

HORTICULTURE DIGEST

Department of Horticulture
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In this Issue: FRUIT AND NUT CROPS

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HORTICULTURE DIGEST

HORTICULTURE DIGEST is a newsletter of the Department of Horticulture, College of Tropical Agriculture. It is new. It will be published quarterly to disseminate timely information in three fields of horticulture: fruits, vegetables, and ornamentals. The Extension Specialists in the Department of Horticulture will serve as editors.

The first issue deals with fruits and nuts. The second will be on vegetables, and the third on ornamentals.

It is our sincere hope that this new publication will provide you with the most recent information on rapidly advancing fields of horticulture.

H. Kamemoto, Chairman
Department of Horticulture

and ornamentals have been introduced since 1950. He considers the Jaboticaba, Williams Hybrid banana, Zill mango, and *Jatropha hustata* among the most important to date. Other fruit introductions which he believes will be invaluable in years to come include longan, mango, rambutan, durian, and pulusan.

Dr. Hamilton's most recent contribution to Hawaiian agriculture is the introduction of seven species of macadamia obtained from New Caledonia and Indonesia. His trip to these countries was financed through the courtesy of Hawaiian Macadamia Nut Producers' Association.

Dr. Hamilton has travelled extensively in Central and South America as well as Asia. His travels have taken him to more than 20 countries, including Brazil, Costa Rica, Guatemala, New Caledonia, Indonesia, Thailand, Malaysia, Japan, Pakistan, and the Philippines. Some of these trips were initiated at the request of the Agency for International Development (AID), The Rockefeller Foundation, and the Food and Agriculture Organization (FAO) of the United Nations.

Dr. Hamilton received his Bachelor of Science degree at North Dakota Agricultural College, his M.S. at Ohio State University, and his Ph.D. at the University of Minnesota. The topic of his doctorate thesis was *A Quantitative Study of Growth and Fruiting in Inbred and Crossbred Progenies from Two Solo Papaya Strains*. While studying for his advanced degrees, he worked for the Department of Agriculture and also as a county agent in Minnesota and North Dakota. During World War II he served in the U. S. Navy as a line officer on destroyers and motor torpedo boats.

Richard A. Hamilton

Dr. Richard A. Hamilton, Professor of Horticulture, heads the fruit and nut program of the Department of Horticulture, University of Hawaii.

Author and co-author of more than 75 articles and publications on macadamia nuts, papaya, guava, mango, etc., Dr. Hamilton's energies are directed toward the development of new varieties of macadamia nuts, papaya, avocado, lychee, and mangos. Among the Hawaiian varieties released under his program are the macadamia variety Keeau, the Pope mango, the Sunrise and Line-8 Solo papayas and the Groff lychee.

In his new plant introduction program, more than 1,500 species and varieties of fruits, nuts,

CITRUS ROOTSTOCKS

One of the biological factors affecting fruit quality of citrus in Hawaii is the rootstock. A rootstock for citrus is usually a seedling on which the desired variety is budded or grafted. The rootstock can contribute to the vigor, size control, virus and nematode resistance, and rot resistance of the grafted tree and it can improve

or depress fruit quality. Common rootstocks include Rough lemon, Sweet orange, Cleopatra mandarin, and Troyer citrange.

Rough lemon is often used in Hawaii for all citrus. It is vigorous, produces a large tree and often lots of fruit, and is resistant to quick-decline virus. However, the fruit tends to be lower in sugars, acid, and juice content. It can be coarse-textured (show granulation) and thick-skinned. In other words, fruit quality is lower and often poor. This is true the world over. And the tree may die in a few years from gummosis or root rot.

Rough lemon is acceptable for lemons, limes, and possibly grapefruit in sandy soil or in poor, rocky, dry areas where the vigor is needed. It is not recommended for oranges or tangerines. If your nurseryman doesn't know what rootstock a tree is on, it is probably Rough lemon. It is better to place an order with your nurseryman and wait a few months and pay a little more to get a better rootstock for tangerines or oranges. Almost any rootstock is better.

Sweet orange seedlings, such as Hawaiian orange, as rootstocks are also susceptible to gummosis and root rot although they do not reduce (or improve) fruit quality. Some Sweet oranges may make acceptable rootstocks for oranges and tangerines in well-drained soil but they should not be planted in heavy clay or poorly drained soils.

Cleopatra mandarin (Cleo), a tangerine type, makes an excellent rootstock for tangerines, oranges, and grapefruit. It is more resistant to gummosis and root rot than Rough lemon or Sweet orange. However, Cleo is slow-growing and trees take longer to bear fruit. Time of harvest may be little later. Cleopatra is more tolerant of basic soils and salt than the other rootstocks and may give better results near the ocean or on coral subsoils. Production is good in later years. Orange quality is average, tangerine quality is good.

