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Landscape, Floriculture, and Ornamentals News

A Newsletter for the Professional Landscape, Floriculture, and Ornamentals Industries

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Contents

Words of Wisdom for Low-Maintenance Landscaping

David Hensley
CTAHR Extension Landscape Specialist

The right plant in the right location
Choose the plants that work in the environment. Plant sun-lovers in the sun and shade-lovers in the shade. Some plants adapt to several locations, while others are pretty particular. Remember pH, salts, and water requirements.

Use the "iron-clads"
Select the toughest plant for the site, not those that have the brightest flowers. Eliminating problems by picking the best plant for the site keeps work and problems to a minimum. Look at what nature grows. Native plants can work but are not the only answer. Find out what does well around the neighborhood.

Give the plant plenty of room
Do not crowd plants with too many individuals in a limited space. This increases problems and pruning. Know how big they will get and give them room to roam. Trying to keep a 12-foot-growing plant beneath a four-foot window frustrates the plant and the gardener.

Keep it simple
The greater the variety of plants used in the landscape, the greater the amount of work expertise required. Things required for particular plants are forgotten or overlooked. Simple is usually better, but remember—too simple is boring.

Mulch, mulch, mulch
A 2–3-inch layer of mulch reduces weeds and water requirements. Organic mulches add organic matter to the soil as they decompose. Mulching is possibly the most important single thing you can do to reduce landscape maintenance.

Be realistic
No landscape is perfect. There may be a few insect-eaten leaves, a couple of small weeds, and maybe a few dead flower heads. This is not to say the leaves should pile up, the weeds grow higher than the plants, or the irrigation is never fixed. Be realistic: aim for what can be achieved on the budget of time or cash allowed. Perfectionism costs money and time.

*Note to librarians: This newsletter replaces *Horticulture Digest*. The first two issues of *LFO News* were published as issues in vol. 1. Beginning with this one, no. 3, issues will be numbered sequentially, without volume numbers. *LFO News* will be published irregularly. Libraries who wish to receive it should write to the editors and request to be put on the mailing list.

Shady Places in Hawaii

Doug Friend
Professor Emeritus, Dept. of Botany, UH-Manoa

"I just can't get anything to grow there!" How often have we heard this cry when looking at the densely shaded part of a friend's garden? Why won't plants flourish or even grow under a banyan or other dense tree, or sometimes even on the shady side of the house?

Part of the problem is the low level of light. All green plants need light to carry on photosynthesis which provides energy needed to turn the carbon dioxide gas into the many carbon compounds that make up the plant. Without sufficient light to maintain the plant's energy needs, we cannot expect growth or even survival.

Sometimes pruning overhanging branches or removing obstructions can increase the amount of light reaching the plants. An alternative is to increase the of reflected light by painting walls and fences white. It is usually impractical to use artificial lighting to supplement natural daylight; the lights would have to be very close to the plants and the wattage needed would be too costly. The most effective solution is to select plants that are naturally adapted to low-light conditions. In the tropics there are many plants that have evolved under the low-light conditions of the forest floor. Survival of these plants depends on their ability to greatly increase the area of their leaves in the shade. This enables them to catch enough light to survive and grow.

Lack of water is often an unrecognized problem in shaded areas. Trees, other large plants, and obstructions prevent rain from reaching the soil. An irrigation system and improving the water-holding capacity of the soil reduces this problem. Evaporation can be reduced by covering the soil with several inches mulch. Given sufficient water, plants such as tree ferns will grow under as little as 10% daylight.

There is a wide choice of plants for growing under tropical shade conditions. Ferns and aroids are especially suitable. *Selaginellas* are primitive fern-like plants that may be used as ground covers or as small shrubs. The leaves of begonia are often variegated and as attractive as the flowers. Plants in the prayer-plant family, like maranta, also have attractive patterned leaves. A wide variety of hostas are available on the mainland. These have rosettes of leaves, often variegated, and also flower under shaded conditions. Only a few types are grown in Hawaii. It would be interesting to see results of trials of new varieties under our growing conditions.

While many shade-tolerant plants provide interesting foliage, the range of brightly colored flowering plants is rather limited. The popular impatiens is a reliable shade

Plants suitable for shaded areas in Hawaii

Palms 20–30 ft when mature
Archontophoenix alexandrae
Calyptrocalyx spicatus
Chamaedorea woodsoniana
Howea forsteriana
Laccospadix australasica
Livistona chinensis
Neodypsis decaryi
Pritchardia pacifica
Trachycarpus fortunei
Veitchia joannis

Palms 10–20 ft when mature
Areca latiloba
Butia capitata
Caryota mitis
Chrysalidocarpus lutescens
Cyrtostachys renda
Geonoma sp.
Howea belmoreana
Hyophorbe lagenicaulis
Licuala grandis
Licuala spinosa
Phoenix roebelinii
Rhapis excelsa
Veitchia merrillii

Palms below 10 ft when mature
Chamaedora cataractarum
Chamaedora erumpens
Pinanga kuhlii
Rhapis excelsa

Dwarf palms, about 3 ft
Chamaedorea elegans
Chamaedorea geonomaeformis
Chamaedorea metalica

Bromeliads
Aechmea, Forster's favorite
Aechmea pyramidalis
Niduldularium fulgens
Gusmania ligulata

Groundcovers
Asparagus densiflorus 'Sprengeri'
Asystasia gangetica
Erodium chamaedryoides
Polygonum capitatum
Rheo spathacea 'Dwarf'
Sedum confusum

Shrubs and herbaceous plants
Adiantum
Alocasia
Anthurium
Ardisia
Asplenium
Begonia
Caladium
Dieffenbachia
Episcia
Fittonia
Maranta
Monstera
Pellionia
Peperomia
Philodendron
Pilea randia
Saintpaulia
Sinningia
Tacca
Tradescantia
Xanthosoma
Zebrina

plant. A number of spectacular gingers are avilable for tropical gardens. The nun orchid is one of several ground orchids that thrive in shade, and bulbous lily plants can provide seasonal flowers. Some bromeliads are well suited to shade and have striking foliage as well as long-lasting flowers. Some bromeliads can be attached to logs, or grown on tree trunks. Soil condition is of little importance because bromeliads use the water and minerals held in the base of the vase-like rosette of leaves.

Larger shade plants include various palms, such as the bamboo palm and our own loulu. A more complete list of plants that grow well in shade at lower elevations in Hawaii is provided in the accompanying table.

When landscaping a large shaded area we may wish to duplicate the many-layered look of the tropical rain forest. Clumps of shrubs or small palms could give height; beneath and around these could be a layer of taller herbaceous plants, and low groundcovers would complete the layering

If water is sufficient,even the most deeply shaded area should be able to support a growth of mosses. The ground can be covered with logs or large stones, and the moss can be "seeded" by sprinkling chopped up moss mixed with peat over the area. To help the moss pieces stick, first splash dried milk or buttermilk over the rocks. This also provides the moss cuttings with starter nutrients to help them get established.

With same careful planning, any neglected shaded area can turn into a pleasantly cool, green garden.

