



DEPARTMENT OF AGRICULTURE
BUREAU OF PLANT INDUSTRY

DURIAN

PRODUCTION GUIDE



Durian
Durio zibethinus L.



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Introduction

Durian (*Durio zibethinus* Murr.) belongs to the genus *Durio* and the family Bombacaceae, which is best known for showy flowers and woody or thin-shelled pods filled with small seeds and silky or cottonlike fiber. It is the most important native fruit of southeastern Asia and neighboring islands. Widely known and revered in southeast Asia as the "king of fruits", the durian is distinctive for its large size, unique odor, and formidable thorn-covered husk.

The durian, native to Brunei, Indonesia and Malaysia, has been known to the Western world for about 600 years. The 19th-century British naturalist Alfred Russel Wallace famously described its flesh as "a rich custard highly flavoured with almonds". The flesh can be consumed at various stages of ripeness, and is used to flavor a wide variety of savory and sweet edibles in Southeast Asian cuisines. The seeds can also be eaten when cooked.

Description

The durian tree, reaching 27 to 40 meters in height in tropical forests, is usually erect with short, straight, rough, peeling trunk to 1.2 meters in diameter, and irregular dense or open crown of rough branches, and thin branchlets coated with coppery or gray scales when young.

The fruits are ovoid or ovoid-oblong to nearly round, 15 to 30 cm long, 12.5 to 15 cm wide, and up to 8 kg in weight. The yellow or yellowish-green rind is thick, tough, semi-woody, and densely set with stout, sharply pointed spines, 3- to 7-sided at the base. Handling without gloves can be painful. Inside there are 5 compartments containing the creamy-white, yellowish, pinkish or orange-colored flesh and 1 to 7 chestnut-like seeds, 2 to 6 cm long with glossy, red-brown seedcoat. In the best fruits, most seeds are abortive. There are some odorless cultivars but the flesh of the common durian has a powerful odor

Some fruits split into 5 segments, others do not split, but all fall to the ground when mature.

Related Species

There are estimated to be 28 species in the genus *Durio* in Malaysia. Only 5 species in addition to the durian bear edible fruits. These are *D. dulcis* Becc., in Sabah and Indonesian Borneo; *D. grandiflorus* Kost., in Sabah, Sarawak, and Indonesian Borneo; *D. graveolens* Becc., in peninsular Malaya and all of Borneo and Sumatra; *D. kutejensis* Becc., all over Borneo, and ranked second to the durian in edibility; and *D. oxleyanus* Griff., in peninsular Malaya and all of Borneo and Sumatra. All five are cultivated in Brunei and a few to some extent in Malaysian Borneo.

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It is believed that some of the other species, especially *D. malaccensis* Planch. and *D. Wyatt-Smithii* Kost., which are very closely allied to *D. zibethinus*, may be useful in breeding for pest- and disease-resistance and other characters.

There is evidence that natural interspecific cross-pollination is going on because a hybrid of *D. zibethinus* and *D. graveolens* has been found in northeastern Indonesian Borneo, and some trees of normally white-flowered *D. malaccensis* have been discovered in Johore State with reddish flowers, perhaps from cross-pollination by the pink or red-flowered *D. lowianus* King and *D. pinangianus*.

Production Statistics

As of 2010, the area planted to durian in the Philippines was estimated at a total of 18,837.75 has., with a total of 774,772 bearing trees. Of these, a total of 11,409.00 has. or 60.56 percent with a total of 492,121 bearing trees are found in the Davao region.

The volume of production in 2010 was estimated at 77,548.50 mt., with 55,606.33 mt, or 71.70 percent, coming from the Davao region. Of these, 1 mt. were exported and 4,653 mt. were as feed and/or waste, leaving a total net food disposable of 72,894 mt.

Uses of Durian

Durians are sold whole, or cut open and divided into segments, which are wrapped in clear plastic. The flesh is mostly eaten fresh, often out-of-hand. It is best after being well chilled in a refrigerator. Sometimes it is simply boiled with sugar or cooked in coconut water, and it is a popular flavoring for ice cream.

Durian flesh is canned in syrup for export. It is also dried for local use and export. Blocks of durian paste are sold in the markets. The unripe fruit is boiled whole and eaten as a vegetable.

The seeds are eaten after boiling, drying, and frying or roasting. In Java, the seeds may be sliced thin and cooked with sugar as a confection; or dried and fried in coconut oil with spices for serving as a side-dish.

