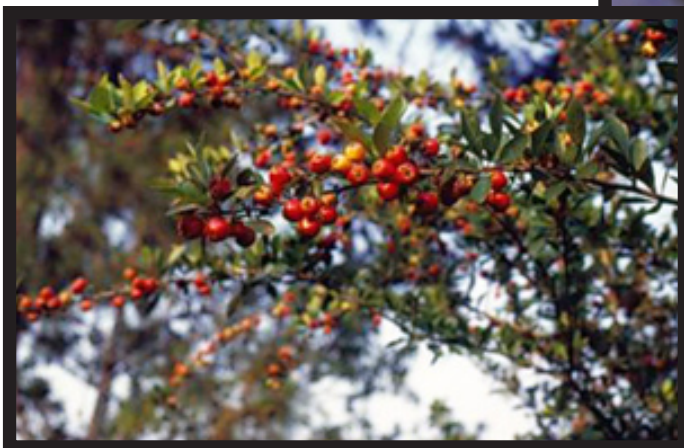
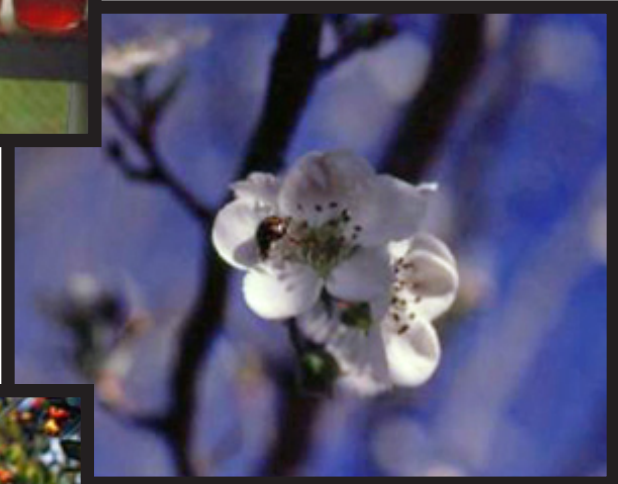




THE UNIVERSITY OF GEORGIA
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Experiments and Observations on Growing Mayhaws as a Crop in South Georgia and North Florida



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Introduction

Since antebellum times, mayhaw (*Crataegus aestivalis* – (Walter) Torrey & Gray, *C. opaca* – Hook. & Arn., and *C. rufula* – Sarg.) fruit has been treasured in the Deep South for its culinary uses. Mayhaws are highly esteemed for making jelly, sauces and wine, and are one of the few ornamental flowering trees adapted for use in lake-shore and wet area landscaping.



Mayhaws are members of the family *Rosaceae*, subfamily *Maloideae*, tribe *Crataegeae*. This round-topped small tree (25 to 30 feet high) has attractive foliage, showy white blossoms (0.6 to 1.1 inches in diameter), clusters of brilliantly colored fruits and an upright or pendulous tree form. Mayhaws are locally abundant in low, wet areas such as limesinks, bays, sloughs, river bottoms and along streams and in swamps from North Carolina to Florida and west to Arkansas and Texas (Payne and Krewer, 1990; Payne, Krewer and Eitenmiller, 1990).

In earlier times, there was sufficient wild fruit available to satisfy most local needs. Recently, however, many native mayhaw stands have been destroyed by land clearing for forestry and agriculture. Many of the remaining mayhaw groves have been designated off-limits, restricting public access for fruit collection.

Increased demand for mayhaw fruit, along with the tree's ability to grow on land too wet for most crops, has created significant interest in commercial mayhaw production. Small commercial manufacturers of mayhaw jelly and syrup have become more prominent, and demand for pick-your-own and direct sales to consumers has also increased. Picked mayhaw fruit currently wholesales for about \$6 to \$8 per gallon and retails for about \$8 to \$12 per gallon. Pick-your-own fruit currently sells for \$6 to \$10 per gallon. Mayhaw fruit is very light and weighs only 4 to 5 pounds per gallon.

