



# Landscape, Floriculture, and Ornamentals News



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

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## CTAHR and HAN to Sponsor Workshop

*Jay Deputy  
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The University of Hawaii, College of Tropical Agriculture and Human Resources, in conjunction with Hawaii Association of Nurserymen will present a workshop titled "A Landscape and Ornamentals Short Course." The program is to be held on Tuesday Feb.15 and Wednesday Feb.16, 2000 at the Honolulu Country Club, 1690 Ala Puumalu Street. All members of Hawaii's Green Industry are encouraged to attend. The audience should find the speakers well informed and the topics very current. The program is intended to bring Hawaii's landscape and nursery industry professionals together with national and local members of USDA, University of Hawaii researchers, and other noted professionals of the Green Industry from Hawaii and the Mainland.

UH researchers Dr. Arnold Hara and Dr. Janice Uchida will present information on current advances in local plant protection programs. Dr. Hara, Entomologist and Extension Specialist in the Dept of Entomology, will speak on biorational or "reduced risk" pesticides, including Merit, Cinnamite, Floramite, Conserve and Millenium. These pesticides are synthetic or natural products that effectively control insect pests, but with low toxicity to non-target organisms, and are non-polluting to the environment. He will discuss resistance management strategies for these biorational insecticides and miticides, and share results of efficacy and phytotoxicity tests conducted in Hawaii on alien pests. Dr. Uchida, Associate Plant Pathologist in the Department of Plant Pathology will cover topics dealing with recent advances in tropical plant diseases.

The USDA will be well represented at the meetings, with Dr. Jerry Quisenberry, Director of the new U.S. Pacific Basin Agricultural Research Center (PBARC) which is presently under construction in Hilo, and Dr. Peter Bretting, from USDA/ARS in Washington, D.C. Dr. Bretting is the national leader of a new program in floral and nursery crops. Prior to 1997, ARS did not conduct research in this area. Bretting's purpose will be to help get Hawaii's nursery and floral industry involved in this national program. Quisenberry will discuss the role of the new USDA facility in Hilo. The mission for PBARC is to increase the economy and well-being of Hawaii and Pacific Basin societies by strengthening their agricultural sectors, thereby providing opportunities in agriculture for the next generation. The Center's mission is also to strengthen small farming culture by focusing upon the development of crops and farming systems, provide necessary profitability and efficiency to those farms and farmers, and at the same time develop farming practices consistent with the preservation of fragile island ecosystems.

Quisenberry will be accompanied by Dr. Robbie Hollingsworth, Research Biologist at PBARC. Dr.

Hollingsworth will speak on the feasibility of biological control for insect and mite pests on ornamental crops. Also on the program is Dr. Neil Reimer of the Hawaii DOA who will speak on the growing Fire Ant problem in Hawaii and other quarantine issues.

Several mainland agribusiness professionals will make presentations over the two-day session. Of particular interest will be Dr. Jim Knauss who will speak during lunch on the first day and give two separate presentations on the second day. Knauss has been in the horticulture/floriculture industry since 1963. He has been a professor of plant pathology at a mainland university and served several commercial companies in a variety of ways. He is currently Director of plant protection for The Scotts Company. The lunch topic will be a discussion of Contrast and Ovation, two new products from Scotts. The second day presentations are "Disease and Pest Diagnosis" and "Plant Nutritional Diagnosis." The program will also feature Dr. Bill McElhannon who obtained his Masters and Ph.D. from the University of Georgia, and has over 20 years of experience in the horticulture industry. He is currently Chief Horticultural Consultant for Micro-Marco Analytical Laboratory and Director of Technical Services and Research for Agrivert Inc., world wide suppliers of Nutricote controlled release fertilizer. McElhannon's topic will be "Plant nutrition in containers and in the landscape." He will discuss how to design a complete fertilizer program for container production or the general landscape. Rounding out the mainland guest speakers will be Karl Drescher of Chem Search/OptiGrow Inc. Drescher's topic will be "Fertigation – A tool for nursery/landscape professionals."

Two local agribusiness professionals are also scheduled to speak. Ray Cain, Vice Chair of Belt Collins Holding Co., an international planning, engineering, environmental consulting and landscape architectural firm, will speak on "Golf Course Landscaping with Maintenance in Mind." Mr. Cain's specialty is hotel, resort, and golf course development projects. His company has worked on most of the major resort projects throughout Hawaii and in over 55 different countries in Asia and the Pacific basin.

The second local Green Industry speaker is Garrett Webb, a landscape contractor in Kona, and president of Hawaii Island Landscape Association (HILA). Webb is also presently serving as Project Director for the recently initiated Certified Landscape Technician Program on the Big Island, funded through HILA by the State of Hawaii Dept. of Labor and Industrial Relations. The CLT Program is administered by the Associated Landscape

Contractors of America (ALCA) and also offers certification in Irrigation and Construction as well as in Maintenance. Mr. Webb will be speaking about this new pilot program for the Big Island and of the possible development of similar programs on Oahu and Maui in future years and of the CLT in Irrigation on the Big Island next year. Other speakers from local industry may also make presentations.