Young leaves and shoots are occasionally cooked as greens. Sometimes the ash of the burned rind is added to special cakes.

Nutritional Value of the Durian Fruit

Value:(per 100 gram of the edible part)	Minerals	Vitamins
Water - 64.990 gram Energy - 147 kcal Energy - 615 kj	Calcium, Ca - 6 mg Iron, Fe - 0.430 mg Magnesium, Mg - 30 mg	Vitamin C, ascorbic acid - 19.7 mg Thiamin - 0.374 mg

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Protein - 1.47 gram Total lipid (fat) - 5.33 gram Carbohydrate, by difference - 27.09 gram Fiber, total dietary - 3.8 gram	Phosphorus, P - 38 mg Potassium, K - 436 mg Sodium, Na - 1 mg Zinc, Zn - 0.28 mg Copper, Cu - 0.207 mg Manganese, Mn - 0.324 mg	Riboflavin - 0.2 mg Niacin - 1.074 mg Pantothenic acid - 0.23 mg Vitamin B-6 - 0.316 mg Vitamin A, IU - 45.000 IU Vitamin A, RE - 5.000 mcg_RE
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Source: *US Department of Agriculture*

Toxicity

The seeds are believed to possess a toxic property that causes shortness of breath.

Other Uses

Rind: The dried or half-dried rinds are burned as fuel and fish may be hung in the smoke to acquire a strong flavor. The ash is used to bleach silk.

Wood: The sapwood is white, the heartwood light red-brown, soft, coarse, not durable nor termite-resistant. It is used for masts and interiors of huts in Malaya.

Medicinal Uses: The flesh is said to serve as a vermifuge. In Malaya, a decoction of the leaves and roots is prescribed as a febrifuge. The leaf juice is applied on the head of a fever patient. The leaves are employed in medicinal baths for people with jaundice. Decoctions of the leaves and fruits are applied to swellings and skin diseases. The ash of the burned rind is taken after childbirth. The leaves probably contain hydroxy-tryptamines and mustard oils.

The odor of the flesh is believed to be linked to indole compounds which are bacteriostatic. Eating durian is alleged to restore the health of ailing humans and animals. The flesh is widely believed to act as an aphrodisiac.

Adaptation

Durian is adapted to sandy loam and clay loam, with high organic matter, reasonably deep and slightly acidic soil, pH of 5.6.

Durian grows in lowland tropics in elevation up to 800 meters above sea level with optimum temperature of 25-35 °C and 80% relative humidity.

Recommended Varieties

NSIC Registered Durian Varieties and their Characteristics

	Fruit shape	Fruit	Maturity	Peel Color	Percent	Aroma	Flesh	TSS
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		Size (kg)	(# of days)		Edible Portion		Color	
Chanee (Fig. 1)	Cylindrical	2-4	110-115	Greenish brown	35-40%	Moderate	Golden	25
Monthong (Fig. 2)	Elongated	2-5	120-125	Golden yellow	25%	Moderate	Creamy yellow	27
Atabrine (Fig. 3)	Ellipsoidal	2-4	105-115	Greenish brown	25%	Strong	Naples yellow	25
Mamer (Fig. 4)	-do-	1-2	105-115	-do-	25%	Strong	Barium orange	25
GD 69 (Fig. 5)	Obovate	2-4	113-118	-do-	36%	-do-	Canary yellow	26
Alcon Fancy (Fig. 6)	Round	1-2	90-110	-do-	35%	-do-	Yellow	27
Lacson Uno (Fig. 7)	Obovate	3-6	115-120	Brownish green	35%	-do-	Mimosa yellow	27
Arancillo (Fig. 8)	Ovoid to Cylindrical	1-3	115-120	-do-	38%	-do-	Chrome yellow	27
Puyat (Fig. 9)	Cylindrical	3-5	120-125	Greenish brown	40%	-do-	Chrome yellow	27
Oboza	Cylindrical	3-4	120-125	Green	21%	Moderate	Yellow	26
Duyaya (Fig. 10)	Cylindrical	3-5	120-125	Green brown	31%	Weak	Yellow	27
SMIARC #2	Ovoid to cylindrical	2-3	115-120	Brownish-green	28	Moderate	Barium yellow	27

Methods of Propagation

It is reported that, in some countries, seedling durian trees have borne fruit at 5 years of age. In India, generally, they come into bearing 9 to 12 years after planting, but in South India they will not produce fruit until they are 13 to 21 years old. In Malaya, seedlings will bloom in 7 years; grafted trees in 4 years or earlier.