Limited information is available on the commercial production of mayhaws (Craft, Melcher and Langston, 1996; Puls, 1991); thus, the objective of our research has been to:

- 1) determine if mayhaws are adapted to commercial orchard production,
- 2) identify cultivars with excellent cropping ability and quality, and
- 3) identify potential problems in their commercial production, such as insects and diseases.



Experimental Orchards and Cultivar Evaluations

In 1985, four named mayhaw cultivars selected from wild groves in Mississippi, Louisiana and Texas were planted at a test orchard near Tifton, Georgia. Native seedlings from Georgia were also included in the planting. From 1988 to 1996, the test orchard expanded to include an additional 20 named cultivars and additional seedlings. One to four trees of each cultivar were planted.



Most trees in the orchard were grafted on *Crataegus aestivalis* or *C. opaca* rootstock; a few were on their own roots. Some trees were grafted on Washington hawthorn (*C. phaenopyrum*) rootstock. The trees were planted on either a moderately wet Alapaha loamy sand without irrigation or on a moderately dry Tifton loamy sand with and without drip irrigation. Soil pH was adjusted to 6.0 to 6.5. Young trees were fertilized in the early spring and early summer at the rate of 1/2 to 1 pound of premium grade 10-10-10 per inch of trunk diameter. Older trees were fertilized twice a year – in early spring and summer – with a balanced fertilizer at about the same rate as the

adjacent peach orchards. Insecticides and fungicides were applied post-bloom each year on bearing trees, and winter dormant oil sprays were used to control scale if needed.

In 1987, an orchard was established at the University of Georgia Attpulcus Research Farm near Bainbridge, Georgia. One hundred trees (mostly *Crataegus aestivalis*) collected from 33 diverse sites in North Florida and South Georgia were planted on a moderately dry Norfolk loamy sand with drip irrigation. In 1992, this planting was expanded to include 21 cultivars of *Crataegus opaca* from Mississippi, Louisiana and Texas grafted on *Crataegus opaca* rootstock. Soil pH was adjusted to 6.0 to 6.5. Young trees were fertilized in the early spring and early summer at the rate of 1/2 to 1 pound of premium grade 10-10-10 per inch of trunk diameter.



Older trees were fertilized twice a year with a balanced fertilizer at about the same rate as the adjacent peach orchard. Peach insecticides and fungicides were applied post-bloom each year on the bearing trees.

Cultivars and seedlings were evaluated on the basis of bloom date, crop load, tree form, and fruit size, shape, firmness, appearance, color and retention on the tree. Typical full bloom dates varied from mid-February to mid-March, depending on the cultivar.

Crop loads varied from no production to heavy production depending on cropping ability and date of the last spring freeze. Severe freezes occurred at Tifton and Attpulcus on March 13 to 15, 1993 (low temperature about 22° F), March 9, 1996 (low temperature about 20° F), and March 13, 1998 (low temperature about 24° F).



Fruit size (measured in width) varied from 0.43 inches to over 0.83 inches. Fruit shape varied from oblong to oblate. Fruit appearance was rated on a 1-to-10 scale, with 10 considered the best possible, and ranged from 4 to 8 with 8 being a fairly uniform cherry red color. Many buyers consider cherry red fruit with a glossy red finish and a pink flesh the most desirable. Fruit firmness was rated on a 1-to-10 scale, with 10 considered the best possible, and ranged from 4 to 8. Fruit retention on the tree was rated on a 1-to-10 scale, with 5s dropping (shattering) more easily than desired, 7s considered commercially ideal, 8s slightly too well retained and 10s excessively retained. Fruit retention varied from 3 to 9, depending

on the cultivar. Trees that retain their fruit well under normal weather conditions but drop it with vigorous hand shaking of the scaffold limbs are considered desirable.

