Crop Profile for Lychee and Longan in Florida

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Production Facts

- Lychee (*Litchi chinensis*) and longan (*Dimocarpus longan*) are both tropical evergreen trees of the Sapindaceae. The plants are of Asian origin and produce fruits that are similar. These two crops share similarities in addition to fruit, such as environmental requirements and pest spectrum (1,2).

- United States production of lychee is estimated to be approximately 430 tons, of which Florida produces about a million pounds (3). At an average seasonal price of $3 per pound, the crop would be estimated as worth $3 million (4). The United States production of longan is estimated to be 1.4 million pounds (5). At an average seasonal price of $2.00 per pound, the Florida crop would be estimated as worth $2.8 million (4).

- Lychee and longan plantings have greatly increased over the past eighteen years. Since 1990, lychee acreage has increased from 200 acres to between 800 and 1,200 acres (3,6). Longan acreage has increased similarly, from 72 acres to approximately 400 acres (4,7).

- Lychee average yields range from 600 pounds per acre in an “off” year to 10,000 pounds per acre in a heavy-bearing year (economic average is 5,000 pounds per acre). With a pack-out of 70 percent and a price of $3 per pound, income from an acre of lychee averages approximately $10,000 (3). Longan returns are similar. Total costs for an acre of lychee are a little over $6,000 an acre, with about ten percent of the costs involved in pest management (3). These values are similar for longan as well.

- Ninety-nine percent of the longan acreage is planted with the variety “Kohala”, while the two main cultivars for lychee are “Mauritius” (85 percent) and “Brewster” (1,2).

- Florida is ranked first in the United States in lychee and longan production (5).

Production Regions

Lychee and longan are grown exclusively in south Florida. Eighty percent of the lychee production is located in Miami-Dade County. Approximately 90 percent of the longan production is in this same county (4). The remaining acreage is primarily located in counties adjacent to Miami-Dade County.

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Production Practices

The lychee tree is medium-sized (12 m), with compound leaves that bear two to eight pairs of leaflets. Leaves are reddish upon initial flush but become shiny and green as they mature. Flowers are small, greenish, and are borne on a large thyrse (a many-flowered inflorescence) which emerges anytime from late December to April. Consequently, the peak harvest is from mid-May through early July. The fruit (2.5 to 3.8 cm in diameter) are borne in loose clusters of three to 50 fruit, which are round or oval. The leathery skin ranges from yellow to pinkish or red and fruit must be allowed to ripen on the tree. The pulp is whitish and translucent (1).

When grown in south Florida, the longan tree is medium-sized (12 m), with pinnate compound leaves that bear six to nine pair of leaflets. The leaves may be as long as 30 cm and appear dark green. The leaves are leathery, wavy along the margins, and have a blunt point at the tip. Flowers are brown-green or yellow-green, and are borne on a panicle which emerges from late February through April. Consequently, the peak harvest is from July through August. The fruit (2.2 to 3.6 cm in diameter) are borne in clusters of several to 350 fruit, which are round or oval. The skin ranges from tan to light brown and is leathery (2).

Neither lychee nor longan come true from seed. In Florida, air-layering is the most common method of propagation. April through August is the best time to perform this task, and roots begin to form within ten to twelve weeks. No special or improved rootstocks have been reported. Typical tree densities for both species range between 50 and 100 trees per acre. Air-layered plants may begin to bear within two to three years while seedling trees require five or six years. Pruning of lychee branches greater than 2.5 cm in diameter may lead to continuous vegetative growth and reduced yields. Both lychee and longan bear fruit erratically, although the “Mauritius” variety of lychee is fairly constant. In general, yields from mature lychee trees range from under 50 to 125 pounds per tree, while longan yields between 50 and 500 pounds per tree (1,2).

The lychee is more cold hardy than longan, but both trees are injured at near freezing temperatures. The trees are tolerant of drought, but irrigation is recommended for young tree establishment, from fruit set through harvest, and during prolonged drought conditions. Soils must be well-drained. The trees grow and bear best on acid sands with high organic matter content. Sandy soils and calcareous soils are adequate if fertility is adjusted (1,2).

Lychee and longan flowers are pollinated by bees and flies. Recent research would seem to indicate that the yield from lychee can be increased by planting two varieties, so that cross-pollination occurs (1).

Worker Activities Lychee and longan fruit are harvested between two and four times each season. Fruit are harvested by cutting the main stem bearing the fruit cluster several inches behind the cluster. Each worker can typically harvest an acre of trees in a day. Both lychee and longan trees are mechanically pruned directly after harvest (4).