In durian, inarching can be accomplished with 50% success but is not a popular method because the grafts must be left on the trees for many months. Selected cultivars are propagated by patch-budding (a modified Forkert method) Grafted trees never grow as tall as seedlings; they are usually between 8 to 10 m tall; rarely 12 m.

Preparation of planting materials

The following are recommended:

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- a. Use fully developed seeds from mature/ripe durian fruits of the recommended varieties.
- b. Germinate the seeds in seed box or seed bed with coco peat, fine river sand or saw dust as germination medium.
- c. Prick the germinated seedlings into 6 x 10 in. x 0.0025 or 7 x 11 in. x 0.003 PE bags as growing medium containing 1 part each of garden soil, fine river sand and compost at 9-12 days after germination and place them in the nursery with a net cover with 70 percent sunlight penetration.
- d. Water them immediately after planting in polyethylene bags, then water them every 2 to 3 days thereafter or as the need arises.
- e. Seedlings are ready for grafting at 21-30 days old using hypocotyl grafting; epicotyl side grafting at 2-4 months old; cleft grafting for 5-months and patch budding for 8 months & older rootstock.
- f. Gradually reduce nursery shade from 30% to full sunlight two months before field planting.

Can the author provide illustration for hypocotyl grafting and patch budding?

Cultural Management

Land Preparation

- a. Clear and remove all stumps and grasses.
- b. Plow twice and harrow thrice to loosen the soil.

Distance of Planting

- a. 8 x 8 meters = 156 plants/ha.
- b. 10 x 10 meters = 100 plants/ha.

Preparation of Holes and Planting

- a. Dig holes measuring 30 cm wide and 30 cm deep. Deeper and wider holes are recommended for heavy soil types.
- b. Remove the plastic bag and plant the seedling into the hole without breaking the ball of soil. Prune spiraled roots to enhance root branching.
- c. Plant the young seedlings at their dormant stage.
- d. Cover the hole with soil-manure mixture and gently press the surface of the soil.
- e. Plant during the rainy season.

Maintenance

Provide temporary shade to the newly planted durian seedlings for a period of two weeks to a few months depending on weather condition to enable the plants to recover from transplanting shock and to shade it from strong sunlight.

Fertilization

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- a. Apply as basal 50 grams (5 tbsp.) of complete fertilizer (14-14-14) or based on soil analysis and cover with thin layer of soil.
- b. Periodic application of fertilizers should be based on soil or plant tissue analysis.

Intercropping

Grow seasonal crops between rows of durian before they become productive.

Weeding

Ring weeding should be done regularly and before fertilization.

Pruning

- a. Pruning improves air circulation which results in decreased relative humidity, thus, reducing the incidence of pests and diseases.
- b. Removing low-lying branches prevents splashing during rains which help prevent pathogens from coming in contact with the branches and leaves of the durian trees.
- c. Prune/remove dead, broken or diseased branches and water shoots to obtain desired canopy shape and to enhance production of fruits.

Mulching

Mulch the trees with rice straw, dried leaves, cut grasses, or coconut husk during the dry season.

Irrigation

Water the trees during the dry season. Cut banana pseudostems could also be used as mulch especially in areas where source of water is a problem since these have high water content.

Pollination

The durian has a high rate of self-incompatibility, thus hand-pollination is recommended to ensure a much higher percentage of fruit setting.

Fruit Thinning

- a. Normally, fruit thinning is done 4 to 6 weeks from flower opening

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- b. The small and misshapen fruits are removed, leaving 1 to 2 fruitlets per cluster. The recommended number of fruits per tree are as follows:

Age of tree (yrs)	No. of fruits per tree
4	5
5	15
6	25
7	40
8	55
9	70
10	85

Propping

- a. Use bamboo or wooden poles
- b. Tie the branches upward to the main trunk or to an external support such as wire network in an orchard.

Harvesting

- a. Well-cared durian trees start bearing fruits as early as five years old.
- b. The common practice to wait until the fruit drops. However, picked matured fruits before they fall ripens in 3 to 5 days, thus allowing transport to distant markets

Maturity Indices

- a. The fruits can be harvested and allowed to ripen in 106 -108 days from flower opening for local cultivars (Accessions 916, 806, etc.); 112-113 days for Chanee; and 125 days for Monthong.
- b. Emits a dull and hollow sound when tapped.
- c. Color of the pericarp is light brown with yellowish green
- d. Strong aroma
- e. Very pliable spine
- f. Very distinct suture (Fig. 11)
- g. Sweet with full characteristic durian flavor.