Heliconia Wagneriana Is a Short-Day Plant

Richard A. Criley[1] and William S. Sakai[2]
[1]CTAHR Department of Horticulture
[2]College of Agriculture, UH-Hilo,

Seasonal flowering behavior of *Heliconia wagneriana* was found to be caused by short daylengths (SD) using artificial short days (8-9 hr) and long days as daylength extension or night break lighting with incandescent lamps. The natural time for flower initiation was estimated to be mid- to late October (11 hr 40 min to 11 hr 20 min) in Hawaii, and 120 to 150 days were required from the onset of inductive SD to inflorescence emergence. The results may be used to manipulate flower availability for flower markets.

Commercial Cut Flower Production in India

Ken Leonhardt
CTAHR Extension Floriculture Specialist

Two articles in recent issues of FloraCulture International highlight aspects of cutflower production in India. Bob Galinsky, in his November 1997 article, "Orchid grower aims to be India's largest," features an orchid production company named Natural Synergies which cultivates eight hectares of dendrobium in the south of India near Madras. They have about one million plants in production from varieties obtained in Singapore. In the 1995-96 production season, which runs from September through April, two million stems were produced, fetching approximately $500,000. Revenues were expected to double the following season. About half of the production was exported, mostly to a wholesaler in Holland.

Cultivation at Natural Synergies appears to be similar to that in Hawaii in that plants are grown in containers with stones as the medium. Cocopeat and red brick were tried but found to be inferior to stones.

Although dendrobium will remain the primary crop, mokara and aranda were recently added. Expansion plans at other locations will include cymbidium, anthurium, and possibly oncidium and lilies. The company presently cultivates 15 orchid varieties but intends to expand to 60 varieties.

Nancy Laws, in her January 1998 article, "India's floriculture industry faces reality," provides an overview of India's floriculture industry, including its domestic obstacles and an economic profile of its industry which has devoted 150 hectares to export floriculture at a capital investment estimated at $100 million.

Flower exports in the 1995-96 season were $9 million and estimated to be $20 million for the 1996-97 season. The main export product is 45-60 cm cut roses. Orchids and anthurium are listed among several "minor export crops". Freight charges to markets in Europe range from $2.17 to $2.56/kg with an additional 46% premium at holidays. Freight to Japan is $2.36/kg, plus a premium at holidays. Duty paid on Indian flowers in the EC is 18% in the summer and 12.8% in the winter.

Among the obstacles Nancy points out are a lack of air cargo space and no priority with the airlines, government red tape, insufficiently trained workers, and an overburdened road system.

Efficient Cut Flower Handling and Processing

Luis Segal, Director, Mechanics Luis Segal Ltd.,
Moshav Yad Natan, Israel
(Reproduced from FloraCulture International, *Oct. 1997)*

There are many varieties of flowers available for final delivery to the wholesaler. I have not made a methodical and extensive examination of all of them, I have just formulated general concepts to use in my work. The ideas may seem simple, but they are the basis for productive and profitable cut flower processing and handling.

Growers produce flowers to make profits from their sales—this is a fundamental idea. Flower growing also provides beauty for the world, establishes jobs and so on. These are good ideas, but they would not exist without profit to support them.

Profit is the difference between all the costs of production and all generated income. A grower's natural desire is to increase this difference. Mathematically, there are two ways to do this: reduce production costs or increase income from sales. Obviously, you want to keep your income higher than your costs.

There are other ways to help improve your profit, as we will discuss here. Marketing courses can also provide helpful insight.

The human factor

Because we cannot change the economical and political conditions in every country, we have to carefully check salary expenses. What is the optimum compensation for a person's job? Here are some points to consider.

Simplify the job. Salary levels should match a job's level of difficulty. In other words, a simple job should be compensated on a lower level than one that requires more experience.

Distribute jobs correctly. Delegate work according to your employee's physical capabilities. Stronger workers should always perform the heavy, physical labor, and those with good motor skills may be better suited to work such as planting cuttings or plugs. Remember, also that not every tool is suitable for a left-handed person.

Periodically check workers' production levels. Make notes about the performances. Only compare performances within your company; do not compare your employees with the competition.

Pay attention you your workers' abilities. They may have special talents or capabilities. Some jobs may not be suited for a particular individual, and the mistakes of one person can be very costly.

Provide comfortable working conditions. This greatly influences workers' production. Toward the end of the day, efficiency levels will fall off, but if workers are tired, the effect is more dramatic. What are the climatic conditions in the working environment? Obviously, you cannot control conditions outdoors, but you can change indoor conditions in the packing house. Consider the following: Are the workers standing on a wet floor? Is the machinery noisy? Is it too dark? Is the area open to strong winds? Or are the employees standing when they could be doing their job from a sitting position? If any of these conditions exist, they should be changed. Paying attention to the site conditions and your workers' health will benefit you and your business.

Be sure that job distribution is rational. There are no rigid rules. Sometimes it is a good idea to alternate heavy work with an easy job or to be flexible in job distribution to a man or a team of workers.

The business pyramid

There is a pyramid in all businesses, big or small—from general manager or owner through foreman or superintendent, to the general and specialized workers. The lower levels of the pyramid are subject to periodic changes, but the important rule is that the knowledge should still remain within the business. And the second important rule is that any one of the employees is replaceable, and they know that.

Usually in a big business, the general manager or owner is very busy with more large-scale problems; his knowledge of day-to-day activities is limited to what he hears from his superintendents or foremen. He learns about production quality through feedback of sales. On the other hand, the small to medium business owner is so busy with all the aspects of his enterprise that he cannot find the opportunity to finely tune any details.. In both cases, each owner should dedicate some time each day to relaxing and thinking generally. This will identify possible problems. And anticipating problems is easier than fixing them.

Handling cut flowers

Let us examine the steps involved in handling cut flowers before and after the packing room. The process begins when the worker takes a rack of flowers from the cooling room and selects his flowers by hand, basing his choice on qualities such as stem length, weight, number of flower heads or stem diameter.

Because it is impossible to give advice for every situation, here are some general concepts for help.

Do not give workers too may jobs to do at the same time. For example, a worker may have already chosen the flowers, but if he must also think about how to pack and bunch the flowers at the same time, his efficiency will decrease.

One of the basic elements when handling cut flowers is the worktable. What is the best height? When working with tiny objects like diamonds or transistors, a high table works best. Workers can rest their eyes and bend their arms. For work with bigger items the ideal table height is below the waist so workers can keep their arms almost straight.

For flowers with long stems lay the stems horizontally across the table rather than vertically. If this is impossible then increase the height on the opposite side of the table so the top of the table is tilted toward you. If the work requires you to check the flower heads, then you must be able to rotate the table toward you until it is almost vertical.

Remember that your primary purpose is to save time and work, particularly in the beginning of the process. One second saved in handling every flower can add up to a lot of productive time.

Analyzing the details

For medium to large businesses, it is often mot economical to have a professional analyze your production, but that is an individual choice. Here are some other details that can be overlooked, but will improve efficiency and increase profits.

Avoid unnecessary movement. It is absurd to see a worker assemble a bunch of flowers horizontally on his work table, then arrange them vertically, stem by stem, in a bucket for further processing. If the worker checks how far a flower head has opened, he needs to look at the top of the flower, not at the bottom.

