

Hanna Jugo, L. Robert Barber Jr., Mark Acosta, and Clarissa Barcinas

Mulberry as a Fast to Fruit Tree

Morus nigra; commonly known as black mulberry, is a fruit tree native to central Asia. The mulberry is a very fast to fruit tree, bearing fruit in 1-2 years, when propagated by cuttings. For many new farmers establishing agroforestry or fruit tree plantings, fast to fruit trees provide rapid economic returns and local market impact. Chefs on Guam have expressed the desire for more local variety in fruits that convey local ambience, during both monthly Micronesian Chefs' Association meetings and in focus groups (L. Barber personal communications, 2013-2018). Mulberry offers producers the potential for commercial quantities of fruit in only two to three years.

Culture at a Glance

Names: *Morus nigra*; black mulberry
Size: potentially 20-30 ft.
Flowering and fruit production: On Guam in flushes year-round with irrigation
Light: Full sunlight
Soil: Well drained soils tolerant of a wide range of soil conditions
Spacing: 14-16 feet; Away from pavements and concrete
Propagation: By hardwood cuttings, aird layering, or grafting
Watering: Moist soils; drought resistant, but must be watered in dry seasons; tolerant of seasonal waterlogged soils
Pruning: Prune laterals to develop spurs near main branches; avoid heavy pruning, pruning is usually done at the end of the dry season.
Common Diseases: Popcorn disease, Phyllactinia

Plant Appearance and Growth

Description of Tree

Mulberry (*M. nigra*) is a fast-growing deciduous tree that can potentially reach a height of up to 60 feet

(UC Integrated Pest Management, 2017). On Guam, mulberry trees often grow to about 15 – 25 feet high, it is recommended that the height be controlled through pruning. It has a slender trunk with many branches, which can lead to a bush-like appearance if not properly trained (Datiles, 2015). Unpruned the branches spread outward and are usually wider at the top, and can create dense shade. Depending on the way it is pruned, the form of the tree can vary from pyramidal to drooping. Black mulberry leaves are rough to the touch, and can be a variety of shapes (Datiles, 2015).

Description of Fruit

The fruit is not actually a berry, but a collective of fruit clusters (California Rare Fruit Growers, Inc., 1997). Black mulberry fruits are large and juicy. They are described as having a sweet aroma with a uniquely tangy flavor (Abdalla, 2006). The color of the fruit does not identify the mulberry species, however, as *Morus nigra* can produce fruit both deep red and black in color (California Rare Fruit Growers, Inc., 1997). Because the dark colored juice of the fruit stains easily, fruits should be harvested and handled with care.

Varieties of Mulberry

White mulberry (*Morus alba*) and red mulberry (*Morus rubra*) are common varieties of mulberry in the US mainland. White mulberry fruits can be white, lavender, or black in color. Red mulberry fruits are usually deep red, and have similar taste to that of black mulberry fruits (California Rare Fruit Growers, Inc., 1997).

Propagation

On Guam mulberry are most commonly propagated by cuttings (hardwood). They readily root in a moist shady environment. Sprig budding is the most common method for mulberry grafting. Although other types of grafting can be successful, black and white mulberry trees tend to be incompatible (California Rare Fruit Growers, Inc., 1997).

Planting Establishment & Maintenance

Spacing & Pruning

Trees should be spaced at least 15 feet apart (California Rare Fruit Growers, Inc., 1997). They should be planted away from sidewalks and concrete to make way for shallow roots that grow near the soil surface around the trunk (Carter, 2007).

It is advisable to keep mulberry trees short to facilitate harvest. It is ideal to keep mulberry short and let it grow outward rather than upward. Pruning increases air circulation in the plant canopy and allows for faster drying of leaves after periods of rain (helps to prevent fungal growth). Mulberry should be pruned at the end of the dry season to the beginning of the rain season.

Planting

The recommended time to plant mulberry trees on Guam is at the beginning of the rainy season. But if watered regularly mulberry can be planted year-round. A hole should be dug at least twice the diameter of the root ball and deep enough to accommodate the existing root system. The hole should be large enough to accommodate the mulberry's first-year root growth. To provide a more fertile soil, mix amendments such as compost, manure, or fertilizer with the existing soil and refill around the root ball.

An old farmer saying from South Georgia that should be considered when planting a tree:

“It is better to plant a \$1 plant in a \$10 hole than a \$10 plant in a \$1 hole.”

Sheet Mulching

Sheet mulching is a low maintenance practice for weed suppression and erosion control that simultaneously builds soil organic matter. Sheet mulching is a three-layered mulch system used for crops and trees. Waste materials such as cardboard, shredded paper, grass clippings, green waste, etc. can be used. Sheet mulching around a newly planted tree is recommended to reduce weeds, improve soil fertility, and conserve water.

