



The UVM Apple Program:

Extension and Research for the commercial tree fruit grower in Vermont and beyond...

Our commitment is to provide relevant and timely horticultural, integrated pest management, marketing and economics information to commercial tree fruit growers in Vermont and beyond. If you have any questions or comments, please [contact us](#).

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Apple Orchard Information for Beginners.....

[The following material is from articles that appeared in the "For Beginners..." Horticultural section of the 1999 Vermont Apple Newsletter which was written by Dr. Elena Garcia. Please see <http://orchard.uvm.edu/> for links to other material.]

Websites of interest:

UVM Apple Orchard

<http://orchard.uvm.edu/>

UVM Integrated Pest Management (IPM) Calendar

<http://orchard.uvm.edu/uvmapple/pest/2000IPMChecklist.html>

New England Apple Pest Management Guide [*use only for biological information*]

<http://www.umass.edu/fruitadvisor/NEAPMG/index.htm>

Cornell Fruit Pages

<http://www.hort.cornell.edu/extension/commercial/fruit/index.html>

UMASS Fruit Advisor

<http://www.umass.edu/fruitadvisor/>

Penn State Tree Fruit Production Guide
<http://tfpg.cas.psu.edu/default.htm>

University of Wisconsin Extension Fruit Tree Publications
<http://learningstore.uwex.edu/Tree-Fruits-C85.aspx>

USDA Appropriate Technology Transfer for Rural Areas (ATTRA) Fruit Pages:
<http://www.attra.org/horticultural.html>

Considerations before planting:

One of the questions most often asked is, "What do I need to do to establish a small commercial orchard?" The success of an orchard is only as good as the planning and site preparation that goes into it. One important factor you should think about is whether the location or the tract of land you have selected meets certain economic criteria and environmental criteria.

Economics

- Availability of money: If you have to borrow money to start an orchard, is there a bank or some type of lending institution near you which understands and will be able to meet your needs?
- Availability of resources and supplies: How far will you have to drive to buy your orchard supplies? How long will you have to wait for your orchard supplies?
- Cooperatives: Is there a group in your area with whom you can join forces to buy supplies or market your fruit?
- Professional groups: Are there university personnel or private consultants near you who can make regular visits to your orchard or be easily accessible to answer your questions?
- Marketing: How do you plan to market your fruit? Will the population in the area support your type of marketing strategies? The marketing avenue you select will determine your rootstock and cultivar selection
- Transportation. How far is the orchard from packing houses? Are the roads in good condition to transport your fruit? If you choose to have a pick-your-own operation, is your location easily accessible?

Environment

- The temperature parameters of a location are critical for fruit production.
- The state of Vermont is at the temperature limits for apple production. Trying to grow apples in Hardiness Zone 3 is very risky.
- Other climatic consideration include:

Spring frosts: If the site is prone to spring frost, you may lose your crop before it begins to grow.

Heavy winds: Heavy winds may break the graft union or make your trees lean. This breaks the roots and weakens the anchorage of the roots to the soil.

Site Selection

Once you have considered the above economic and environmental factors, you will be selecting a site. Site refers to the way the tract of land is in relation to the environment surrounding it. These are some things you should consider in selecting a site:

- **Slopes:** The ideal site should be on rolling or elevated land so that cold air can drain during spring frost. A 4% to 8% slope is ideal. A steeper than 10% slope may make it difficult to operate machinery. Avoid areas at the bottom of the hill where cold air settles and frost pockets form.
- **Slope exposure:** A south facing slope receives more sun, thereby warming faster in the spring. A north facing slope will be colder, warming up late in the spring.
- **Soil considerations:** Soils provide anchorage, nutrients, water, and the biotic environment in which the trees will live. Deep, sandy clay loam soils are best for orchard sites.

Soil Preparation

Soil preparation should be done in the fall before planting. This is the time to do a soil test to determine the needs of your soil. This way you have time to correct any deficiencies and improve soil fertility.

Correcting the soil pH is one of the most effective nutrient management practices to improve fertility in an apple orchard. Try to maintain the soil pH in the range of 6.0 for the subsoil to 6.5 for the topsoil because the pH influences the availability of the various elements to the plant. For example, as the soil pH becomes acidic (pH <5.5), the phosphorous in the soil becomes unavailable to the plant. It does not matter if there is an adequate amount of phosphorous in the soil; the roots are unable to uptake it, or some elements become toxic at high or low pH. Correcting the soil pH needs to be done before planting because once the trees are in place, it is very difficult to change it. In regions with acidic soils, lime, preferably dolomitic for apple orchards, is usually used to raise the pH.

