



Plant Care: Native Hawaiian Species

Common name: Aalii

Scientific name: *Dodonaea viscosa*

Origin: This species is native to all the main Hawaiian Islands and occurs widely throughout the tropics.

Special features: Aalii is a multi-branched shrub or sometimes a small tree that can grow to about 25 feet in height. It has reddish brown to blackish gray bark. The narrow leaves range from 1 to 4 inches long. Although the leaves are variable, they are often wavy, papery, and covered with a sticky covering. The small flowers of aalii are greenish or yellowish to red. The dry fruits vary in color from straw-colored to reddish purple. Each fruit has 2 to 4 papery wings that contain a small, round seed.



Aalii is an extremely hardy plant that is resistant to wind, drought, and salt spray. It is adapted to a variety of climates and habitats, occurring from sea level to high elevations areas with a wide range of annual rainfall. This plant prefers full to partial sun and well-drained soil, although they can thrive in a variety of soils. The deep, fibrous root system helps to stabilize the soil and prevent erosion. Once established, it requires little maintenance.

Pruning: This plant responds well to pruning. Regular pruning can promote uniform, thicker hedges. It can also be trimmed and shaped to have a single trunk.

Irrigation: Aalii is drought tolerant and survives in dry conditions. Once established, it requires minimal watering likely due to the extensive deep root system.

Fertilization: Aalii needs little supplemental fertilization if the surrounding landscape is fertilized annually. Slow-release fertilizer every six months. Over fertilizing can attract pests.

Common pests: This plant has relatively few insect pests, although scales and mealy bugs have been observed, especially on new growth. A systemic insecticide such as Orthene® or Merit® should control these pests. Slugs have also been noted to consume aalii foliage at night.

Common name: Alahee

Scientific name:
Psychrax odoratum

Origin: Alahee is indigenous to all the main Hawaiian Islands. It also occurs on the islands of Micronesia and the South Pacific.



Special features: This shrub or small tree has horizontal branches and can grow between 20 and 30 feet tall. Its bark is durable and whitish. The leaves are oval-shaped with pointed ends and about 2 to 3 inches long. The upper leaf surfaces are glossy, while the lower surfaces are dull. The bright white flowers are arranged in clusters and can be mildly to strongly fragrant. The Hawaiian name of this plant refers to the flower's fragrance (ala), which is slippery or elusive like an octopus (hee). The roundish fruits are shiny green and turn blackish when ripe. Many features of alahee resemble mock orange (*Murraya* spp.), an introduced plant that is commonly used in landscaping.

This tough, drought tolerant plant can make an attractive hedge or tree. Alahee can adapt to a variety of habitats from dry shrublands to wet forests. It prefers full sun and well-drained soil, but tolerates partial shade and moist conditions. Once established, alahee requires little maintenance.

Pruning: In general, little to no pruning is necessary for this species. Annual maintenance pruning removes any dead or hazardous branches.

Irrigation: Alahee is drought tolerant. For a few months after outplanting, supplemental irrigation may be necessary if plants show signs of drought stress. Once established, minimal watering is required.

Fertilization: Young plants can be foliar feed with slow-release fertilizer every six months. Once established, little supplemental fertilization is necessary. If leaves appear yellowish, foliar feed them with Miracid®.

Common pests: Seeds are commonly attacked by seed borers. This can be prevented by spraying developing fruits/seeds with a standard insecticide. The species is also vulnerable to sucking insects like aphids, scales, mealy bugs, and thrips. A systemic insecticide, such as Orthene® or Merit®, should control these pests.

Common names:
Beach Naupaka,
Naupaka Kahakai

Scientific name: *Scaevola sericea*

Origin: This species of naupaka is indigenous to the Hawaiian Islands, as well as throughout the tropical and subtropical Pacific and Indian Ocean coasts.



Special features: Beach naupaka is a dense, spreading shrub that can grow up to 10 feet tall and 6 to 15 feet wide. The waxy and fleshy medium green leaves grow from 2 to 8 inches long. The flowers are white or cream colored, often with purple streaks, and have a pleasant fragrance. All five petals are on one side of the flower making them appear to have been torn in half. The fruits are fleshy white berries about 1/2 inch long. They can float for months in the ocean and still germinate after having been in salt water for up to a year.

Naupaka is one of the most widely used of our native plants and can be planted in practically every form of landscape, from beach parks, along roads and highways, commercial lots, and anywhere else requiring low maintenance and xeric needs. It is common in hot dry coastal areas on most of the Hawaiian Islands. Naupaka is easy to grow from seed and to propagate from cuttings. Even large cuttings up to 3 feet long can be rooted.

Naupaka is very commonly used for hedges in medians in the ROW, where it is often planted in combination with St. Augustine grass and shower trees or monkeypods. It grows best in full sun but will tolerate medium shade. Heavier shade, such as it may get under mature shower or monkeypod trees, will produce lankier growth.

Pruning: Plants prune well, growing back thickly at cut branches and twigs. It is best to hedge them often to prevent them from becoming overgrown. Monthly pruning will keep them within size restrictions and shaped well. Infrequent over pruning results in a bald appearance that looks bad and takes a long time to fill back out. Keep lower branches pruned high enough to provide enough room to mow and trim under the hedge. Do not allow grass or other weeds or ground cover to grow up inside the hedge.

Fertilization: Beach naupaka grows well in clay, sand, cinder or coral soils as long as drainage is good. It is wind tolerant and is not injured by salt spray. It does not require much extra fertilizer. An annual application of slow-release nitrogen fertilizer in the medians or in the general landscape around the naupaka is enough for good growth of naupaka.

Irrigation: Naupaka is drought tolerant and does not require any more water than is regularly supplied to the median or general landscape. If irrigation is not used, normal rainfall is usually adequate in most locations in Hawaii.

Common pests: These shrubs are prone to ants, as well as scale, spider mites and other sucking insects.

If treatment becomes necessary a systemic insecticide, such as Orthene® or Merit®, will control the infestation. Merit® applied as a soil drench around the root zone is very effective for long-term control.

Common names: Hibiscus, aloalo

Scientific names: *Hibiscus* spp.

Hibiscus arnottianus

Hibiscus brackenridgei

Hibiscus clayi

Hibiscus furcellatus

Hibiscus kokio

Hibiscus tiliaceus

Hibiscus waimeae



Origin: Two of the native Hawaiian hibiscus species (*Hibiscus furcellatus* and *Hibiscus tiliaceus*) are indigenous to the Hawaiian Islands. The remaining five native species are endemic, or found only in the Hawaiian Islands.

Special features: Hawaiian hibiscus flowers are found on all the main Hawaiian Islands, except Niihau and Kahoolawe. Most Hawaiian hibiscus shrubs grow to a height of 3 to 15 feet tall with a spreading diameter of 8 to 15 feet. Young Hawaiian hibiscus plants have smooth tan trunks; the trunks of older plants have a wrinkled appearance. Hawaiian hibiscus shrubs bear blooms almost every day, but the blossoms last only for a day even when on the bush. Each native Hawaiian hibiscus is unique as described below.

Hibiscus arnottianus – This small shrub or tree can grow over 30 feet in height. It has several Hawaiian names including kokio keokeo, hau hele, kokio kea or pua aloalo. These names all refer to the species' white flowers. This plant is only found on Oahu, but an endangered subspecies is also found on Molokai.

Hibiscus brackenridgei – Mao hau hele is a tall shrub (up 33 feet) with bright yellow flowers. This species is the official State flower of Hawaii and is also listed as endangered because few individuals remain in the wild. Its Hawaiian name refers to the green (mao) dye and its branching habit that is similar to *Hibiscus tiliaceus* (hau). In addition, it appears to move (hele) because after several years of growth, the shrub falls over then re-roots and forms a new shrub next to where it originally fell.

Hibiscus clayi – This endangered species is a shrub or small tree with bright red flowers. It is only found on in dry forests on the Island of Kauai.

Hibiscus furcellatus – This pink-flowered hibiscus is an herb or small shrub. In Hawaiian it is known as akiohala, akiahala, hau hele, and hau hele wai. It is often found growing near water (wai), such as wetlands or taro patches. This is the only species that is indigenous rather than endemic to the Hawaiian Islands.

