

Spondias Growing in the Florida Home Landscape¹

Jonathan H. Crane and Jeff Wasielewski²

Scientific Name and Common Names

Spondias dulcis Parkinson (synonym: *S. cytherea* Sonn.). Common names include ambarella, Otaheite apple, and golden apple (English-speaking countries); kedondong (Malaysia and Indonesia); ma kok farang (Thailand), juplon (Costa Rica); and caya (Brazil) (Andall and Paull 2012a).



Figure 1.
Credits: Jonathan H. Crane, UF/IFAS

Spondias mombin, L. Common names include yellow mombin and hog plum (English-speaking countries); jobo and ciruela amarilla (Spain, Latin America); and taperebá and cajá (Brazil) (Andall and Paull 2012b).



Figure 2.
Credits: Jonathan H. Crane, UF/IFAS

Spondias purpurea, L. Common names include purple mombin and red mombin (English-speaking countries); jobillo, jocote and ciruela (Central and South America and Mexico) (Andall and Paull 2012c).

1. This document is HS63, one of a series of the Horticultural Sciences Department, UF/IFAS Extension. Original publication date April 1994. Revised January 2019. Visit the EDIS website at <https://edis.ifas.ufl.edu> for the currently supported version of this publication.
2. Jonathan H. Crane, professor and tropical fruit crop specialist, Tropical Research and Education Center; and Jeff Wasielewski, commercial tropical fruit crops Extension agent, UF/IFAS Extension Miami-Dade County, UF/IFAS Extension, Gainesville, FL 32611.



Figure 3.
Credits: Jonathan H. Crane, UF/IFAS

Family

Anacardiaceae

Relatives

Spondias tuberosa, *S. pinnata*, *S. acida*, *S. novoguineensis*, and *S. borbonica*, cashew (*Anacardium occidentale*), mango (*Mangifera indica*), and pistachio (*Pistacia vera*).

Origin

Ambarella is native to the South Pacific Islands from the Indo-Malaysian region to the Tahiti Islands (Andall and Paull 2012a). The yellow mombin is native to tropical America (Martin, Campbell, and Ruberté 1987). Purple mombin is native to southern Mexico, the Bahamas, Haiti, and Central America (Andall and Paull 2012c; Miller and Knouft 2006).

Distribution

Ambarella was introduced into Florida circa 1905, yellow mombin in 1914, and red mombin circa 1839 (Morton 1987; Popenoe 1979). Ambarella and yellow mombin are grown in humid tropical and subtropical lowlands throughout the world. Purple mombin grows in similar conditions but may also grow in slighter higher elevations. In Florida, dwarf ambarella and purple mombin are grown commercially on a very small scale; dwarf ambarella and purple mombin are more common than yellow mombin. *Spondias* may be found as dooryard trees in warm locations along the southeastern and southwestern coastal areas and along the southern shore of Lake Okeechobee.

Uses

Spondias are appreciated for their heavy fruit production and the ease with which they are propagated and managed.

The fruit of superior selections are sweet with a smooth texture and are sold in markets in many countries to be consumed fresh (Campbell and Sauls 1994).

Description

The *Spondias* species are best adapted to the hot, lowland tropics, although the red mombin may be found up to an elevation of around 1800 m (6000 ft.). They will grow in warm subtropical areas where no frost occurs, or which experience only occasional light frosts. Cultivation in Florida is limited to the warm southern coastal areas. The trees grow best in fertile, well-drained soils but can be grown satisfactorily in a variety of poorer soils if they are given adequate nutrition.

Tree

The ambarella is a potentially large tree (up to 60 ft, but 30 ft in south Florida), although a dwarf form is now available (up to 11 ft); the yellow mombin is a medium-sized tree (up to 50 ft but 40 ft in south Florida), whereas the purple mombin is generally smaller (less than 50 ft) (Andall and Paull 2012a,b,c). All three trees have open spreading canopies with branches that tend to extend horizontally. The wood is very brittle and prone to breakage and subsequent rotting.