Several insect and diseases were noted during the study and identified by university entomologists and plant pathologists.

Results

Orchard Adaptability

Mayhaws appear to be well adapted to commercial orchard production in the Southeast. A spacing of 15 to 20 feet in the row and 20 feet between rows has been adequate to prevent excessive orchard crowding during the first 12 years on upright spreading cultivars. Since mayhaw fruit is very susceptible to sun scald once it falls off of the tree, until a canopy is formed, sun scald can be a serious problem if the fruit is not harvested immediately. For this reason, a closer spacing of 12 feet in the row by 18 feet between rows should be considered in situations where the fruit may lay on the ground for several days before harvest.



Minimal detailed pruning is needed after the initial training phase (years one through four) to establish a modified central leader form or vase form. Annual removal of basal suckers and root sprouts is required. Undoubtedly, mayhaws would benefit from more detailed pruning to increase light penetration into the interior of the tree; however, this is very time consuming because prunings must be carried out of the orchard since the presence of numerous thorns does not allow mowing of prunings with rubber-tire tractors.

Some trees required staking after severe windstorms and hurricanes. Trees grafted on mayhaw rootstock (*Crataegus aestivalis* and *Crataegus opaca*) or growing on their own roots have performed well. Trees grafted on Washington hawthorn have grown very slowly, with trunk diameters of only 2 inches after four years and thus poor anchorage.

Mayhaws grow well on upland sites with irrigation. During extreme droughts, trees on upland sites without irrigation can show marginal leaf burn. Mayhaws appear to be a potential crop for low areas too wet for most crops. On these sites, they can be grown without irrigation. Tree survival has been better on low land than upland sites, however. This appears to be due to root rot that is more severe on upland sites.

Mayhaw trees can be slow to come into good production. Of the better cultivars, six-year-old trees have produced 10 to 20 pounds of fruit per tree per year, and nine-year-old trees have produced 25 to 40 pounds of fruit per tree per year at an orchard spacing of 15 feet in the row by 20 feet between rows.

Harvesting mayhaw fruit is a time-consuming process. Since the fruit on most cultivars ripens over a period of a week or more, multiple harvests are necessary. Many growers allow the fruit to ripen and naturally fall to the ground. If the area under the trees is completely clean and free of weeds, it is easy for workers or pick-your-own customers to harvest the fruit from the ground. While some growers spread plastic tarps or seine netting under the trees to keep falling fruit off the ground, this also catches bird droppings. Fruit hand-picked off the ground requires only minimal cleaning (to remove sand and a few bad berries) to be ready to sell. Pick-your-own customers also harvest fruit directly from the lower tree limbs.

A shake-and-catch system can also be used; however, care must be taken to not break off too many spurs, which will produce next year's crop. Place tarps or catch frames under the tree, and then shake the scaffold limbs by hand and jar the remaining ripe fruit in the upper part of the tree with a bamboo pole or shake pole. After harvesting the fruit, run it across a blower and grading belt to remove leaves and green berries or pour it on a screen table and pick out the leaves and green berries by hand.



Some cultivars, such as ‘Mason’s Superberry’ and ‘T.O. Superberry,’ hold so tightly to the tree that fruit sometimes sunburns before dropping. Other cultivars, such as Superspur and Big V, shatter so easily that windstorms can knock off a lot of fruit between shakings. For pick-your-own purposes, fruit that hold well to the tree allow for harvest directly off young trees and from lower limbs on older trees. Cultivars with fruit that release fairly easily from the tree make harvesting onto catch frames much easier. Information on fruit retention is presented in Table 1.

Fruit harvested from the water can be cleaned by using a vibrating, sloped board. Placing a jigsaw without a blade on a metal plate can provide the vibration. The wet leaves stick to the board and the fruit rolls down the slope.

Fruit size has a large influence on hand harvesting and cleaning speed. Cultivars with large fruit can be much more rapidly hand harvested and graded. This is a major consideration for both pick-your-own and commercial harvest operations.

