



Papaya Research

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Papaya Research

Papaya (*Carica papaya*) is a fast-growing tropical fruit tree widely cultivated in Southeast Asia and the Philippines. Known for its sweet, orange flesh and abundant enzymes like papain, papaya is valued for both fresh consumption and culinary versatility. It thrives in warm climates, bears fruit quickly, and provides year-round harvests. Both ripe and unripe fruits are used in dishes, while its seeds, and leaves also have traditional applications.

Culinary Uses (Dishes)

- Green papaya salad (e.g., Thai *som tam*)
- Tinola with green papaya
- Papaya pickles/atchara
- Papaya stew or curry
- Papaya chutney
- Papaya salsa
- Papaya jam or preserve
- Baked papaya with cinnamon
- Papaya in fruit salads

Drinks

- Papaya shake
- Papaya–banana smoothie
- Papaya–mango smoothie
- Papaya milk drink and juice
- Papaya–pineapple juice blend
- Papaya detox smoothie (with ginger & lemon)

Nutrients per 100 g (Approx.)

- Calories: 43 kcal
- Carbohydrates: 11 g
- Sugars: 7.8 g
- Fiber: 1.7 g
- Protein: 0.5 g
- Fat: 0.3 g
- Vitamin C: 60–65 mg
- Vitamin A (beta-carotene): 950 IU
- Folate: 38 µg
- Potassium: 182 mg
- Magnesium: 10 mg
- Papain and other enzymes





Health Benefits

- Supports digestion via papain
- High vitamin C boosts immunity
- Rich antioxidants (beta-carotene, lycopene)
- Aids skin health and collagen formation
- Supports heart health
- May reduce inflammation
- Good for eye health (vitamin A)
- Hydrating and low-calorie fruit for weight management

Tree & Root Characteristics

Tree Characteristics

Papaya is a **fast-growing, short-lived perennial** that behaves like a small tree but is technically a giant herb with a hollow, soft trunk. It reaches **2–5 meters** in height within 12–24 months. The canopy is narrow and upright, with large palmate leaves clustered at the top. Papaya begins fruiting early—usually **8–12 months from planting**—and produces continuously under warm, moist, and sunny conditions. Its flowers can be male, female, or hermaphrodite, with hermaphrodite trees preferred for commercial production due to predictable fruit shape.

Root Characteristics

Root Structure

- **Primary root system:** A short taproot that quickly transitions to a fibrous root system.
- **Fibrous lateral roots:** Spread widely near the soil surface (top 30–45 cm).
- **Sensitivity:** Papaya roots dislike waterlogging and poor drainage; they need aerated soils.
- **Root life:** Root systems are **fragile and easily damaged**, with low tolerance to transplant shock.
- **Depth:** Generally shallow; 60–80 cm effective rooting depth.

Growing Implications

1. **Drainage is critical**

- Because the roots sit near the surface, papaya quickly suffers from **root rot** in heavy clay or waterlogged soils.
- Mounds or raised beds are recommended in high rainfall areas.



2. **Mulching benefits**

- Since roots are shallow, mulching helps reduce temperature stress, improves moisture retention, and prevents soil crusting.

3. **Fertilization must be light but frequent**

- Shallow roots mean nutrients must be applied in smaller, evenly distributed doses (NPK, calcium, boron).

4. **Wind vulnerability**

- The combination of a tall, soft trunk and shallow roots makes papaya easily uprooted during strong winds or typhoons. Windbreaks are valuable.

5. **Intercropping considerations**

- Papaya roots compete strongly for surface nutrients but do not penetrate deep, making them compatible with **deep-rooted** trees but not with other surface-feeding crops.

Sunshine & Shade Demand

2. **Sunshine requirement:**

- a. Papaya requires **full sun** (at least **6–8 hours** direct light daily).
- b. Shading reduces flowering and fruiting.

3. **Shade tolerance:**

- a. **Low to none.**
- b. Mild partial shade (20–30%) can help young seedlings, but mature trees lose vigor under shade.

4. **Secondary canopy role:**

- a. Papaya is **not suitable** as an understory crop under coconuts or taller fruit trees unless canopy is thin or spaced wide.
- b. It must be in a **high-light zone** to produce commercial yields.

