

## PRODUCTION GUIDE FOR SANTOL



Santol, although widely distributed according to P.J. Wester who did the earliest extensive research on tropical fruits in the country, is one fruit crop that could be considered minor in cultivation in the Philippines. It can be attributed to the short shelf life and limited uses of its fruits. It is scientifically known as ***Sandoricum koetjape*** Merr., native to Malaysia, Cambodia and Southern Laos. It is commonly called wild mangosteen by English speaking countries, santol in Filipino, krathon or sathon in Thai, kecapi in Malay and Indonesian, and faux mangoustanier in French.

The tree is hardy, vigorous, and fast growing, thrives even in prolonged dry season. It reaches a height of 15 to 45 meters high, branched close to the ground, and buttressed when old. It makes a good shade tree. The evergreen very briefly deciduous, spirally-arranged leaves are compound, with 3 leaflets, elliptic to oblong-ovate, 20-25 cm long, blunt at the base and pointed at the apex. The greenish, yellowish or pinkish yellow, 5-petalled flowers, about 1 cm long are borne on the young branchlets in loose, stalked panicles 15-30 cm in length. The fruit is globose or oblate, with wrinkles extending a short distance from the base; 4 to 7.5 cm wide; yellowish to golden, sometimes blushed with pink. The downy rind may be thin or thick and contains a thin, milky juice. It is edible, as in the white, translucent, juicy

pulp (aril), sweet, sub-acid or sour, surrounding the 3 to 5 brown, inedible seeds which are up to 2 cm long, tightly clinging or sometimes free from the pulp.

### Economic Importance

The different parts of santol tree have various uses.

- a. Santol fruit pulp - is eaten raw and plain or with spices added. It is also cooked and candied or made into marmalade. Grated pulp is cooked in coconut milk (with bits of pork and hot pepper), and served as a dish in Bicol. With the seeds removed, it is made into jam or jelly. Pared and quartered, it is cooked in syrup and preserved in jars. The preserved pulp may be used as astringent.
- b. Santol leaves and bark – have medicinal uses, as poultice on itching skin. The bark is used in tanning fishing lines.
- c. Santol stem - has shown anti-cancer properties *in-vitro*.
- d. Extracts from santol seeds have insecticidal properties.
- e. Wood from santol tree - is popularly useful for construction; usually easy to saw, work and polish. If carefully seasoned, it can be employed for house-posts, interior construction, light framing, barrels, cabinetwork, boats, carts, sandals, butchers blocks, household utensils and carvings.

#### Food Value Per 100 g of Edible Santol Fruit Pulp

(Source: J. Morton, 1987)

	Yellow type	Red type	Fruits (unspecified type)
Moisture	87.0 g	83.07-85.50 %	85.4 g
Protein	0.118 g	0.89 %	0.06 g
Carbohydrates		11.43 %	
Fat	0.10 g	1.43 %	0.52 g
Fiber	0.1 g	2.30 %	1.26 g
Ash	0.31 g	0.65-0.88 %	0.39 g
Calcium	4.3 mg	0.01 %	5.38 mg
Phosphorus	17.4 mg	0.03 %	12.57 mg
Iron	0.42 mg	0.002 %	0.86 mg
Carotene	0.003 mg		
Thiamine	0.045 mg	0.037 mg	
Niacin	0.741 mg	0.016 mg	
Ascorbic Acid	86.0 mg	0.78 mg	
Pectin			14.89 mg
			17.01 g

## Varieties of Santol

1. **Yellow type** (formerly *S. indicum* or *S. nervosum*) . Leaflets are about 15 cm long that turned yellow when old; flowers are pinkish-yellow in panicles; fruits have thin rind and pulp is about 0.6 to 1.25 cm thick around the seeds and typically sweet; found wild in Malayan forests.
2. **Red type** (formerly *S. koetjape*). The leaflets is about 30 cm long, velvety beneath, turn red when old; the flowers are greenish or ivory, in panicles 30 cm long; the fruit has a thick rind, frequently 1.25 cm; there is less pulp around the seeds, and it is sour. The fruit falls when ripe.

However, Corner says that these distinctions are not always clear-cut except as to the dying leaf color, and the fruit may not correspond to the classifications. There are sweet and acid strains of both the Yellow and Red types and much variation in rind thickness (J.F. Morton, 1987).

3. **NSIC 2001 Sn 01** - This is a Bangkok santol selection from La Granja National Crop Research and Development Center, La Carlota City, Negros Occidental approved by the National Seed Industry Council (NSIC) for commercial planting. It is popularly known as La Granja #19, describing its tree number in the orchard of BPI Las Granja NCRDC. It has spreading growth habit and has fruit bearing regularity. It bears flowers from December to February and fruits are harvested from July to October. Fruit weight averages 400.90 g, ovoid to globose in shape, yellow skin which is smooth textured. It has white flesh, soft, juicy, sweet, with mild aroma and not fibrous. It has 18.01% brix total soluble solids; 42.15% edible portion. Each fruit contains 4-5 kidney shaped seeds, weighing 20 g each.
4. **NSIC 2001 Sn 02** – Another NSIC approved Bangkok santol tree from BPI La Granja NCRDC. It is locally known as La Granja #26. It has also spreading growth habit, and a regular fruit bearer. Fruit weight averages 378.5 g, globose in shape, smooth yellow skin, white flesh about 15.50 mm thick, juicy, sweet, with total soluble solids of 19.62 brix, can be scooped from the skin when ripe; with 45.52% edible portion. It has usually 4 kidney shaped seeds in each fruit averaging 20.32 g each.
5. **Other NSIC approved santol trees include PSB 1992 Sn03, PSB 1992 Sn04, PSB 1992 Sn05 of BPI Los Baños NCRDC, PSB 1991 Sn01 of UPLB.**