Leaves

Ambarella and both yellow and purple mombin trees are deciduous, especially in areas with a distinct dry season.

- Ambarella: Leaves are pinnate (no terminal leaflet) and 7 to 24 inches long with 9 to 25 pairs of leaflets (Andall and Paull 2012a).
- Yellow mombin: Leaves are imparipinnate (have 1 terminal unpaired leaflet) and are 6 to 11 inches long with 5–27 leaflets (Andall and Paull 2012c).
- Purple mombin: Leaves may be simple, pinnate, or bipinnate and 8 to 20 inches long with 7 to 31 pairs of leaflets (Andall and Paull 2012b; Hoyos 1989).

Inflorescence (Flowers)

In all three species, flowers are held in panicles that generally emerge before new leaf and shoot growth (Andall and Paull 2012a,b,c). Under south Florida conditions, ambarella generally flower in the spring/early summer, although the dwarf form of the tree may flower multiple times during the year. Ambarella has small whitish male, female, or bisexual flowers held on 20-inch-long terminal panicles; yellow mombin has male, female, and bisexual whitish flowers held on 8-inch-long to 24-inch-long terminal panicles.

There may be up to 2,000 flowers per panicle. Purple mombin has bisexual, pink or red to purple flowers held along the branches on axillary 0.5- to 4-inch-long panicles. Yellow and purple mombin flower in spring or summer.

Fruit

The fruit of all three species are oval to oblong drupes, possessing a stone (woody endocarp) that may have 1 to 5 seeds. Dry season determines when flowering occurs and as a consequence, fruit set and time to harvest. Thinning young fruit has been used successfully to increase fruit size at harvest (Anonymous 2014). Fruit is ready to harvest at various times of the year depending on species (see Table 1). Dwarf ambarellas tend to overproduce which results in stunted growth or sometimes even death. Fruit thinning is recommended for dwarf ambarellas.

Cultivars

There are no known named cultivars of ambarella or yellow mombin. However, there are some purple mombin selections, most with no standard cultivar name. Superior selections of ambarella and yellow mombin are often propagated vegetatively because the plants do not come true from seed. Purple mombin is almost always propagated vegetatively because the fruit rarely produce viable seed (Campbell and Sauls 1994).

Climate and Soils

Spondias are adapted to tropical and warm subtropical areas that typically do not experience freezing temperatures. Mature trees may be able to withstand air temperatures as low as 25°F (-3.9°C) for a few hours with some injury to leaves and small branches. However, young trees may be killed at 29°F to 30°F (-1.7 to -1.1°C). Flowers and small fruits may be damaged or killed if temperatures fall below 40°F (4.4°C) for a few hours.

In Florida, *Spondias* spp. should only be planted in the warmest areas of the state, i.e., along the southeast and southwest coasts; however, they have been grown in a few protected locations as far north as Merritt Island and along the southeast and southwest shoreline of Lake Okeechobee.

Spondias spp. grow well in a wide variety of well-drained soils including the limestone and sandy soils of south Florida. Although moderately tolerant of occasional flooding, they will not perform well in poorly drained soils and may develop root rot.

When planting *Spondias* spp., select a section of the yard in full sun with rapidly draining soil that is free of standing water after typical summer rains. If there is a potential for flooding, plant the tree on a berm (mound made up of native soil) 2 to 3 ft high (0.6 to 0.9 m) by 4 to 6 ft in diameter (1.2 to 1.8 m).

Cold Protection

Spondias in the home landscape may be provided limited protection from cold damage by being planted in a sheltered part of the landscape and/or within 25 ft to 30 ft of a building. The latter assumes the trees are maintained at 15 ft or less.

Propagation

While ambarella and yellow mombin can be propagated from seed, purple mombin may only occasionally have viable seed; all three trees can be propagated vegetatively. Vegetative propagation methods include grafting, but cuttings using mature wood are preferred; truncheons cut from large branches readily root when stuck in the ground or a sterile potting mix. Yellow and purple mombin have the ability to photosynthesize through their bark, which is why propagation by cuttings is almost universally a success. For this reason both trees are often used in the tropics as “living fences.” The dwarf ambarella can be grown using seed, from which it appears to come true (Winsborrow 1995).