Sometimes it is not necessary to take the flower but only move it a little and separate it from the others. Additionally, it may not be necessary to take out all the flowers in a bunch in order to count them; instead, just count the ends of the stems.

Do not cut the stems one by one if you can cut 10 or 20 together in a bunch (this also gives the bunch a better shape.)

Stop and study your specific systems of work. Analyze your efficiency systems. Here is an example:

If you secure a flower bunch with an elastic band, you have two ways to do it. With the first method, open the band in your right hand, place the stems inside the band, and wrap the band three or four times around the bunch. In the second method, first wrap the band around just two or three stems, then wrap the band around the entire bunch. This second system takes one third less time than the first and provides a stronger hold on the stems. But in my visits to growers, I still find workers who struggle by using the first method.

Think about your packaging system. Are you sure your wholesaler likes it? Is your special packaging just making extra work for employees at the wholesaler's end? This is just one more detail to consider in your cut flower handling system. By looking at all aspects, you can help increase your profit.

U.S. Floriculture Production Increased 3 Percent

The United States Department of Agriculture, National Agricultural Statistics Service, reported in its Floriculture Crops 1996 Summary that the wholesale value of floriculture crops produced in the United States was $3,421 million, an increase of 3% over the previous year. The US ranks third in production behind Japan and the Netherlands. The US also ranks third in consumption of floriculture crops, behind Japan and Germany.

At $14,961,000, Hawaii ranked fourth in total cutflower production, behind California, Florida, and Colorado. At $13,067,000, Hawaii ranked fourth in total potted plant production, behind Florida, California, and Texas. At 1,298,000 square meters (about 130 hectares, or 320 acres) Hawaii is third in shade covered area behind Florida and California.

Guide to California Cut Flowers

The California Cut Flower Commission has produced a 44-page guide to educate growers, wholesalers, and retailers about the enormous variety of cut flowers grown in California. It features nearly 300 color photos of basic flowers, new varieties, fillers, foliage, and specialty items. It provides information about care and handling, vase life, grower tips and merchandising ideas for a wide range of California flowers and foliage. Contact California Cut Flower Commission, 11344 Coloma Rd., Suite 450, Gold River, California 95670-4461, Ph: 916-852-5166, Fax: 916-852-5177.

Root Barriers

Dennis R. Pittenger
Area Environmental Horticulturist
Univ. of California Cooperative Extension, Riverside

When too little urban space is allocated for tree root systems to grow and develop naturally, damage to nearby man-made infrastructure should be expected. Aside from providing adequate room, i.e., unpaved land area, for tree roots, there is no "silver bullet" for eliminating the damage roots may eventually cause.

Costs are always associated with urban trees. With tree roots, the costs can be paid up front: additional land area given for roots to develop without interfering with hardscape; or be paid later as remedial treatments or replacement and repair of hardscape. When inadequate space is given for root growth, root barriers are a tool that may be used in conjunction with other strategies to substantially delay or reduce the ensuing cost of dealing with root/infrastructure conflicts. Root barriers don't necessarily eliminate the problems.

Research-based information on the efficacy of root barriers is limited. Barriers that completely surround a rootball may appear to be the ideal solution when limited space is given for future root development. However, the evidence for the barrier's effectiveness is largely observational and anecdotal. The field research that has been completed on these barriers has typically shown that some roots grow out the bottom of a barrier and then return to the upper several inches of soil where air and water are more consistently available. The distance from the trunk and where the roots return is variable and dependent on several factors. A barrier often creates a "clear zone" of at least a few feet of root-free. surface soil. Roots returning to the surface are generally small and do not cause damage immediately.

However, the root spread of a tree in a circular root barrier is very restricted, and the tree may be much less stable under windy conditions. This has been observed especially in species that develop dense, compact crowns such as *Magnolia grandiflora*, which catches a great deal of wind.

Placement of a linear root barrier parallel to the hardscape surface that is to be protected can reduce root damage but not reduce tree stability since: root spread is only restricted on one side of the tree. Another problem occurs in climates that experience significant freezing of soil. Here, physical root barriers are known to heave out of the soil within two to three years after installation.

Root barriers should only be used as part of a system for root management that employs all available tools within landscape design and horticultural principles to effectively deal with potential root/infrastructure conflicts. Such systems include providing as much rooting space as possible for root development (offering more than the typical four-foot-by-four-foot cutout for trees in parking lots and placing trees no less than five feet from other infrastructure elements); selecting tree species whose mature size is in scale with rooting space allocated for them; modification of soil structure and manipulation of irrigation to provide optimum conditions for root growth in areas where tree roots will not interfere with infrastructure and non-optimum conditions for root growth near and under infrastructure; using paving materials that are somewhat flexible and relatively easy to repair should tree roots invade the soil beneath; and, finally, placement of linear root barriers in soil adjacent to hardscapes that could be damaged if roots from adjacent trees invade beneath them.

Increase Life of Landscape Flowers with Smart Design

David Hensley
CTAHR Extension Landscape Specialist

Bedding plants or annuals are an important part of landscapes in Hawaii. Bedding plants can provide color through the year and can be an easy and inexpensive way to perk up a dull landscape. Flowering annuals, however, can also be a major drain on the landscape budget. Poorly maintained, weedy flower beds reflect poorly on the designer, the landscape maintenance professionals, and the client. Good design and maintenance help everyone get the most for the money spent.

Smart design

- Use only flowers that will grow well in your site. Keep shade, sun, soil pH, soil and aerial salt, and temperatures in mind.
- Select bedding plants that reach the desired height at maturity. Pruning too-tall flowers adds costs and loses the original effect.
- Flowers that are planted close for instant impact be-

come overcrowded. Overcrowding increases disease potential, reduces blossom production, and can result in decline of the plants.

- Pick annuals that drop spent petals easily to reduce maintenance. Self-cleaning plants include begonias, impatiens, vinca, and several others. Avoid annuals such as geranium and some marigolds that have to be de-headed to keep looking good.
- Consider plants with interesting foliage. Dusty miller, coleus, caladiums and other colorful plants combine with flowering plants, are nice in their own right, and require less maintenance.

Smart maintenance

- Prep the beds by working in organic matter and deep tilling. Organic matter improves root penetration into the soil, reduces compaction, holds water, and provides a slow release source of some nutrients.
- Water is essential, but not too much and not too little. Encourage deep, infrequent waterings rather than short daily sprinklings. Watch for marker plants. Impatiens wilt before other bedding plants. Waiting to irrigate until the impatiens start to wilt is one way to supply water based on plant needs rather than a rigid schedule.
- Weed beds manually and look at some of the herbicides available. Avoid frequent cultivations since it brings up new weed seeds and can damage roots. There are number of post-emergence herbicides that can be used over many annual flowers to control grasses.