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what effect the rootstock is going to have on the aerial portion of the tree. The genetic control of the rootstock on the cultivar include:

- Size. The overall size of an apple tree will be greatly determined by the rootstock, but you must consider the cultivar that will be grafted onto the rootstock. You may not want to have a low vigor cultivar grafted onto a very dwarfing rootstock because the result may be a very 'runted' tree
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up was M.7; it was designated M.7a. Later still, more viruses were removed from all of the Malling and Malling-Merton series of rootstocks. These were then designated EMLA for the East Malling and Long Ashton research stations in England. While the viruses have been removed, some of the rootstocks' size control has been lost. Therefore, the old "dirty" M.9 will produce a smaller tree than the "clean" M.9EMLA. Currently in the industry nearly all apple rootstocks are virus free.

The next few years will bring several new rootstocks, many developed in Europe. Those likely to be available first are the Budagovsky series. Designated as either Bud or B, they were developed in the central plains of the Soviet Union for their cold-hardiness. The next rootstocks to be released will probably be from Poland and are called the "P-series." Like the Russian series they are expected to have some cold-hardiness. The P-series was developed from crosses between M.9 and common Antonovka. Reportedly, these stocks have good resistance to collar rot.

The newest rootstocks, however, are being developed here in the United States. One group comes from Cornell University's breeding program, which has bred rootstocks for resistance to fire blight. Some of these rootstocks are also resistant to other problems such as apple scab, collar rot, and woolly apple aphids, and exhibit a reduction in burrknot formation.

A large multistate research program known as the NC-140 Research Project is primarily responsible for conducting most evaluations of these new rootstocks. Penn State has been a member of this project since its inception.

Growers should be aware of each rootstock's known capabilities and limitations. Many of the newer rootstocks will probably be available to the commercial industry before they have been thoroughly evaluated with different cultivars.

Specific rootstocks

Following are brief descriptions of and comments on apple rootstocks. Rootstocks are listed in order from smallest to largest. (Much of the information was gleaned from research reports of the NC-140 committee from around the country.)

Poland 22 (P.22): P.22 produces trees that are smaller than those grown on M.9. It is reported to be resistant to collar rot, apple scab, powdery mildew, and crown gall. P.22 is susceptible to fire blight and woolly apple aphids. Its major benefit may be

blight and collar rot.

Budagovsky 9 (B.9 or Bud9) is a new dwarfing rootstock bred in the Soviet Union from the cross of M.8 x Red Standard (Krasnij Standart). Like the other stocks in this series, the leaves are a distinctive red. Trees on this stock are 25 to 35 percent smaller than M.9EMLA depending upon the cultivar. In a 10-year trial at University Park, York Imperial, Rome Beauty, and Empire on B.9 were approximately 25 percent smaller than the same cultivar on M.9EMLA; while Jonagold, Golden Delicious, and McIntosh were approximately 35 percent smaller. B.9 appears to be resistant to collar rot and is very cold-hardy. In limited trials, it has performed very well across a wide range of conditions. Trees will need to be supported.

Poland 2 (P.2) was developed from a cross between M.9 and Common Antonovka. Trees grown on P.2 are 15 to 25 percent smaller than M.9. The rootstock is resistant to collar rot and slightly susceptible to apple scab and powdery mildew. Young test plantings in Pennsylvania with Gala and Ginger Gold show that P.2 is nearly as precocious as M.9. Smoothie Golden Delicious on this rootstock produces a very smooth and straight union. However, Delicious grown on P.2 is reportedly as susceptible to apple union necrosis as the same cultivar grown on MM.106.

Malling 9 (M.9): The traditional and best-known dwarfing rootstock. It should be planted on a well-drained site. Trees on this rootstock always require leader support. The rootstock is very susceptible to fire blight and can develop burr knots. Numerous clones of M.9 are now being sold by nurseries, including

Malling 26 (M.26): A more vigorous rootstock than M.9. It can be used to produce either a dwarf or a semidwarf tree, depending on scion variety, production system, and soil type. It is susceptible to collar rot and fire blight and should not be planted in a wet site. Certain varieties, such as Rome, Stayman, Golden Delicious, and many triploids, when grafted onto this rootstock may exhibit signs of graft union incompatibility. When incompatibility occurs, the trees may break off at the union in high winds. Because exposed portions of the rootstock have a strong tendency to produce burr knots, the union between the scion variety and the rootstock should be set no more than 1 to 2 inches above the final soil level.