Fruit firmness should also be considered. Very soft cultivars are prone to bruising that greatly detracts from the appearance of the fresh fruit. Soft cultivars must be harvested more frequently, rapidly handled and frozen. The shelf life of many fresh mayhaw cultivars is very short since the fruit is usually bruised during the harvest and can only be held at room temperature for one or two days. However, since most customers use frozen mayhaws to make jelly, freezing the fruit in gallon-sized freezer bags is a good storage method.



Cultivars

Thirty-five different named mayhaw cultivars and 100 selections (designated Turnage 1-100) were evaluated during the course of this study. The most promising cultivars and selections are listed below and in Table 1 in approximate order of ripening. Growers should also consult information from Louisiana, where much research has occurred in recent years.

‘T.O. Superberry’ is an upright spreading tree that blooms in mid- to late February; fruit ripens in late April. The fruit is large and dark red with pink flesh. Fruit firmness is excellent and retention on the tree is nearly ideal. Its early bloom time resulted in very light crops in 1993, 1996 and 1998.

‘Mason’s Superberry’ (aka ‘Texas Superberry’) is an upright spreading tree that blooms in mid- to late February; fruit ripens in late April. The fruit is large and very dark red with pink flesh. Fruit firmness is excellent but retention on the tree can be excessive. Its early bloom time resulted in very light crops in 1993 and 1998.

‘Superspur’ is an upright tree that blooms in late February and early March; fruit ripens in late April and early May. The fruit is large with a light red/yellow skin and yellow flesh. Fruit firmness and retention are poor. Its early bloom time resulted in light crops following the 1993 and 1996 freezes. ‘Superspur’ is very productive in years without late spring freezes.

‘Saline’ is an upright, spreading tree that blooms in early to mid-March; fruit ripens in late April and early May. The fruit is large with mostly red skin and light pink/orange flesh. Fruit firmness and retention are excellent. ‘Saline’ produced a 60 percent crop following the 1996 freeze.

‘Big Red’ is an upright, spreading tree that blooms in early March; fruit ripens in late April and early May. The fruit is large with red skin and pink flesh. Fruit firmness and retention are good. ‘Big Red’ produced a very light crop following the 1996 freeze.

‘Crimson’ is an upright, spreading tree that blooms in mid-March; fruit ripens in late April and early May. The fruit is large with mostly red skin and light pink flesh. Fruit firmness and retention are only fair. ‘Crimson’ produced a 30 percent crop following the 1996 freeze and an 80 percent crop following the 1998 freeze.



‘Royal Star’ (aka G-5), a new cultivar from southeast Texas, is under testing at Tifton. It is reported to be performing well in Louisiana and Texas. Fruit ripens in late April and early May. The fruit is soft, but very large with red skin. The calyx opening is large.

‘Big V’ is an upright tree that blooms in early to mid-March; fruit ripens in late April and early May. The fruit is large with light red skin and pinkish flesh. Fruit firmness and retention are poor to fair. ‘Big V’ produced a 40 percent crop following the 1993 freeze, a 50 percent crop following the 1996 freeze and a 50 percent crop following the 1998 freeze.

‘Texas Star’ is an upright tree that blooms in mid-March and ripens in early to mid-May. The test trees were only a few years old in 1999, so information at that time was limited. It was reported to be performing well in Texas and Louisiana following spring freezes. The fruit is large (sometimes very large) with red/orange skin and yellow flesh. Fruit firmness appears to be fair and fruit retention might be somewhat excessive.

‘Turnage 57’ is an upright tree that blooms in early to mid-March; fruit ripens in early to mid-May. The fruit is medium in size with light red skin and yellow flesh. Fruit firmness and retention are poor to fair. ‘Turnage 57’ produced an 80 percent crop following the 1993 freeze, an 85 percent crop following the 1996 freeze and an 80 percent crop following the 1998 freeze. Flowers appear to be pollen sterile, but it is very precocious and set heavy crops in both test orchards.