Production

Little information on crop yields of purple and yellow mombin exist, but mature trees 12–15 ft tall may produce several hundred fruit. Yields from 5- to 7-year-old ambarella trees are reported to range from 380 to 500 lbs, and for large mature trees more than 7 years old, greater than 700 lbs per tree (Winsborrow 1994).

Spacing

Spondias, like most tropical fruit, need exposure to full sun for maximum production. If the tree is to receive minimal pruning, provide sufficient space to accommodate a mature tree (see “Tree Description” above for tree sizes). In general, *spondias* (non-dwarfing ambarella) should be planted 20–30 ft or more from the nearest trees, buildings, and power lines. Trees planted too close to other trees or structures may not grow normally or produce much fruit due to shading. The dwarf ambarella may be planted more closely.

Planting a Spondias Tree

Proper planting is one of the most important steps toward successfully establishing and growing a strong, productive tree. The first step is to choose a healthy nursery tree. Commonly, nursery spondias trees are grown in 3-gallon (11-liter) containers, and trees stand 2 to 4 ft (0.6–1.2 m) from the soil media. Large trees in smaller containers should be avoided because the root system may be “root bound.” Such trees are slow to establish and may well ultimately fail to thrive. Inspect the tree for insect pests and diseases, and avoid trees with wounds and constrictions on the trunk. The tree should be installed as soon as feasible; if that is not possible, water it regularly in preparation for planting in the ground.

Site Selection

Pick the warmest area of the home landscape to plant spondias. In general, spondias trees should be planted in full sun for best growth and fruit production. Select a part of the landscape away from other trees, buildings and structures, and power lines. Remember, spondias trees may become very large if not pruned to contain their size.

Planting in Sandy Soil

Remove a 3- to 10-ft-diameter (0.9- to 3.1-m) circular area of turf, and then dig a hole in the center that is 3 to 4 times the diameter of and 3 times as deep as the tree's container. There is no need to add fertilizer, topsoil, or compost to the hole. In fact, placing topsoil or compost in the hole before installing the tree can cause the top of the root ball to eventually sink below grade. If you wish to add topsoil or compost to the native soil, mix it with the excavated soil in no more than a 50-50 ratio.

Backfill the hole with some of the excavated soil, and then remove the tree from the container and place it in the hole so that the top of the root ball is at or slightly above grade. Fill the hole with soil in around the tree roots and tamp slightly to remove air pockets. Immediately water the soil around the tree and tree roots. Staking the tree with a wooden or bamboo stake is optional. However, do not use wire or nylon rope to tie the tree to the stake because they may eventually damage the tree trunk as it grows. Use a cotton or natural-fiber string that will degrade slowly.

Planting in Rockland Soil

Many areas in Miami-Dade County have a very shallow soil, and several inches below the soil surface there is hard, calcareous bedrock. Use the same dimensions as for sandy

soil when removing turf and digging a planting hole. In order to dig a hole, use a pick and digging bar to break up the rock, or contract with a company that has auguring equipment or a backhoe. To avoid damage to underground electrical and water pipes, be sure to contact your local utility company before digging or auguring. Plant as described in the section above.

Planting on a Mound

Many areas in Florida are within 7 ft (2.1 m) or less of the water table and experience occasional flooding after heavy rains. In addition, for locations near the ocean, salt damage to trees can be a problem as a result of saltwater intrusion of groundwater. *S. purpurea* in particular is known to be highly sensitive to salt. To improve plant survival, consider planting fruit trees on a 2- to 3-ft-high (0.6- to 0.9-m) by 4- to 10-ft-diameter mound of rock and native soil. After constructing the mound, follow the appropriate directions above for planting a tree depending on whether the soil is native or rocky.