Geneva 935 (G.935) is a 1976 cross of Ottawa 3 and Robusta 5. Size is reported to be slightly larger than M.26, but the rootstock has resistance to fire blight and crown rot. It is not resistant to wooly apple aphid. Production efficiency is rated equal to M.9. In the Golden Delicious trial at Rock Springs in 2005, tree size was about 25 percent larger than M.9 and 4 percent larger than M.26. Production efficiency was not significantly different although slightly higher than M.9 in 2005. Finished trees should be available in late 2006 or early 2007 in limited quantities.

Geneva 11 (G.11): The second release of the Cornell breeding program; only limited plantings exist in Pennsylvania. Reported to be similar in size to M.26 but more productive. Has the advantage of being resistant to fire blight and crown rot as well as only rarely producing suckers or burr knots. Availability limited. Tissue-cultured trees are larger than trees propagated by stool beds.

Geneva 202 (G.202) is a semidwarfing rootstock that produces a tree slightly larger than M.26. It was developed from a cross of M.27 and Robusta 5. It is fire blight and Phytophthora resistant as well as having resistance to wooly apple aphids. The rootstock has been mainly tested in New York and New Zealand. In New Zealand they are looking at this rootstock as a possible replacement for M.26 since it is more productive than M.26. In a 9-year study with the scion cultivar of Liberty, G.202 was about 50 percent smaller than M.7 but had much greater production efficiency.

Pillnitzer Supporter 4 (Pi.80), a cross between M.9 and M.4, has recently been introduced from Germany. It is reported similar in size and in anchorage to M.26. Yield capacity is reported to be better than that of M.26. A planting with McIntosh as the cultivar was established in 1999 at Rock Springs. To date, Supporter 4 is about 15 percent larger than M.7 EMLA. Yield in 2001 was nearly double that of McIntosh/M.7EMLA and 50 percent greater than McIntosh/M.26EMLA. Interstems are becoming increasingly popular in Pennsylvania orchards. This stock is composed of an understock such as seedling MM.111 or MM.106, onto which an intermediate stem piece of M.9 or M.27 is grafted. The variety is budded or grafted onto M.9 or M.27. Size control is directly related to the length of the intermediate stem piece. Interstem apple trees offer a strong root system while reducing the size of the overall tree.

Interstem trees should be planted so that a portion of the interstem is buried. Test plantings in Pennsylvania indicate that interstems on either MM.106 or MM.111 sucker, and very vigorous varieties and Stayman have not performed well on interstems.

Geneva 30 (G.30) is currently available from commercial nurseries. The advantages of this M.7-size rootstock are early production, fewer burr knots, and less suckering. Tests at Rock Springs do indicate that trees on this rootstock come into bearing earlier and produce more fruit than M.7. Unfortunately, in the last two years questions have arisen about the graft compatibility of this rootstock with Gala. In tests around the country in the NC-140 trials, there have been occasions where Gala/G.30 have snapped off at the bud union during high winds. Therefore, it is recommended that if Gala is propagated on G.30, the trees be supported by two wires, one at approximately 36 to 40 inches above the ground and a second wire at 8 to 9 feet. Individual stakes or poles have not been sufficient because they allow excessive twisting of the trees in the wind.

Malling 7 (M.7): This rootstock produces a semidwarf tree that is freestanding in deep well drained soils. In rocky, steep, or shallow soils, it tends to lean. High budding and deeper planting may help remedy this problem. The rootstock may sucker profusely and is susceptible to collar rot. M.7a is a clone of the original M.7. but which has had some of the inherent viruses removed.

Poland 1 (P.1): This rootstock appears to be about the size of M.7. It may, however, require some tree support.

Budagovsky 490 (B.490): This rootstock produces a tree the size of MM.106 and .001 of MM.one of the ea6(f .4(chs7em)s6d9)-4.