Hibiscus kokio – Kokio or kokio ula is a shrub or small tree (10-23 feet) with red to orange (or rarely yellow) flowers. This species is not officially listed as threatened or endangered, but is considered rare in nature.

Hibiscus tiliaceus – Hau is common on all the main Hawaiian Islands, especially coastal areas.

Hibiscus waimeae – Kokio keokeo or kokio kea (white hibiscus) is a gray-barked tree, 20-33 feet tall, with white flowers that fade to pink in the afternoon. This hibiscus is only found on Kauai.

Pruning: Almost all of the native hibiscus (except *Hibiscus brackenridgei*) can be pruned any time during the year to shape future growth, invigorate old plants, manage plant size and get rid of diseased and dead wood. Prune by shearing back longest branches every 4 to 6 weeks to maintain shape. Leave the shorter branches to produce flowers. It is recommended that native hibiscus be pruned less than introduced hibiscuses that are often used as hedges. Over pruning native hibiscus can make them more susceptible to insects and disease. Unlike most hibiscus, the yellow-flowered *Hibiscus brackenridgei* does not respond well to pruning and does not perform well as a hedge.

When pruning native Hawaiian hibiscuses, use sharp, clean shears and make a clean cut just above and angled down and away from an “eye” or node. Cutting above outward pointing “eyes” will encourage growth in that direction. Fresh growth comes below every cut. The new growth resulting from pruning invigorates the plant and will provide a source for many new blooms. Regular pruning is necessary to have a bushy plant and to control its shape. About half an inch of wood should be left between the cut and the leaf node on each branch. See Chapter 6 for details about pruning.

Fertilization: Fertilize lightly and often. Hibiscus is a heavy feeder but does not tolerate excessive applications of water soluble fertilizers. Use fertilizers that include the micronutrients iron, manganese, copper and boron. Slow-release fertilizers may have advantages over conventional water soluble ones.

A dry fertilizer, such as a 10-10-10, is acceptable; however, a low phosphate fertilizer, such as a 7-2-7, is preferred as this might help produce the most impressive quality and quantity of blooms. The so-called “bloom specials” with the 10-40-10 type of formula are generally avoided; phosphorous can build up in the soil over time and cause a general decline in the health of tropical hibiscus plants.

Over-use of high nitrogen fertilizers may encourage leaf growth rather than flower production. Water soluble fertilizers are good for spraying leaves (foliar feeding). High phosphorous water soluble fertilizers can be used successfully when applied as a foliar feeding. Slightly acid soil (a pH of 6 to 7) helps the plant absorb nutrients. Hard water and proximity to things like concrete can move the pH in the wrong direction – toward an alkaline pH. Yellowing of leaves may indicate that the plant is under stress either because of too much or too little fertilization, disease or a variety of other reasons.

Soil and light: Hibiscus is tolerant to many conditions, but grows best in well-drained sandy soil with some organic content and slight acidity. For best results, the plants should have direct sunlight at least six hours a day. The drainage should be good so that water will not pool at the base of the plant. This can be tested by filling water in the pit taken for planting and observing how long it takes to drain out.

Irrigation: New plantings of hibiscus need to get regular watering until the roots are well established. Moisture retention is important, and organic compost soil amendments added at planting and mulching the surface around the planting hole helps to retain moisture in a sandy soil.

Established hibiscus plants should receive regular watering either from rainfall or irrigation. Irrigation watering cycles of once every two to three days with run times that deliver about one inch of water at each watering is adequate. Make sure there is no long lasting standing water after irrigation. *Hibiscus arnottianus* requires more soil moisture than most of the other native hibiscus species, while *Hibiscus brackenridgei* can survive several months without watering

Common pests: Insects, such as aphids, thrips, scale, whiteflies, Chinese rose beetles, and mites can be persistent pests. For most insect problems Orthene®, a systemic pesticide, is widely used. Products such as Merit®, containing the systemic active ingredient imidacloprid are excellent for controlling most insects. Merit® can be applied as a soil drench, and is an effective treatment for erinium mites when applied after infected branches are pruned out. Certain types of oils, such as Ultra Fine Oil®, is effective for whiteflies and scales. Many report good results with neem products. Plant native hibiscus near a street light to prevent damage from the Chinese rose beetle or use a systemic herbicide such, as Orthene®.

Water plants thoroughly before using insecticides to lessen shock. It is usually best to apply in the early morning or late afternoon when temperatures are below 80°F. When applying, both the tops and undersides of the leaves should be sprayed. When used as a soil drench, soak the soil out to 10 feet from the base of the plants. Of course, follow the label directions. NEVER use liquid Malathion® on hibiscus; it will cause severe damage to the leaves resulting in yellowing and leaf drop.

Common name: Kou

Scientific name:
Cordia subcordata

Origin: Although this species was originally believed to be brought to the Hawaiian Islands by Polynesian voyagers, recent evidence finds that kou was actually in the islands before humans arrived. It is now considered indigenous to Hawaii.



Special features: Kou is a small evergreen tree with a broad, dense wide canopy that grows to about 25 feet in height. The canopy can spread to a width of 25 to 30 feet. The trunk is usually less than 16

inches in diameter with pale gray flaky or furrowed bark. The bole of the tree is often crooked and shaped by the wind. Large orange flowers are formed all year at the ends of branches and in leaf axils and last only a few days. The light green leaves are oblong with blunt ends and about six inches long. Kou trees with variegated green and white leaves are also known. Kou fruits are woody, small round balls. Generally, kou fruit all year long, but may be sporadic. The green fruits soon become brown and then dry to a blackish color when ripe. Young and old fruits are on the tree all year and constantly fall to the ground, which may present a hazard if planted too close to driveways, streets or along sidewalks where they can present a threat for slipping.

Kou is naturally found at elevations from sea level to 100 feet in areas with 40 to 160 inches of annual rainfall. Kou will not grow at higher altitudes. It prefers neutral to alkaline soils (pH of 6.1 to 7.4), with soil textures ranging from sand, sandy clay and clay. Kou prefers full sun but tolerates some shading. It has a shallow root system and can be damaged by too much surface disturbance. Once established, it requires little maintenance. However, new shoots are readily produced from the extensive shallow roots, sometimes forming thickets, and can become naturalized in low elevation, dry, coastal areas.

Pruning: Kou trees will often grow crooked and corrective pruning during the early establishment period is necessary to keep a nice shape. Annual maintenance pruning to remove dead or hazardous branches and sucker growth from the roots is necessary for established trees.

Irrigation: Kou trees are moderately drought tolerant and can survive short dry conditions. The extensive shallow root system does not require deep watering; consistent light irrigation is sufficient where annual rainfall is above 25 inches. Kou leaf drop makes excellent mulch. Leaving the leaves in place will save water and maintenance costs.

Fertilization: Kou can grow in saline soils and tolerate some salt spray, but heavy spray can severely damage leaves. Once established, kou needs little supplemental fertilization if the surrounding landscape is fertilized annually. Kou is not suitable on acidic clay soils, particularly on former sugarcane lands.

Common pests: The kou leaf worm (*Ethmia nigroapicella*), from a moth, can defoliate and kill kou trees. The wood is very termite resistant. Large trees can develop heartwood rot.

Common name:
Kukui nut (candlenut)

Scientific name:
Aleurites moluccana

Special features: The kukui nut tree (often called candlenut) was designated the official State tree of Hawaii in 1959 due to its beauty and usefulness to Ancient Hawaiians. It is a medium to large-sized ornamental tree, up to 50 feet tall, with wide-spreading branches. The leaves are variable in shape. Young leaves are large, up to 12 inches long, palmate, with three to seven lobes. Mature leaves are oval shaped with long petioles, whitish on top when young and green with age. The dingy white or creamy flowers are not showy. The round fruit is a nut 2 inches or more in diameter. The thick rough hard shell, making up about 2/3 of the fruit, is difficult to separate from the kernels and contains one or two seeds.