Care of Spondias Trees in the Home Landscape

Spondias trees should be periodically fertilized in order to promote growth and regular fruiting. Watering during flowering and fruit development may improve fruit set and size. Newly planted and young trees may need to be watered during severe drought conditions. Insect pests and diseases are minimal and should be controlled only in severe situations. Please see the cultural calendar to assist in managing trees in the home landscape (Table 2).

Fertilizer

There are no field-trial-based fertilizer recommendations available for spondias. Observation of trees in Florida indicates that they will grow and fruit well with very little input; however, small amounts of fertilizer may enhance fruit yields and size. Young trees can be fertilized every two to three months during the first year, beginning with a ¼ lb (114 g) allotment of fertilizer and gradually increasing to one pound (455 g). Thereafter, 2 to 4 applications per year in amounts proportionate to the increasing size of the tree are sufficient. Use no more than 10 to 12 lbs per tree, per year for mature trees.

Fertilizer mixtures containing 6 to 10% nitrogen, 6 to 10% available phosphorus pentoxide, 6 to 10% potash, and 4 to 6% magnesium give satisfactory results with young trees. For bearing trees, potash should be increased to 9 to 15%

and available phosphoric acid reduced to 2 to 4%. Examples of commonly available fertilizer mixes include 6-6-6-2 [6 (N)-6 (P₂O₅)-6 (K₂O)-2 (Mg)] and 8-3-9-2 [8 (N)-3 (P₂O₅)-6 (K₂O)-3 (Mg)].

Spondias trees growing in calcareous soils may receive two to three nutritional sprays per year that contain magnesium, zinc, manganese, and boron mixes. These mixes are available from many garden centers and online. Iron should be applied in a chelated form as a soil drench 1 to 2 times per year (products containing iron chelated as FeEDDHA are preferred for high-pH soils such as those found in Miami-Dade). The months of June through October are the best months for applying nutritional sprays and chelated iron.

Spondias trees growing in neutral- and acid-pH soils may be fertilized with soil-applied dry materials of magnesium, zinc, manganese, and boron either separately or in mixes. Iron may be applied in chelated (FeEDTA compounds instead of FeEDDHA) form as a soil drench or in non-chelated form (e.g., ferrous sulfate) as a dry material that is watered in 1 to 2 times per year.

Irrigation (Watering)

Newly planted spondias trees should be watered at planting and every other day for the first week or so, and then 1 to 2 times a week for the first couple of months. During prolonged dry periods (e.g., 5 or more days of little to no rainfall), newly planted and young spondias trees (first 3 years) should be watered once a week. Once the rainy season arrives, irrigation can cease or the frequency reduced. Spondias are adapted to climates with a seasonal dry period during which they may lose most or all their leaves (Andall and Paul 2012a, b, c). The onset of the rainy season triggers their flowering; therefore, mature trees need little to no watering, although trees with flowers or fruit may benefit (i.e., better fruit set and fruit size) from periodic watering during prolonged dry periods.

Arthropod Pests

A number of insects have been reported to attack spondias including scales and thrips; several species of mites have also been described as pests of spondias. (Windsborrow 1994; Barbeau 1994). These pests do not appear to be a major problem for spondias in Florida at this time.

Caribbean fruit fly (*Anastrepha suspensa* [Loew]) lays its eggs in the fruit and is the major fruit pest of spondias in Florida. At present, there is little practical way to control

this pest other than bagging the fruit, which is generally impractical for purple mombin (small sessile fruit). Bagging dwarf ambarella fruit may be more practical. In general, fruit fly infestations are less intense after cool or cold winters due to the suppressive effect of temperatures on fruit fly populations.

Rugose spiraling whitefly (*Aleurodicus rugioperculatus* Martin) may attack spondias and weaken the tree by feeding on plant sap. Symptoms of this whitefly include egg spirals on the underside of leaves, presence of copious amounts of white cottony wax, sticky honeydew, and black sooty mold on leaves. Call your local UF/IFAS Extension office for recommendations regarding pest control on spondias.