- Information about a nursery from other growers can be invaluable. Ask growers about their experiences with the nursery.
- Tell the nursery when you want the trees to be delivered, and ask them to let you know when they are being shipped so you will be prepared. Here in Vermont, planting is done in the spring when ground has thawed and the danger of hard freezes has past.

Tree Fruit Nurseries

A Partial List of Nursery Sources for Fruit Trees:

[Not all nurseries are included in this compilation. No discrimination or endorsement is intended or implied. We encourage you to examine all of the sources of nursery trees.]

Adams County Nursery <http://www.acnursery.com/>
26 Nursery Rd PO Box 108 Aspers, PA 17304 (717) 677-8105
Commercial-grower oriented nursery.

Cummins Nursery <http://www.cumminsnursery.com/>
738 W. Hunt Rd. Alcoa, TN 37701 (865) 681-8423 (Nov-March)
4233 Glass Factory Bay, Geneva, NY 14456 (315) 789-7083 (April-November)
Specializing in hard-to-find varieties as well as large orders.

Lawyer Nursery <http://www.lawyernursery.com/>
950 Highway 200 West Plains, MT 59859 (406) 826-3881
trees@lawyernursery.com
Wholesaler of nursery stock with a selection of fruit trees. Grafted selections include newer, often cold-hardy varieties. Also carry clonal and seedling fruit rootstock.

C&O Nursery <http://www.c-onursery.com/>
PO Box 116 Wenatchee, WA 98807 (800) 232-2636
West Coast commercial-grower oriented nursery.

Van Well Nursery <http://www.vanwell.net/>
2821 Grant Road & PO BOX 1339 Wenatchee, WA 98807 (800) 572-1553
vanwell@vanwell.net
West Coast commercial-grower oriented nursery.

Stark Brothers Nursery: <http://www.starkbros.com/>,
<http://www.starkbros.com/wholesale.jsp>
PO Box 1800, Louisiana, MO 63353 (800)325-4180
Homeowner and commercial-oriented nursery. Oldest fruit tree nursery in the US.

Hilltop Nursery
60395 County Road 681 Hartford, MI 49057 (800) 253 2911
Commercial-oriented nursery.

Summit Tree Sales <http://www.summittreesales.com/contact.htm>
55826 60th Ave, Lawrence, MI 49064 (800) 424-2765
Wholesale tree brokers. They work with many nurseries...if you need it
they can probably find it.

Willow Drive Nursery: <http://www.willowdrive.com/>
3539 Road 5 NW, Ephrata, WA 98823 (888) 548-7337
Commercial nursery.

Steps for Planting Fruit Trees:

How to plant fruit trees is one of the most often requested pieces of information. Although the following steps are designed for the person who is planting a few trees in their backyard, the procedure, other than more detail on pre-planting soil preparation (see April 21, 1999 issue) and orchard design, is basically the same whether you are planting one or one hundred trees.

- 1) After you have decided where you want to plant, you need to clear the sod from that area. A circular area of at least 30 inches is recommended.
- 2) Dig a hole large enough to accommodate the roots.
- 3) You may want to lightly prune the roots; so as to encourage growth. Spread the roots out in the hole. (A mixture of peat moss, limestone and soil can be placed around the roots to ensure water uptake by the roots)
- 4) The graft union (where the scion and rootstock were grown together) should be 2 to 5 inches above the ground.
- 5) Make sure that the graft union is facing 90° against the wind direction (so as to prevent easy breakage)
- 6) Fill the hole in with soil and gently tamp it down to get rid of any air pockets.
- 7) Water immediately.
- 8) Stake the trees (if required by rootstock size) and loosely tie the tree to the stake with a plastic or fabric tie.
- 9) Head back the tree with a diagonal cut so the tree is approximately 36" in height. Cut just above a bud, if possible. If branches are present cut 10"-12" above the highest branch. Also, remove any branches or buds below two feet.
- 10) As new growth begins in the spring, be sure to spread the limbs to get the desired growth form (this can be done with clothes pins).
- 11) You may also want to apply some fertilizers after growth has begun. Do not fertilize at planting because it may burn new roots. It is generally recommended

14) In the dormant season, prune trees according to nursery/training system recommendations.

