

# Apples

Cheryl Kaiser<sup>1</sup> and Matt Ernst<sup>2</sup>

## Introduction

Over the past 40 years Kentucky growers have produced apples (*Malus domestica*) using free-standing trees in low- to medium-density plantings. Today's high-density orchards have closely planted trees on dwarfing rootstocks requiring permanent support structures. Earlier production, quicker returns on the investment, and improved fruit quality are just a few of the many benefits of the new high-density systems.

Growers, however, who do not have an excellent site or a source of water for drip irrigation should not consider high density plantings. Additionally, because high density systems require a significantly greater level of grower expertise and cultural management, semi-dwarf plantings may be more suitable for producers who are new and inexperienced.

## Marketing and Market Outlook

Kentucky's fresh apple market is almost exclusively retail, with very few growers selling on the wholesale market. For wholesale apple production to be profitable in Kentucky, the grower would usually need to receive a fresh price of more than \$0.25 per pound. The national average for grower prices exceeded \$0.25 per pound only twice from 1990 to 2005. The national average fresh wholesale apple prices then increased, ranging from \$0.30 to \$0.40 since 2006; even at these price levels, extensive wholesaling is not recommended for Kentucky growers.



There is a strong demand for locally grown, full-flavored, quality apples, especially varieties not commonly available in supermarkets. Direct marketing, value-added processing (cider), and entertainment farming are the primary reasons that Kentucky apple orchards can be profitable. Farmers markets, U-Pick, and roadside stands are all good outlets for selling apples. Restaurants are interested in local apples, and value-added apple products (fried apple pies, preserves, etc.) are very popular with Kentucky consumers. Apple producers may maximize profitability by developing multiple market channels based on their production volume, location, and marketing preferences. Diversifying sales between different market channels helps guard against product oversupply to any one channel.



## Production Considerations

### *Cultivar selection*

Selecting cultivars that produce quality fruit in our area, perform

<sup>1</sup>Cheryl Kaiser is a former Extension Associate with the Center for Crop Diversification.

<sup>2</sup>Matt Ernst is an independent contractor with the Department of Agricultural Economics.

reliably, and meet the market demand is a critical step in establishing an apple orchard. Cultivars differ in such horticultural traits as fruit characteristics (e.g. size, color, flavor, and intended use), earliness (early, mid, and late season), as well as disease and insect resistance. Tree size, which is determined by the rootstock, may be dwarf, semi-dwarf, or standard. Consult University of Kentucky Extension horticultural specialists and state research trial results for information on cultivars best suited for your locale and market.

### *Site selection and planting*

Select an orchard site that is considerably higher than surrounding areas and has excellent air drainage. Apples perform best on deep, friable, fertile soils with good internal drainage. Avoid heavy, poorly drained soils, as well as those with impervious hardpans close to the surface. Irrigation is essential for high-density plantings, so the orchard should be located near a ready source of water.

Apple planting stock may need to be ordered as much as 24 months in advance of planting to obtain commercial quantities (275 to 350 trees per acre) of the desired cultivars and rootstocks. While more costly per tree than conventional unbranched whips, planting well-branched or feathered trees can be well worth the investment by bringing the orchard into full production one year earlier. Trees are best planted in fall or early spring in rows running north and south.

### *Orchard maintenance*

Pruning and training methods employed in high-density plantings are considerably different from those in conventional orchards. The goal in high-density orchards is to promote early fruiting and to discourage excessive vegetative growth. Efforts are initially focused on training limbs, rather than pruning. A permanent tree support system is essential because dwarf trees have brittle graft unions that can break; they should be in place as soon after planting as possible.

### *Pest management*

There are a large number of insects and diseases

to control on apples. These include the San Jose scale, codling moth, oriental fruit moth, plum curculio, stink bug, aphid, and leafhopper insects and scab, cedar apple rust, fire blight, sooty blotch, flyspeck and fruit rot diseases. The Brown marmorated stink bug is a new difficult to control invasive pest on apples that is moving into the state. It has become a serious problem in Boyd County and populations are building in Jefferson and Fayette counties. The Integrated Pest Management (IPM) approach helps growers determine exactly when pesticide applications are needed. Using IPM in Kentucky can reduce the number of pesticide applications by about one third when compared with a calendar-based program. IPM involves collecting detailed data regarding the crop, pests, and weather conditions to make sound pest management decisions. Kentucky apple growers may use insect and disease predictive models on the UK Ag Weather Center site that use the Kentucky Mesonet or National Weather Service station closest to their orchards to make informed spraying decisions. Deer browsing and rubbing causes considerable damage to trees and will need to be managed through electric fencing or hunting. Voles will need to be controlled during the winter to prevent root and trunk feeding.