Kukui trees can be planted as a single tree or used as hedges. They withstand both steady strong winds and severe storm winds, which makes them suitable for windbreaks or soil stabilization. They thrive in moist tropical regions up to 2,300 feet altitude. Kukui prefers well-drained, medium textured soils with pH of 5.0 to 8.0. They do best in full sun but tolerate up to 25% shade. Kukui is usually propagated from seed, requiring three to four months to germinate. Once established, trees require little to no attention, depending on their intended use.

This species is originally native to tropical Asia, but was first brought to the Hawaiian Islands by Polynesian voyagers to be used for light, medicine and dyes.

Pruning: Kukui trees and hedges can re-grow after very occasional severe pruning, but tend to die out if severe pruning is too frequent. Lower branches tend to remain on the trunk and should be periodically removed during the first five to 10 years of establishment if the tree is to be used as a single specimen. Because of the multiple stem growth habit, the trunk of single trees tends to be very crooked and multi-branched, even with corrective pruning.

Irrigation: Kukui is quite drought tolerant when established, but grows best with regular irrigation. In the wild, kukui is an indicator of stream courses. It tolerates moderate salt spray but not highly saline soils.

Fertilizer: Kukui trees grow in a variety of soils, including low fertility soils. Regular fertilization during the first several years of establishment is beneficial. If the general landscape is fertilized on an annual basis, the kukui will need no further fertilization.

Common pests: A number of fungus diseases are known to attack kukui trees. These are more common in wet locations where the kukui remains un-pruned. Soil nematodes may also become a localized problem.

Common name: Milo

Scientific name:
Thespesia populnea

Origin: This species is currently considered indigenous to the Hawaiian Islands, but may have been introduced to the islands by early Polynesians.



Special features: Milo is a small tree or shrub that reaches a height of 20 to 35 feet and a trunk diameter of 8 to 12 inches. The leaves are a glossy dark green and the canopy is round and dense. It produces yellow hibiscus-like flowers throughout the year that last only one day before drop. Seed pods and leaves are also dropped constantly and make for a litter problem in maintained urban areas.

Milo grows at elevations from sea level to 900 feet in areas that receive 20 to 60 inches of annual rainfall. It prefers full sun and does not do well as an understory shrub. It tolerates steady coastal winds and is very tolerant of salt spray. It is a tough plant and can survive the poor drainage and hot, dry conditions common to urban areas and rural roadsides.

Pruning: Milo does not self-prune well, tending to develop crooked stems with stout, low branches that stay on the main structure of the tree. It forms multiple trunks and must be pruned to a single-stem tree form in the early stages of establishment. Mature trees are large and gnarled, spreading out rather than growing tall. Milo tolerates heavy pruning, even if topped, but this weakens the new growth and branches will never be as strong as original branches. Prune mature trees only to remove dead wood and for minor corrective pruning.

Irrigation: Milo develops a deep tap root in sandy soils once established and can withstand long dry periods. When planted on shallow, rocky or occasionally flooded soils, roots tend to be shallow, spreading on the surface. Once established, milo should not require irrigation other than from normal rainfall.

Fertilizer: Milo thrives on sandy coastal soils, tolerates saline soils, and does not do well on upland acidic clay soils. A pH range of 6.0 to 7.4 is best. Fertilize annually with a balanced slow-release fertilizer for the first five years of establishment. After the tree is established, additional fertilization other than for the general surrounding landscape is not necessary.

Common pests: Milo is highly resistant to drywood termites. It is susceptible to fungal leaf spot and to a fungal root and stem rot. These are more common in wet, un-pruned growth.

Common name: Naio, bastard sandalwood

Scientific name: *Myoporum sandwicense*

Origin: Naio is native to all the main Hawaiian Islands and also occurs in the Cook Islands.



Special features: This plant has a highly variable appearance, ranging from a prostrate, sprawling form (“naio papa”) to an erect shrub or small tree up to 15 feet tall. The bark is dark yellow-green and can smell similar to sandalwood. The lance-shaped, somewhat fleshy leaves are between 1 and 8 inches in length. Leaves are often crowded near the branch tips. Tiny white to purplish pink flowers form along the stem near the leaves. Naio fruits are either greenish-white to pink or purplish. These become ribbed when dry.

Naio is found at elevations from sea level to 7,800 feet in dry to wet areas. This plant can adapt to a variety of habitats as long as the soil is well drained. It prefers full sun. Once established, this hardy species requires little maintenance.

Pruning: Maintenance pruning should be done carefully and only when plants are vigorously growing. The prostrate form can be trimmed as a ground cover.

Irrigation: Naio is drought tolerant and requires minimal watering. Supplemental watering should be provided immediately after outplanting and during prolonged drought conditions. Overwatering the soil can cause black sooty mold.

Fertilization: A slow-release fertilizer can be applied to young or prostrate plants every six months.

Common pests: This plant is somewhat vulnerable to ants, scales, mealy bugs, spider mites, and aphids. Damage from naio thrips (*Klambothrips myopori*) has been noticed on prostrate and upright naio plants in the northwestern portion of Hawaii Island. To date, the naio thrip has not spread to other areas in the Hawaiian Islands. This pest causes leaf curling and gall-like deformations on leaves and tips of new growth. Thrips are often difficult to treat because they live in leaf folds.

Common name: Pili grass

Scientific name: *Heteropogon contortus*

Origin: This grass is indigenous to the Hawaiian Islands and also occurs widely throughout the tropics and subtropics of Africa, southern Asia, northern Australia and Oceania. The species has also become a naturalized weed in tropical and subtropical regions in the Americas, East Asia and the Pacific.



Special features: Pili grass is a tropical, short lived (less than five years) perennial grass that grows in clumps to a height of 5 feet and a spread of 2 to 5 feet. It recovers well and thrives by frequent burning. Pili grass develops dark seeds with a single long stem at one end and a sharp spike at the other, which are capable of drilling the seed into the soil.

It can be used to control erosion on slopes up to 20°, and grows best in full sun, but tolerates moderate shade. It is drought and wind tolerant, has a high tolerance to salt spray but not to high salt soils. Native Hawaiians used pili to thatch huts.

Pili grass can be planted from seeds or vegetatively. Commercial seed production is very low and most small-scale establishment has been by vegetative splits. However, when seed is used it is important to recognize the existence of two dormancy processes: one for the first four months after harvest and the other delaying germination up to about 12 months.

Although there are attempts to restore native populations in Hawaii, pili grass has become a weed in certain areas of the tropics and subtropics of the American continent and in East Asia. Its spread is assisted by the use of seasonal fires. This grass can form pure stands in dry areas which are very difficult to walk through because of the sharp leaves, and spiked seeds can cause potential discomfort or injury.

Mowing: None, but can be mowed yearly or bi-yearly to six inches to encourage new growth.

Fertilization: Pili grows on a wide variety of well-drained soils, ranging from sand to very fertile clay loams. It is less common on heavy clay soils. It is well-adapted to low fertility, but does not tolerate extremely low fertility, poor drainage or high salinity soils. Pili responds to moderate applications of nitrogen fertilizer, but high levels of nitrogen can kill the plants. Once established, pili grass should not need regular fertilization.

Irrigation: Water pili grass well under dry conditions until it is well established. Mature pili grass grows best under dry conditions but will also thrive with regular irrigation. It will remain greener longer and looks nicer with regular watering. It does not tolerate long periods of flooding or constant waterlogging, but can tolerate a few days of flooding on otherwise well-drained soils. Once established, pili grass stands can remain un-irrigated in areas that get at least moderate annual rainfall.

Common pests and diseases: Pili grass is occasionally subject to attacks by scale, mealy bugs, locusts and grasshoppers, but is otherwise generally pest-free. Smut diseases can affect seed production and often tillering behavior. Leaf rust is common on more mature leaves in some locations. Herbicides, such as triclopyr-picloram mixtures and tebuthiuron, are used for woody weed and broadleaf weed control in pili grasslands. Like most grasses, it is tolerant of 2,4-D, but susceptible to glyphosate.

Pili grass acts as a host for a downy mildew which also infects *Zea mays* (corn). Therefore, the use of pili grass near seed corn production areas of Oahu may not be advisable.