Planting density

The planning of a new orchard block can be more difficult than its actual planting. When planning an orchard block, one of the most crucial decisions the orchardist must make is the planting density of the

- For trees 1 to 2 years, spray 1/4# Solubor/acre at 1st and 2nd cover sprays; for 3 to 5 year old trees spray 3/4# per acre at each of the two cover sprays. Boron is an important element in root development.
- Eliminate as much stress from the plant as possible by the applications of herbicide near the tree to eliminate weed competition, and by the addition of mulches around the tree to increase the organic matter. The following table indicates the impact of herbicide, mulches or both on various aspects of young tree growth versus a sod cover around the tree.

Table 1. Impact of herbicide mulches (or both) versus sod cover around the tree in various aspects of young tree growth

Aspect of Young Tree Growth	Sod Cover	Herbicide	Mulches	Herbicide + Mulches
Survival	100%	100%	100%	100%
Height	100%	100%	100%	100%
Trunk Diameter	100%	100%	100%	100%
Root Development	100%	100%	100%	100%
Leaf Area	100%	100%	100%	100%
Chlorophyll Content	100%	100%	100%	100%
Stomatal Conductance	100%	100%	100%	100%
Water Potential	100%	100%	100%	100%
Relative Humidity	100%	100%	100%	100%
Temperature	100%	100%	100%	100%
Soil Moisture	100%	100%	100%	100%
Soil Temperature	100%	100%	100%	100%
Soil pH	100%	100%	100%	100%
Soil Nitrogen	100%	100%	100%	100%
Soil Phosphorus	100%	100%	100%	100%
Soil Potassium	100%	100%	100%	100%
Soil Calcium	100%	100%	100%	100%
Soil Magnesium	100%	100%	100%	100%
Soil Sulfur	100%	100%	100%	100%
Soil Zinc	100%	100%	100%	100%
Soil Boron	100%	100%	100%	100%
Soil Iron	100%	100%	100%	100%
Soil Manganese	100%	100%	100%	100%
Soil Copper	100%	100%	100%	100%
Soil Nickel	100%	100%	100%	100%
Soil Cobalt	100%	100%	100%	100%
Soil Molybdenum	100%	100%	100%	100%
Soil Selenium	100%	100%	100%	100%
Soil Vanadium	100%	100%	100%	100%
Soil Chromium	100%	100%	100%	100%
Soil Arsenic	100%	100%	100%	100%
Soil Cadmium	100%	100%	100%	100%
Soil Lead	100%	100%	100%	100%
Soil Mercury	100%	100%	100%	100%
Soil Silver	100%	100%	100%	100%
Soil Gold	100%	100%	100%	100%
Soil Platinum	100%	100%	100%	100%
Soil Palladium	100%	100%	100%	100%
Soil Rhodium	100%	100%	100%	100%
Soil Rhenium	100%	100%	100%	100%
Soil Ruthenium	100%	100%	100%	100%
Soil Selenium	100%	100%	100%	100%
Soil Tellurium	100%	100%	100%	100%
Soil Thallium	100%	100%	100%	100%
Soil Uranium	100%	100%	100%	100%
Soil Vanadium	100%	100%	100%	100%
Soil Xenon	100%	100%	100%	100%
Soil Yttrium	100%	100%	100%	100%
Soil Zirconium	100%	100%	100%	100%
Soil Niobium	100%	100%	100%	100%
Soil Molybdenum	100%	100%	100%	100%
Soil Technetium	100%	100%	100%	100%
Soil Rhenium	100%	100%	100%	100%
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have been developed to aid in IPM decision-making. Disease risk can be reduced by planting disease-resistant apple cultivars which are commercially available. However, depending on your marketing goals, these may not be appropriate for your orchard. Disease-resistant apple cultivars are highly recommended for those considering organic apple production.

Information about the various insects and diseases which you will have to manage can be found on the **Vermont Apple IPM Focus website**: <http://orchard.uvm.edu/uvmapple/pest/index.html>.

A **synopsis of key arthropod and diseases** affecting apples can be found at: <http://orchard.uvm.edu/uvmapple/pest/BacktoBasics/index.htm>.

An **IPM Checklist** of management items for consideration during the year is at: <http://orchard.uvm.edu/uvmapple/pest/2000IPMChecklist.html#An%20IPM%20Checklist%20for%20Vermont>

It is **highly recommended** that all orchardists obtain education and training in the safe use and storage of pesticides. Information on how to obtain your Vermont Pesticide Application License is at: <http://pss.uvm.edu/pesp/>

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