The cost of the two day program, which includes lunch both days and refreshments at all breaks, is \$75 for current HAN members and \$100 for all others. Look for the full program schedule on page 19 of this issue. Special room rates are available for off-island participants at the Outrigger Hobron Hotel. The deadline for special rates is Jan. 24, 2000. Any questions or requests for hotel reservation or program registration forms can be directed to Madeleine Shaw at (808) 951-0055. Limited space is available and early registration is advised. The deadline for regular registration is Jan. 31, 2000.

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## CTAHR Releases Seven New Hybrid Pincushion Protea (*Leucospermum*) Cultivars

*K. Leonhardt, P. Shingaki, D. Oka, S. Ferreira, and N. Nagata.*

The pincushion protea (*Leucospermum*) hybridizing program at CTAHR's Maui Agriculture Research Center in Kula, Maui, was revitalized in 1994 with funding from a federal floriculture research grant. A survey of growers helped to determine that the breeding criteria would include resistance to root and foliar fungal diseases, and improved horticultural characteristics such as a more vertical plant growth habit, with long, straight and lightweight stems having small leaves. Since a breeding program relies on the heritability and combining ability of genes for these desired characteristics, the first step was to identify species and hybrids with one or more of these

desirable characteristics. Following that, a breeding strategy was developed to involve a series of primary crosses, sibling crosses, and back crosses. The crosses were made and in three to four months the seeds were collected, sown, and germinated. Plants were nursery grown until about six to eight inches tall, then planted in irrigated fields and grown for two years to first flowering. Upon first flowering the seedlings were evaluated against the criteria for an improved commercial cultivar and selected for possible introduction to industry, or selected for possible future breeding, or kept for continued observation, or destroyed. Approximately 98% of all seedlings were destroyed following their first flowering.

Earlier research by CTAHR determined that *L. saxosum* is highly resistant to *Sphaceloma* (Elsinoe scab disease), and South African research reports it to have low susceptibility to *Phytophthora* root rot. It would be a challenge to use this plant in breeding since it has small flowers of poor substance on short stems, poor vigor, and a plant growth habit that hugs the ground. Research at CTAHR had earlier determined that *L. Rachel* (UH hybrid #29), with parentage [*L. glabrum* x (*L. vestitum* x *L. lineare*)], has the best combined disease resistance ratings to Elsinoe scab, *Drechslera* leaf blight, and *Botrytis* leaf blight diseases. Later we would determine *L. Rachel* to be one of our most reliable stud plants for transmitting improved horticultural characteristics to its progeny. South African research determined that *L. Spider*, (*L. formosum* x *L. tottum*), has some tolerance to *Phytophthora cinnamomi*. It is used by many South African growers as a root stock, on which other selected clones are grafted. Another South African hybrid, T88-09-02, (*L. cuneiforme* x *L. glabrum*), has vigorous growth, good plant structure and long stems, large and well formed flowers, and apparent tolerance to root disorders. These, as well as other species and hybrids, have been used in the breeding program with good results. Since 1994, over 600 hybrids have been made and nearly 3000 seedlings have been evaluated. About 70 plants have been identified for continued observation, or for use in future breeding, or to increase for distribution of cuttings to industry. In October 1999, CTAHR released seven new *Leucospermum* hybrids (over 1500 cuttings) to protea growers in Hawaii, as follows:

**UH hybrid #72**, (*L. Spider* x *L. T88-09-02*). The blossoms have orange styles and red ribbons. This plant is in bloom nine months a year.

**UH hybrid #82**, (*L. Rachel* x *L. saxosum*). The blossoms have bright red styles and ribbons. It appears to

have some resistance to Elsinoe scab disease, but scientific tests are not yet completed. Its young foliage is an attractive maroon red. The blooming period is December through March.

**UH hybrid #89**, (UH #58 x *L. Tango*). Styles and ribbons are deep red, with an attractive white "frost" on the ribbons. This plant blooms almost year round. It is one of our favorites.

**UH hybrid #104**, (*L. Ballerina* x UH #31). This plant has slender stems and leaves. The blossoms have dark orange styles and metallic ribbons. This plant is a heavy bloomer from January through June.

**UH hybrid #105**, (*L. Ballerina* x UH #31). Styles are orange and ribbons are blood red. This plant is a heavy bloomer from January through June. It is a sibling of UH #104.

**UH hybrid #133**, (*L. T88-09-02* x UH #49). Styles are dark yellow and ribbons are dark orange. The blooming period is December through June.

**UH hybrid #135**, (*L. T88-09-02* x *L. Spider*). Styles and ribbons are yellow. Flower shape is like *L. Spider*. This plant blooms heavily from November through June. It was selected from a reciprocal cross of UH #72.

The information on yield and seasonality given above is based on plant performances at the Maui Agriculture Research Center in Kula, Maui. Yield and seasonality may be different at other locations.