Mulch and annuals

- Mulch, but avoid over-mulching. Three inches of mulch is right for trees and shrubs but a bit heavy for annuals. Use about 1 inch of mulch to cover the soil and control weeds until the flowers grow together, and to conserve water.
- De-head flowers that are not self-cleaning regularly. Regular removal of old flower buds and seed promotes continuous flowering and produces a stronger plant.
- Do not try to keep them too long. Bedding plants grow for a long period in Hawaii since they are not bothered by frost. Quality and flowering decline as the plants pass maturity and begin to die. Some such as petunia and impatiens can be rejuvenated once or twice by pruning and fertilization. Remember that bedding plants are called annuals because they complete their life cycle in a year. They all will eventually wear out and die. Oftentimes we spend too much time and money trying to keep from replacing a 59¢ plant.

Tourists drive Hawaii's golf game

(from *Pacific Business News*)

A 1996 survey conducted by Coopers & Lybrand LLP has determined that Hawaii's golf industry produced more than $327 million in total revenues, an increase of 6.1 percent over 1995.

The survey also determined that annual play volume in 1996 was 4.6 million rounds compared to the 4.3 million rounds played in 1995. An increase in average rounds played per course occurred in 1996 when 58,499 rounds of golf were played, compared to 55,155 rounds in 1995.

Joseph Toy, director of hospitality consulting for Coopers & Lybrand, said that although revenues were up in 1996, a decrease in play was noted on Hawaii's municipal courses.

"This was offset by an increase in visitor play, which went from 23 percent to 27 percent of the market mix in 1996," Toy said. "Much of the increase came in the first quarter of 1996 when Hawaii saw record levels of both eastbound and westbound visitors due to a strong Japanese yen and severe winter weather on the continental United States. The increase in our visitor component of the market mix of golf play reflected the nearly 4 percent increase in visitor arrivals to Hawaii in 1996."

Included in the survey was income based on greens fees, merchandise, food and beverage purchases, rentals, and driving range revenues.

The Seeley Conference

New cultivars, new species, new companies, and new technologies are bringing basic shifts to the floriculture industry's production marketing. This year's Seeley Conference, 27 to 30 June, 1998, Ithaca, New York, will explore this topic. Known for its think-tank philosophy, The Seeley Conference typically addresses a topic to examine its impact on the entire floriculture industry.

Conference topics will include what is a new crop and what is driving the hunger for new germplasm. For more information, contact Thomas C. Weiler, Seeley Conference Board of Directors, 20 Plant Science Building, Cornell University, Ithaca, New York 14753-5908, Ph: 607-225-1789, Fx:607-225-9998, e-mail: tcw2@cornell.edu.

Substitutions for Peat in Hawaii Nursery Production

David Hensley and Julie Yogi
CTAHR Department of Horticulture

Sphagnum peat is the primary organic component of nursery container media in Hawaii. It is expensive and will become even more so because of as ecological concerns about current harvest methods.

Several other organic materials such as compost, paper sludge, composted sewage sludge, and others have been successfully substituted for peat. Bagasse was tested as a peat substitute in Hawaii in 1978. Acceptable growth and quality were obtained only from replacing 1/3 of the peat with fresh or composted bagasse. High-quality coir pith appeared to be an acceptable substitute for peat in soilless container media. Coir is already widely used in Europe and Australia. Coir pith and dust are the short fiber and dust remaining after the long fibers of coconut are extracted. Fertilizer regimes and lime amendment must be adjusted if coir or any other organic material is substituted for peat.

A small study was established to determine if several different organic materials might be substituted for peat in production of some nursery crops. Dwarf poinciana (*Caesalpinia pulcherrima*) seedlings were planted into 6-inch pots using various organic materials (Table 1). The media was a 1:1 (v:v) of organic material: medium perlite. Each test medium was amended with a slow-release fertilizer and gypsum. Two sphagnum peat controls were prepared, one with gypsum and the other with dolomitic lime. Plants were pruned to 10 inches at planting. Plant heights were periodically measured and fresh weights taken at the end of the study. Porosity or air space of the media was also measured.

Plant Growth

Growth of the dwarf poinciana seedlings was good in each test media over the duration of the study. There were no differences statistically among the different media at any measurement. Growth of the plants in both peat mixtures was less than that achieved by the other organic materials at the last measurement. The plants in the peat with lime media were noticeably smaller and less thrifty as indicated by fresh weight at the conclusion of the study. The plants received no additional fertilizer.

Porosity

Porosity is a concern with organic materials to growers for several reasons. First, the mix must have adequate large pore space to be well aerated for the roots. Excessive large pores, however, decrease the amount of water the media can store. The particles of organic material often become smaller with time due to decomposition and can sift down in the pot clogging the pores and reducing aeration. This problem is avoided by using a relatively stable organic material.

Table 1. Organic materials used in media study.

Organic material: Notes

Sphagnum peat with dolomitic lime: Control medium with dolomite.

Sphagnum peat with gypsum: Control medium with gypsum.

Coir: Coco-peat™ coir from Sri Lanka.

Composted municipal sewage waste (msw): Rapid aerobic compost of municipal sewage waste from Japan.

Green debris compost: Green residue compost from Oahu.

Municipal sewage waste and green debris compost: Municipal sewage waste and yard trimmings co-compost from Maui.

Macadamia husk compost: Composted macadamia nut husk from Big Island.

Container media for outdoor production should have 20 to 30 percent large pore space by volume. This range provides good aeration and water holding capacity, yet allows excess water to drain away. Porosity of all of the media tested was within the 20 to 30 percent range at two examinations.

All of the composted organic materials and coconut coir tested produced dwarf poinciana growth equal to or better than that of peat. The plants in the compost were larger than those grown in peat at the end of the 173 day study. This was due to the release of nitrogen and other nutrients from their organic sources. The plants in all medium would have grown larger had supplemental fertilizer been added.

Growth indicated that any of the materials tested could be a peat alternative to grow dwarf poinciana seedlings. We do not suggest that this may be the case with every plant. Experiment with your material and operation to determine the suitability of any substitute. There a number of factors to consider.

Research shows that composts can successfully replace at least some of the peat in nursery mixes. Research conducted in Hawaii and elsewhere also indicates that there can be differences in the quality of compost. Variation occurs with batch, season, and with changes in the raw inputs. Look for stability in particle size, pH, and soluble salts. Variation in batches of compost diminishes dramatically as producers gain experience and technology. Most composters in Hawaii have stable sources of input material and are producing a consistent product.

Compost and coir have different chemical and physical characteristics than peat. Adjust amendments added to reflect the difference in pH. Supplemental fertilization will require some fine tuning.

None of the peat substitutes tested, with the possible exception of coir, are suitable for producing certified nursery material for export. All are produced or stored on the ground and this is not allowed for export media. The organic materials appear, however, to have good potential for production of nursery stock for local consumption.

Contact D. Hensley for a more complete description of the study.

Use of Primo™ Plant Growth Regulator and Postemergent Herbicide Combinations in Bermudagrass

Dr. Wayne Porter
Hammond Research Station, Hammond, LA
Adapted from Lousiana Agriculture *39(3):31, 1996.*

Plant growth regulators (PGRs) have grown in importance as a management tool for turfgrass. They are especially important in maintaining difficult-to-mow areas such as steep slopes and grassy medians in parking areas. PGRs also reduce the amount of grass clippings going into landfills. Using PGRs in turfgrass presents a unique problem. While the grass stops growing, the weeds continue to grow, resulting in the need to mow.