Diseases

In Florida, spondias have few disease problems. Overwatering and flooding may lead to root rot and fruit infested with fruit fly may rot. Scab (*Sphaceloma* spp.) has been reported to attack the fruit peel (A. Palmateer, personal communication). Other diseases of the fruit (e.g., stem-end rot) and wood (e.g., gummosis) have been reported in the Caribbean region (Windsborrow 1994; Barbeau 1994).

Spondias Trees and Lawn Care

Spondias trees in the home landscape are susceptible to trunk injury caused by lawn mowers and line trimmers. Maintain a grass-free area 2 to 5 or more feet (0.6–1.5 m) away from the trunk of the tree. Mechanical damage to the trunk will weaken a tree and, if severe enough, lead to its death or at least die-back.

Roots of mature spondias trees spread beyond the drip-line of the tree canopy, and heavy fertilization of the lawn next to spondias trees is not recommended because it may reduce fruiting and or fruit quality. The use of lawn sprinkler systems on a timer may result in overwatering and cause spondias trees to decline. This is because too much water too often applied causes root rot.

Mulch

Mulching spondias trees in the home landscape helps retain soil moisture, reduces weed problems near the tree trunk, and, if organic, improves the underlying soil. Mulch with a 2- to 6-inch (5- to 15-cm) layer of tree bark (e.g., pine or melaleuca but not cypress) or wood chips. Keep mulch 8 to 12 inches (20–30 cm) from the trunk.

Pruning

Annual or biannual pruning is recommended to control tree size, but care must be taken not to make too large a wound because the soft and brittle nature of these trees can lead to rot in the open wounds. It is recommended that selective pruning to control tree height (and occasionally width) be undertaken during a period of hot dry weather to facilitate the wound healing process. Do not paint the wounds with anything including pruning sealer; instead, let them dry and heal naturally. If maintained at a height of 12 to 15 ft (3.7–4.6 m) or less, trees are easier to care for, less susceptible to severe wind damage, and less likely to drop limbs and damage structures nearby.

Harvest and Ripening

Spondias should be carefully picked by hand because their peel is thin and easily broken. Fruit quality is best when fruit is allowed to ripen or nearly ripen on the tree. Ripe fruit may be eaten immediately or refrigerated for several days. Non-ripe fruit should not be refrigerated until ripe.

Uses and Nutritional Value

Spondias are generally eaten fresh (out of hand) although they may be juiced and used in desserts and pastries. Spondias are a good source of certain nutrients and vitamins (Table 3, 4 and 5).

Literature Cited

Andall, R., and R.E. Paull. 2012a. *Spondias cytherea* (ambarella). In: *The Encyclopedia of Fruit and Nuts*. J. Janick and R.E. Paull, editors. CABI International, Cambridge, MA. P.29–31.

Andall, R., and R.E. Paull. 2012b. *Spondias mombin* (yellow mombin). In: *The Encyclopedia of Fruit and Nuts*. J. Janick and R.E. Paull, editors. CABI International, Cambridge, MA. P.31–34.

Andall, R., and R.E. Paull. 2012c. *Spondias purpurea* (red mombin). In: *The Encyclopedia of Fruit and Nuts*. J. Janick and R.E. Paull, editors. CABI International, Cambridge, MA. P.34–36.

Anonymous. 2014. Ambarella. City of Darwin Community Orchard. 2 pages. <http://www.darwin.nt.gov.au/sites/default/files/Ambarella.pdf> (Accessed 11-5-14).

Barbeau, G. 1994. Plums. In: Third Regional Workshop on Tropical Fruits, Grenade, 16–20 May, 1994. IICA Office in Trinidad and Tobago. P.131–133.

Campbell, C.W., and J.W. Sauls. 1994. Spondias in Florida. Horticultural Sciences Dept., Fla. Coop. Extn. Service, Univ. of Fla., Gainesville, FL. 4 pages.

Hoyos, F. J. 1989. Frutales en Venezuela (Nativos y exóticos). Sociedad de Ciencias Naturales La Salle, Caracas, Venezuela. P.30–32.