Troyer citrange rootstock is vigorous and quite resistant to gummosis and root rot. It improves the quality of fruit grafted on it by increasing sugar content, acid and juice percentages. Production on Troyer is good and earlier than on Cleo. It is resistant to most strains of quick-decline virus but is susceptible to Exocortis virus. Exocortis is spread by pruning shears and by the use of diseased scion wood. If clean scion wood is used, there is little problem. The new trend is to use Carrizo in place of the Troyer as rootstock because of better quick-decline and citrus nematode resistance. Otherwise, Carrizo and Troyer are about the same. The citranges are recommended for oranges and tangerines.

Of the four rootstocks mentioned above, Troyer gave the best productivity and quality for Dancy Tangerines and Navel and Valencia oranges in our experiments. The citranges, especially the Troyer, show mottling of the leaves on neutral or soils of basic reaction (pH 7.0 or above). Treatment with zinc will correct this problem.

The Trifoliolate orange is the rootstock used for 90 percent of the citrus of Japan, principally Satsuma mandarins, and its use is increasing slowly in central California and northern Florida where conditions and varieties are both different from Hawaii. It is one of the parents of the Troyer and Carrizo citranges. Trifoliolate is highly resistant to quick-decline virus and is almost immune to gummosis and root rot. It is susceptible to Exocortis virus. The most desirable feature of Trifoliolate is that it contributes to improvement in fruit quality. Only the Sour orange can equal it in this respect, but the Sour orange cannot be used in Hawaii because quick-decline virus wipes it out here. Certain varieties on Trifoliolate grow smaller and more compact but this cannot always be predicted. Trifoliolate is precocious in bearing and the fruit size and total yield will be smaller than on Troyer. When available it might be recommended for tangerines and oranges in home gardens in wet areas or on acid or heavy soils.

Other rootstocks are used in various parts of the world. Grapefruit, lime, and sour orange are not recommended in Hawaii because they are very susceptible to quick-decline virus (Tristeza) and such trees die or become stunted when infected. Quick-decline virus is prevalent in Hawaii and the two species of aphids which affectively spread it from infected trees are present here. The Heen Naran rootstock is good; it is resistant to both gummosis and quick-decline. Pummelo as a rootstock is recommended only for pummelo scions.

Nurserymen are now beginning to supply citrus trees on Troyer. Trees on Trifoliolate are not yet available except for some dwarf citrus. Those who want to have better-quality fruit should place orders with their garden shops or nurseryman. If citrus on the preferred rootstock is not available, it is better to wait a few months and get the best, than to be disappointed after growing a tree for several year.

Robert M. Warner

BANANA IMPORTS INCREASE

Produce shelves in Honolulu Supermarkets well stocked with labelled "Chiquita" or "Cabanana" bananas from Central America are good evidence of the competition which Island banana

growers must now face. Data of Hawaiian production and imported bananas during the last few years show the following trend:*

	Pounds produced	Pounds imported
1967	8,000,000	22,000
1968	6,485,000	1,200,000
1969	5,930,000	1,583,000

*Data from Hawaii Crop and Livestock Reporting Service, Hawaii Department of Agriculture.

Seasonality, nematodes, wind damage, diseases, urbanization, poor marketing and cultural methods, and a small pocket market are considered some of the important factors affecting the supply of Hawaiian fruits reaching the market.

In spite of the problems faced by Island growers, banana-growing can be economically feasible. However, major adjustments to present cultural and marketing practices must be made first. These include: (1) planting the Williams Hybrid banana variety in place of Brazilians and Bluefields wherever and when possible; (2) using nematode-free suckers; (3) spraying fungicides for the control of foliar and fruit diseases; (4) providing supplementary irrigation; and (5) using better marketing methods which include handling, ripening, and packaging.

To assist growers make the adjustments necessary to meet the challenge of ever-increasing imports, the College of Tropical Agriculture in cooperation with the Department of Agriculture has taken a major role in organizing the "Hawaii Banana Industry Association." This association brings growers, wholesalers, and government representatives together to work cooperatively for a stronger banana industry.

Some of the recent activities in which the College has participated to improve the banana industry in Hawaii include:

- (1) Introduction of the Williams Hybrid banana as well as many other varieties.
- (2) Organization of a county and a state banana association.
- (3) Development of a spray program to control fungal diseases.
- (4) Initiation of a hot-water treatment program to obtain suckers that are not contaminated with the burrowing nematode, *Radopholus similis*.
- (5) Publication and distribution of a monthly series of articles on banana production.
- (6) Initiation of a plant tissue analysis survey program to accumulate data on the nutrients found in the plants in different locations and at different times of the year.