Common names: Lonomea, aulu, kaulu, manele, ae, soapberry

Scientific names: *Sapindus* spp.
Sapindus oahuensis (lonomea, aulu)
Sapindus saponaria (manele)

Origin: The native soapberry trees include one endemic and one indigenous Hawaiian species. The endemic species, *Sapindus oahuensis*, occurs only on Kauai and Oahu, while the indigenous species, *Sapindus saponaria*, is found only on Hawaii Island. *Sapindus saponaria* also occurs in Mexico, South America, Africa, and the Pacific basin.



Special features: The endemic lonomea is a medium to large-sized tree that can grow up to 50 feet tall. The bark is gray and has a rough texture. The papery, dark green leaves are between 3 and 8 inches long and have a prominent yellow midrib. The indigenous manele grows up to 80 feet tall and often has a wide canopy depending on the climate and growing conditions. It has pale brown bark that tends to fall off when older. This species has shiny green, feather-shaped leaves about 2 to 6 inches long. Manele is one of the few native Hawaiian trees that loses its leaves seasonally. Both *Sapindus* species have small, whitish to cream-colored flowers that develop at the ends of the branches. The dark brown-black fruits are oval, fleshy, leathery and about 1 inch long. These trees are often referred to as soapberry because the fruit pulp produces abundant suds that lather like soap when mixed with water.

The native *Sapindus* species are tough trees that grow best in full or partial sun. Lonomea requires direct daily sunlight, while manele is adaptable to many climates. Soils must be well drained, with soil textures ranging from sand to cinder and coral. The trees are best grown from seed; the large black seeds need to be cleaned and scarified to germinate readily.

Pruning: Dead branches and twigs can be pruned as needed. If trees become infested with black twig borers, cut and remove infected branches. Fallen fruits can become sticky or slippery in high traffic areas and should be cleaned up.

Fertilization: Foliar feed every three to six months with small amounts of slow-release fertilizer to ensure healthy growth.

Irrigation: Lonomea is drought tolerant and does not require much water once established. Water monthly during the driest months, but normal rainfall is usually adequate in most locations during the remainder of the year. Overwatering can result in stem rot. Manele is also drought tolerant, but typically requires moister conditions than its endemic relative.

Common pests: These trees are prone to ants, as well as scale, mealybugs, whiteflies, aphids and other sucking insects. Manele is also vulnerable to red spider mites. A standard systemic insecticide, such as Orthene® or Merit® will work well to control sucking insects. Young branches are also susceptible to attack by the black twig borer. Mature trees are typically more pest resistant. The bark can be sprayed with an insecticide to prevent attacks by the black twig borer. Quickly remove branches that become infested. If additional treatment for the twig borer becomes necessary, use a systemic insecticide to control the infestation.

Common names: Loulou, *Pritchardia* palms

Scientific names: *Pritchardia* spp.
Pritchardia affinis (Kona, Hawaii Island)
Pritchardia hillebrandii (Molokai);
Pritchardia remota (Niihau)

Origin: There are 19 *Pritchardia* species endemic to the Hawaiian Islands and all are called loulou palms. Of the Hawaiian species, only three (*Pritchardia affinis*, *P. hillebrandii*, and *P. remota*) are typically used in landscaping. Several other commonly used palm species are endemic to Fiji (Fijian fan palms).



Special features: Loulou palms vary in height from 20 to 130 feet although most grown in Hawaii range 30 to 50 feet. The leaves are fan shaped and the trunk is columnar, naked, smooth or fibrous, longitudinally grooved, and ringed by leaf scars. The flowers and fruit are borne in large clusters at the ends of long woody flower stems that, in some

species, are longer than the leaves. Loulu palms have course, wavy, fan-shaped leaves about four feet across. They are emerald green to grayish or bluish green on top and a waxy grayish green below.

The three endemic loulu palms typically used in landscaping grow best in full sun and prefer moderately moist and well-drained sand, cinder or coral soils. Due to the natural coastal habitat of loulu, it does very well in low-elevation landscapes and tolerates some salt spray.

Pruning: The dead leaves, flowers and fruits can be removed in a landscape setting for a cleaner appearance. Dead leaves will stay attached to the trunk for a long time if not removed on a regular basis. Pruning will make them grow taller faster, especially if flowers and fruit are removed.

Fertilization: Apply a complete palm fertilizer with minor elements. Be certain that enough magnesium and potassium is present in the fertilizer component. This is especially critical for a loulu in a pot. Magnesium and potassium deficiencies are two of the most serious nutritional disorders in palms. The deficiencies are characterized by bright yellowing (chlorotic) on leaf edges or yellow streaking of the entire fronds. This can be difficult to reverse. Applications of Epsom salt, or magnesium sulfate ($MgSO_4$), are good but do not last and usually wash out of the soil in rainy periods. There are some very good slow-release fertilizer spikes made especially for palms which contain a good balance of minor elements with magnesium and potassium.

Irrigation: Loulu palms can withstand short drought periods, but should be irrigated on a regular basis for best growth and appearance.

Common pests: Loulu palms are prone to damage from leaf rollers, whiteflies, red spider mites and sugarcane borers. Rats will eat the fruit. Apply systemic insecticides, such as Orthene® or Merit®, to control insects.



Plant Care: Common Roadside Non-native Species

Common name: Bermuda grass

Scientific name: *Cynodon dactylon* (Common Bermuda grass); *C. dactylon* x *C. transvaalensis* (hybrid Bermuda grass)

Special features: Bermuda grass is the most widely used turfgrass in Hawaii. There are two forms of Bermuda grass: common and hybrid Bermuda.



Common Bermuda grass is a pure breeding species, but has many different selected varieties that are referred to as “improved common Bermuda.” All forms of common Bermuda can be planted from seed and remain true breeding. One of the best common selections for Hawaii is Sahara.

Hybrid Bermuda grasses have all been developed from crosses between *C. dactylon* and *C. transvaalensis*. There are many selected varieties of hybrids, ranging from general utility and sports turf, such as Tiffway 419® to the “ultradwarf” hybrids, such as TifEagle®, that are only used for golf greens. Bermuda grass hybrids do not produce viable seed and must be sodded or planted from pieces of stolons (above ground runners) or rhizomes (below ground runners). The most commonly used Bermuda grass selections for Hawaii roadsides are a few improved common Bermudas, and the hybrid Tiffway 419® in high visibility areas with higher maintenance level.

Light: Both common and hybrid Bermuda grass grow best in full sun and are very intolerant of shade.

Mowing: Important factors to consider in mowing any grass are how often and at what height to mow. How often to mow is determined mainly by the growth rate of the grass, and the setting of the mower for mowing height. Mow often enough so that no more than 1/3 of the leaf blade is removed during a single mowing. Mowing intervals generally can be farther apart when higher mowing heights are used. However, for purposes of turf maintenance in the rights-of-way, all mowing and other maintenance activities are on a once every two weeks schedule.

Mowing height for common Bermuda grass is 1½ to 2 inches in rural areas and 1 to 1½ inches in high visibility urban areas. All hybrid Bermuda grass should be mowed at 1/2 to 3/4 inch.

To prevent damage use proper equipment, such as rotary mower and keep the blades sharpened on a regular basis. Weed eaters should only be used to trim in narrow or other inaccessible areas. Do not use weed eaters for mowing.

Fertilization: Bermuda grass requires more fertilization than other warm season species. For Bermuda grass in the Landscape Maintenance Zone (LMZ), at least two applications of a slow-release, high-nitrogen formulation per year will be enough to maintain good health and a consistent rate of growth. The recommended formulation of fertilizer will be made available to you by the HDOT Engineer. Refer to Chapter 11 for details about fertilizers.

Irrigation: Bermuda grass is among the more drought tolerant grass species. They can survive long dry periods by going dormant, where they turn brown and stop any active growth. The deep roots allow them to recover when water is again available. Actively growing Bermuda grass requires between 1 to 2 inches of water per week, either as rain or irrigation, to stay green and healthy. Deep watering twice a week is recommended for mature Bermuda grass stands to promote good root development. The soil should be moistened to a depth of 12 inches with each watering.

Common pests: All varieties of Bermuda grass can occasionally be attacked by certain caterpillars, which are the larval stages of several small moths. Armyworm and sod webworm are the most destructive, chewing out large patches of grass in a short period. A small mite, called Bermuda grass mite, is also a common pest causing the grass blades to become stunted and dry out.

