LYCHEE CULTURE AND MANAGEMENT

Francis Zee, Curator
U.S. Department of Agriculture,
National Clonal Germplasm Repository for Tropical Fruit and Nut Crops,
Hilo, Hawaii

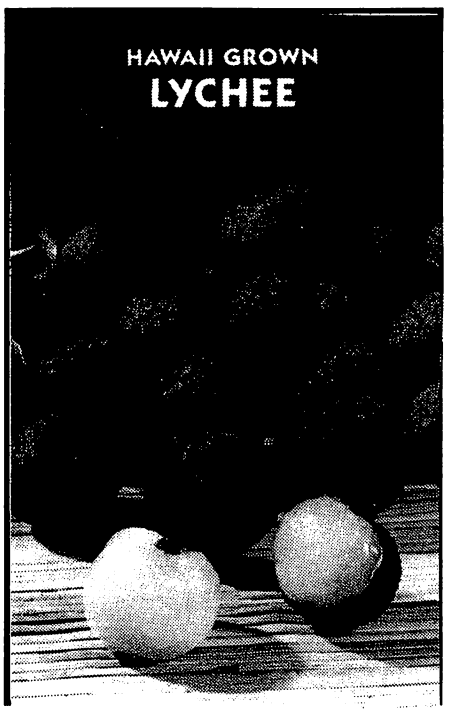
INTRODUCTION

There is a renewed interest in the culture and production of lychee, *Litchi chinensis*, in Hawaii. A serious problem with lychee culture in the tropics is the lack of a consistent cold and dry period needed for flower induction. The use of suitable cultivars along with proper timing of fertilizer applications and irrigation are means to improve production in this less-than-ideal environment.

CULTIVARS

Lychee varieties, such as Hak ip, Tai so (erroneously known as Kwai mi in Hawaii), Kaimana and Bosworth-3 can be relatively consistent producers in Hawaii if properly managed. The two most recently available varieties, Kaimana and Bosworth-3 are of good potential.

Kaimana is a University of Hawaii release selected from Hak ip seedlings. Harvesting season is mid-May to June; fruit weight averages 33.4 g, 71% flesh, with medium seed size and 20% total soluble solids (Hamilton et al. 1992). Bosworth-3 is an Australian selection from Kwai mi seedlings, harvesting season is July to August. Fruit weight averaged 14 g with 75% flesh and 21.3% total soluble solids. It was observed in Hawaii that when Bosworth-3 trees were planted alone, or with Kaimana, a large number of the fruits had aborted or had "chicken tongue" seeds. However, when Bosworth-3 was planted with Groff (a late season variety) all fruits had large seeds.



FERTILIZER

From field planting to 3 years, fertilizers should be generously applied to promote canopy development. An Australian recommendation included a monthly application, during September to February (March to August in N. Hemisphere), of 30, 40, 60, and 80 g of urea/tree for one, two, three and four year old trees respectively. In the months of September and December (March and June in N. Hemisphere), fertilizer with the following analysis (in percentage) : 11.4 N, 4.8 P, 14.6 K, 7.5 S, 4.3 Ca, 1.3 Mg, 0.1 B, 1 Mn, 0.04 Cu, 0.02 Zn and 0.0006 Co, should be applied at the same rate. Fertilizers should always be placed along the drip line or at least 20 cm away from the trunk.

For bearing trees, the recommended rate is 2000 g of 12-5-14 fertilizer per tree per year for four to five year old trees; 3000 g/tree/year for six to seven year old trees, and a 1000 g/tree/year increase for each two years advance in tree age.

Micro-nutrients can be applied in summer and fall as foliar sprays. The recommended rates are:

	G/LITER
Boron (solubor)	2
Zinc sulfate heptahydrate	1
Copper Sulfate pentahydrate	2
Ferrous Sulfate	5
Manganese	2.5

Boron and iron should be applied to matured summer and fall growths. Zinc, copper and manganese should be applied to expanding summer and fall flushes (Greer & Campbell, 1990)

TREE TRAINING

Under ideal growing conditions, young lychee trees produce up to five vegetative flushes a year. Training and shaping of trees should be done during the first three to four years according to the growth habits of the cultivar and the environment.

For cultivars with short internodes and a low spreading canopy, such as Kaimana, an open center type of pruning can be adopted. Three to four evenly spaced laterals with wide branching angles are initiated at about 50 cm above the ground to form the main branches for a spreading

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canopy. Very light thinning is done to remove tangled, weak, diseased or dead branches. In Sichuan, China, the branching for the main frame was reported to be as low as 10 cm above the ground. This training system was reported to encouraged early fruiting and low canopy height.

In Chiang Mai, Thailand, some trees were observed as trained with a central leader system. A main stem is retained with lateral branches evenly spaced on the main trunk at different heights to form an upright canopy. This training style appeared to be suitable for cultivars with vigorous growth. These trees are maintained at about 5 to 7 meters, with heavy thinning of the interior for good light and air penetration. Two to three new growths on each branch from the summer/fall flushes are retained for flowers and production. Despite the tree height, harvesting is relatively simple since the long-limbed branches are forced downwards by the weight of the fruit clusters. Pruning at harvest is significant, with 15 to 20 cm of each branch removed with the fruit cluster. The harvest pruning and biannual topping maintains tree height and shape at a desirable level.