To sheet mulch after planting add compost, manure, or other amendments to the soil around the tree. Next,

place a weed barrier (layer of overlapping cardboard or newspaper) around the tree in the shape of a ring. The materials used for the weed barrier, such as cardboard, should overlap one another, so weeds will not emerge. Soak this weed barrier layer thoroughly with water. Finally, spread a layer of mulch material over the weed barrier. It is important to leave a gap of several inches (2"- 6") between the sheet mulch materials and the tree trunk for good air circulation. On Guam where feral chickens are a problem a ring of lemon grass may be planted around the sheet mulched perimeter to prevent spreading of mulch to the surrounding area.

Nutrients and Fertilizers

Mulberry, like many fruit trees, can survive in Guam's soil types without additional fertilization. However, supplemental nutrition can improve the health of the tree, enhance growth, increase yields, and reduce pest problems.

Application of fertilizer varies with the age and size of the tree and the type and condition of the soil. A “complete” fertilizer is one that has all three primary plant nutrients nitrogen (N), phosphorous (P), and potassium (K). Young non-bearing and fruit-bearing trees respond well to applications of complete fertilizers, such as 16-16-16, 10-20-20, or 10-30-10 on a regular basis.

Do not use a complete fertilizer that has a higher percentage of nitrogen than phosphorous and potassium for fruit trees because nitrogen encourages leaf growth at the expense of fruit and root production.

Fertilizer application

Optimum fertilizer application rates are those based on soil tests. Tables 1 and 2 provide general fertilizer recommendations that may be used in the absence of recommendations based on soil tests. Table 1 provides frequency and fertilizer rates to apply to young, non-bearing mulberry trees. Table 2 provides frequency and fertilizers rates of two common complete fertilizers for application to mature fruit-bearing mulberry trees. For instructions on how to take a soil sample see UOG CE&O's “Soil Sampling” brochure (Motavalli, 1998).

Table 1. Fertilizer program for young trees.

Year	Times/Year	Amount per Tree Application (lbs) 10-20-20	Amount per Tree Application (lbs) 16-16-16
1	6	0.50 lbs 3.0 lbs/year	0.25 lbs 1.5 lbs/year
2	6	1.0 lbs 6.0 lbs/year	0.50 lbs 3.0 lbs/year
3	6	1.50 lbs 9.0 lbs/year	0.75 lbs 4.5 lbs/year

Table 2. Fertilizer for fruit-bearing trees.

Apply ½ pound of (10-20-20) or ¼ pound of (16-16-16) complete fertilizer per foot of the diameter of the tree canopy per year		
Time of application	Amount per 16' Tree Canopy 10-20-20	Amount per 16' Tree Canopy 16-16-16
After harvesting all fruit apply ½ the amount of fertilizer for the year	4.0 lbs	2.0 lbs
Apply ¼ of the amount of fertilizer two months later	2.0 lbs	1.0 lbs
Apply ¼ of the amount of fertilizer two months later	2.0 lbs	1.0 lbs
Total	8.0 lbs yearly	4.0 lbs yearly

Irrigation

Proper irrigation is important especially during the mulberry tree's early years. If mulberry trees are planted during Guam's dry season (January to June), and/or for year-round fruiting, irrigation is recommended. Drip irrigation is recommended for water conservation and economic efficiency. Funding assistance, for Guam producers, for drip irrigation is available through the Natural Resource Conservation Service's (NRCS) Environmental Quality Incentive Program (EQIP) program. For more detailed information on design and installation of drip irrigation systems see Cooperative Extension & Outreach's publication, "Drip Irrigation Basics" (Tuquero, et. al., 2019).

Incentive Programs

On Guam, incentives for farmers are possible through participation in the USDA Natural Resource Conservation Service's (NRCS) Environmental Quality Incentive Program (EQIP). Participating farmers may receive cash reimbursements for establishment costs of recommended conservation practices. Drip irrigation is one of the many sound environmental practices recommended under the EQIP program. Incentives for implementing conservation plans make this an attractive farm program. Under EQIP, farmers have the ability to both increase the environmental sustainability of their operations and improve their bottom line.