Control: Several treatments with systemic insecticides, such as Merit®, and Orthene®, are effective controls when applied a month apart.

Common name: Be-still

Scientific name: *Thevetia peruviana*

Special features: Be-still is a close relative to *Nerium* oleander, and like oleander, be-still produces a milky sap containing a compound that is extremely poisonous. All plant parts are poisonous, especially the seeds.



Common symptoms of poisoning: numbness, burning of the mouth, nausea, vomiting, abdominal pain and diarrhea. Others include drowsiness, coma, occasional convulsions, and irregular heart beat. In extreme cases, death can be caused by heart attack. If any of these symptoms occur shortly after exposure to be-still, call 911 immediately.

Be-still is a fast growing evergreen tropical shrub or small tree that grows to 10 to 15 feet. It blooms repeatedly all year round with yellow or orange-yellow, trumpet like flowers and its fruit is deep red/black in color. The fruit produces a large seed that bears some resemblance to a Chinese "lucky nut." The long leaves are green and lance-shaped and are covered in waxy coating to reduce water loss, which is typical of oleanders. The stem is green and turns silver/gray as it ages. Be-still can be grown as shrub or tree. It tolerates most kinds of soil as long as it is well drained and situated in full sun in a wind sheltered area. Be-still is useful as a roadside landscaping plant as it does not need much maintenance and thrives in hot conditions. It can be grown from seeds or cuttings.

Pruning: Can be used as a hedge, or trained into small tree form. Prune occasionally to maintain size and shape. Be careful to wear protective clothing, gloves and eye protection. Dispose of clippings by bagging and do not allow exposure to yourself or others.

Irrigation: Water on a regular basis, especially in dry locations, for best growth and appearance.

Fertilizer: Apply a balanced slow-release fertilizer as needed to maintain slow growth and color. Requires pH range of 6.8 to 7.6 (mildly alkaline) and grows best in sandy and coral soils.

Common Pests: This plant is attractive to bees, butterflies and/or birds. No insect or disease problems.

Common name:
Bougainvillea

Scientific name: *Bougainvillea* spp. (over 300 cultivars and hybrids)



Because many of the hybrids have been crossed over several generations, it is difficult to identify many of them. There is a lot of confusion over the names of bougainvillea varieties and cultivars.

Special features: Bougainvillea often has spiny, cascading stems which end with colorful bracts of red, orange, purple and other shades with small white, inconspicuous flowers. Bougainvillea can be used in a multitude of ways: as individual accent plants, as privacy or barrier hedges, as cascading erosion control plantings on steep slopes, and some varieties can be pruned into a single-trunk small tree like an ornamental. The growth rate of bougainvillea varies from slow growing to rapid, depending on the particular variety and the location. They grow best in full sun and somewhat dry, fertile soil. They tend to flower all year round in Hawaii. Typically, bloom cycles are four to six weeks.

Caution: The sap of the bougainvillea can cause skin rashes similar to poison oak/ivy. So, when working with this plant (e.g., pruning), caution should be exercised to avoid skin contact with the sap (and thorns).

Pruning: Prune by shearing with power hedge shears to promote the greatest growth and flowering, as bougainvillea only blooms on new growth. Shearing is the method of removing the soft tips of young plant stems to encourage fuller growth. Bougainvillea sends out multiple new stems just below the sheared tip. To increase vitality, lushness, and color, shear frequently. The best time to shear is after the flush of color or flowering cycle (four to six weeks) is completed. Do not allow bougainvillea to become woody and overgrown unless it is being used on steep hillsides or other locations where it is intended to cascade and cover a large area.

Fertilization: Bougainvillea roots are susceptible to burn from fertilizers. Do not over fertilize. In this case, less is better than more. Bougainvillea has good salt tolerance and does best with soil pH of 5.5 to 6.5.

Here are some quick fertilizer tips:

- ▶ Use a low nitrogen and high phosphorus formulation with micro-nutrients, as well as additional iron and magnesium. Too much nitrogen will cause excess leafy growth and reduced flowering.
- ▶ Slow- or time-release fertilizers are good. Follow the fertilizer label.
- ▶ Plants grow best with small amounts of nutrients constantly available.
- ▶ Do not apply fertilizers to dry soil; water well after fertilizing.

Irrigation: The amount of watering needed is related to the climate, soil type, plant size and weather conditions. Plant in well-drained soil.

Helpful guidelines:

- ▶ Bougainvillea is drought tolerant and requires very little water once established. If overwatered, bougainvillea will not flower, may lose leaves or wilt, or even die from root decay.
- ▶ Drought stress can stimulate flowering. Allow the soil to dry between watering, but not bone dry, as bracts and foliage will drop.
- ▶ The first sign of wilting is the best indicator of over/underwatering.
- ▶ Irrigation should be infrequent but watering run times should be long enough to thoroughly soak the soil.
- ▶ Avoid constant, light, and frequent watering. This will promote a weak and shallow root system and prevent coloring.
- ▶ Do not allow bougainvillea to sit in water. This may cause bracts to drop or stop blooming altogether.

Common pests: Common insect pests include caterpillars, mites and aphids. The “bougainvillea looper,” a small caterpillar of a common moth, is the most troublesome pest causing extensive chewing damage to the leaves. Mites and aphids can become problems in overgrown, un-pruned plants, causing damage to leaves by sucking juices. The sugary excretions from aphids often result in development of black sooty mold on the leaves.

Control: Insect pests are best controlled with periodic foliar and soil applications of systemic insecticides. Orthene® and Merit® are the best choices. “Leaf spot” can be a problem if foliage or soil stays too wet, especially in cool weather. Treat with fungicides; correct excessive overhead watering.

Common name: Coconut palm

Scientific name: *Cocos nucifera*

Special features: Two forms of coconut palms are found in Hawaii. The common form has a slender, often slightly leaning, ringed trunk that can reach a height of 100 feet. The trunk is thickest at the base and may show some sections of narrowing as the tree grows taller. These narrowing areas (called pencilling) result from some environmental stress, often long periods of drought during earlier years of growth, but are not necessarily weak spots on the trunk.



A smaller form known locally as Samoan coconut has a shorter, thicker trunk that grows no higher than 40 feet. It has larger, wider fronds and bears large bright green fruit.

Pruning: Remove old fronds that hang lower than 90° (approximately horizontal). Remove dead, dying, damaged and diseased fronds. Developing coconuts (fruits) and flower clusters of both forms of coconut palms should be removed on a regular basis. Take care not to cut too close to the inner cone at the top of the trees. A wound can make the tree more prone to fungal infection that will eventually kill the palm (see pest section below). When feasible, tree trimming should be done during dry weather.

Fertilization: Coconut palms do not grow well under heavy nitrogen fertilization. Apply a balanced complete formulation, such as 16-16-16, containing a high percentage of slow-release nitrogen and at least 2% magnesium. Early yellowing of the older fronds can be caused by a magnesium deficiency; therefore, the need for a magnesium supplement. Coconut palms have good salt tolerance at the root zone, but are subject to salt spray damage on the fronds unless washed off periodically.

Irrigation: Palms do best in sandy, well-drained soils and should get regular watering. The slender palm roots grow shallow in the soil and spread far from the trunk. They do not require the deep watering that some other trees need. Overwatering can lead to disease problems.

Common pests: A fungal disease called “palm heart rot” is the most serious pest problem. It has become a major factor in the demise of mature coconut trees in Hawaii and has devastated coconut stands on Kauai and Oahu. Coconut plants of all ages can be infected with this disease.

Cause: *Phytophthora* fungus is relatively new to Hawaii.

Symptoms:

- ▶ The early stage is characterized by the drop of young coconut fruits.
- ▶ The stem end of small, young fruits or the entire coconut is dark and rotten.
- ▶ Larger, immature or mature green fruits have brown, mottled, irregular to circular patterns.
- ▶ Heart rot of the plant (a rot of the growing point at top of the trunk) becomes evident as the youngest emerging spear leaf dies.
- ▶ Eventually all leaves are killed and the palm dies.