### *Harvest and storage*

The optimum maturity level for harvest will depend on the cultivar, intended market, and whether the fruit will be stored. Color, starch level, sugar content, and firmness are important harvest indicators. Fruit is hand-picked and handled carefully to avoid bruising. Cold storage will be needed to extend the marketing season.

### *Labor requirements*

A medium density system will require nearly 300 hours of operator labor per acre per year. Trees take 4 to 6 years to reach full bearing. A high-density system can require more than 2,000 hours per acre over 4 years.

An experienced apple picker can harvest about 12½ bushels of apples per hour. At a yield of 450 bushels per acre, this will require about 36 hours of harvest labor. On-farm packing and grading

will require additional labor (15 to 25 hours), depending on packaging used. Packing labor can be minimized by field sorting and having customers select their own apples from retail bins.

## Economic Considerations

The cost of establishing a high-density orchard is greater than that of a lower-density orchard. Total (variable and fixed) costs for establishing an apple orchard can range from \$7,500 per acre for medium-density plantings of 300 trees to more than \$14,000 for high-density plantings of 600 trees per acre. Initial investments include land preparation, purchase of trees, tree establishment, installation of an irrigation system, and construction of a tree support system. Pest control equipment and pesticides, including tree guards, fencing for deer control, plus an air blast sprayer for insect and disease control and a boom sprayer for weed control, will also be needed.

Annual pre-harvest production costs for each production system can come to approximately \$1,500 per acre. Harvest costs will vary depending on the wage rate paid to labor and the availability of harvest equipment, but can be estimated between \$1.50 and \$2 per bushel. At a retail price of \$20 to \$40 per bushel, returns to land, labor and management from the central leader (medium-density) and high-density systems can range from \$2,250, to \$7,500 per acre in a full production year. Wholesale production on well-managed plantings can result in returns to land, labor and management in the \$1,500 range.

## Selected Resources

- Ag Weather Center (University of Kentucky) <http://www.wagwx.ca.uky.edu/>
- Apple Cultivar Performance, HortFact-3006 (University of Kentucky, 2007) <http://www.uky.edu/Ag/HLA/masabni/Publications/applecultivar.pdf>

- Apple Integrated Crop Management Manual (University of Kentucky) <http://www.uky.edu/Ag/IPM/appleipm/appleipm/ap-man.php>
- Apple Integrated Pest Management (University of Kentucky) <http://www.uky.edu/Ag/IPM/appleipm/appleipm/index.php>
- Kentucky Mesonet (Western Kentucky University) <http://www.kymesonet.org/index.html>
- Midwest Tree Fruit Pest Management Handbook, ID-93 (University of Kentucky, et al., 1993) <http://www.ca.uky.edu/agc/pubs/id/id93/id93.htm>
- Midwest Tree Fruit Spray Guide, ID-92 (University of Kentucky, et al., 2015) [http://www2.ca.uky.edu/agcollege/plantpathology/ext\\_files/PPFShtml/MwTreeFruitSprayGuideID92.pdf](http://www2.ca.uky.edu/agcollege/plantpathology/ext_files/PPFShtml/MwTreeFruitSprayGuideID92.pdf)
- Total Quality Assurance: Apple Production: Best Management Practices, ID-137 (University of Kentucky, 2001) <http://www.ca.uky.edu/agc/pubs/id/id137/id137.htm>
- Training and Culture of Dwarf Apples Using the Vertical Axis System, HortFact-3501 (University of Kentucky, 2008) <http://www.uky.edu/hort/sites/www.uky.edu.hort/files/documents/appletraining.pdf>
- Rootstocks for Kentucky Fruit Trees, HO-82 (University of Kentucky, 2011) <http://www2.ca.uky.edu/agc/pubs/ho/ho82/ho82.pdf>
- Apples (Ontario Ministry of Agriculture, Food and Rural Affairs, 2009) <http://www.omafra.gov.on.ca/english/crops/hort/apples.html>
- Planting New Apple Orchards in Ontario (Ontario Ministry of Agriculture, 2012) <http://www.omafra.gov.on.ca/neworchard/english/apples/index.html>
- Apples: Organic Production Guide (ATTRA, 2011) <https://attra.ncat.org/attra-pub/summaries/summary.php?pub=4>
- Pennsylvania Tree Fruit Production Guide (Pennsylvania State University, 2014-2015) <http://tfpg.cas.psu.edu/default.htm>

---

*Reviewed by John Strang, Extension Specialist, University of Kentucky (Revised 2014)*

*Photos by Steve Patton, UK Agricultural Communications Services (fruit) and John Hartman, UK Department of Plant Pathology (blossom inset)*

**April 2014**

For additional information, contact your local **County Extension** agent

Educational programs of the Kentucky Cooperative Extension Service serve all people regardless of race, color, age, sex, religion, disability, or national origin.