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CIR 1400

Florida Crop/Pest Management Profile: Lychee and Longan[1]

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Production Facts

• Lychee *(Litchi chinensis)* and longan *(Dimocarpus longan)* are both tropical evergreen trees of the Sapindaceae family. The plants are of Asian origin and produce fruits that are similar. These two crops are also similar in terms of their environmental requirements and pest spectrum (1,2).

- Florida is ranked first in the United States in lychee and longan production (6).
- United States annual production of lychee is estimated to be approximately 430 tons, of which Florida produces about two-thirds of a million pounds (3). At an average seasonal price of $3 per pound, Florida's lychee crop would be estimated as worth $3 million (4).
- The annual United States production of longan is estimated to be 1.4 million pounds (6). At an average seasonal price of $2.00 per pound, the annual Florida longan crop would be estimated as worth $2.8 million (4).
- Lychee and longan plantings in Florida have greatly increased over the past 18 years. Since 1990, lychee acreage in Florida has increased from 200 acres to between 800 and 1,200 acres (3,7). Similarly, longan acreage in Florida has also increased, from 72 acres to approximately 400 acres (4,8).
- 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 in Florida is planted with the variety 'Kohala' while the two main cultivars for lychee are 'Mauritius' (85 percent) and 'Brewster' (1,2).

Production Regions

In Florida, lychee and longan are grown in Miami-Dade County and in counties adjacent to Miami-Dade. Eighty percent of the lychee production and approximately 90 percent of the longan production is in Miami-Dade County (4). The remaining acreage in production of lychee and longan is primarily in counties adjacent to Miami-Dade.

Production Practices

The lychee tree is medium-sized (12 m), with compound leaves that bear two to eight pairs of leaflets. Lychee leaves are reddish upon initial flush, but become shiny and green

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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 for lychee fruit is from mid-May through early July.

The fruit (2.5 - 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. Fruit must be allowed to ripen on the tree. The pulp is whitish and translucent (1).

The longan tree, when grown in South Florida, is also medium-sized (12 m), with pinnate compound leaves that bear six to nine pair of leaflets. The leaves of the longan 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 for longan is from July through August. The fruit (2.2 - 3.6 cm in diameter) are borne in clusters of several to 350 fruit, which are round or oval. The skin of the fruit 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 10 - 12 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 trees 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 - 125 pounds per tree while longan yields between 50 - 500 pounds per tree (1,2).

The lychee is more cold hardy than longan, but both trees are injured at near-freezing temperatures. These trees are tolerant of drought, but irrigation is recommended during establishment of young trees, from fruit set through harvest, and during prolonged drought conditions. Soils must be well drained for successful production. 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 indicates 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 that are often managed by natural and released parasites, predators, and pathogens. In places where the natural balance of predation has been disrupted, scale populations may increase to levels requiring treatment. Most effective control is obtained when the scales are in nymphal stages, as egg and adult stages are recalcitrant to insecticide applications (1,2).

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 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, dieback of stems and limbs, and sooty mold on the surfaces of leaves and stems.

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 root weevil species impact tree health through direct root damage, which also provides entry routes for fungal infection in the root tissue. *D. abbreviatus* larvae are by far the largest and most damaging of these weevils.

Mature weevils cause only minimal damage from leaf feeding, which is apparent as notches on leaf margins (9). Most mature female root weevils place their eggs in clusters between two leaves on newly flushed foliage. After 10 - 20 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 larval feeding does not girdle these roots, lesions provide entry to debilitating fungi, such as *Phytophthora* spp. and *Rhizoctonia solani.*

The adult weevils emerge over a three-month period that may begin as early as March. Larval development time ranges from eight to 18 months, a period that includes an inactive pupal stage of one to three months. Dry weather delays development and emergence (9).

Lychee Webworm *(Crocidosema* sp.)

This moth is a recently discovered lepidopteran species and apparently an introduced species to Florida from the Caribbean. Reports from extension research in South Florida state that this 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 is 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 (10).

Corky Bark *(Marmara* sp.)

Branches infested with this barkminer become covered with rough, brownish lesions, which range in size from 6 - 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 as it is hypothesized that barkminer infestation may lead to greater damage from bark scale (4).

Chemical Control

Fifty-six percent of Florida lychee growers responding to a 2001 survey and 59 percent of Florida longan growers responding to the same survey reported insecticide use (5). Those survey respondents that provided estimates of insect damage indicated that, without insecticide use, from 5 - 100 percent of the lychee crop would be lost to insect damage (n=31, mean of 51 percent). For longan, survey respondents reported from 10 - 100 percent of the crop was expected to be lost to insect damage if insecticides were not used (n=13, mean of 42 percent) (5).