Spread: The disease is slow in development, and early stages of infection may be difficult to detect. The disease can be spread by the movement of infected nuts and transplanted trees. Because transplanting coconut is a common landscaping practice in Hawaii, symptomless but infected trees may be transported great distances.

Tree pruning operations can also spread palm heart rot by carrying fungal spores from diseased plants to healthy plants on contaminated trimming equipment and tools. Wounds to the top growing heart of the palm caused by careless pruning can also spread the disease. Insects, birds and rodents can also spread the fungus by carrying spores or infected palm tissue.

Prolonged rainy periods favor disease development and spread, as well as over watering in combination with too much nitrogen fertilization.

Control: Fungicides and other pesticides are not effective. Diseased trees and nuts should be removed and burned at the first signs of infection. The presence of infected host tissue is a serious threat to healthy coconut trees in the surrounding area. Diseased plants keep the fungus for many months, even after the plants have died. Tools should be cleaned, then immersed in a disinfectant (e.g., rubbing alcohol) after trimming operations on each tree are finished, especially at sites known to have the disease.

Common name: Fijian fan palm

Scientific name: *Pritchardia pacifica*

Special features: Fijian fan palms are medium-sized palms that reach between 20 and 30 feet in height. The fan-shaped fronds (or leaves) are coarse, pleated and about four feet across. They are covered in whitish-brown fuzz when young but older fronds are mostly hairless. The trunk is columnar, smooth, unarmed and pale gray. The flowers and fruit are borne in large clusters at the ends of long woody flower stems. The flowers are yellowish-green and the round fruits are dark brown to blackish.



The Fijian fan palm is used widely in landscaping throughout the Hawaiian Islands. It is originally native to Fiji, Tonga, and possibly Samoa. This species prefers full to partial sun and tolerates some wind. It grows best in moist, but well-drained soils.

Pruning: The dead leaves, flowers and fruits can be removed in a landscape setting for a cleaner appearance. Dead leaves will stay attached to the trunk for a long time if not removed on a regular basis. Pruning will make them grow taller faster, especially if flowers and fruit are removed.

Fertilization: Apply a complete palm fertilizer with minor elements. Be certain that enough magnesium and potassium is present in the fertilizer component. This is especially critical for a loulou in a pot. Magnesium and potassium deficiencies are two of the most serious nutritional disorders in palms. The deficiencies are characterized by bright yellowing (chlorotic) on leaf edges or yellow streaking of the entire fronds. This can be difficult to reverse. Applications of Epsom salt, or magnesium sulfate ($MgSO_4$), are good but do not last and usually wash out of the soil in rainy periods. There are some very good slow-release fertilizer spikes made especially for palms which contain a good balance of minor elements with magnesium and potassium.

Irrigation: Fijian fan palms prefer moist soil and should be irrigated on a regular basis for best growth and appearance.

Common pests: Fan palms are prone to damage from leaf rollers, red spider mites and sugarcane borers. Rats will eat the fruit. Apply systemic insecticides, such as Orthene® or Merit®, to control insects. This species is susceptible to a disease called lethal yellowing that causes fruit drop and yellowing fronds.

Common name: Monkeypod

Scientific name: *Samanea saman*

Special features: The monkeypod tree is a very large, fast growing shade tree. In Hawaii, it will typically grow to heights of 50 to 80 feet and forms an umbrella shaped canopy over 100 feet in diameter. It is a fast growing tree, producing 3 to 5 feet of new growth per year until it reaches a mature size. The mature monkeypod usually forms a single short, stout trunk about 6 to 8 feet high and 3 to 5 feet in diameter. The top of the trunk forms a bole with three to five large scaffold branches radiating out to form the main structure of the canopy.



The leaflets are light sensitive and close up at night and during very cloudy weather. The monkeypod can be very messy during February through April in Hawaii. Leaves and seed pods begin to drop during these months. A large tree can drop hundreds of pounds of sticky, brown seed pods that cover the entire area under the tree canopy, requiring daily removal from sidewalks and parking lots in high maintenance areas. Removal of pods from the lawn area may also be necessary before mowing.

Monkeypods have adapted to a wide range of soil types and pH ranges. They grow well in sandy or heavy clay soils. However, monkeypods form a massive root system that can be very shallow in clay soils or in urban areas where streets and sidewalks surround the tree canopy. These surface roots often become destructive to sidewalks, walls and foundations. Monkeypod trees in these locations are also very susceptible to uprooting in hurricane force winds. When grown in sandy or gravel type soils, surface roots are not as common and the root system is deeper.

Pruning: Selective, correctional pruning of lower branches as the tree grows is necessary only until the mature height of the main trunk is

reached. After that, the maturing tree should be pruned to remove dead branches and other possibly hazardous limbs as described in Chapter 6. Although monkeypods can recover well from very heavy pruning, this practice should never be necessary if planted in a location that allows for the full mature canopy size and if early corrective developmental pruning has been done.

Irrigation: Monkeypods need regular irrigation during the first years of establishment. As they become well established in their particular environment, additional irrigation is usually required only in very dry locations.

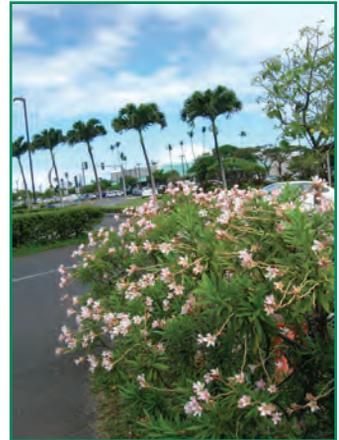
Fertilization: Monkeypods are well adapted to low fertility soils. Fertilize every six months with a balanced slow-release fertilizer during the first three to four years of establishment. Change to an annual application as the trees mature and then only as needed.

Common pests: The caterpillar stage of several moths and butterflies can feed on the young leaves as they emerge. Ants can burrow into twigs and cause damage to the growing tips of branches. Several other wasps and flies can lay eggs in developing seed pods but this is not necessarily all bad. Treatment with insecticides is usually not required. If insecticides are applied, injection and root drench are most effective.

Common name: Oleander

Scientific name: *Nerium oleander*

Special features: Oleander is a tough, durable fast-growing evergreen shrub or small tree that is inexpensive and easy to grow. It reaches heights up to 25 feet, with spreading upright branches. The flowers grow in clusters at the end of each branch. They are white, pink, red or yellow and are often sweetly scented. The fruit is a long narrow capsule, 2 to 9 inches long, which splits open at maturity to release numerous downy seeds.



Oleander is tolerant of poor soils and hot, dry conditions and grows best in full sun to part shade. It is commonly used in landscaping free-way medians and along roadsides because it is easily maintained and

able to survive the heat and exhaust fumes of heavy highway traffic. Oleander shrubs that have become stressed or diseased may generate a type of oil from the trunk and shallow roots that can saturate the soil in its vicinity. The oil is light-brown colored and has a rancid scent.

Oleander is normally grown from vegetative cuttings. It can also be grown from seed but selected cultivars may not grow true to form. Young plants grow best in spaces not competing with other plants for nutrients.

Safety First! Be careful when handling oleander – it is poisonous! Oleander is one of the most poisonous of commonly grown garden plants and in some cases can cause death, especially in young children, if eaten in even small amounts. All parts of the plant are poisonous, including dry leaves and the smoke if burned. Contact with the leaves, especially the sap, can cause severe blisters and rash on the skin and possible permanent damage to eyesight if in the eye.

Reactions to eating the leaves or sap can consist of nausea and vomiting, excess salivation, abdominal pain, and diarrhea that may or may not contain blood. Reactions affecting the heart consist of irregular or erratic heartbeat, sometimes a racing heart at first that slows to below normal. Arms and legs may become pale and cold due to poor blood circulation. Other symptoms can include drowsiness, tremors or shaking of the muscles, seizures, collapse, and even coma that can lead to death.

Medical treatment: Poisoning reactions to oleander plants appear very quickly and may require immediate medical care. Induce vomiting as a protective measure to reduce absorption of the poison. Charcoal can be chewed and swallowed to help absorb any remaining toxins. Further medical attention may be required and will depend on the severity of the poisoning and symptoms. Call 911 and get immediate medical help if any of the severe reactions described above occur.