DIURON REGISTRATION IN PAPAYA

Registration of diuron for use in papaya (*Carica papaya*) orchards in Hawaii is being requested with the following suggested label:

"Karmex" Diuron Weed Killer for Selective Control of Weeds in Papaya Orchards

Du Pont "Karmex" diuron weed killer is recommended for use in established papaya orchards for control of annual weeds such as crabgrass, foxtail, sandbur, rice grass, pigweed (Amaranth), Flora's paint brush and buttonweed.

How to Apply:

Use only where papaya trees have been established for at least 6 months. Apply as a directed spray on a band or broadcast basis, using sufficient water (40 gals. per acre minimum) to provide thorough and uniform coverage of the ground beneath and or between the trees. Avoid contact of the fruit with spray or drift; do not spray foliage as injury to trees may result.

Apply 2 to 4 lbs. "Karmex" per acre preferably before weeds emerge. If weeds have emerged, add 1 to 2 qts. Surfactant WK per 50 gals. spray to increase contact activity on weeds. Use the lower rate on lighter soils and the higher rate on heavier soils.

Apply with a properly calibrated-fixed boom power sprayer. Avoid overlapping, and shut off spray booms while starting, turning, slowing or stopping, or injury to trees may result. Continuous agitation as directed on the container label is required to keep the material in suspension.

Best results are obtained when the herbicide is moved by moisture (rainfall or irrigation) into the upper layer of soil within 2 weeks after application.

Note: Do not replant treated areas to any crop within two years after last application as injury to subsequent crops may result. Do not apply to home planting nor to areas into which the roots of other valuable plants or trees may extend as plant injury may result.

Du Pont De Nemours & Company hopes to 'clear' diuron for use in papaya orchards in Hawaii through the Food and Drug Administration but expects it will take some time before labelling is approved.

According to results of research by Dr. Roman Romanowski, Jr., diuron plus surfactant provide the most complete and longest lasting weed control of all herbicides tested. In some experiments diuron-treated rows out-yielded check treatments. The experiment was conducted over a period of 6 years in five different locations.

Papaya growers are reminded that fruits from fields treated with diuron should not be placed

on the commercial market, because, to date, diuron is not registered for use on papaya. Although diuron is not registered for papaya, it has been approved for use in such crops as banana, pineapple, citrus (grapefruit, lemon, orange, tangelo, tangerine), and macadamia nut.

Jack Tanaka

HMPA IS 10 YEARS OLD

To conceive of a macadamia association independent of the University, then put that thought into successful action is easier said than done. The organization of the Hawaii Macadamia Producers Association is an outstanding example of a successful program that has benefited the macadamia industry.

The idea of forming a statewide macadamia association was not new in 1960; the College of Tropical Agriculture had nurtured the thought as far back as 1956. In 1956, however, the response from growers as well as from county staffs was lukewarm. It was not until 1961 after several advisory council meetings composed of industry leaders and University personnel that the idea was brought up again and action was taken. The advisory council felt the time was appropriate. The growers were consulted. The result of these efforts was that the first Hawaii Macadamia Producers Association meeting was held on June 17, 1961, and a total of 154 became paid members. One of the most important factors causing growers to join the association probably was the frequent price fluctuation of in-shell macadamias paid to the growers.

The mutual benefit gained by a united industry was recognized by the large corporations led by Richard Cooke, Jr., and the small farmers represented by such members as Jack Tokunaga. As a result of the farsightedness of this group, State funds in the form of an advertising subsidy, tax benefits in the form of a land tax moratorium, and increase in macadamia research in such areas as processing were obtained.

In 1967 an era ended when Richard Cooke, Jr., President of HMPA for 7 years, left the employment of C. Brewer & Company. He became the first honorary member of the association, an honor bestowed upon him in recognition of his leadership in developing the organization. At the same time, the organization assumed a status fully independent of the University of Hawaii in that all of its officers are now elected from its regular membership of commercial growers and other businessmen. The College of Tropical Agriculture continues to serve the industry through its ongoing extension and research programs.

1970 is the 10th anniversary of the association. HMPA has come a long way.

FRUIT AND NUT INDUSTRY HIGHLIGHTS

Banana Research

Dr. Robert M. Warner, the Department of Horticulture's project leader in banana culture research, met on April 20th with a banana advisory committee composed of banana growers Shige Shiroma, President of the Hawaii Banana Industry Association, and Peter Pak Chong, President of the Oahu Banana Industry Association. County Extension Agent Bunki Kumabe, Dr. Richard A. Hamilton, and Horticulture Specialist Warren Yee made up the rest of the committee. The meeting was held to determine the most important applied research projects needed by banana growers in the state. Suggestions included nematode control, irrigation needs, disease control, fertilizer rates, and plant density. The variety selected for research was Williams Hybrid.