Martin, F.W., C.W. Campbell, and R. M. Ruberté. 1987. Perennial Edible Fruits of the Tropics: An Inventory. USDA-ARS, Agriculture Handbook No. 642, U.S. Gov. Printing Office, Washington, DC. P.15.

Miller, A.J., and J.H. Knouft. 2006. GIS-based characterization of the geographic distributions of wild and cultivated populations of the Mesoamerican fruit tree *Spondias purpurea* (Anacardiaceae). *Amer. J. Bot.* 93:1757–1767.

Morton, J. 1987. Fruits of Warm Climates. J.F. Morton, Miami, FL. p.242–245.

Orwa, C., Mutua, A., Kindt, R., Jamnadass, R., & Simons, A. 2009. *Spondias purpurea*. In: Agroforestry Database: a tree reference and selection guide version 4.0. World Agroforestry Centre, Nairobi, Kenya. 5 pages.

Popenoe, J. 1979. The genus *Spondias* in Florida. *Proc. Fla. State Hort. Soc.* 92:277–279.

Windsborrow, C. 1994. Golden apple production. In: Third Regional Workshop on Tropical Fruits, Grenade, 16–20 May, 1994. IICA Office in Trinidad and Tobago. P.113–114. <https://books.google.co.cr/books/p/iica?id=9zlkAAAIAAJ&pg=PA72&dq=Regional+Workshop+on+Tropical+Fruit&hl=es&cd=1#v=onepage&q=Regional%20Workshop%20on%20Tropical%20Fruits&f=false>

Table 1. Spondias: Seasonality and characteristics of fruit.

Common name	Season	Shape/size	Characteristics
Ambarella	Nov.–May	Oval, 2.5 to 3.5 inches long (typically 5–8 oz but some up to 16 oz)	Fruit held on long stalks in bunches. Green, hard fruit may drop over several weeks and then ripen (golden-yellow color). May be eaten green or ripe. One to 5 seeds inside a woody stone with projections that extend into the pulp.
Yellow mombin	Aug.–Nov.	Oblong, 1.25 to 1.5 inches long and 1 inch wide	Fruit held on long stalks in loose bunches. Golden yellow when ripe. One seed inside a woody smooth stone.
Purple mombin	June–Oct.	Oblong to roundish and may be lumpy, 1.0 to 2.0 inches in length.	Fruit held singly or in small bunches of 2–3 before leaves emerge. Fruit may be purple, dark- or bright red, orange, yellow, or red and yellow. One to 5 seeds inside a fibrous, hard, knobby stone.

Table 2. Cultural calendar for spondias production in the home landscape.

Operation	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Dry fertilizer ¹			The period from March through September is generally the best time to apply granular mixes containing nitrogen-phosphate-potash-magnesium (N-P-K-Mg).									
Nutritional sprays			When leaves are present, apply 2 to 3 nutritional sprays to the leaves any time from March through October. These sprays should include magnesium, manganese, zinc, molybdenum, and boron.									
Iron soil drenches				The period from April through September is generally the best time to apply 1 to 2 soil drenches of chelated iron material.								
Watering			Water young trees during dry periods of 5 or more days. Watering during the summer may be unnecessary unless drought conditions prevail. Water less during the winter (Nov.–Feb.).									
Insect control	Monitor trees year-round for signs of insect infestation.											
Disease control	Monitor trees year-round for signs of disease.											
Pruning	In general, early spring after the danger of freezing temperatures is best. Avoid pruning during the fall and winter.											
¹ Dry fertilizer mix that includes nitrogen, phosphate, potash, and magnesium. See text for composition of nutritional sprays and iron soil drenches.												

Table 3. Nutritional content of ambarella.