Sedges (*Cyperus* sp.) are the most serious of the problem weeds when using PGRs because they are the most difficult to control with herbicides. Green kyllinga (*Kyllinga brevifolia*), a member of the sedge family, is a highly invasive weed in improved turfgrass. This weed is a mat-forming perennial that spreads by seeds and rhizomes. Because this sedge has narrow, dark green leaves and stems similar to turfgrass leaves and stems, this weed is often not noticed until its seedheads appear.

Primo™ has been described as a near-perfect turfgrass PGR since it is active on a wide range of turfgrass species with good crop tolerance. Image™ and Manage™ are postemergence herbicides labeled for sedge control in turfgrasses.

This study evaluated combinations of Primo at 2.3 pt/A with Image (1.4 or 2.8 pt/A) or Manage (1 to 2 oz/A) on bermudagrass for growth regulation and color and control of green kyllinga. Bermudagrass color and height and green kyllinga control were determined at 2-week intervals for 10 weeks.

Bermudagrass treated with Image alone or in combination with Primo was slightly discolored for 2 weeks after treatment.

Bermudagrass treated with Primo or Image, alone or in combinations, was shorter (21 to 72 percent) than the untreated plots throughout the 10 weeks of the study. Primo alone reduced the height of bermudagrass by 35 to 51 percent during the 10 week period compared with the untreated check. From 4 through 10 weeks after applicaiton, treatments containing Primo were shorter than plots treated with Manage or Image alone.

The addition of Primo to Manage or Image did not reduce control of green kyllinga compared with the herbicides applied alone for the first 4 weeks of the study. Beginning at 6 weeks after treatment, green kyllinga control by mixes of Primo+Image remained consistent (91 to 100 percent) throughout the period of the study.

Both Manage and Image provided 75 percent or greater control of green kyllinga at 10 weeks after application. Decisions as to which postemergence herbicide to use include: are there weeds present, other than sedges that might be controlled by Image; will the discoloration associated with Image be acceptable; will the reduced green kyllinga control after 6 weeks with Manage be a deterrent to its use? Primo will not eliminate mowing altogether, but will reduce the number of mowings and volume of grass clippings. For season-long growth restriction of bermudagrass, additional applications of Primo are necessary. These intervals are 4 to 6 weeks apart depending on growing conditions.

About Research . . . CTAHR Students' Work

Abstracts from CTAHR Student Research Symposium April 4, 1997, Campus Center, UH-Manoa

Hot water and postharvest vase life of red ginger. Theeranuch Chantrachit[1] and Robert E. Paull[2]. Departments of [1]Horticulture and [2]Plant Molecular Physiology, CTAHR, University of Hawaii at Manoa. Different ranges of temperatures and exposure times were studied to determine the suitable hot water treatments to extend red ginger vase life. The boundary line for slight damage on the flower bracts was represented by the equation: Log (Y) = -0.216 (X) + 11.95, R^2 = ($P \leq 0.0001$), where Y = exposure time (min) and X = temperature (°C). Hot water at 50°C for 12 to 15 min showed a high potential to prolong vase life. Damage caused by hot water treatments correlated with the amount of rainfall 7 days before harvest ($P \leq 0.01$), whereas, vase life of hot water-treated flowers showed a negative correlation with the amount of rainfall one month before harvest ($P \leq 0.05$).

Preconditioning treatments were studied by subjecting flowers to hot water at lower temperatures (35, 37.5 and 40°C) for 15 and 30 min before applying of the hot water. Intervening period between preconditioning and hot water treatment of 1, 3, 6, 9 and 18 hr were studied. Preconditioning at 40°C for 15 min significantly reduced damage from the hot water treatment. Preconditioned flowers lost their tolerance to the hot water treatment if the intervening period was longer than 6 hr. The suggested treatment to extend vase life was a combination of preconditioning at 40°C for 15 min, standing I the bucket of water at room temperature (23 to 25°C) for intervening one hr, and then hot water treating at 50°C for 12 to 15 min. The mechanism of hot water extension of vase life in unknown.

Radiation effects on tropical flower vase life. Ching-Cheng Chen[1] and Robert E. Paull[2]. Departments of [1]Horticulture and [2]Plant Molecular Physiology, CTAHR, University of Hawaii at Manoa. The effects of gamma radiation on vase lives of anthurium, dendrobium, pincushion protea, bird-of-paradise, *Heliconia psittacorum*, red ginger and green ti leaf were studied. The response of the cut flowers to gamma radiation varied. Anthurium showed damage at 25 Krad, while red ginger tolerated 75 Krad. Gamma radiation caused blackening of anthurium spadixes and discoloration of spathes, and vase life was significantly reduced by 25 krad. Doses above 25 Krad also caused blackening and suppressed the rate and degree of opening of *Heliconia psittacorum* and bird-of-paradise flowers. Symptoms of injury on the petals of dendrobium included yellowing and wilting, and the rate of shedding was faster in irradiated flowers. The vase lief of dendrobium declined from 22 to 17 days and 24 to 11 days with 25 Krad exposure in two trials, respectively. The leaves of irradiated pincushion protea dried faster than the control, and 25 Krad caused a small decline in vase life. There were also indications of seasonal variation in phytotoxicity of radiation. The ability to tolerate 75 Krad radiation suggests that gamma radiation might be suitable for insect disinfestation on red ginger and green ti leaf.

Biological Control of Insect Pests of Ornamentals Using Entomopathogenic Nematodes

Ken W. Leonhardt, CTAHR Dept. of Horticulture
Lynne M. Higa and Chris Z. Womersley, Dept. of Zoology, College of Natural Sciences, UH-Manoa

Years of chemical use for the control of insect pests has caused an increasing concern for the welfare of the environment and public health. The ban of several effective insecticides by the EPA and the development of insect resistance to some insecticides has reduced producers' arsenal of useful controls. With the growing demand for alternative measures to replace those methods of control considered environmentally unsafe, insect-attacking (entomopathogenic) nematodes look promising as a tool for controlling troublesome pests of ornamental crops.

Nematodes are well known for causing extensive damage by parasitizing plants. However, some nematode species are actually beneficial. Specifically, the *Steinernematidae* and *Heterorabditidae* families of entomopathogenic nematodes show great promise for insect control, because of their symbiotic association with *Xenorhabdus* bacteria, which rapidly kill host insects. Many agrochemical companies anticipate a trend toward increasing use of entomopathogenic nematodes, as demonstrated by Ciba Geigy, which has secured selective marketing rights for nematode products produced by Biosys in California.

Interest and research in the commercial application of these nematodes to control insect pests of floral crops is on the rise. In Denmark, they are used to control fungus gnats on poinsettia and wingless weevils on hedera, in England for curative control of vine weevil larvae, which attack the roots of many ornamental species. In Florida, *S. carpocapse* is used against the beetle armyworm in commercial chrysanthemum nurseries in a control program that has eliminated the use of three conventional chemical insecticides. The chrysanthemum leafminer has been successfully controlled *with H. heliothidis steinernematid* nematodes, and research at the University of Hawaii has shown that all larval stages of this leafminer are susceptible to infection by S. carpocapse. Larvae of the green garden looper and adults of the sweet potato weevil have also been shown to be susceptible. Wood boring pests, which usually damage trees, have also been known to attack shrubs and other perennial plants. The tree borers *Holcocerus insularis* and *Zuezera multistrigata*, serious pests of ash shade trees, Chinese hawthorn, and *Casuarina equisetifolia* in China, were shown to be susceptible to *S. carpocapsae*.