Major Insect Pests and Disease And Their Control

Insect Pests

1. Fruit borer
 - a. *Conogetes punctiferalis* (Figs. 13 & 14)
 - Rare in local clones
 - Dominant in Arancillo, Chanee and Monthong
 - b. *Tonica* sp. (Figs. 15 & 16)

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- Eggs are laid singly on the fruit spines
- Entry points are at the fruit peduncle, base or side
- Dominant in local clones

Control and Management:

- Monitoring of fruit borer infestation at the early stage of fruit development.
- Fruit thinning must be done to reduce infestation.
- Fallen fruits must be collected and burned or buried.
- Light trapping decreases adult population.
- Insecticide spraying starts 4 weeks after fruit set.

2. Shot-hole borer (*Xyleborous* sp.) (Fig. 19)

- Tiny black or brown beetle
- Pest associated with fungal pathogen phytophthora
- Beetle-pathogen confined on main trunk or main branches

Control and Management:

- Shot-hole borer invades damaged or physiologically stressed trees. Maintain tree vigor, i.e., through fertilization, irrigation and regular pruning.
- Wider planting distance
- Use resistant varieties
- Scrape infested portion, then apply w/ insecticide

3. Durian Psyllids (*Allocarsidara incognita*) (Fig. 21)

- The adult is greenish brown to brownish sucks sap of young leaves

Control and Management:

- Predators feed on this foliar pest. Psyllid is prevalent during flushing. Spray with the following insecticides: Malathion, deltamethrin, Lambda cyhalothrin, Chlorpyrifos, or dimethoate 4-5 times from June to November

4. Bao-bao (*Haplaphalara* sp.) (Fig. 22)

- The adult is brownish in color, short and stubby; infests shoots, flowers and fruitlets. It sucks the plant sap of young leaves and flowers and contributes to dropping of fruitlets. The tree may eventually die due to defoliation.

Control and Management:

- Same as control measures for durian psyllids.

5. Twig Borer or Carpenter Moth (Fig. 23)

- The larvae bore holes on young plants and small branches or twigs of old trees.

Control and Management:

- Prune or cut damaged branches, then burn.

6. Mealy Bugs (Fig. 24)

Control and Management:

- Spray w/ insecticide when there is heavy infestation

Tabulate as to (a) name of insect pest and its scientific name, (b) mode of attack and symptoms if appropriate, and (c) prevention and or control mechanisms

Diseases

1. *Phytophthora* Diseases

- Serious disease of durian
- Soil borne fungus can infect all parts of the tree in all stages of growth and development.
- Spread by wind, rain water, insects and snails

a. Patch canker (Fig. 25a)

- Cause serious damage among orchards.
- Commonly observed in durian trees at bearing stage depending on the variety planted.

Symptoms:

- Appearance of wet lesions on the bark surface, usually near the crotch region
- Bark necrosis is accompanied by discoloration and exudation of reddish brown, gummy, resinous substance.

Control and Management:

- Provide wide spacing, remove weeds & prune low hanging branches.
- Apply chemical at the first sign of infection.
- Scrape and remove diseased barks. Paint infected wood with fungicide.

b. Seedling Dieback and Foliar Blight (Fig. 25b)

Symptoms:

- Infection initiated on the leaves induces symptoms characterized by small, off-colored, water-soaked spots which become dark and coalesce into large necrotic or dead patches

Control and Management:

- Sanitation, aeration and drainage are key factors in nursery operation.
- When needed, periodically spray systemic fungicides such as Metalaxyl or Fosetyl Aluminum or combining Metalaxyl-Mancozeb

c. Phytophthora fruit rot (Fig. 25c)

Symptoms:

- The first sign of infection appears as tiny water-soaked lesions which later coalesce and become brown then dark on the fruit surface, which later result into peel cracks on the infected fruit as it approaches maturity.

Control and Management:

- Phytophthora fruit rot is best controlled by integrated phytosanitary measures, cultural practices and chemical treatment during pre-harvest stage.

Tabulate as to (a) name of disease and its causal organism, (b) mode of attack and symptoms and (c) prevention and or control mechanisms

Physiological Disorders

1. Uneven Fruit Ripening

- a. Characterized by the formation of hardened leathery aril in a ripe fruit.
- b. Affected aril remains unripe, whitish, odorless and tasteless

2. Wet or Watercore (Fig. 27)

- a. Characterized by the presence of too much moisture and a very soft core and flesh of the fruit.