Growing Characteristics Table

Category	Characteristics
Botanical Type	Giant herb; soft, hollow trunk
Height	2–5 m (sometimes 6 m in ideal conditions)
Growth Rate	Very fast (fruiting at 8–12 months)
Lifespan	3–5 years productive; often replaced after 4 years
Root Type	Shallow, fibrous, sensitive to waterlogging
Light Requirement	Full sun; low shade tolerance
Water Requirement	Moderate, consistent moisture; no standing water
Soil Preference	Well-drained loam or sandy loam; pH 6.0–6.5
Temperature	22–32° C ideal; frost-sensitive
Wind Tolerance	Low; needs windbreak in open areas
Spacing	2.0–2.5 m between trees (single-row or grid)
Fruiting Start	8–12 months after planting
Productivity	30–60 kg of fruit per tree/year, depending on care and variety
Flower Types	Male, female, hermaphrodite; hermaphrodite preferred



Short Summary

Papaya is a fast-growing tropical fruit tree with a shallow, fibrous root system that demands excellent drainage, warm temperatures, and full sunlight. It grows rapidly and bears fruit within the first year, but its roots are sensitive to waterlogging, compaction, and mechanical damage. Because it requires strong sunlight and has low shade tolerance, papaya must be planted in open areas, not under taller trees. With proper moisture, aerated soils, and wind protection, papaya produces high yields year-round.

Common Papaya Varieties

Variety Name	Key Features / Description
Cavite Special	Semi-dwarf type; fruits are large, oblong, weigh 3–5 kg ; yellow-orange flesh; favored for fresh local consumption and for markets that prefer large papayas. Pinoy Bisnes Ideas +2 YUMPU +2
Solo (e.g., “Sunrise Solo”, “Kapoho Solo”)	Smaller fruit (\approx 500 g), with reddish-orange flesh. Pear-shaped, sweet. Good for small households, direct consumption, or fresh-cut market. Pinoy Bisnes Ideas +2 eDepot +2
Sinta	First Philippine-bred hybrid papaya. Semi-dwarf, fruit 1.2–2.0 kg, sweet and firm flesh; moderately tolerant to the papaya ringspot virus (PRSV). Reliable yield and easier to harvest. Pinoy Bisnes Ideas +1
Red Lady	F1 hybrid, early-bearing and productive; fruits weigh around 1.5–2.0 kg; good for markets wanting consistent medium-sized papayas; also more tolerant to PRSV relative to many older cultivars. Pinoy Bisnes Ideas +2 EcoHome Innovations Gardening +2
Waimanalo	Medium-sized papaya (\approx 0.5–1.0 kg), with yellowish flesh; sometimes used for domestic markets. YUMPU +1
(Others — less common or older)	There are also other named varieties in older catalogs such as “Morado”, “Cariñosa”, “Red Royale” among the list of recognized commercial papaya varieties in the Philippines. PPSSD +1

According to national standards (as of 2015), the commercial papaya varieties in the Philippines include: Cavite Special, Morado, Solo, Sinta, Cariñosa, Red Lady, and Red Royale. PPSSD[+1](#)





Top 5 Varieties for Commercial Use

Here are five I highlight as especially suited for commercial cultivation — whether for fresh-fruit markets, local sale, or small- to large-scale farms.

Rank	Variety	Strengths / Why Top For Commercial Use
1	Sinta	Developed locally to resist PRSV, reliably bears fruit (no wasted male plants), good fruit size (1.2–2 kg), early maturing, yields well — great for commercial farms. horizon.uplb.edu.ph ⁺² Pinoy Bisnes Ideas ⁺²
2	Red Lady	Hybrid with consistent productivity, medium-sized fruits (1.5–2 kg), early fruiting, good quality — widely cultivated. Pinoy Bisnes Ideas ⁺² EcoHome Innovations Gardening ⁺²
3	Cavite Special	Large fruits (3–5 kg) — desirable in local markets where consumers prefer big papayas; good for fresh market sale. Pinoy Bisnes Ideas ⁺² Pinoy Entrepreneur ⁺²
4	Solo (Sunrise / Kapoho variants)	Small but high-quality fruits, ideal for local consumption or fresh-cut markets, quick turnover due to small size and quick ripening. Pinoy Bisnes Ideas ⁺² YUMPU ⁺²
5	Waimanalo	Medium-sized, manageable fruits — useful for markets preferring mid-size papayas without the bulk and handling issues of giant papayas. YUMPU ⁺¹

Note: “Top” here refers to suitability for **commercial cultivation and marketing** (yield, disease tolerance, market preferences), not necessarily to “best taste” — that may vary by consumer preference.