Insect/Mite Management

Insect/Mite Pests

The principal pests on lychee and longan in Florida are scale (bark, plumose, banana-shaped, long brown, hemispherical, barnacle, *Philephedra*), root weevils, lychee webworm, and barkminer (1,2).

SCALE (*Andaspis punicae, Thysanofiorinia nephelii, Morganella longispina, Coccus acutissimus, Coccus longulus, Saissetia coffeae, Ceroplastes cirripediformis, Philephedra tuberculosa*)

Scales are plant-feeding insects which are often managed by natural and released parasites, predators, and pathogens. In cases when the natural balance of predation has been disrupted, scale populations may increase to levels requiring treatment. Since scale insects are relatively immobile and at least one month is required for the egg to reach the adult stage, an infestation builds up slowly (in comparison to mites or aphids) and may be hard to spot. It is also important to verify that the scale insects attached to the plant are alive, as mummies accumulate on the plant over time. Symptoms of scale infestation include leaf chlorosis, leaf abscission, stem and limb dieback, and sooty mold on leaf and stem surfaces. Most effective control is obtained when the scales are in nymphal stages, as egg and adult stages are recalcitrant to insecticide applications (1,2).

CITRUS ROOT WEEVILS (*Diaprepes abbreviatus*, *Pachnaeus litus*, *Artipus floridanus*)

There are at least three species of root weevil that are known to attack lychee and longan trees in Florida. The larvae of these species are important with regard to tree health, as they are capable of direct root damage and provide entry routes for fungal infection in the root tissue. *D. abbreviatus* larvae are by far the largest and most damaging of the group. Mature weevils cause only minimal damage from leaf feeding, which is apparent as “notches” on the leaf margins (8).

Most mature female root weevils place their eggs in clusters between two leaves on newly flushed foliage. After ten or twenty days, eggs hatch and larvae fall to the ground. The larvae begin feeding on the fibrous feeder roots. Successively larger larval instars feed on larger roots. For *D*. *abbreviatus*, the final larval stages (of at least eleven) proceed to the tap root and major lateral roots of the tree. Even if direct feeding does not girdle these roots, lesions provide entry to debilitating fungi such as *Phytophthora* spp. and *Rhizoctonia solani*. Adult weevils emerge over a three month period which may begin as early as March. Larval development time ranges from eight to 18 months, which includes an inactive pupal stage of one to three months. Dry weather delays development and emergence (8).

LYCHEE WEBWORM (*Crocidosema* sp.)

This moth is a recently discovered lepidopteran species that is apparently an introduced species to Florida from the Caribbean. Reports from extension research in south Florida state that the moth is most active between six and nine in the evening, and oviposition occurs on newly emerging vegetative and reproductive buds. The life cycle

of the moth is about 35 days, depending on temperature. Populations begin to build during November and peak during January and February. No alternative host plants have been found and it has been hypothesized that the moth maintains a very low population in lychee and longan groves from April through October. The current recommendation is to scout during November through February for signs of wilted or dead terminal shoots, webbing, and very small fruit bore holes. If 30 percent of the terminal shoots inspected show signs of the moth, insecticide applications are advised (9).

CORKY BARK (*Marmara* sp.)
Branches infested with this barkminer become covered with rough, brownish lesions which range in size from six to 18 millimeters. The larval stage of the moth irritates the outer bark of stems, branches, and the trunk. This irritation results in cork-like lesions. However, no apparent economic damage from this larvae has been observed and control is not recommended. However, the interaction between this species and the bark scale is being investigated, for it is hypothesized that barkminer infestation may lead to greater bark scale damage (4).

Chemical Control

Fifty-six percent of responding surveyed lychee growers and 59 percent of longan growers reported insecticide use. Those survey respondents that provided insect damage estimates indicated that from 5 to 100 percent of the lychee crop would be lost to insect damage (n=31, mean of 51 percent). For longan, from 10 to 100 percent of the crop would be lost to insect damage (n=13, mean of 42 percent).

Insecticides and miticides registered for use on lychee and longan in Florida include buprofezin, imidacloprid, pyrethrins+/- rotenone, methidathion (longan only), methoxyfenozide, spinosad, spinetoram, insecticidal oil, insecticidal soap, azadirachtin, pyriproxyfen, and methoprene (for ants). Materials that can be used during the non-bearing period are bifenazate, hexythiazox, bifenthrin, pymetrozine, and fenpropathrin. Ant materials such as hydramethylnon and fenoxycarb are also available for non-bearing acreage. Biological insecticides include *Bacillus thuringiensis* and *Beauveria bassiana* (10).