‘Turnage 88’ is an upright, vigorous tree that blooms in early to mid-March and ripens its fruit in mid-May. The fruit is medium in size with light red skin and yellow flesh. Fruit firmness and retention are poor to fair. ‘Turnage 88’ was slow to come into heavy bearing, but since 1994 it has shown outstanding cropping ability. It was the highest-yielding selection in the orchard at Attapulcus following the 1996 freeze, producing 41.2 pounds of fruit per tree.

Pest Problems

A number of bird, insect and disease problems were noted during the study. Native songbird and cedar waxwing feedings have been a problem on some sites in some years. New shoots may be broken and ripe fruit eaten and pecked. Deer feeding can also be a serious problem on young trees in some orchards. Since the orchards received pesticide applications during the post-bloom period, plum curculio (*Conotrachelus nenuphar* – Herbst) and apple maggot (*Rhagoletis pomonella* – Walsh) were not a significant problem.



Several scale insects have required treatment with dormant oil. Quince rust (*Gymnosporangium clavipes* – Cke. & Pk.) has been a major problem in some commercial orchards, especially where cedar trees are located nearby. However, was only been a minor problem in the two test orchards in this study. The fungicide myclobutanil (Nova) is now labeled for use on mayhaws to control rust.

In 1997, a spring foliage and blossom blight was noted in two Thomas County orchards. Two distinct species of *Monilinia* have subsequently been isolated from blighted tissue samples collected in Georgia orchards. This disease is potentially very serious and reduced the crop at Attapulcus by approximately half in 1997. It caused nearly a 100 percent crop loss in Thomas County orchards that same year. The fungicides Flint and Nova are labeled for use on mayhaws as potential controls for these diseases.



Leaf spots can partially defoliate mayhaw trees prematurely in September, but have not required treatment to date. Fire blight, caused by the bacterium *Erwinia amylovora*, occurs sporadically on mayhaws in the Southeast (McCarter and Payne, 1993). Little is currently known about the disease on mayhaws except that the crop is susceptible under proper environmental conditions during bloom. Glyphosate (Roundup) is labeled for use on mayhaws and can be used for weed control after the root suckers have been removed. Goal herbicide is labeled for winter application as a postemergent and preemergence herbicide. Lack of chemicals registered for control of plum curculio and *Monilinia* blossom blight are currently major limiting factors in the commercial culture of mayhaws.

Cultivar	Typ. date ripe	Typ. bloom date	Fruit size (mm)	Fruit color (skin/flesh)	Firmness	Retention	Comments
'T.O. Superberry'	late April	mid- February	15-18	dark red/pink	8	8	early bloom a problem
'Mason's Superberry'	late April	mid- February	17-18	dark red/pink	8	9	early bloom a problem, holds on tree tightly
'Super-spur'	late April/ early May	late February/ early March	17-18	lt. red-yellow/ yellow	5	5	productive, poor color, soft, shatters
'Saline'	late April/ early May	early/ mid- March	15-19	mostly red/ light pink	8	8	late blooming, productive, good firmness and retention
'Big Red'	late April/ early May	early March	18-19	red/pink	7	7	good size and color
'Crimson'	late April/ early May	mid- March	16-18	mostly red/ light pink	6	5.5	late blooming
'Big V'	late April/ early May	late February/ early March	16-18	lt. red/ pink- ish-yellow	5	5	most of crop ripens in early May, soft, shatters
'Turnage 57'	early/ mid- May	early/ mid- March	13-16	red/ yellow	5	5	late ripening, late blooming, soft, shatters
'Turnage 88'	mid- May	early/ mid- March	15-17	red/ yellow	5.5	6	late ripening, late blooming, somewhat soft

Ratings are on a 1-10 scale where 7 = very good and 8 = excellent, except in the case of fruit retention where 8 = slightly excessive and 9 = excessive.

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