Pruning: Wear heavy work gloves, long sleeves and eye protection to protect yourself from any poisonous parts of the oleander. Oleander has a tendency to become tall and leggy. Overgrown plants should be pruned as needed to maintain a nice rounded shape.

Keep oleander trimmed to 6-10 feet tall when grown in open medians and interchanges. In narrow medians and roadside locations prune to keep the size within safe limits. Prune the branches all over the oleander, from the very bottom to the top. Pay special attention to the bottom

of the plant where it needs to be the strongest and bushy. Allow enough room under the plant for mowing and other regular maintenance. By removing suckers, and leaving just a few stems at the bottom, oleander can be formed into very attractive small trees.

Fertilizer: Oleander grows well in most soils with a pH range of 5.5 to 7.8. It has medium salt tolerance but does not grow well in soils with high coral content. An annual application of a balanced slow-release fertilizer, such as 10-10-10 at a rate of 15 pounds per 1,000 sq. feet around the root zone is enough to keep the plants flowering and growing at a slow rate.

Irrigation: Water newly planted oleander two to three times a week as it is getting established. Once it becomes established it is very drought tolerant. However, it can survive both dry and well-drained wet soils. Fastest growth occurs when irrigated during drought. Occasional deep watering once every several weeks during normal weather is enough to maintain healthy plants in Hawaii.

Common name: Rainbow shower tree

Scientific name: *Cassia x nealiae*

Special features: Rainbow shower trees are cultivars of a sterile hybrid between amaltas (*Cassia fistula*) and Java cassia (*Cassia javanica*). One advantage of its sterility is that there are no seed-pods, and the tree is tidier than other shower trees. Propagation is by air layer or grafting. The rainbow shower tree is a moderately fast grower, reaching a mature size of to 40 to 50 feet if allowed to grow unpruned. It grows best in full sun, hot and dry conditions.



The four cultivars of rainbow shower trees provide a wide range of colors:

- ▶ **'Wilhelmina Tenny'**: This cultivar produces a heavy bloom of flowers from March through September. The flowers are multi-colors of deep cerise to yellow and no seed pods are ever produced.
- ▶ **'Queen's Hospital White'**: Flowers open pale yellow and fade rapidly to white. This cultivar flowers from March through August and produces a limited amount of seed pods.

bright yellow with age. This is the only rainbow shower cultivar that has a fragrance. It flowers May to September and produces few seed pods.

- ▶ **'Nii Gold'**: Similar to 'Wilhelmina Tenny' with flowers of deep gold to strong yellow. Its short month-long flowering period is highly variable, occurring anytime from spring to fall. It rarely produces seed pods.

Pruning: Prune rainbow shower trees after flowering period. Prune back (heading back not thinning) mature rainbow showers in urban areas each year to keep their size within the bounds of the surroundings and to maintain proper clearance for sidewalks and streets. Dead and damaged branches should also be removed at this time.

Young rainbow shower trees should be lightly pruned annually to shape and direct growth. Mature trees in open suburban and rural areas should be allowed to grow to their mature size without major pruning. Lower branches should be removed as the tree grows to raise the canopy high enough to allow mowing and other regular maintenance in the surrounding landscape. Prune to remove dead or damaged branches when necessary.

Fertilization: These trees have a low salt tolerance. Fertilize annually with a balanced slow-release formulation, such as Triple 15® or Triple 16®, at a rate of 6 to 10 pounds of fertilizer per 1,000 sq. feet of root zone. Measure the root zone by calculating the area under the drip line of each tree. Irrigate well after applying fertilizer. See Chapter 11 for details about fertilizers.

Irrigation: Rainbow shower trees are very drought tolerant and show moderate wind tolerance. Newly planted trees should get frequent watering until well established. Refer to Chapter 8. Once established, mature trees do not require frequent irrigation. Windy slopes may need extra watering during hot dry months. Irrigation schedules should be adjusted to account for seasonal demands. See Chapter 12 for details about irrigation.

Common pests: Rainbow shower trees are relatively pest free. Occasional attacks from chewing or sucking insects can be treated with pesticides that are commonly used for the ornamental landscape. Refer to Chapter 10 for details about pesticides.

Common name: Seashore paspalum

Scientific name: *Paspalum vaginatum*

Special features: Seashore paspalum spreads rapidly by stolons and rhizomes to form a fine-textured, dense turf with a deep root system. In the ROW, it is used exclusively for high visibility, high maintenance areas. Seashore looks very similar to hybrid Bermuda grass, but is darker green with thicker stolons and rhizomes and slightly wider leaf blades. Compared to Bermuda grass, seashore paspalum can form a higher quality turf in shadier conditions and in waterlogged soils.



There are several cultivars of seashore available in Hawaii. The original form, introduced in the mid 1970s, was simply called seashore paspalum and is still in heavy use today. Newer cultivars have recently been introduced, such as 'Sea Isle 1' and 'Sea Isle 2000.' All three of these do not produce viable seed and must be grown vegetatively from sod or stolons. A more recent seeded cultivar, called 'Seaspray,' has proven to be a very acceptable alternative to the more expensive vegetative cultivars.

Mowing: All seashore paspalum varieties are best mowed below one inch; however, this requires the use of a reel type mower and is not practical for most purposes in the ROW. Mowing with a high quality rotary mower at a height of 1/2 to 1 inch is the best alternative. Thatch problems increase with higher mowing heights. Weed eaters should be used only for trimming in narrow or inaccessible areas, never for larger open areas where a rotary mower has access. Since seashore paspalum is used exclusively in high visibility locations, edging along curbs and sidewalks should be done with a power edger, not a weed eater.

It is very important that mowing schedules be kept to once every two weeks and that no more than 1/3 of the leaf blade is removed at each mowing. Scalping is common in seashore when it is not mowed often enough.

Fertilization: Once established, seashore paspalum does not need much fertilization. It tolerates a wide range of soil conditions and pH from 3.6 to 10.2. For the purposes of the ROW, one application of a

slow-release high nitrogen formulation per year will be enough to maintain good health and a consistent rate of growth. Too much fertilizer will lead to a rapid thatch buildup and interfere with mowing. The recommended formulation of fertilizer will be made available to you by the HDOT Engineer. Refer to Chapter 11, "Fertilizers" for more details.

Irrigation: Seashore paspalum is very salt tolerant and can be irrigated using non-potable water, including high salt brackish water. It can survive in waterlogged soils for long periods of time. Actively growing seashore needs 1 to 2 inches of water per week as rain or irrigation. Deep watering twice a week is recommended for mature seashore stands to promote good root development. The soil should be moistened to a depth of 12 inches with each watering. Early morning irrigation times (between 2:00 a.m. and 5:00 a.m.) work best.

Common pests: Seashore paspalum can occasionally be attacked by armyworms, sod webworms, mole crickets and grubs. Weeds are also a common problem in all turf grasses.

Control: Several treatments with systemic insecticides, such as Merit® and Orthene®, are very effective controls when applied a month apart.

Be careful when using herbicides on seashore paspalum, many of them will injure this grass. Most mixes of 2,4-D, MCP, and dicamba are labeled for seashore and are effective post-emergent controls for broad-leaf weeds. The products Sedgehammer® and Certainty® are labeled and effective on nutgrass and kylinga. A list of approved herbicides will be provided to you by the HDOT Engineer.

Special Considerations: Excessive thatch buildup is the most common problem with seashore paspalum. Thatch is the brown stemmy undergrowth between the soil and the green part of the leaf blades. When thatch gets thicker than 1/2 inch it begins to interfere with mowing, causing scalping. It also prevents water from soaking down into the soil, increasing water run-off, and often leads to increased insect and disease problems.

Rapid thatch buildup is caused by over watering, over fertilizing, and mowing infrequently at heights above 1½ to 2 inches. When thatch reaches levels of over one inch, it must be removed by verticutting to restore it to favorable conditions.