METHIDATHION
There is a Special Local Needs [24(c)] registration for the use of methidathion on longan. Methidathion is an organophosphate insecticide used to manage sucking insects such as scale and mealybug. The price of methidathion is $29 per pound of active ingredient and the approximate cost per application is $15 per acre (11,12). Twenty-seven percent of surveyed longan growers applied methidathion to their acreage once (33 percent) or twice (67 percent) for an average use rate of 1.7 times per season. There is a maximum of two applications per year, which must be made at a minimum of 45 days apart. The PHI is 21 days and the REI is 48 hours.

FENOXYCARB
Fenoxycarb is a carbamate compound used as an insect growth regulator, which causes death in the last pupal stage. The bait product is used to manage ants (particularly the imported red fire ant) on non-bearing lychee trees. The price of fenoxycarb is $715 per pound of active ingredient and the approximate cost per application is $14 per acre (11,13). Twenty-one percent of surveyed lychee growers applied fenoxycarb to their acreage once (44 percent), twice (44 percent), or three (12 percent) times per season for an average seasonal use rate of 1.7.

CROP OILS
Crop oils work by smothering poorly mobile insects such as scales, aphids, and mites. The oils are usually made up as 1.5 to 3 percent solutions, which are applied thoroughly to each tree. Price varies based on amount, formulation, and brand used, but at an average of $6 per gallon, a treatment would cost approximately $60 per acre. There is a four hour REI for crop oils. Nine percent of surveyed lychee growers and 6 percent of longan growers in Florida applied crop oil either one (67 percent) or two (33 percent) times for an average use of 1.3 times per season.

AZADIRACHTIN
Azadirachtin is a natural compound derived from the neem tree (*Azadirachta indica*) that has insect growth regulator as well as deterrent activity. The compound is used to manage whiteflies, aphids, some scale insects, and caterpillars. The price of azadirachtin is $2000 per pound of active ingredient and the approximate cost per application is $75 per acre (11,12). The PHI for azadirachtin is 0 day and the REI is 4 hours (12). Seven percent of lychee growers and 9 percent of longan growers applied azadirachtin to their acreage once a season.

PYRETHRIN + ROTENONE
These two natural compounds both have contact and stomach activity. The mixture is used to manage sucking and chewing insects. The median price of the mixture is $900 per pound of active ingredient and the approximate cost per application is $25 per acre (11,14). The PHI and REI for the mixture are both 12 hours. Two percent of lychee growers and 3 percent of longan growers reported the use of this combination either 6 or 12 times a year, respectively.

BACILLUS THURINGIENSIS
The biopesticide *Bacillus thuringiensis* (*B.t.*) is used to manage young lepidopteran larvae. The median price of *B.t*. is $160 per pound of active ingredient and the approximate cost per application is $20 per acre (11,15). *B.t*. may be applied up to the day of harvest (PHI= 0 day), and the REI is 4 hours. Two percent of lychee growers and 3 percent of longan growers reported the use of a *B.t.* compound two times a year.

Cultural Control
Based on survey results of all tropical fruit growing respondents, 44 percent reported keeping records of pest problems, 50 percent adjusted applications (timing or rate) to protect beneficial insects and mites, and 52 percent alternated pesticides to reduce resistance. Sixty-two percent reported selecting the pesticide that is least toxic to

beneficial insects and mites and 63 percent spot sprayed only infested plants or areas. Seventy percent reported selecting pesticides that are least toxic to the environment to make this the dominant form of cultural pest control.

Biological Control
Seven percent of the responding tropical fruit growers reported release of predatory wasps for control of lepidopteran pests. Additionally, 30 percent reported the use of biological-derived pesticides like *B.t*.

Weed Management

Weed Pests
Weeds can reduce fruit yields by competing primarily for water and nutrients. Although individual weed species may vary from region to region within the state, predominant weed species in groves are grasses, sedges, and pigweeds. However, species composition is less important as the herbicides available for tropical fruits are non-selective, post-emergent herbicides.

Chemical Control
Eighty-eight percent of surveyed lychee and longan growers reported herbicide use. The herbicides registered for use in Florida for lychee and longan include glyphosate, carfentrazone, pelargonic acid, and flumioxazin (non-bearing only) (10).

GLYPHOSATE
Glyphosate is a systemic herbicide used for total vegetation control. Glyphosate is applied as a directed spray so that foliage is not injured. The median price of glyphosate is $10 per pound of active ingredient and the approximate cost per application is $20 per acre for annual weeds and $55 per acre for perennial weeds (11,16). The REI for glyphosate is 12 hours.
Eighty-eight percent of surveyed lychee and longan growers in Florida applied glyphosate either two (9 percent), three (28 percent), four (25 percent), five (14 percent), six (18 percent), seven (3 percent), or twelve (3 percent) times for an average use of 4.4 times per season.

