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Kiwifruit and Hardy Kiwi (Kiwiberries)

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Kiwifruit is well-known for its high nutritional value and has become very popular with consumers all over the world. More than 90% of kiwifruit is currently grown in New Zealand. Kiwifruit production in the United States is mostly concentrated in California because kiwifruit is not cold hardy.

In recent years, there has been a growing interest in hardy kiwi production due to its high nutritional values, smooth skin, and sweet taste. Hardy kiwi is also known as kiwiberry. Hardy Kiwi is available in some grocery stores, but is still considered a novelty fruit. However, the growing interest in hardy kiwis provides hope that this rare fruit may someday be widely accepted by consumers.

Limited research has been conducted on hardy kiwi breeding and growing. Hardy kiwi breeding is still at its infancy stage, even though there are quite a

few named varieties available, and it is still difficult to say which cultivars are superior to others. There are limited numbers of hardy kiwi farms in the United States. There is an active hardy kiwi breeding program at the University of New Hampshire, and a cultivar trial was conducted at The Ohio State University South Centers from 2018 to 2020 to determine if hardy kiwi can be a viable crop for Ohio farmers as a part of the 2017 Specialty Crop Block Grant from the United States Department of Agriculture (USDA) through the Ohio Department of Agriculture (ODA).



Figure 1. Ripening hardy kiwis on the plant. Photo by Will Hastings, University of New Hampshire.

Information in this fact sheet is designed to introduce potential commercial growers to growing hardy kiwi in Ohio. However, much of this information can be used for growing hardy kiwi in home gardens as well.

Kiwifruit

Kiwifruit, which has replaced the Old English name “Chinese gooseberry,” is native to the mountains and hills of southwestern China, where it grows wild in trees and on bushes. The kiwifruit was introduced to Europe, the United States, and New Zealand between 1900 to 1910. Commercial plantings were first made in New Zealand around 1930 and have become widespread over the last 50 to 60 years.

There are more than 50 species in the genus *Actinidia*, to which kiwifruit belongs. All of these are long-lived perennial vines or creeping types. The plants are dioecious, which means that male



and female flowers are found on different plants. Thus, one male plant is needed for six-to-eight female plants for pollination. Male plants do not produce fruit. The fruits range from round to oblong in shape, and from smooth-skinned to hairy. The flesh color may be green, orange, or yellow.

Figure 2. Kiwifruit is commonly seen in grocery stores. It is very high in vitamin C, but is not cold hardy in Ohio. Photo by Gary Gao, The Ohio State University.

“Hayward” is a female variety of *A. deliciosa*, which is now the primary variety grown commercially. This is because of its large fruit size, superior keeping quality (up to six months), and fine flavor. There are now a number of strains of “Hayward” being grown.

“Hayward” fruit are fuzzy, brown, and oblong in shape. The flesh is tart-sweet and tastes like a combination of citrus, melon, and strawberry. When fruit are cut cross-wise, the emerald-green flesh has a ring of small black edible seeds. This variety is primarily grown in California’s Central Valley in the United States. It is only winter hardy down to approximately 10°F and, consequently, will not survive in the Midwest.

Hardy Kiwi or Kiwiberry

Actinidia arguta is more cold hardy than kiwifruit and is reported to survive temperatures of -25°F.

This species has been purchased and planted by many backyard fruit growers in the Midwest United States. Fruit size is considerably smaller than that of the “Hayward” variety and can range from as small as a blueberry to as big as a large sweet cherry. The skin of *A. arguta* is smooth and consumed with the fruit.

Most hardy kiwi fruits are greenish-yellow in color and acidic until ripe. However, some varieties, when exposed to the sun, can develop a nice reddish blush on the skin. When

ripe, hardy kiwi can be quite sweet and juicy. Their flavor is considered to be better than that of kiwifruit.

Several cultivars or varieties of hardy kiwis in *Actinidia arguta* listed in a Penn State fact sheet are Ananasnaya (commonly known as Anna), Dumbarton Oaks, Geneva, Issai, and Meader (male plant). More information on each of the listed cultivars can be found at extension.psu.edu/hardy-kiwi-in-the-home-fruit-planting.

Anna, Chang Bai Giant, Cordifolia, Geneva, Hardy Red, Issai, Ken's Red, MSU, and Prolific were purchased for trials at The Ohio State University. Since none of them have produced fruit thus far, it is too early for us to report on them. Most kiwiberry cultivars are known to take three to five years to produce fruit. Issai is advertised to be self-fruitful and to produce fruit in year three. One home gardener has reported that his Issai produced a lot of fruit during year three. One commercial grower in Pennsylvania has been growing Anna for many years and has had success with it. Since we have very limited knowledge on kiwiberry cultivars, no recommended cultivars are provided at this time. All growers are encouraged to conduct their own trial before installing a large planting.

Actinidia kolomikta bears smaller fruit than *A. arguta*. *A. kolomikta* is very winter hardy and will survive temperatures as low as -40°F. Fruits are very sweet and have a superb aroma and flavor. They are also very high in vitamin C, which can be one percent of the fresh weight. The vine is the least vigorous of the three *Actinidias* discussed here. It is generally known as a landscape plant for



Figure 3. A mature hardy kiwi planting at the Kiwi Berry Organics Co. Farm in Danville, PA.

its pink and white variegated leaves, which are particularly attractive on male plants.

