for trial.

Quince A—Size is 45 to 55% of standard size. A semidwarfing pear rootstock selected in East Malling Station, England. Quince A is more vigorous but not as precocious as Quince C. Quince A is resistant to crown gall, mildew, nematodes, and pear decline. Quince A is susceptible to fire blight.

OHxF 513—Size is 60 to 65% of standard size. A semivigorous pear rootstock, resistant to fire blight, crown rot, woolly pear aphids, and pear decline. OHxF 513 is reported to be a precocious and well-anchored pear rootstock.

OHxF 87—Size is 60 to 65% of standard size. A semivigorous pear rootstock, resistant to fire blight, crown rot, woolly pear aphids, and pear decline. OHxF 87 is reported to be a precocious and well-anchored pear rootstock.

Plum Rootstocks

St. Julian GF 655-2—Clonal rootstock for peaches and plums. Produces moderately vigorous, productive trees. Does well on heavy, wet soils. Resistance to Phytophthora and bacterial canker is fair.

Myrobolan (Myro)—Standard-size rootstock. Produces a well-anchored tree and grows well on a wide range of soil types. Highly compatible with many cultivars. Suckers at the trunk base are common.

Marianna GF 8-1—Vigorous French rootstock somewhat more tolerant of poorly drained soils than Myrobolan. Tolerant of calcareous soils. Winter hardiness is questionable. Sensitive to common nematodes. Suggested for limited trial.

Table 1. Apple Rootstock Trial Summary at University of Kentucky Research and Education Center, Princeton, Ky.

Apple Rootstocks ¹	Cumulative Yield, 2001-2006 (lbs/tree)	Yield, 2006 (lbs/tree)	Area, Trunk Cross-section (sq. in.)
Dwarf			
CG.4031	511	55	17.0
CG.3041	494	20	11.1
G.16T	454	60	11.7
CG.5179	434	57	10.5
G.16N	417	46	11.6
CG.5202	390	71	10.5
M.9 NAKBT337	370	66	9.7
Supporter 2	335	40	8.2
Supporter 1	320	20	6.4
Supporter 3	302	7	7.2
M.26 EMLA	287	53	8.9
Mean	377	44	9.8
LSD (5%) ²	139	49	2.5
Semidwarf			
CG.30N	571	62	14.5
CG.7707	459	55	13.6
CG.4814	362	66	11.7
M.7 EMLA	331	33	11.3
M.26 EMLA	313	35	11.6
Supporter 4	123	18	2.5
Mean	373	46	11.7
LSD (5%) ²	198	NS	NS

¹ Arranged by cumulative yield in descending order. Spacing is 8 feet between trees in rows 16 feet apart. This is equivalent to 340 trees per acre.

² Least significant difference at the 5% probability level. Numbers with the same letter are not considered statistically different.

Kentucky Rootstock Research

The University of Kentucky has an ongoing program on evaluating rootstocks for fruit trees. UK is a member of NC-140, a cooperative rootstock research group whose membership includes most fruit-producing areas in the United States, in addition to Mexico, Australia, and three provinces in Canada. Because rootstock evaluation is a long-term project, this group plans and executes cooperative research projects. This sharing of information and cooperative effort reduces the time needed to evaluate rootstock characteristics. While Kentucky's cooperative rootstock plantings are distributed throughout Kentucky, most are at the UK Research and Education Center in Princeton, Ky. Results of an apple rootstock planting established in 1999 and of a peach planting established in 1994 are presented in Tables 1 and 2, respectively. A number of these stocks are not yet commercially available and are presented here for comparative performance to rootstocks described above.

Table 2. Peach Rootstock Trial Summary at University of Kentucky, Research and Education Center, Princeton, Ky.

Peach Rootstocks ¹	Cumulative Yield, 1996-2001 (lbs/tree)	Yield, 2001 (lbs/tree)	Area, Trunk Cross-section (sq. in.)
GF 305	507	148	27.0
Lovell	507	115	27.8
BY 520-9	503	146	26.7
Rubira	460	108	25.5
Montclar	459	99	27.3
Stark's Redleaf	443	95	27.8
Ta Tao 5	437	119	20.1
BY 520-8	437	75	25.8
Tenn Natural	428	112	20.4
Bailey	408	95	18.9
Ishtara	397	104	16.3
Higama	375	82	21.4
Mean	448	108	23.8
LSD (5%) ²	90	42	0.2

¹ Arranged by cumulative yield in descending order. Spacing is 13 feet between trees in rows 20 feet apart. This is equivalent to 167 trees per acre.

² Least significant difference at the 5% probability level. Numbers with the same letter are not considered statistically different.

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