Insecticides and miticides registered for use on lychee and longan in Florida include the following: 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 the following: bifenazate, hexythiazox, bifenthrin, pymetrozine, and fenpropathrin. Ant-control materials, such as hydramethylnon and fenoxycarb, are also available for non-bearing acreage. Biological insecticides include *Bacillus thuringiensis* and *Beauveria bassiana* (11).

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; the approximate cost per application is $15 per acre (12,13).

Twenty-seven percent of longan growers in Florida surveyed in 2001 reported using methidathion. Of that group, 33 percent reported applying methidathion to their acreage once in a season. Sixty-seven percent of the Florida longan growers who reported using methidathion indicated that they applied it twice in a season. These survey results from Florida longan growers indicated an average rate of 1.7 applications of methidian per season (5).

The label-allowed maximum of two methidian applications per year must be made at a minimum of 45 days apart. The pre-harvest interval (PHI) for methidathion is 21 days, and the reentry interval (REI) is 48 hours.

FENOXYCARB

Fenoxycarb is a carbamate compound used as an insect growth regulator. Fenoxycarb 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; the approximate cost per application is $14 per acre (12,14).

Twenty-one percent of Florida lychee growers surveyed in 2001 reported applying fenoxycarb to their acreage. Of that group, 44 percent reported applying fenoxycarb once in a season; 44 percent reported applying fenoxycarb twice in a season, and 12 percent reported applying fenoxycarb three times per season. These survey results from Florida lychee growers indicated an average rate of 1.7 applications of fenoxycarb per season (5).

CROP OILS

Crop oils work by smothering poorly mobile insects, such as scales, aphids, and mites. The oils are usually made up as a solution of 1.5 - 3 percent and applied thoroughly to each tree. Price varies, based on amount, formulation, and brand used. At an average cost of $6 per gallon, a treatment would cost approximately $60 per acre. Crop oils have a four-hour REI.

Of Florida lychee growers surveyed in 2001, 9 percent reported use of crop oil applications. Of Florida longan growers surveyed that year, 6 percent reported use of crop oil applications. Of these growers who reported use of crop oil applications, 67 percent reported applying crop oils once per season, and 33 percent reported using crop oils twice each season. These survey results from Florida growers of lychee or longan indicated an average rate of 1.3 applications of crop oils per season (5).

AZADIRACHTIN

Azadirachtin is a natural compound derived from the neem tree (Azadirachta indica). Azadirachtin is an insect growth regulator and also a repellant. The compound is used to manage whiteflies, aphids, some scale insects, and caterpillars. The price of azadirachtin is $2000 per pound of active ingredient; the approximate cost per application is $75 per acre (12,13). The PHI for azadirachtin is 0 days, and the REI is 4 hours (13).

Seven percent of Florida lychee growers and 9 percent of Florida longan growers surveyed in 2001 reported applying azadirachtin to their acreage once per season (5).

PYRETHRIN + ROTENONE

These two natural compounds affect insects upon contact and when ingested by the insect. The mixture is used to manage sucking and chewing insects, such as lychee webworm.

The median price of the mixture is $900 per pound of active ingredient; the approximate cost per application is $25 per acre (12,15). The PHI and REI for the mixture are both 12 hours.

Two percent of Florida lychee growers surveyed in 2001 reported use of this combination 6 times a year. Three percent of Florida longan growers responding to the same survey reported use of this combination 12 times a year (5).

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; the approximate cost per application is $20 per acre (12,16). *Bacillus thuringiensis* may be applied up to the day of harvest (PHI= 0 day). The REI is 4 hours.

Two percent of Florida lychee growers and 3 percent of Florida longan growers surveyed in 2001 reported the use of a *B.t.* compound two times a year (5).

Cultural Control

In a 2001 survey of tropical fruit growers in Florida, including growers of lychee and longan, 44 percent of the growers who responded to the survey reported keeping records of pest problems. Fifty percent on the respondents reported adjusting applications (timing or rate) to protect beneficial insects and mites, and 52 percent of the respondents reported alternating pesticides to reduce resistance. Sixty-two percent of the respondents reported selecting the pesticide that is least toxic to beneficial insects and mites, and 63 percent reported spot spraying only infested plants or areas. Seventy percent reported selecting pesticides that are least toxic to the environment, suggesting that this practice is the dominant form of cultural pest control among tropical fruit growers in Florida (5).