Critical control of the microenvironment is necessary if nematode applications are to be successful in noncryptic habitats. For infections to be successful against insects in these habitats, high humidities must be maintained for the nematodes to survive.

There is concern as to the ecologically damaging effects of releasing Steinernematid or Heterorhabditid exotics into an environment as fragile as Hawaii. All entomopathogenic nematodes developed as biocontrol agents to date are also temperate-climate species, which may not be as effective in a tropical environment. Research defining the environment limitations for field applications has been conducted in Hawaii. Natural populations of *Steinernema sp.* and *Heterorhabditis sp.* have been discovered in Hawaii. These populations should be investigated to determine their effectiveness as biological insecticides for local crops, since naturally occurring nematodes, when used as biological agents, may reduce the risk to non-target organisms.

With ecological concerns in mind, our laboratory has undertaken preliminary investigations to determine the efficacy of one exotic *S. carpocapsae* 'Kapow' strain against several important insect pests of floral crops and a few common garden animals. Results with long-horn beetle grubs, long-horn beetle adults, orchid weevils, hibiscus snow scale, coffee root mealybug, foliar mealybug, and whitefly were positive. Results with aphids, sowbugs, pond snails, tadpoles and garden slugs were negative.

From the results of these investigations, as well as increasing worldwide interest, entomopathogenic nematodes deserve continued research toward their practical use as biological insecticides against pests of commercially important ornamentals.

Wal-Mart to Expand

Increasingly, Hawaii growers of potted orchids and foliage plants are looking at mass-merchandising outlets, or the brokers who service them, as potential customers as the local industry increases its production capacity. Wal-Mart is the largest retailer of live plants and is about to become larger.

Wal-Mart Stores Inc., the world's largest retailer, headquartered in Bentonville, Arkansas, announced that it will open 185 stores in 1998. About 90 of these stores will be expansions or relocations of existing stores. Overseas expansion will include 50 to 60 stores in Argentina, Brazil, Canada, China, Indonesia, Mexico, and Puerto Rico. This planned growth will add about 2,415,480 square meters (nearly 600 acres) of retail space.

In Search of the Perfect Compost Activator?

Dr. Chris Starbuck
Woody Ornamentals Specialist, University of Missouri

There are a number products on the market which, their manufacturers claim, will turn a smelly pile of grass clippings into dark, rich compost in just a few weeks. These may contain microorganisms, mineral nutrients, vitamins, enzymes or readily available forms of carbon.

Researchers at the University of Wisconsin-Stevens Point tested the efficacy of seven commercially available products in speeding up the composting of a mixture of grass clippings and wood chips. Products tested included Envirotec Plus Compost Maker, Ringer Compost Maker, Humus Maker, Compost Bioactivator, Bonide Compost Maker, Roebic Bacterial Composter, and Hi-Yield Composter. Compost piles were made following manufacturers' directions, and additional piles were made using the "naturally occurring activators," topsoil, and mature compost. Piles with no additive served as controls. Based on measurement of weight loss, and reductions in volume and percentage of volatile solids, the authors concluded that, in the end, none of the piles containing commercial additives performed better than those with soil or mature compost added. While several of the commercial products stimulated microbial activity during the first two weeks of composting, as measured by rate of oxygen uptake, this effect was transitory. The authors speculated that some of the initial stimulation may have been due to soluble nitrogen in the products (one contained 38% N), which was soon depleted by leaching or volatilization. The commercial products ranged in cost from $1.37 to $9.36 per cubic yard of grass clippings being composted.

While additional testing may provide results more to the liking of the manufacturers of compost additives, the authors stress that no additive will substitute for poor pile management. The most important additive is still work.

Source: A.S. Razvi and D.W. Kramer. 1996. Evaluation of compost activators for composting grass clippings. Compost Science and Utilization 4:72-80.

More About Research . . .

Eileen Herring
Science Librarian, Hamilton Library, UH-M

The growth and flowering of some annual ornamentals on coconut dust. Y. Awang and MR Ismail. 1997. In: Proceedings of the International Symposium on Growing Media and Plant Nutrition (*Acta Horticulturae*, 450). The growth and flowering of four annual ornamentals, zinnia (*Zinnia elegans*), celosia (*Celosia plumosa*), marigold (*Tagetes erecta*), and vinca (*Catharanthus roseus*), were evaluated in growing media containing varying percentages of coconut dust (coir). Percentages used were 100%, 75%, 50%, 25%, and 0% by volume. Generally, the growth of annual plants tested in this study was enhanced in media containing a high proportion of coconut dust. The authors felt that the improvement was associated with the higher moisture holding capacity of the media. Although the responses varied between species, utilization of coconut dust at between 25 and 75% of the medium volume generally produced plants of good quality. The addition increased wettability of the medium without reducing its moisture holding capacity. This study was conducted in Malaysia.

Nutrition and post-production performance of Phalaenopsis pot plants. S. Amberger-Ochsenbauer. 1997. In: Proceedings of the International Symposium on Growing Media and Plant Nutrition (*Acta Horticulturae*, 450). This greenhouse experiment investigated the effect of five different fertilization rates on growth, quality and post-production performance of the *Phalaenopsis* hybrids 'Sylba,' 'Nopsya,' and 'Abylos.' Plants were grown in a peat medium and supplied with 150, 275, 400, 525, or 650 mg (.005, .010, .014, .018, or .023 oz) N per plant from a soluble fertilizer (N:P:K 16:4:18). For all three cultivars, increasing fertilization rates resulted in larger plants. At higher fertilizer levels, plants developed significantly more inflorescences and flowers and branching of the inflorescences was promoted by higher nutrient supply. However, the three cultivars differed in their optimum nutrient supply. For 'Abylos', no clear optimum level appeared, but for the other two cultivars, 525 mg (.018 oz) was enough. A very high nutrient supply resulted in inferior plant quality and a decrease in flowering period from 13 weeks to 6 weeks, especially in 'Sylba.' Optimal fertilization rates for growth and quality were the same as for post-production performance of the plants. These investigations show differences in the nutritional requirements of various Phalaenopsis cultivars.

Growth regulator effects on plant height of potted Mussaenda 'Queen Sirikit.' CS Cramer and MP Bridgen. 1998. HortScience 33(1):78. Mussaenda is a tropical ornamental shrub which has potential as a potted floriculture crop. However, the upright growth habit of some *Mussaenda* cultivars is undesirable for pot plant culture. Three growth regulators, B-Nine, A-Rest, and Bonzi, were applied at two commercially recommended rates and with two application methods (spray and drench) to determine their effects on plant height. Bonzi (paclobutrazol) as drench or spray was ineffective for controlling plant height at all concentrations tested. The most attractive potted plants were produced with two spray applications of B-Nine (daminozide) at 5000 mg/liter (0.6 oz/gallon) of active ingredient or two drench applications of A-Rest (ancymidol) at 0.5 mg of active ingredient per pot. Applications at 2 and 4 weeks post pinch resulted in the least delay in time to flowering.