Disease Management

Disease Pathogens
The principal diseases affecting lychee production in Florida include fungi and algae. Anthracnose (*Colletotrichum gloeosporioides*) is by far the most damaging disease. Stem canker (*Botryosphaeria* sp.) and pink limb blight (*Erythricium salmonicolor*) are other fungal diseases which affect lychee trees. Algal spot (*Cephaleuros virescens*) may become apparent in summer. Fungal diseases which are non-manageable (removal and destruction) include mushroom root rot (*Armillaria tabescens*), *Fusarium*

root rot, *Pythium* root rot, and *Rhizoctonia* stem rot. Longan appears to be little affected by fungi. Only algal spot and parasitic lichen (*Strigula* sp.) have been reported as pathogens of longan (1,2,17).

ANTHRACNOSE (caused by *Colletotrichum gloeosporioides*)
The fruit from the lychee variety "Mauritius" are more susceptible to anthracnose than those of the "Brewster" variety. Anthracnose attacks both leaves and fruit. The fruit is susceptible to infection from blossom until it is half-grown. Most of the decay on mature fruit is from latent infection when the fruit is small. The small spots coalesce into large brown spots as the fruit ripens. A white mycelial mat grows over the fruit during storage (17).

STEM CANKER (caused by *Botryosphaeria* sp.)
This fungus is normally found attacking the terminal branches of the lychee tree. Signs include sunken, shrinking, oval to irregular lesions which may crack and expose wood. The fungus is managed by pruning out infected branches and limbs (17).

PINK LIMB BLIGHT (caused by *Erythricium salmonicolor*)
This pathogen attacks the limbs and trunk of the tree. The fungus grows above and below the bark. The outer layer appears light pink to white. The fungus encircles the plant part and girdles the vascular tissue causing foliage wilt and death. This fungus is also managed by pruning exposed wood (17).

ALGAL SPOT (caused by *Cephaleuros virescens*)
Algal spot has a wide host range among tropical trees. Lesions on leaves are roughly circular, raised, and greenish-gray in color. The alga will eventually produce rust-colored microscopic "spores" on the surface of the leaf spots, giving them a reddish appearance. The alga may also spread to branches. If branch splitting occurs, these structures may become girdled and die. This organism seems to flourish in groves which are treated with organic fungicides rather than copper-based compounds (17,18).

Chemical Control

Thirty-seven percent of surveyed lychee growers reported fungicide use. Those survey respondents that provided damage estimates indicated that from 5 to 100 percent of the lychee crop would be lost to disease (n=38, mean of 38 percent). Longan growers indicated that from 0 to 100 percent of the crop would be lost to disease (n=12, mean of 23 percent). Fungicides registered for use on lychee and longan include copper hydroxide/sulfate (lychee only), cyprodinil + fludioxonil, azoxystrobin, and hydrogen peroxide. Mefenoxam is available for use in non-bearing trees. *Bacillus subtilis* and fermentation products of *Trichoderma harzianum* are biological materials available to lychee and longan growers (10).

COPPER
Copper has long been used as a fungicide and can be applied in multiple forms (copper hydroxide, copper sulfate, etc). Copper is primarily used in an attempt to manage anthracnose and algal spot. The median price of copper hydroxide is $2 per pound of

active ingredient and the approximate cost per application is $3 per acre (11,19). The PHI and REI for copper hydroxide/copper sulfate are 0 day and 24 hours, respectively.

Thirty percent of surveyed lychee growers in Florida applied copper hydroxide and 7 percent applied copper in the sulfate form. Copper was applied either one (25 percent), two (44 percent), three (19 percent), five (6 percent), or six (6 percent) times for an average use of 2.4 times per season.

Nematode Management

Nematode Pests

Plant-parasitic nematodes are microscopic roundworms, found in soils, which primarily attack plant roots. General signs of nematode damage include stunting, premature wilting, leaf yellowing, root malformation, and related signs characteristic of nutrient deficiencies. Stunting and poor stand development tends to occur in patches throughout the grove as a result of the irregular distribution of nematodes within the soil. Species of nematodes reported to be associated with unaffected lychee trees include *Hemicriconemoides mangifera*, *Quinisulcius acutus*, and *Macroposthonia* sp. (20).

Chemical Control

No nematicides are registered for use on either lychee or longan. None of the surveyed growers reported the use of nematicides.

Key Contacts

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