Which Varieties Dominate Local Markets & Why

- Bulk-market sellers, wet markets, and households that prefer **large papayas** often favor **Cavite Special** because of its size (3–5 kg) and “value for money.” [Philstar](#)⁺¹
- For **fresh-cut fruit stalls**, supermarkets, or small families, **Solo (Sunrise/Kapoho)** and **Waimanalo** are common — easier to handle, ripen faster, and often sweeter. [YUMPU](#)⁺¹
- Commercial farms that sell in bulk or to processing plants lean toward **Sinta** or **Red Lady** because of their balanced size, productivity, disease tolerance, and reliability. horizon.uplb.edu.ph⁺² [Pinoy Bisnes Ideas](#)⁺²

Additional Notes & Context

- The arrival of the Papaya ringspot virus (PRSV) in the Philippines in the 1980s caused serious losses, which motivated breeding of more tolerant hybrids like Sinta. horizon.uplb.edu.ph⁺¹
- According to a 2015 standard from the national agriculture agency, there are **seven** main commercial papaya varieties for sale and consumption in the Philippines. [PPSSD](#)⁺¹
- Choice of variety depends on purpose: fresh market sale, export/fresh-cut, canning/processing, or home consumption.

Papaya in Cosmetics & Skincare

Papaya (*Carica papaya*) has long been used in beauty and personal-care products because it contains natural enzymes, vitamins, and mild exfoliating compounds. It is valued for brightening, smoothing, and clarifying the skin.

Main Cosmetic Uses of Papaya

Papaya is used in skincare and cosmetic formulations for:

- ✓ Exfoliation (gentle enzymatic peeling)

Thanks to papain and other proteolytic enzymes that remove dead skin cells.

- ✓ Skin brightening & evening of skin tone

Papaya contains vitamin C, beta-carotene, and natural bleaching enzymes.

- ✓ Anti-acne applications

Its enzymes help clear clogged pores; seeds and leaves contain mild antimicrobial compounds.

- ✓ Moisturizing & conditioning

Papaya pulp contains sugars and polysaccharides that hydrate and soften the skin.

- ✓ Anti-aging benefits

Antioxidants (vitamin C, lycopene, beta-carotene) help reduce oxidative stress and support collagen.





Scar and pigmentation lightening

Regular use of papaya enzyme extracts may reduce dark spots and minor scars.

Parts of the Papaya Used in Skincare

Fruit Pulp (Ripe Papaya)

- Most commonly used in **masks, soaps, scrubs, and creams**
- Contains **papain**, vitamins A & C, and natural fruit acids
- Functions: **moisturizing, brightening, gentle exfoliating**

Unripe Green Papaya

- High enzyme concentration, especially **papain** and **chymopapain**
- Often used in **peeling gels, enzyme exfoliants, soaps, and acne treatments**

Papaya Seeds

- Contain **fatty acids**, mild antibacterial compounds
- Used in **scrubs, exfoliating cleansers, massage oils**, and sometimes anti-acne products
- When dried and ground, they act as a natural micro-exfoliant (safer than plastic beads)

Papaya Leaves

- Contain alkaloids and antioxidants
- Sometimes used in **herbal skin-healing balms** or anti-inflammatory rinses
- Less commonly used in commercial cosmetics than pulp or sap





Which Sap is Valuable for Cosmetics?

Papaya produces two main milky saps:

Latex (the white sap from unripe papaya) — Most Valuable

This is the **primary cosmetic ingredient** extracted from the unripe fruit.

- Rich in **papain**, a powerful proteolytic enzyme
- Used in **exfoliating products, whitening soaps, enzyme peels, acne gels**
- Also used in **hair removal creams** (papain breaks down keratin proteins)

💡 **Papain is the key cosmetic compound** and is obtained almost entirely from **unripe fruit latex**.

Stem and Leaf Latex

- Contains lower amounts of papain than fruit latex
- Sometimes used in **medicinal skin preparations** in traditional use
- Not commonly used in commercial cosmetics due to stronger odor and irritation potential

Importance of Papain in Skincare

Papain is the **most valuable enzymatic ingredient** extracted from papaya. It is used because it can:

- Remove dead skin cells
- Smooth rough skin
- Help lighten dark spots
- Reduce acne and clogged pores
- Improve skin texture without harsh scrubbing

Commercially, papain is purified from the **latex of unripe papaya fruits**, dried into powder, and added to cosmetic formulas.

Short Summary

Papaya is widely used in skincare due to its natural enzyme **papain**, antioxidants, and moisturizing sugars. The most valuable cosmetic component is **papaya latex from the unripe fruit**, which contains high levels of papain. The fruit pulp, seeds, and leaves are also used for exfoliation, brightening, moisturizing, and acne care.