Higher concentrations or additional applications excessively reduced plant height.

Suppression of seashore paspalum in bermudagrass with herbicides. SD Davis, RR Duncan, and BJ Johnson. 1997. *Journal of Environmental Horticulture* .15(4): 187-190. A mixture of seashore paspalum (*Paspalum vaginatum*) with bermudagrass (*Cynodon* spp.) results in an overall poor quality turf on golf course fairways. A field experiment was conducted in 1997 at two locations on Royal Kunia Resort Gold Course, Oahu, Hawaii to determine if herbicides would control paspalum encroachment without causing undesirable injury to the bermudagrass. Several herbicides were applied alone, tank-mixed, or as sequential applications in a program designed to suppress paspalum growing in Tifway bermudagrass. Herbicides tested included Ally (metsulfuron), Asulox (asulam), Image (imazaquin), Surflan (oryzalin), MSMA (monosodium methanearsonate), and Trimec Plus (MSMA + 2,4-D + mecoprop + dicamba). Herbicides effectively suppressed paspalum in Tifway bermudagrass, but caused severe injury to the bermudagrass. Three Asulox applications at a total rate of 4.0 lb/acre (4.4 kg/ha) suppressed paspalum when encroaching into bermudagrass, but resulted in 50% severely injured Tifway bermuda. Trimec Plus at a total rate of 9.6 lb/acre (11.1 kg/ha) also suppressed paspalum, but resulted in 91% severe injury to the bermuda. By 10 weeks, the bermuda grass in all test plots has started to recover. The overall injury ranged from 28% to 40%. The authors note that iron (Fe) was not included in this study and that injury may not be as severe when Fe is tank-mixed with the herbicides.

Influence of seed treatments on germination and initial growth of ornamental palms. *1997.* J.P. Morales-Payan and B.M. Santos. *Hortscitnece* 32(4):601. Experiments were conducted to determine the effect of physical and chemical treatments on the germination of *Roystonea hispaniolana* (royal palm), *Acrocomia quisqueyana* (corozo palm), *Sabal umbraculifera* (Cana palm), *Pheonix canariensis* (Canary Islands date palm), *Veitchia merrillii* (manila palm), *Chrysalidocarpus lutescens* (areca palm), and *Caryota urens* (fishtail palm). Treatments were seed immersion in gibberellic acid 3 (GA_3) solution for 72 hours, immersion in concentrated nitric acid for 5 minutes, or cracking of the seed coat. Rate and percent emergence 90 days after treatment were measured. The best results for *Roystonea, Phoenix, Veitchia, Caryota,* and *Chrysalidocarpus* were obtained by soaking the seeds in a 200-ppm gibberellic acid solution. Nitric acid and seed coat cracking significantly reduced the germination percentage in all the species, except *Acrocomia guisqueyana* and *Sabal umbraculifera.* Seeds of *Acrocomia* did not germinate. *Sabal* seeds germinated only after coat cracking or nitric acid treatment. The work was conducted at the University of the Dominican Republic.

Growth response of marigolds (Tagetes erecta 'Hybrid Gold') in mulched landscape plantings. R.A. Mirabello, A.E. Einert, and G.L. Klingaman. *HortTechnology* 7(3):310. The effects of a mulch material on nutrient availability remain questionable. As organic materials decompose, the increased activity of microorganisms immobilizes nutrients (particularly nitrogen) to perform this process. The decomposition of mulch material and the activity of microorganisms may compete for nutrients applied to ornamental species in the landscape. Four widely available mulch materials in Arkansas (pine bark, cypress pulp, pine straw, and cottonseed hulls) and three fertilizer application methods (granule, liquid, and time release), which were applied either above or below the mulch, were evaluated. Beds with and without mulch cover and no fertilization were established as controls. 'Hybrid Gold' Marigolds were planted within the beds. Growth response was greatest in beds with cottonseed hulls. Cottonseed hulls have a high nitrogen content results in less immobilization of nitrogen during decomposition. Beds using pinebark showed significant reduction in plant growth. Fertilization application method also demonstrated significant differences in plant response. The use of granule fertilizer produced the greatest growth response although initial plant loss was observed in beds using this method. The fast release nature of granule fertilizer and potential toxicity were the suspected reason for this observation. Growth data indicated plant performance was unaffected by fertilizer placement.

Disease resistance in twenty Dieffenbachia cultivars. D.J. Norman, R.J. Henny, and J.M.F. Yuen. 1997. *HortScience* 32(4)709. Twenty commonly grown *Dieffenbachia* cultivars were tested for their resistance to production diseases caused by the following bacterial and fungal pathogens: *Xanthomonas campestris* pv. *dieffenbachiae, Erwinia chrysanthemi*, *Fusarium solani*, and *Myrothecium roridum*. Cultivars having horizontal resistance toward tested pathogens could then easily be identified. The cultivars 'Camille', 'Compacta', and 'Parachute' showed the broadest horizontal resistance, with resistance toward three of the four pathogens tested.

Disease resistance identified in this research permits the selection of plants to be used in breeding, and also creates a baseline to compare resistance of newly developed cultivars. Work conducted at the Univ. Of Florida-Apopka Center.

Response of 'Tifdwarf' bermudagrass to seaweed-derived biostimulants. M.L. Elliott and M. Prevatte. 1996. *HortTechnology* 6(3):261. 'Tifdwarf' hybrid bermuda-grass (*Cynodon dactylon* x *C. transvaalensis*) grown on a putting green in southern Florida was treated for two years with two seaweed-derived biostimulants, Kelpak and PanaSe Plus. No significant treatment differences were observed in turfgrass quality (44 observation dates) or root weights (eight collection dates). There was only 1 of 22 collection dates for clipping weights in which a significant difference among treatments was observed. Although the biostimulants did not enhance plant growth or quality, they were not harmful to the turfgrass.

On Maile . . .

Ken Leonhardt
CTAHR Extension Floriculture Specialist

A recent newspaper report on the shortage of maile has prompted many calls to CTAHR Extension offices on all islands enquiring about the propagation and cultivation of maile. The literature is scant, but four articles by Professor Mike Tanabe and students at UH Hilo appeared in the April 1979 and February 1982 issues of *Horticulture Digest*. The article "Ecology of maile," which reports the effects of environmental factors on the growth of uncultivated maile in two locations, is reprinted on the next page. The other three articles, reporting on seed germination studies and interactions between fertilizer levels and light intensities under cultivated conditions, are summarized here.

Vine-dried seeds with and without pulp, harvested from uncultivated plants, were sown and germination was compared over a 10-week period, and seeds without pulp, from the same source, were pretreated at four temperatures for two exposure periods to determine how germination might be enhanced.