## Soil and Climate

Santol grows well in deep and organic grounds with well distributed rainfall throughout the year. It can thrive at sea level up to 76 meters above sea level.

## Culture and Management

- 1. Propagation** - Santol can be propagated by seeds, marcotting, inarching, grafting or budding
- 2. Land Preparation** - Clear the area with unnecessary vegetation. Plow and harrow to eradicate weeds. Do this before the onset of rainy season. Set and dig holes of about 50 cm wide and 50 cm deep distanced 6 x 7 meters apart. On each hole, place about 2 kg of compost before planting.
- 3. Planting** - The best time to plant is at the onset or during the rainy season. Prior to planting, harden the santol seedlings at least a week before planting by exposing them gradually to sunlight. During planting, carefully remove the potting containers or plastic bags, seeing to it that roots are not disturbed; carefully place santol seedling on dug hole, then cover it with fine soil up to the base of the seedlings. Water the seedlings right away if soil moisture is not sufficient.
- 4. Weeding and Cultivation** - Shallow cultivation around the base of the plant is recommended to prevent root injury. Do ring weeding around the santol plant periodically to eradicate competing weeds.
- 5. Irrigation** - Although santol is a sturdy plant and can tolerate dry spell, supplementary irrigation during prolonged dry periods is desirable to provide adequate water supply for the growing santol tree.
- 6. Fertilization** - In the absence of definite information regarding the fertilizer requirement of santol in the Philippines, apply about 100 to 500 g ammonium sulphate around the base of tree twice a year. See to it that the newly applied fertilizer is immediately covered with fine soil. Apply fertilizer one month after planting and 6 months thereafter towards the end of the rainy season. Increase the amount of fertilizer applied as the trees grow bigger. At the start of fruiting, each tree should be given about 300-500 g complete fertilizer, preferably one containing more nitrogen and potassium per application. At the peak of fruit production (about 10 years and onwards), apply 2 kg or more of complete fertilizer per tree; split application may be required to sustain growth and development as well as fruit production.
- 7. Pruning** - It may be necessary to prune santol trees to remove overcrowded, unproductive and diseased or dead branches. Pruning is also necessary to achieve the desired form or size of the santol tree.
- 8. Intercropping** - While the santol trees are not yet fully productive, intercropping of cash crops like vegetables, legumes, root crops and other annual crops are recommended. Aside from added income, it will also prevent the growth of weeds

and loosen the soil in the orchard. However, intercrops should be stopped as soon as santol trees become too crowded.

**9. Crop Protection** – a few pests are observed attacking santol trees.

- a) **Spider mite** (*Tetranychus urticae*) is a common pest particularly among Bangkok santol trees. To minimize infestation, prune overcrowded and overlapping branches to allow better sunlight penetration and aeration.
- b) **Caribbean fruit fly** (*Anastrepha suspense*) causes freckle-like blemishes on the surface of the santol fruit but cannot penetrate the rind.

**10. Harvesting** - Santol fruits ripen from July to October. The ripe fruits are harvested by climbing the tree and plucking the fruit by hand, alternatively a long stick with a forked end may be used to twist the fruits off. Fruits should be harvested when skin color is fully yellow indicating the pre-climacteric stage; in doing so, the best eating quality is achieved.

**11. Post-Harvest Handling** - Santol is a climacteric fruit having distinct climacteric respiration and ethylene production. After harvest, the peels firmness and titratable acidity decreased while soluble solids increased moderately. However, soluble solids and titratable acidity of the aril are rather stable. Storage of santol should be done above 14°C to avoid chilling injury, extend shelf life of santol fruits up to 3 weeks. Chilling injury symptoms are browning of the skin and the inner peel portion, and translucency of the aril.

Pack newly harvested santol fruits in bamboo baskets lined with banana leaves to protect the fruits from bruising during transport. It is advisable to market santol fruits as soon as harvested to be able to have premium santol fruits which can command better price.

## References

<http://en.wikipedia.org/wiki/Santol> (fruit)

Kaneda, N. et.al.1992. "Plant anticancer agents, L. Cytotoxic triterpenes from *Sandoricum koetjape* stems". *Journal of natural products* 55 (5): 654–9.

Morton, J. 1987. In: Fruits of warm climates. Pp 199-201

\_\_\_\_\_. 2011. "Santol". Center for New Crops and Plants. Purdue University.

National Seed Industry Council Seed Catalogue

"*Sandoricum koetjape* (Burm. F.) Merr.". Germplasm Resources Information Network (GRIN) online database. Retrieved June 19, 2011.