Photo by M. Ryan Slaughter, The Ohio State University.

Both *A. arguta* and *A. kolomikta* are considered hardy kiwis and have only succeeded in commercial plantings on a limited scale. They are also grown by home gardeners in areas where low winter temperatures prevent the cultivation of kiwifruit.

Pollination

Both kiwifruit and hardy kiwi are dioecious, which means they have male and female flowers on different plants. Hence, male plants and female plants need to be planted. The suggested ratio is one male to six to eight female plants. Only female plants will produce fruit.

Kiwifruit and hardy kiwis are primarily pollinated by bees and other pollinators. However, wind can play a role in pollinating them. Hence, it is also important to know the direction of the prevailing wind, and plant male plants upwind from the female plants. Strong wind during bloom can be very helpful in improving fruit set.

Even with ideal placement of both male and female plants, the fruit set can still be quite disappointing. Bees are known to only visit one type flower, thus limiting the chance of cross pollination. Growers and gardeners are encouraged to do their own hand pollination to ensure good fruit. Commercial grower are known to purchase dry pollens from commercial vendors as a way to increase kiwi yields. Refer to the fact sheet “Kiwifruit Growing” for more information on the biology and practices of kiwifruit pollination (Oregon State University, 2005). The principles for hardy kiwis are quite similar.

Frost Hardiness

One of the primary problems in growing any of the *Actinidia* species is that the plants begin growing early in the spring, when the young shoots and developing flower buds are extremely susceptible to injury from spring frost.

The plants can be damaged by even brief exposures to 30°F or lower. Thus, the flower buds are normally killed by spring freezes and the plants rarely produce fruit. Successful cropping of kiwifruit may require a long, frost-free growing season of about 220 days.



Figure 4. The flowers of kiwiberries are quite susceptible to spring freezes. Photo by Will Hastings, University of New Hampshire.

The plants, particularly young ones, are susceptible to trunk injury from spring frosts. The trunk increases in hardiness as it gets older and develops a thicker layer of bark, but it is recommended the trunks be protected. This can be done by laying the plants on the ground and covering them with leaves, wrapping the trunks, or using sprinklers and heaters for frost protection.

Site Selection and Planting

Hardy kiwi often do not survive the first growing season. This is generally due to planting in a poorly drained soil and the development of root rot or neglect after transplanting.

Survival can be improved by growing them in five-gallon containers for the first season. Plants should be staked and transplanted only after they have become well established late in the first growing season or after the danger of frost has passed the following

season. The plant must either be transplanted to the yard or the field, or the containers must be protected during the winter to prevent the roots from freezing. Water the plants adequately, but not excessively.

Select a planting site that has good air drainage, is protected from high winds, and is not frost-prone. The soil should be a well-drained loam since heavy clay soils make plants much more prone to root rot. Plants do best when the soil pH is around 6.5. Set plants 15-18 feet apart in the row because kiwiberry plants can be extremely vigorous. Dave Jackson, a commercial kiwiberry grower since 1988 and the owner of Kiwi Berry Organics Co. in Danville, PA, suggested to Ryan Slaughter that a spacing of 30 feet between plants may be even more ideal. Growers or gardeners will need to make their own decision based on scientific research/suggestions and personal observations.

Fertilization

Specific fertilization guidelines have not been established for commercial growers in Ohio due to limited research and experience. Growers are still encouraged to conduct a soil test to determine soil pH and nutrient levels. They may have to experiment with the fertility program based on the levels established for other fruit crops.

For home gardeners, there are suggested fertilization rates from different universities. From Penn State University: “Because hardy kiwi roots burn rather easily, apply fertilizer cautiously. No fertilizer will be necessary in the year of planting. In the spring of the second year, apply 2 ounces of 10-10-10 per plant, and increase this amount by 2 ounces each year until plants receive a total of 8 ounces per plant” (Penn State University, 2016). Broadcast the suggested amount as a soil surface broadcast over the entire root system to avoid root injury.

Trellising

There are several different trellis types and training systems available. The T-bar trellis will be described here. Construct your trellis prior to, or shortly after, planting. It must be strong enough to support the weight of the plants. Use posts that are four to six inches in diameter and eight to nine feet long.

Set the posts 15 to 18 feet apart and set them two to three feet deep. Brace the end posts well. Attach a six foot long, two by six inch cross arm to the top of each post and brace it back to the post with wire or wood. Then stretch five 12-gauge wires along the tops of the cross arms. Place two of the wires at the ends of the cross arms, one down the center, and the other two spaced evenly in between.

Hardy kiwi plants are set between posts, similar to how grapevines are grown. It is very important to train a straight and strong trunk since it will support the weight of the cordon itself. The weight of canes and fruits will be supported by the trellis and the wires. Refer to figures 3, 5, and 6 for more information.