BOOK SHELF

LISA FOR HAWAII VIDEO

This hour-long video presentation gathers reports on various sustainable agriculture strategies, techniques and practices utilized by LISA for HAWAII project grantees. It features informative interviews with farmers, researchers and others along with on-farm location footage to demonstrate concepts. Copies for viewing are available at Cooperative Extension Service offices throughout Hawaii and at the Wong Audio Visual Center, Sinclair Library, UH Manoa.

HMNA 35TH ANNUAL CONFERENCE PROCEEDINGS

The 1995 Proceedings, produced with a grant from the County of Hawaii Department of Research and Development, are now available. The topics of the papers include irrigation, integrated pest management, MQD and the Worker Protection Standard. Copies are available: 322-0935.

CYCLING

Proper use and timing of fertilizers and irrigation are proven management tools for lychee cycling. Lychee flower induction occurs between October and January in Hawaii. The fully matured vegetative flushes need a period of dormancy for flower initiation. The period of dormancy can be induced by low temperature, drought or low available nitrogen. Flower induction has been reported to occur in some early cultivars after being subjected to a period of low temperature (<20 degrees C) for six to eight weeks. Some late season cultivars, such as No mai tsz, Kwai mi and Wai chi require much lower temperature (11-14 degrees C) for flower induction. The optimal leaf nitrogen level correlated to flowering in early varieties was reported to be 1.75 to 1.85%. (Menzel et al., 1986, 1988 a,b; Menzel and Simpson 1991, 1992; Menzel 1983, 1990; Anon. 1978, 1985).

For the early season (May to June) varieties, such as Tai so, Hak ip and Kaimana, it is desirable to have two vegetative flushes after harvest; one in June/July which matures around August, and a second round in August/September which matures by October/November. Immediately after harvest, one-half of the yearly fertilizer should be applied to the tree with irrigation. The remaining should be divided into two equal applications, one applied in spring during flower panicle elongation, and one in early summer when fruits reach pea-size.

The late season (July and August) varieties, such as Bosworth-3 and Wai chi, are generally less vigorous, and due to their late harvest season, only a single vegetative growth is promoted after harvest. One-third of the yearly fertilizer should be applied at two weeks prior to harvest. The remaining fertilizer is applied in two equal parts during spring flower panicle elongation and in summer when fruits reach pea-size. The early application prior to harvest is to ensure sufficient time for the vegetative growth to mature before winter, and the lesser amount to avoid high leaf nitrogen levels, which hinders flower induction.

LYCHEE CULTURE AND MANAGEMENT will continue in the *Fall issue of Hawaii Grown Tree Crops Journal.*

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LYCHEE CULTURE AND MANAGEMENT, PART II

Francis Zee, Curator
U.S. Department of Agriculture,
National Clonal Germplasm Repository for Tropical Fruit and Nut Crops,
Hilo, Hawaii

MANAGEMENT PROCEDURE FOR KAIMANA

A very simple procedure can be used to manage Kaimana lychee to promote flowering and fruit production in Hawaii. After harvest in mid-May or June, all fruiting branches should be pruned back about 15 cm. Each plant is fertilized with one-half of the allocated 12-5-14 fertilizer, 1.5 Kg of dolomite and one to two cubic feet of chicken or steer manure. Trees are irrigated moderately every other day until bud breaks.

The post harvest pruning and fertilizing synchronizes and induces vigorous vegetative growth in July. The second vegetative flush should occur naturally in mid to late August during a good growing season. The vegetative growth should be mature by October. From October on, no fertilizer or water should be given.

If the leaf nitrogen is too high, and if warm weather prevails in October and November, a vegetative flush may occur. This new growth should be pinched off at 1.5 cm above the base when the first leaf appears. Too early and complete removal of the new shoots only promotes more vegetative growth from the axillaries.

If warm temperatures prevail after a short cold spell in October, an early flush of flowers may occur on some branches in November. This early flowering usually has long panicles bearing mostly male flowers. If allowed to develop, three to five fruits may set on each branch, resulting in poor production. However, these fruits can be harvested earlier and are usually larger. In China, these early flower panicles are normally removed chemically or physically when they reach 7 to 10 cm. stubs of 1 to 2.5 cm are left to inhibit further bud breaks.

After sufficient period of dormancy induced by cold temperatures, drought, or low nitrogen level, short and bunchy flower panicles are produced in spring (branching at below 10 cm). Most flowers on these panicles are functional females and hermaphrodites. One-fourth of the year's fertilizer should be applied at this stage. Weather conditions during flowering are critical for production. A sunny period during flowering ensures good pollination, while a prolonged rainy period is

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LEAFHOPPER

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Trees treated with insecticides were in better shape and had significantly greener leaves. This corresponds to a higher concentration of chlorophyll compared to untreated leaves.