Papaya-sap/papain Profitability

- In one report, using correct techniques and high-yielding papaya varieties, a papaya plantation could yield **250–375 kg papain per hectare** under optimal conditions. [VDoc+2Infonet Biovision+2](#)
- Another source notes that by extracting latex (for papain) from green/unripe fruits, a small-scale farmer may have increased income; e.g. in a case study the income gain from papain extraction added about **19% extra income** over baseline fruit production. [SDI OPR](#)
- The global market price for papaya latex / papain powder (depending on purity/activity) ranges widely — bulk raw latex or lower-activity powder may command modest prices, while high-grade, high-activity papain powder (suitable for cosmetics/food/pharma) commands significantly higher price per kilogram. [Accio+2PW Consulting+2](#)
- Value-addition (e.g. extracting papain instead of selling only fruit) substantially increases profit potential compared to selling fresh papaya only: value-added products such as papain can fetch higher per-kg price than raw fruit. [Startup Financial Projection+2Niir+2](#)

What “ROI on papaya sap/papain” depends on — key variables

Variable	Effect on ROI
Papaya cultivar (variety) & yield per hectare	High-enzyme, high-yield varieties give more latex/papain per hectare — higher revenue base. VDoc+1
Timing & method of latex extraction (age of fruit, tapping technique)	Latex/tap when fruits are unripe (around 75–90 days) — ensures maximum enzyme content. indiansocietyforspices.in+1
Processing method & cost (drying, purification, packaging, labour, energy)	Purification and drying are costly — energy, labour and processing infrastructure reduce net profit. Procurement Resource+1
Market price of papain / latex (depends on enzyme activity, purity, demand)	Higher-grade papain (for cosmetics, food, pharma) yields much better revenue per kg than low-grade latex for rudimentary uses. Accio+1
Scale & consistency (are you doing single-farm small batches, or large-scale integrated production + processing)	Larger scale tends to reduce per-unit costs (economies of scale), improving ROI. Smaller operations see more volatility.
Additional value-added uses of even “tapped fruits” (after latex extraction)	Even after tapping, fruits can still be processed/consumed or sold — increasing total farm return. VDoc+1



An Example ROI Scenario (Hypothetical)

Suppose a farmer uses a high-yield papaya variety, in a climate and soil suited for papain production. With good management:

- They manage to produce **300 kg papain per hectare/year** (after latex extraction and processing).
- If processed papain sells at e.g. **US\$10–20 per kg** (depending on purity/market) — a mid-range but reasonable wholesale price — gross revenue from papain alone could be **US\$3,000–6,000 per hectare**.
- If after subtracting all costs (cultivation, harvesting, processing, energy, packaging), their net profit margin is say 40–60%, net profit could be **US\$1,200–3,600 per hectare per year** from papain alone — on top of any fruit yield revenues.
- If they also sell the tapped fruits (or process them), that adds extra revenue — possibly boosting returns by **~10–30%** more (depending on local fruit market and value-addition).

This is a simplified illustration — actual numbers will vary widely with local costs, yield, market, and scale.

Why ROI is Not Guaranteed / What Are The Risks

- The process is **labor-intensive** (latex tapping, drying, purification), and improper handling reduces papain yield or quality. indiansocietyforspices.in+1
- Enzyme activity and quality vary: low-activity latex yields low-value product — sustaining high-grade production may require careful cultivar and harvest management. ScienceDirect+1
- Market volatility: raw material price fluctuations, demand fluctuations for cosmetic/food enzymes, and regulatory or export-market changes can affect how much one earns. PW Consulting+1
- Initial investment may be needed (for processing, drying equipment, containers, labour). Returns accrue only if value-addition and processing are done properly. SDI OPR+1

Conclusion

Using papaya sap (latex) to produce papain has **real potential for profitable returns**, especially in regions with suitable climate and papaya culture, and if you invest in good processing and target markets that pay for high-quality enzyme (cosmetics, food, pharma). The ROI is **not negligible**, and compared to simply selling fruit it can **meaningfully add** to a farmer's or small-scale processor's income — sometimes as a significant supplementary stream.



Papaya as a Secondary Crop under Coconut

Factor	Recommendation / Notes
Compatibility	Moderate. Papaya can grow under coconuts only if spacing allows sufficient sunlight. Overcrowding reduces fruit yield.
Good Partners	Open spaces between coconuts; areas with young or widely spaced coconut palms.
Poor Partners	Dense coconut plantations or mature palms with heavy canopy — papaya will be shaded and fruit poorly.
Shade Consideration	Low shade tolerance. Papaya requires full sun or at least 6–8 hours direct light per day.
Spacing	3–3.5 m between papaya plants; ensure coconut spacing allows light penetration.
Notes	<ul style="list-style-type: none">- Plant papaya on the edge or in wider gaps between coconuts.- Avoid planting under fully shaded coconut canopy.- Prune coconuts periodically to improve light for papaya.

Summary

Papaya can be intercropped with coconuts, but it is **sun-loving** and does **not tolerate heavy shade**. Best results occur in **wide coconut spacing** or with **light-managed coconut canopies**. Careful positioning and pruning are key to successful intercropping.