3. Tip burn (Fig. 28)

- a. The end part of the flesh turns dark yellow
- b. Probably due to lack of water during flesh or aril development

Harvesting and Post Harvest Management

A well cared durian tree starts bearing fruits as early as five years old. Durian fruits generally fall from the trees at night when already mature and ripe.

Hand picked fruits have longer shelf life of 5-7 days compared to 2-3 days for fallen fruits.

Maturity Indices

- a. The fruit is 106-108 days old from opening for local cultivars, 112,113 days old Chanee and 125 days old for Monthong.
- b. Change in color. Pericarp turns yellowish green or brown.
- c. A dull and hollow sound when tapped.
- d. Strong aroma.
- e. Very pliable spine.
- f. Very distinct suture
- g. Sweet with dull characteristic durian flavor.

Harvesting

In rural areas, villagers clear the ground beneath the durian tree. They build grass huts nearby at harvest time and camp there for 6 or 8 weeks in order to be ready to collect each fruit as soon as it falls. Caution is necessary when approaching a durian tree during the ripening season, for the falling fruits can cause serious injury.

Hunters place traps in the surrounding area because the fallen fruits attract game animals and all kinds of birds. The fruit is also placed as bait for game in the forests.

Yield

Durian fruits mature in 3 1/2 to 4 1/2 months from the time of fruit-set. Seedling trees in India may bear 40 to 50 fruits annually. Well-grown, high-yielding cultivars should bear 6,000 lbs of fruit per acre (6,720 kg/ha).

Keeping Quality

Durians are highly perishable. They are fully ripe 2 to 4 days after falling and lose eating quality in 5 or 6 days.

Post-Harvest Treatments

Fruits that naturally drop must be consumed within 2-3 days. Fruits picked at proper maturity stage can be stored for about a week under ambient condition.

Ripening problems such as uneven ripening of the fruits in locules and variable ripening rates are encountered among fruits harvested at the same time. To minimize

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these problems, harvest fruits at optimum stage of maturity and sort according to cultivar and degree of ripeness prior to packaging. Fruits allowed to drop may have the best flavor but also have the shortest shelf life. On the other hand, those picked too early may have longer storage life but may not develop full flavor.

Refrigeration is the most effective means to extend the shelf life of fruits. In Malaysia, durian is stored at 10°C for two weeks without manifesting chilling injury symptoms such as darkening of peel and failure of fruit to ripen normally at ambient temperature. Mature green fruits of Thailand durian cultivars, 'Mon Thong', 'Chanee' and 'Kanyao' are stored at 15°C. There is still a need to establish the storage temperature range for locally grown introduced cultivars.

Minimally processed durian, (i.e., the extracted pulp with seeds packed in a styrofoam tray and covered with transparent cling-wrap film) is gaining popularity in many suburban and urban centers. Pulp can be stored in the freezer (-18° to -10°C) for as long as six months.

Packaging

Fruits intended for the local or nearby markets are generally packed in 50-kg capacity bamboo baskets. On the other hand, wooden crates with a 25-kg capacity, which contain 10-15 fruits, are used to ship fruits to Metro Manila (Fig. 1b). For inter-island transport, banana cartons, which can accommodate 4-6 fruits, are used.

Bamboo baskets are cheaper and provide good ventilation. However, they are not rigid enough to allow stacking during storage and transport. Therefore, they should not be piled on top of the other during transport. If a second layer is preferred, provide a simple platform where the next tier of baskets will be placed. Likewise to prevent mechanical damage, individual fruits are separated using banana leaf sheaths. A lid may be provided to secure the fruits during transport and handling.

Wooden crates provide better protection and are sturdy enough to allow stacking. Several layers of newsprints are used to line the crates and separate fruits in the container. Fruits intended for distant markets should be packed in wooden crates or cartons.

Transport and Handling

From the collection center or packing shed, fruits in suitable containers are immediately transported to intended markets using jeeps and trucks that are covered with tarpaulin or canvass. Fruits are highly perishable and may crack when exposed to direct sunlight. It is best to transport the fruits at night to avoid exposure to sunlight and prevent heat build-up within the containers.

If it could not be avoided to pile fruits on top of the other in transport vehicles, separate the layers of fruits using pieces of cardboard. This can offer some protection against punctures of spines and compaction damage.

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Farmers transport their fruits directly to the market by trucks. For inter-island trade, fruits are transported by ship or aircraft.

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