Common name:
Silver Trumpet tree

Scientific name: *Tabebuia caraiba*

Special features: This *Tabebuia* is one of over 100 species. It is a medium growing evergreen tree that grows 25 to 30 feet, with a dense irregularly shaped canopy. Flower



blossoms start in late spring and continue through the summer in Hawaii. Its masses of yellow trumpet flowers are very showy. The foliage varies from gray-green to silver-green and is mostly deciduous. Some trees lose leaves prior to blooming while others can hold some of their old leaves while in flower. One good trick is to cut off all added water six to eight weeks before spring. This will encourage leaf drop and produce a much heavier show of flowers. *Tabebuias* in irrigated landscapes are usually poorer bloomers due to this excess water.

The trunk and wood of this *Tabebuia* is brittle and likely to break in strong winds, but the tree always comes back. Newly planted large field grown trees take several years to stabilize root strength. So, strong storms can easily topple large, newly planted trees. Stand them up immediately. The silver trumpet is best used for small spaces, in full sun and on well-drained soil. The tree has no pests.

Pruning: The silver trumpet typically has a single trunk that often grows crooked and twisting and the branches droop. The bark of the trunk and branches is rough and corky and thorns are common.

The wood is brittle and susceptible to breakage. Regular corrective pruning during establishment and the first eight to 12 years of growth is essential to develop a strong single trunk. Annual pruning to remove dead and damaged branches and occasional shaping of the crown is important. Seed pods and leaves are not a litter problem.

Irrigation: The silver trumpet has average water needs. It has moderate tolerance to salt spray and high drought tolerance. Once established, water regularly but do not overwater in winter. Minimal irrigation in winter months will help promote more flowering in the spring.

Fertilization: Silver trumpet does best in well-drained clay or sandy soils with relatively neutral pH (6.6 to 7.5). Fertilize well with a balanced slow-release fertilizer during establishment and semi-annually (March and September) thereafter.

Common name: St. Augustine grass

Scientific name: *Stenotaphrum secundatum*

Special features: St. Augustine grass is a very dense, coarse textured, dark blue-green turf that spreads by thick stolons. It does not produce rhizomes (underground runners) and is more shallow-rooted than most other warm season turf grasses. St. Augustine is very shade tolerant, but wears down rapidly under moderate amounts of foot traffic. It is used most often in the ROW in high visibility narrow medians where shower trees or monkey pods are planted in combination with naupaka hedges, which produce a moderately shaded, low foot traffic area. There are many cultivars of St. Augustine grass; 'Floratine' is most commonly used in Hawaii.



St. Augustine is established vegetatively from sod or small plugs or sprigs of rooted sod. It will build a very thick thatch over time, particularly when given large amounts of water and fertilizer.

Mowing: Due to the very coarse nature and thick thatch of St. Augustine, recommended mowing heights are much higher than for other warm season grasses. Regular mowing every two weeks at 3 to 4 inches is best. A heavy duty rotary mower is necessary and frequent blade sharpening is important. Weed eaters should be used only for trimming in narrow places that are inaccessible to mowers.

Fertilization: St. Augustine does not need much fertilization once it is established. One application of a slow-release high nitrogen formulation per year will be enough to maintain good health and a consistent rate of growth. Too much fertilizer will lead to a rapid thatch buildup and interfere with mowing. When thatch reaches levels of over two inches, it must be removed by verticutting in order to restore it to favorable conditions. Be careful when verticutting St. Augustine. Do not remove all surface growth, leave at least 1/4 inch of rooted stolons on the soil surface to provide the re-growth.

The recommended formulation of fertilizer will be made available to you by the HDOT Engineer. Refer to Chapter 11 for more details about fertilizers.

Irrigation: St. Augustine is shallow-rooted and does not tolerate long dry periods. It should be irrigated on a regular basis and not allowed to dry out. Two inches of water per week as rain or irrigation are necessary for good growth. Deep watering twice a week is recommended for mature stands to promote good root development. The soil should be moistened to a depth of 12 inches with each watering. Heavy thatch may interfere with water penetration and cause excessive runoff. In that case, water more often using shorter run times. Early morning irrigation times (between 2:00 a.m. and 5:00 a.m.) work best.

Although St. Augustine has a higher salt tolerance than most other warm season grasses, it may not tolerate the high salt content of brackish water. Other non-potable water sources are usually acceptable to use.

Common pests: The main insect pest of St. Augustine is the chinch bug. Chinch bugs suck the juices from the leaves and cause dry yellow to brown looking patches. Army worms, sod web worms and grubs also cause damage.

Control: Many insecticides, including Talstar®, Sevin®, Delta Guard® and Dylox®, are available for control. Merit® and Orthene® are effective on a variety of worm pests.

St. Augustine is sensitive to many post emergence herbicides, particularly those that control grassy weeds. Never use any of the arsenic-type herbicides containing MSMA or CMA that are used to control grassy weeds, such as crabgrass. St. Augustine is also sensitive to 2,4-D found in many broadleaf herbicides. Sedges, such as nutgrass and kylinga, can be controlled with Sedgehammer®, Image® or Certainty®. A list of approved herbicides will be provided to you by the HDOT Engineer.

Common name: Zoysia grass

Scientific names: *Zoysia japonica* (Japanese lawn grass); *Zoysia matrella* (Manila grass); *Zoysia tenuifolia* (temple grass, Korean grass, velvet grass)



Special features: Three different species of zoysia are found in Hawaii, as listed above. *Z. japonica* is sometimes called Japanese lawn grass, but is most often referred to simply as zoysia grass. The only zoysia grass used in the ROW is 'El Toro.' Another commonly used home lawn selection is emerald zoysia (often called poky grass), a hybrid of *Z. japonica* x *Z. tenuifolia*.

'El Toro' zoysia is a selection of *Z. japonica* that resembles centipede grass in appearance. It is deeply rooted and forms a dense medium green lawn, spreading by both stolons and rhizomes. The leaf blades have a medium to coarse appearance, thinner than St. Augustine. 'El Toro' is a sterile cultivar and is established by sodding or plugging. The establishment and growth rate of 'El Toro' is much faster than other species of zoysia, but slower than seashore paspalum and Bermuda grass. It has medium shade and drought tolerance. Zoysia grasses also have an extremely high wear tolerance.

A seeded cultivar of zoysia, called 'Zenith,' closely resembles 'El Toro' but is slow to establish from seed and does not match the uniformity and overall quality of 'El Toro.' However, it would make a more easily and cheaply established substitute when used in suburban medians or interchanges.

Mowing: The general appearance of 'El Toro' and other zoysia grasses is influenced more by proper and regular mowing than any other factor. Mowing at regular intervals of every two weeks with proper mowing equipment is very important to keep 'El Toro' healthy. Weed eaters are to be used for trimming inaccessible areas only. The recommended mowing height for 'El Toro' is 3/4 inch to 1 1/2 inches. When used in the ROW, the best maintenance height is just over one inch. This is at the bottom end of the mowing height which can be made with a rotary mower; therefore, a 1 1/2 inch mowing height is more practical. When maintained at heights over two inches, zoysia grasses will form a puffy, tufted, dense mat with a deep thatch. This condition makes it very dif-

difficult to mow and can be scalped very easily. However, when not mowed at all this dense multi-tufted mat will not grow more than 6 to 10 inches tall and may be acceptable in less visible suburban interchanges. In this case, however, weed and tree sapling invasion would be left unchecked due to lack of mowing.

Fertilization: Mature stands of 'El Toro' need only an annual application of slow release, high nitrogen fertilizer. As with other species of turfgrass, too much nitrogen fertilizer causes heavy thatch build up. The recommended formulation of fertilizer will be made available to you by the HDOT Engineer. Refer to Chapter 11 for more details about fertilizers.

Irrigation: Zoysia grasses require very little water once they are fully established. Between one to two inches of water per week, either as rain or irrigation, is enough to keep zoysia green and healthy. Deep watering twice a week is recommended for mature stands. The soil should be moistened to a depth of 12 inches with each watering. Early morning irrigation times (between 2:00 a.m. and 5:00 a.m.) work best.

Common pests: Zoysia grasses usually have very few insect problems. White grubs are the most common problems that may occasionally occur.

Control: Several treatments with systemic insecticides such as Merit® and Orthene® are very effective controls when applied a month apart. Once a zoysia grass stand is fully established, weeds are not usually a big problem. If weeds do become established, there are many effective post-emergence and pre-emergence herbicides that are labeled for zoysia.