For participation in government programs, it is important to verify that the program requirements are met, and plans are in place prior to implementing a practice. For more information on EQIP program, contact your local NRCS field office on Guam. NRCS offices can be reached at (671) 300-8591. For EQIP on the web visit:

<https://www.nrcs.usda.gov/wps/pertal/nrcs/main/national/programs/financial/eqip/>

Pests and Diseases

Birds, on Guam feral chickens, and mealy bugs are pests on mulberry. The *Phyllactinia corelea* and *Uncinula geniculata* pathogens cause a spread of mildew that creates a white powdery coating on the lower leaf surface (Orwa et al., 2009). Canker disease, caused by *Hendersonula toruloides*, causes branches and limbs to wilt. The fungus enters the plant through wounds and cracks in the bark (Johnson et al., n.d.).

Harvest and Handling

Maturity

The fruit is ripe when the color darkens to a deep red or purplish black, and when it is soft to the touch. Ripe fruit falls easily off the branch when shaken or pulled directly. It is very easily damaged so great care should be taken when harvesting.

Shelf Life

Mulberry is a highly perishable fruit. Its delicate texture, sensitivity to fungi, and ripeness during harvest give it a short shelf life. Thermal methods,

such as freezing, are often used to store mulberry (Wang, et al., 2013). If unwashed, the fruit will keep several days in a refrigerator in a covered container (California Rare Fruit Growers, Inc., 1997)

Packaging Preferences

For commercial uses, mulberry fruits are usually kept in plastic clamshell containers, like those of blueberries.

Food Uses and Nutrition

Potential for Value Added Processing

Though black mulberry fruits are delicious when eaten out of hand, they can also be used in a variety of foods. Unripe fruits taste best in pies and tarts. They used in sauces or puddings. They can be eaten dried, or made into wine (California Rare Fruit Growers, Inc., 1997).

Nutritional Value Table

Nutrition Facts	
Serving Size 1 cup (140g)	
Servings Per Container	
Amount Per Serving	
Calories 60	Calories from Fat 5
% Daily Value*	
Total Fat 0.5g	1%
Saturated Fat 0g	0%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 15mg	1%
Total Carbohydrate 14g	5%
Dietary Fiber 2g	8%
Sugars 11g	
Protein 2g	
Vitamin A 0%	Vitamin C 80%
Calcium 6%	Iron 15%
*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:	
	Calories: 2,000 2,500
Total Fat	Less than 65g 80g
Saturated Fat	Less than 20g 25g
Cholesterol	Less than 300mg 300mg
Sodium	Less than 2,400mg 2,400mg
Total Carbohydrate	300g 375g
Dietary Fiber	25g 30g
Calories per gram:	
Fat 9 • Carbohydrate 4 • Protein 4	

References and Additional Readings

Abdalla, E.S. (2006). The Biological Benefits of Blackmulberry (*Morus nigra*) Intake on Diabetic and

non Diabetic Subjects. *Research Journal of Agriculture and Biological Sciences*, 2(6): 349-357

Datiles, M. and Acevedo-Rodriguez, P., (2015). *Morus nigra* (black mulberry). CABI. Retrieved from <https://www.cabi.org/isc/datasheet/34830>

California Rare Fruit Growers, Inc. (1997). Mulberry. Retrieved from https://afghanag.ucdavis.edu/fruits-nuts-vegetables/Fruits/files/mulberry/Man_Fruit_Mulberry_CRFG.pdf

Carter, K. (2007). Fruitless Mulberry Tree (*Morus alba*). University of California Cooperative Extension: Center for Landscape and Urban Horticulture. Retrieved from <http://ucanr.edu/sites/urbanhort/files/80182.pdf>

Johnson, W.S., Morris, R., Mandekic, J. (n.d.). Managing Sooty Canker. University of Nevada Reno Cooperative Extension. Retrieved from <https://www.unce.unr.edu/publications/files/ho/other/fs9626.pdf>

Motavalli, P., (1998). Soil Sampling: For Healthy Plants and a Healthy Environment, College of Agriculture and Life Sciences, University of Guam.

Orwa C., Mutua A., Kindt R., Jamnadass R., Simons A. (2009). *Morus nigra*. Agroforestry Database. Retrieved from <http://www.worldagroforestry.org/output/agroforestry-e-database>

Joe Tuquero, L. Robert Barber, Jesse Bamba, Mark Acosta (2019). *Drip Irrigation Basics*. Cooperative Extension & Outreach, University of Guam.

UC Integrated Pest Management. (2017). Mulberry-*Morus* spp. Retrieved from <http://ipm.ucanr.edu/PMG/GARDEN/PLANTS/mulberry.html>

Wang, R., Dev, S.R.S., Raghavan, V.G.S., Garipey, Y. (2013). Improving mulberry shelf-life using PEAKfresh package in cold environment. *Journal of Food Research and Technology*. 1(2). 73-79.