HMPA Meeting

Horticulturists participated at the May 2, 1970, Hawaiian Macadamia Producers Association 10th annual meeting. They included Dr. Richard A. Hamilton, who spoke on "A Search for New Macadamia Species," Dr. Phillip J. Ito on "Cross Pollination Studies in Macadamia," and Mr. Gordon Shigeura on "Macadamia Crop Logging."

Assisting the association was County Extension agent John Iwane of the Cooperative Extension Service in Kona.

50th State Fair Prize Exhibit

Horticulture Specialist Yukio Nakagawa was chairman of the group of staff members who developed the College of Tropical Agriculture exhibit at the 50th State Fair held on Sand Island in Honolulu June 26 to July 5. The exhibit, called "Plant Crops in Hawaii," featured more than 120 varieties of fruits, vegetables, and ornamental plants. Contributions of products on display came principally from Hawaii Agricultural Experiment Station farms and also from farmer-cooperators. The exhibit won an "outstanding exhibit" award.

THE GOUVEIA MANGO

Gouveia, an Attractive New Mango is a recent circular issued by the Department of Horticulture. It is a 4-page publication on a seedling mango considered outstanding in flavor, color, and texture. Discovered in 1956 by the College of Tropical Agriculture through a mango contest which it sponsored, the Gouveia has been planted in a sufficient number of places so that it can now be evaluated.

The rating given by panel of judges to the Gouveia and other popular mango varieties shows how well the seedling compares (see table).

Name	Flavor	Texture	Skin color	Flesh color	Size and shape	Proportion of seed to flesh	Total
Highest possible score	35	30	20	5	5	5	100
Gouveia	29.0	21.0	12.5	4.3	4.5	4.8	76.1
Pope	26.5	24.1	12.6	3.8	4.1	4.5	75.6
Momi K	25.7	22.5	14.0	3.7	3.0	4.4	73.3
Pirie	29.1	22.3	9.2	3.3	3.0	3.0	69.9
Zill	23.6	18.8	11.9	3.4	3.1	4.2	65.0
Haden	17.7	17.6	15.3	3.4	3.7	2.9	60.6
Joe	17.2	18.9	11.3	3.2	4.2	4.1	58.9
Welch							

The Gouveia Mango was named after the late Mrs. Ruth Gouveia of 1445 Mokuna Place, Honolulu. The original tree was planted 28 years ago in Mrs. Gouveia's backyard.

Call the County Extension Office near you for a copy of Circular 435, Gouveia, An Attractive New Mango.

EGG FRUIT (*Lucuma nervosa*)

The egg fruit, also known as Canistel, is a small tree found growing in the lowlands of the islands. The bright orange-yellow oval fruit varies in size from 3 to 6 inches long and 3 to 7 ounces in weight. There may be one to 3 large dark brown seeds. The pulp is mealy, sweet, and has a distinctive odor. The fruiting season in the islands is early spring.

Canistel, a native to Cuba and Tropical South America, is not widely cultivated in Hawaii. The

present propagation practice is to grow them from seeds.

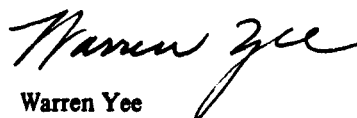
LYCHEE EXPORTS INCREASE

As a result of the fruit fly disinfection treatment on lychee developed by the U.S.D.A. Fruit Fly Laboratory and assisted by Ernest K. Akamine, Plant Physiologist at the College of Tropical Agriculture, in developing tolerance levels, fresh lychee is being shipped to mainland United States in increasing quantity.

Plant quarantine fumigation records for the State Department of Agriculture show a gradual increase in fresh fruits exported. The quantity fumigated with ethylene dibromide ($\frac{1}{2}$ lb./100 cu. ft. for 2 hours at not less than 70° F.) by the Hilo and Honolulu stations during the last 10 years was as follows:

	Honolulu lbs.	Hilo lbs.	Total lbs.
1959	1,932	—	1,932
1960	11,965	—	11,965
1961	3,242	—	3,242
1962	4,877	—	4,877
1963	3,747	334	4,081
1964	13,438	1,970	15,408
1965	3,653	7,800	11,453
1966	11,631	4,991	16,622
1967	7,626	11,181	18,808
1968	19,940	22,000	41,940
1969	25,068	63,964	89,032

The principal lychee variety being exported is Kwai Mi, which is in season from late May to early July.



Warren Yee
Specialist in Horticulture

NOTE

The use of trade names is for the convenience of readers only and does not constitute an endorsement of these products by the University of Hawaii, the College of Tropical Agriculture, the Hawaii Cooperative Extension Service, and their employees.