% edible pulp ^z	Calories ^z	Protein (g) ^z	Fat (g) ^z	Total carbohydrate (g) ^z	°Brix ^y	% Fiber ^y
34	48–50 kcal/100 g pulp	0.51–1.06 (~2%) ^y	0.25–0.56	12.3–25.6	6.0	17
Mineral content (mg/100 g fresh fruit) ^y						Vit. C (mg/100 g) ^y
Phosphorus	Calcium	Magnesium		Sodium	Zinc	5.9 (good)
4,000 (good)	35 (good)	10 (good)		4	0.24	
^z Wenkam, N.A., and C.D. Miller. 1965. Bull. 135. Composition of Hawaii Fruits. Univ. of Hawaii, College of Trop. Agri., Hawaii Agri. Experiment Station, Honolulu, HI. 88 pages.						
^y Ishak, S.A., N. Ismail, M.A.M. Noor, and H. Ahmad. 2005. Some physical and chemical properties of ambarella (<i>Spondias cytherea</i> Sonn.) at three different stages of maturity. Fj. Food Comp. and Analysis 18:819–827.						

Table 4. Nutritional content of yellow mombin.

Calories (kcal) ^z	Protein (g) ^z	Fat (g) ^z	Total Carbohydrate (g) ^z	Ash (g/100 g) ^z	Fiber (g/100 g) ^z	°Brix ^z
61–86	1.06	0.62	13.9	0.76	1.9	14.9
Mineral content (mg/100 g fresh fruit) ^z						Vit. A (RE/100g)
Phosphorus	Potassium	Calcium	Magnesium	Iron	Sodium	
32.9	288.3	11.0	15.1	0.33	5.6	223

^zTiburski, J.H., A. Rosenthal, R. Deliza, R.L. de Oliveira Godoy, and S. Pacheco. 2011. Nutritional properties of yellow mombin (*Spondias mombin* L.) pulp. Food Res. International 44:2326–2331; RE=retinol equivalent.

Table 5. Nutritional content of purple mombin.

Calories ^z	Protein (g) ^z	Fat (g) ^z	Total carbohydrate (g) ^z	Starch (g/100 g) ^z	Fiber (g/100 g) ^z	°Brix ^z
61–86 kcal/100 g pulp	0.1–1.0	0.03–0.8	16.0–22.3	2.5	0.2–0.7	6.0
Mineral content (mg/100 g fresh fruit) ^z			Total phenolics (mg GAE/100g) ^y	Total anthocyanin (mg/100 g) ^y	Vit. C (mg/100 g) ^z	Niacin (mg/100 g) ^z
Phosphorus	Potassium	Sodium				
32–56	230–270	2–9	55.0	1.4	23–73	0.4–1.8

^z Koziol, M.J., and M.J. Maciá. 1998. Chemical composition, nutritional evaluation, and economic prospects of *Spondias purpurea* (Anacardiaceae). *Economic Bot.* 52:373–380.
^y Almeida, M.M.B., P.H.Machado de Sousa, A.M.C. Arriaga, G. Matias do Prado, C.E.C. Magalhães, G.A. Maia, T.L. Gomes de Lemos. 2011. Bioactive compounds and antioxidant activity of fresh exotic fruits from northern Brazil. Food Res. International 44:2155–2159; GAE=gallic acid equivalents.

Table 6. General fertilizer recommendations for spondias.

Year	Times per year	Amount/tree/ application (lbs) ¹	Nutritional sprays (times/year) ²	Iron chelate drenches (oz/tree/year) ³
1	3	0.25–0.5	3	0.5–0.75
2	3	0.5–1.0	3	0.75–1.0
3	3	1.0–1.5	2	1.0–1.5
4	3	1.5–2.5	2	1.5–2
5	3	2.5–3.5	2	2
6	3	3.5–4.0	2	2
7	3	4.0–4.5	2	2
8+	3	4.5–5.0	2	2

¹ Use 6-6-6-2, 8-3-9-3, or similar material. Apply dry fertilizer from April through September.
² The nutritional spray should contain zinc, manganese, boron, molybdenum; it may also contain iron. Foliar sprays are most effective from April to September.
³ Iron chelate soil drenches (iron plus water) will prevent iron deficiency; foliar iron sprays are generally not effective. Apply 1 to 2 soil drench from June to September.