The pesticides used were a tank mix of Align and Pyrenone. Early in the season the pesticide significantly reduced the leafhopper populations, but later in the season, the pesticides were of only limited value in reducing population levels.

Leafhoppers insert their eggs into the leaf mid-rib and into green twigs.

Over 85% of the leafhopper population is found on the youngest 4 leaves on a stem. When searching for leafhoppers, concentrate on young, recently expanded leaves.

A survey of natural enemies of two-spotted leafhopper has begun. So far, we have collected two egg parasites on guava (8 additional species have been found on other plants) and we suspect that the big-headed ant, several species of ladybird beetles, and several brown lacewings are feeding on younger immature stages.

Use of molecular methods by Drs. John Hu and Wayne Borth of the Plant Pathology Department at UH Manoa show no evidence of MLO's in either guava or within the leafhopper itself. Combined with the yield study and lab studies reported elsewhere in this report, we conclude that MLOs have no involvement in any of the crops or forest plants we have surveyed.

FRUIT CO-OP SEEKS TO EXPAND

At its recent board meeting the Hawaii Tropical Fruit Cooperative discussed plans to expand membership and its markets. As the tropical fruit industry continues to grow and fruit yields increase, a cooperative marketing effort is needed to ensure the best price for the growers.

The co-op will implement an assessment program based on box purchases and sales of boxed fruit. All funds collected will be used for fruit promotion. In-store demonstrations are being planned for Oahu during the upcoming rambutan season. The co-op will continue to adhere to its policy of marketing only high quality fruit.

An agreement is being drafted for new members and contracts are in the works with buyers of tropical fruits. The Hawaii Tropical Fruit Cooperative will give a presentation at the HTFG annual meeting on Kauai. For more information on becoming a member, please call Ellen 322-0935.

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detrimental. Irrigation should be available during flowering and fruit development. One-fourth of the fertilizer should be applied when fruits reach pea-size.

Kaimana lychee matures four to five months after fruit set. All watering should be cut off two to three weeks prior to harvest. Fruits should be harvested in the morning or evening on a sunny day to reduce post harvest loss. Lychee fruits are non climacteric and do not ripen once harvested. Fruits for long distance shipping should be harvested at 70 to 80% ripe.

PRUNING DURING HARVESTING

Some early literature recommended no more than two pairs of leaves be removed along with a fruit cluster during harvest. The compacted node above the fruit clusters, known as the "dragon head" in Chinese literature, was alleged to contain fruiting branches for the following season. A preliminary observation with Kaimana in 1995 showed that if this type of node was retained, new growth emerged six to eight weeks later. The multiple branches produced were short, lacked girth and were of poor vigor. However, if the node was removed along with 15 cm of the stem, the new growth emerged approximately four weeks later, the number of shoots per node were less, but were longer and more vigorous. Similar observations were reported on Wai lai, with increase in production in the following season. (Young & Hou, 1992).

PEST AND DISEASES

In Hawaii, reported pests of lychee are birds of various species; Oriental fruit fly, *Bactrocera dorsalis*; Erinose gull mite, *Eriophyes litchii* Keifer; Litchi fruit moth, *Cryptophlebia ombrodelta* Lower; macadamia husk borer *C. illepida*; the green scales *Coccus viridus* Green; *Saissetis hemispherica* Targioni; and various mites and thrips. (Yee, 1982, Chia et.al 1990; Jones et.al, 1992).

Other serious insect pests for lychee reported in Asia but not present in Hawaii are Coco pod moth, *Acrocerops cramerella* Snellen; Coffee leopard moth, *Zeuzer coffeae* Niethner; Small tussock moth, *Notolophus australis posticus* Walker; Grey lychee butterfly, *Deudorix epijarbas* Moore and Lepidarbela sp. The Turtle back beetle, *Aristobia testudo Voet;* and White spotted longicorn beetle, *Anoplophora maculata* Thomson. Longan leaf hoppers, *Fulgora candelaria* Linn and Lawana sp. A long horn beetle, *Xylotrupes gideon* Linne; Lychee stingbug, *Tessaratoma papillosa* Drury. Pink wax scale, *Ceroplaste rubens* Maskell; Indian white wax scale, *C. ceriferus* Anderson, and Lac insect, *Kerria lacca* Kerr. (Anon 1985, 1986; Huang, J.S. 1976)

The most important disease is the Witch's bloom, a virus disease not present in Hawaii. Other fruit decaying diseases include Aspergillus rot, caused by *Aspergillus flavus* and *A. niger*; Pestalotiopsis rot caused by *Pestalotiopsis sp.* in India; Peronophythora rot, an epidemic following a rainy period in China and Taiwan caused by *Peronophythora litchii*; sour rot caused by *Geotrichum candidum*, reported in India and Australia; yeasty rot and other decay caused by *Botryodiplodia theobromae, Colletotrichum gloeosporioides, Rhizopus oryzaw* and others (Snowdon, 1990).

NOTE: A complete bibliography of references in the article is available by calling the HTFG at 322-0935.