Biological Control

Seven percent of the Florida tropical fruit growers responding to the 2001 survey reported release of predatory wasps

for control of lepidopteran pests. Additionally, 30 percent of the survey respondents reported the use of biological-derived pesticides, such as *B.t.* (5).

Weed Management

Weed Pests

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

Chemical Control

Of the Florida lychee and longan growers surveyed in 2001, 88 percent reported herbicide use. Herbicides registered for use in Florida for lychee and longan include glyphosate, carfentrazone, pelargonic acid. Additionally, flumioxazin is registered for use in Florida on lychee and longan trees that are not bearing (11).

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; the approximate cost per application is $20 per acre for annual weeds and $55 per acre for perennial weeds (12,17). The REI for glyphosate is 12 hours.

Eighty-eight percent of Florida lychee and longan growers surveyed in 2001 reported use of glyphosate. Of that group, 9 percent reported applying the herbicide twice per season; 28 percent reported applying it three times per season, and 25 percent reported applying glyphosate four times per season. Of the Florida lychee and longan growers who reported use of glyphosate, 14 percent reported applying the herbicide five times per season; 18 percent reported applying it six times per season, and 3 percent reported applying glyphosate seven times per season. Three percent reported applying glyphosate 12 times per season. These survey results from Florida growers of lychee or longan indicated an average rate of 4.4 applications of glyphosate per season (5).

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 for lychee trees. Stem canker *(Botryosphaeria* sp.) and pink limb blight *(Erythricium salmonicolor)* are other fungal diseases that affect lychee trees. Algal spot (Cephaleuros virescens) may become apparent on lychee trees in summer.

Fungal diseases of lychee that are non-manageable (removal and destruction) include the following: 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 (1,2,18).

Anthracnose (caused by *Colletotrichum gloeosporioides)*

Anthracnose attacks both leaves and fruit of the lychee tree. However, fruit of the lychee variety 'Mauritius' is more susceptible to anthracnose than is the fruit of the 'Brewster' variety. The lychee fruit is susceptible to anthracnose infection from blossom until the fruit is half-grown. Most of the decay on mature lychee 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 (18).

Stem Canker (caused by *Botryosphaeria* sp.)

This fungus is normally found attacking the terminal branches of the lychee tree. Signs of infection include sunken, shrinking, oval to irregular lesions, which may crack and expose wood. The fungus is managed by pruning out infected branches and limbs (18).

Pink Limb Blight (caused by *Erythricium salmonicolor)*

This pathogen attacks the limbs and trunk of the lychee 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 (18).

Algal Spot (caused by *Cephaleuros virescens)*

Algal spot has a wide host range among tropical trees, including both lychee and longan 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 the spots a reddish appearance. The alga may also spread to branches. If branch splitting occurs, the branches may become girdled and die. Algal spot seems to flourish in groves that are treated with organic fungicides, rather than with copper-based compounds (18,19).

Chemical Control

Thirty-seven percent of Florida lychee growers surveyed in 2001 reported fungicide use (5). Survey respondents that provided damage estimates predicted that without use of fungicide from 5 - 100 percent of the lychee crop would be lost to disease (n=38, mean of 38 percent).

Florida longan growers who responded to the survey predicted that without use of fungicides from 0 - 100 percent of the longan crop would be lost to disease (n=12, mean of 23 percent) (5).

In Florida the fungicide copper hydroxide/sulfate is registered for use on lychee. Fungicides registered in Florida for use on both lychee and longan include 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 in Florida (11).

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; approximate cost per application is $3 per acre (12,20). The PHI for copper hydroxide/copper sulfate is 0 days; the REI is 24 hours.

Thirty percent of Florida lychee growers surveyed in 2001 reported applying copper hydroxide. Seven percent of the surveyed Florida lychee growers reported applying copper in the sulfate form. Of the lychee growers who indicated using copper, 25 percent reported applying copper once per growing season; 44 percent reported applying copper twice per growing season, and 19 percent reported applying copper three times per growing season. Six percent reported applying copper five times per season, and another 6 percent reported applying copper six times per season. These survey results from Florida lychee growers indicated an average use of copper 2.4 times per season (5).

Nematode Management

Nematode Pests

Plant-parasitic nematodes are microscopic roundworms found in soils. Nematodes 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 the following: *Hemicriconemoides mangifera, Quinisulcius acutus,* and *Macroposthonia* sp. (20).

Chemical Control

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

Key Contacts

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