Training Young Plants

Train a single shoot up to the top center wire of the trellis by removing any lateral growth. Tie the shoot, which will form the trunk, loosely to a stake or bamboo pole. Keep the trunk straight and keep it from winding around the stake or the bamboo pole. It is important to keep the new shoot as straight as possible because this shoot will become a future trunk and will help support some of the weight of the plant in the years to come.



Figure 5. A strong trellis is required for successful hardy kiwi production since the plants are vigorous and very heavy. Photo by M. Ryan Slaughter, The Ohio State University.

At the top of the trellis, train the shoot along the center wire in one direction. The following year, a shoot will be trained along the center wire in the opposite direction. These two shoots will form the permanent leaders on the vine. Prevent these leaders from twisting around the center wire since this can weaken the vine in future years. The lateral canes that develop from these leaders are tied perpendicular to the leaders to the outer wires. These canes will be the fruiting canes the following year.

Dormant Pruning

The main leaders that were trained to the center T-bar wire are permanent unless they become weak or winter injured. They can be renewed by tying down a new vigorous shoot. Replace all other wood on an annual cycle in late February.

Pruning should be done well before growth starts in the spring to prevent vine bleeding. Remove most of the wood that fruited the previous year and any twisted or broken canes. Retain vigorous one-year-old canes that have not fruited and are well spaced (about every 10-18 inches) along the leaders and form a single canopy layer. Prune these back to the first eight buds. Where vigorous one-year-old canes have not developed or vegetative vigor is reduced, retain the fruiting arms that fruited the previous year by cutting back to eight buds past the last fruit-bearing leaf axil. A small percentage of spurs are also retained for fruit production. These are short laterals that have terminated their growth back close to the leaders. They are produced usually when strong shoots are cut back.



Figure 6. Dormant pruning is required each year for successful fruit production. Photo by M. Ryan Slaughter, The Ohio State University.

As an alternative to the single trunk training practiced in most areas where the hardy kiwi is grown, recommendations for the eastern United States suggest the use of multiple main trunks. This is primarily due to trunk splitting and injury from spring frosts. Multiple trunks can be developed from the ground and each trained as a leader on the trellis. If one trunk is injured, it can be removed and still leave a large portion of the plant.

Inspect plants in the spring for trunk damage. If the bark is lifted completely around the trunk, prune the trunk below the damage. Vigorous regrowth from the stump will replace the trunk.

Summer Pruning

Summer pruning is done just before flowering. Remove shoots that do not have flowers that originate outside the wires. Flowering shoots are cut back four to six leaves past the last flower. Tangled shoots are also removed. Later in the summer, shoots that are not needed for replacement canes are removed and replacement canes are tipped to prevent tangling.

Pruning Male Plants

Since male plants do not produce fruit, they can be particularly vigorous. These plants are pruned immediately after flowering and the flowering shoots are cut to vigorous new growth closer to the leader. Male plants are not pruned during the dormant season so maximum flowering can be achieved.

Irrigation

Irrigation is important for a number of reasons. Lack of water will reduce fruit size and flower numbers and induce early fruit drop. Drought will also induce leaf drop and early

fruit ripening, which leads to uneven ripening and poor fruit flavor. Water stress also delays the development of vine maturity and appears to reduce vine fall hardiness.

Flowering

Flowering on vines, that have not been damaged by spring frost, normally occurs on three-year-old vines. If the plants were propagated from juvenile vines instead of mature vines by the nursery, flowering may take an additional year or two to begin. Flowering takes place around mid- to late-May. The exact timing of flowering may be dependent on location and weather.

Fruit Development and Harvest

The fruit quickly sizes up after pollination and reaches its full size in mid-summer. However, the remaining portion of the season is required to mature the fruit. Harvest usually takes place in late September and the fruit is picked prior to ripening. This fruit tastes better when picked, refrigerated, and ripened as opposed to ripened on the vine.

To determine when to pick, harvest a few fruit and allow them to soften for a few days. When the fruit ripens to a suitably sweet flavor, harvest all the fruit and refrigerate them. Fruit will store in the refrigerator for five to six weeks. Removal from the refrigerator initiates softening and ripening and should be done several days before eating. All the hardy kiwi varieties have a similar flavor. Hardy kiwi often reaches sugar levels of 20 percent and are considerably sweeter than the Hayward kiwifruit. The fruit also contains large quantities of the enzyme actinidin, which will tenderize meat.

Diseases and Pests

Phytophthora crown and root rot is one of the more serious diseases in hardy kiwi. It causes weak plant growth and the development of small yellow leaves. Terminal growth

may be stunted or die back. Plants often collapse and die during hot weather. This disease occurs on heavy wet clay soils, so these soil types should be avoided when planting. Over irrigation can also lead to *Phytophthora* root rot.

Hardy kiwi plants are also damaged by root knot nematodes. Two-spot spider mites can build up on plants during hot, dry weather, particularly on greenhouse-grown plants and occasionally outside. Japanese beetles will feed on the leaves.

There are several reports of cats digging up the roots and clawing the plants and foliage. Hardware-cloth or chicken wire trunk protectors are recommended to alleviate this problem.

Acknowledgments

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