The treatment temperatures were 6°C (43°F, typical of a household refrigerator), 25°C (77°F, room temperature), 30°C (86°F), and 35°C (95°F). At each temperature, 30 seeds were held for two days and another 30 were held for seven days. Following treatments, the seeds were sown in vermiculite and placed in a shadehouse. Germination data was collected at two-week intervals from weeks 4 thru 10.

The data showed that as storage temperature increased, germination decreased. The earliest germination (20% at 4 wks) and the best overall germination (67% at 10 wks) was with seeds held at 6°C. Storage time did not significantly influence the results. Germination results were inferior when pulp was allowed to remain on the seeds.

In another seed germination study, a preplant soak in gibberellic acid (GA) was tested. Depulped seeds were soaked in 500 ppm for 72 hours or in 1000 ppm for 48 hours before sowing. Three months after sowing, the 500 ppm treatment induced 87% germination and the 1000 ppm treatment induced 97% germination, while the control (depulped but no GA soak) had only 40% germination.

In a study to determine appropriate shade levels and fertilizer levels for the cultivation of maile seedlings, the interactions of four shade levels with four fertilizer levels were evaluated. Maile seedlings were planted in 4-inch pots in a peat and vermiculite medium which had Osmocote 13.5-13.5-13.5 fertilizer incorporated into it at rates of 0, 2, 4, and 8 ounces per cubic foot. Eight plants from each fertilizer treatment were placed under light intensities of 200, 400, 1200, and 2400 foot candles and grown for three months.

The results are most interesting, in that a preliminary field study showed that while average light intensities in the forest areas of maile growth were 200 to 300 foot candles, in this study superior results were obtained at the highest light level of 2400 ft-c. The average growth under 200 and 400 ft-c was 5 centimeters (2 inches), while growth under 2400 ft-c was 13 cm (5 in).

The different levels of fertilizer had no effect on plant growth at all light levels, except that any level of fertilizer gave superior results when compared to the unfertilized control. At all light levels (averaged) fertilized plants had 3.6 times more growth than unfertilized plants, and under 2400 ft-c, fertilized plants averaged 16 cm (6.3 in) growth to 4 cm (1.6 in) growth for unfertilized plants, a four-fold increase with fertilizer. The author concluded that the 2 oz/ft^3 rate of this fertilizer provided adequate nutrition for normal growth of maile seedlings during this three-month period of observation.

For those of you looking to add another cash crop and also wishing to cause less trampling to our fragile forest ecosystems, give some consideration to maile.

Effect of environmental factors on growth of maile

Location	Growth rate (mm/week)	Light intensity (ft-c)	Temperature °C	Relative humidity (%)	Soil pH	Tissue Analysis (ppm) N	P	K
Volcano	21	327	21	79	5.8	1.38	0.18	1.10
Panaewa	2	205	27	76	5.2	1.06	0.13	1.43

Ecology of Maile

Michael J. Tanabe, UH-Hilo
Noel D. Ide, student, UH-Hilo
(reprinted from Horticulture Digest *47:3-4, 1979)*

An ecological study was conducted to evaluate the environmental factors that may contribute to the growth of maile (*Alyxia olivaeformis*). Two locations were selected for this study, one at Volcano Kipuka Ki (4000 ft elevation) and the other at Panaewa (650 ft elevation). Twelve plants from each area were randomly selected and used for growth rate studies. It was difficult to ascertain whether the selected plants were all of the same variety, but they were fairly homogeneous based on phenotypic charisteristics.

The average growth rate of the maile was much greater at Volcano than at Panaewa. The major differences in the environment for these two areas were light and temperature. Based on these observations [table above], we feel that light intensity could be playing a major role in the growth rate of Maile. A higher growth rate would be expected at Panaewa if temperature was a highly influential factor, because plant growth generally increases with an increase in temperature within a desirable range.

. . . No Kidding Allowed

These answers were given by 11-year-olds in science exams . . .

When you breath, you inspire. When you do not breath, you expire.

H_2O is hot water, and CO_2 is cold water.

When you smell an odorless gas, it is probably carbon monoxide.

Water is composed of two gins, Oxygin and Hydrogin. Oxygin is pure gin. Hydrogin is gin and water.

Blood flows down one leg and up the other.

The body consists of three parts—the brainium, the borax, and the abominable cavity. The brainium contains of the brain, the borax contains the heart and lungs, and the abominable cavity contains the bowels, of which there are five—a, e, i, o, and u.

The pistol of a flower is its only protection against insects.

The tides are a fight between the Earth and Moon. All water tends towards the moon, because there is no water on the moon, and nature abhors a vacuum. I forget where the sun joins the fight.

Equator: a managerie lion running around the Earth through Africa.

Planet: A body of earth surrounded by sky.

Before giving a blood transfusion, find out if the blood is affirmative or negative.

To keep milk from turning sour: Keep it in the cow.

Benjamin Franklin produced electricity by rubbing cats backwards.

The dodo is a bird that is almost decent by now.

The process of turning steam back into water is called conversation.

The Earth makes one resolution every 24 hours.

The cuckoo bird does not lay his own eggs.

If conditions are not favorable, bacteria go into a period of adolescence.

Vegetative propagation is the process by which one individual manufactures another individual by accident.

It is a well known fact that a deceased body harms the mind.

C/T/A/H/R
College of Tropical Agriculture & Human Resources
University of Hawaii at Manoa

This newsletter is produced in the Department of Horticulture, a unit of the College of Tropical Agriculture and Human Resources (CTAHR), University of Hawaii at Manoa, as a participant in the Cooperative Extension Service of the U.S. Department of Agriculture. CTAHR is Hawaii's Land Grant institution, established in 1907, from which the University of Hawaii developed. For information on CES horticulture programs or to receive future copies of this newsletter, please contact:
David Hensley or Kenneth Leonhardt
Department of Horticulture, University of Hawaii
3190 Maile Way
Honolulu, HI 96822-2279

About Research . . . CTAHR Students' Work

CTAHR Student Research Symposium, April 15, 1998, Campus Center, UH-Manoa

Controlling red ginger (*Alpinia purpurata*) inflorescences postharvest geotropic curvature. Theeranuch Chantrachit[1] and Robert E. Paull[2] Departments of [1]Horticulture and [2]Plant Molecular Physiology, CTAHR, University of Hawaii at Manoa. A hot water treatment of red ginger inflorescence between 45°C and 50°C controlled geotropic curvature. Dipping the inflorescence in hot water at 45°C for 15 min supressed geotropic response for up to 72 hr, whereas application of hot water at 50°C for 7.5 to 15 min controlled geotropic response for up to 7 days. Dipping red ginger inflorescence in 200 ppm TIBA, an auxin inhibitor, supressed geotropic curvature, whereas 2.5 mM EDTA, a Ca++ chelator, did not show any significant effect. The hot water treatment may prevent geotropic curvature of red ginger inflorescence by disrupting the lateral movement of auxin.

Thank you. We hope you've enjoyed this issue of *Landscape, Floriculture, and Ornamentals News.*

David Hensley Ken Leonhardt

David L. Hensley Kenneth W. Leonhardt
Extension Specialists in Horticulture

Cooperative Extension Service
U.S. Department of Agriculture
University of Hawaii at Manoa
3050 Maile Way
Honolulu, HI 96822

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