Several new hybrids will be introduced late in 2000, including the first time release of hybrids involving the species *L. reflexum*. The influence of *L. reflexum* has produced hybrids with very long stems and flowers with an architecture not previously seen in *Leucospermum*. Flower shape is ovoid to globose when young, and as the styles reflex with age the flower becomes a flat disk, larger in diameter than any *Leucospermum* we have seen. The plants are also vigorous and high yielding. These will be unusual new additions in the floral marketplace. The next distribution of new *Leucospermum* hybrids from CTAHR will be in September or October 2000. Interested Hawaii growers can place orders with the Protea Cultivar Distribution Foundation, at P.O. Box 425, Kula, Hawaii 96790.

## Weed Control Options In Landscape Beds

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Weed management in landscape plantings is a complex task. The diverse nature of the ornamental plant material and weeds present as well as differences in the size and slope of the beds can create a big challenge. Herbicide options are limited by the mixture of woody and herbaceous ornamentals, as well as health and environmental concerns. Therefore, the integration of multiple strategies is necessary to keep weeds from detracting from the beauty and quality of a landscape.

Weeds can be divided into three general types – broadleaf, grasses, and sedges. Each type presents its own special problems and often requires different control measures. With the year-round growing season we have in Hawaii, all of these of weeds can constantly become established in the landscape. For that reason, a continuing year-round program is necessary to keep weeds under control.

Most of the common broadleaf weeds that infest Hawaii's landscape are annuals, that is they grow from seed, flower and produce more seeds, then die off within one growing season. This process may take several weeks to several months or more. These kinds of weeds are most likely to enter the cultivated landscape area by seed dispersal from wind or birds. In Hawaii's year-round growing season, most annuals do not exhibit a seasonal appearance. They do not undergo a winter dormancy, and therefore are able to exhibit a continuous life cycle, presenting a constant problem.

Grassy weeds are either annual or perennial. Perennial grasses live for many years. They can spread by seeds like annuals, but creeping perennials also spread by rhizomes or stolons. They are especially hard to control because of the difficulty in completely killing all of the rhizomes and stolons. Popular turfgrasses like bermudagrass and zoysia are warm-season perennials that often invade neighboring landscaped garden areas by sending "runners" into the area. These types are more likely to be a continuing problem during the warm summer months when they are actively growing. Repeated treatments may become necessary to maintain a killed strip between landscape beds and the turf. Quackgrass is a cool-season perennial and is more of a problem during the cooler winter months in Hawaii. Quackgrass is also much more likely to become established through dispersal of its seeds by birds.

Annual grasses are easier to control. They are classified as summer or winter weeds based on their emergence pattern. Both types tend to persist through out the year in Hawaii. Summer annuals germinate more prolifically in spring, grow during the summer months and then flower in late summer or early fall and gradually begin to die off. Common summer annuals include large crabgrass in landscape beds and smooth crabgrass, goosegrass, and smutgrass in turf areas. Winter annuals tend to emerge more in the fall in Hawaii and persist through the winter into spring and die off in the hot dry summer months.

**Design and prepare the ornamental planting bed with weed control in mind.** The ideal landscape according to a weed scientist might not win any awards for diversity, but grouping similar plant material together allows for more weed control options in the beds. Herbaceous plants, especially annual flowers, are more sensitive to herbicides than ornamental shrubs or trees. In such flower beds, mulching and hand pulling of weeds are often the only weed control options. More herbicides are registered for use around woody ornamentals, which also help shade out weeds that might otherwise germinate.

Certainly, a rich variety of plant types and colors in a landscape are desirable and attractive, but designers should at least consider the requirements for maintaining the landscape over time. Before establishing a planting, evaluate the site for soil type and slope and identify existing weeds so suitable plant material, mulching and herbicide use can be selected. Control existing weeds with a nonselective herbicide such as Round Up, or Finale, before the beds are established.

Avoid introducing weeds or their propagules (seeds, rhizomes) into the landscape, and eliminate weeds that emerge before they begin to form seed. Root balls of field-grown nursery stock may contain tubers or rhizome fragments of perennial weeds, which are then transplanted into the landscape with the shrubs.

**Mulches are an effective tool.** Mulches are commonly used in landscape beds to improve appearance, moisture conservation and weed control. Mulches can control annual weeds but will generally not control perennials. Mulches can be classified as organic (bark, wood chips, composted leaves, pine needles), inorganic (crushed rock, crushed coral, gravel) or synthetic (black plastic, landscape fabric). Mulches limit light and physically block seedling growth. As organic mulches break down into finer particles, the mulch layer becomes a

good growing medium for weeds. Inorganic rock mulches will therefore usually give better weed control than the organic mulches. Although natural inorganic mulches like gravel or stone are generally more expensive than organic mulches, they are stable over time, allow good water drainage and air flow and can make very attractive mulches.

Coarse-textured organic mulches can be applied up to 4 inches deep and provide long-term weed control. Fine-textured mulches pack more tightly and should be limited to a depth of 2 inches. They degrade more quickly and consequently provide weed suppression for a shorter period of time. The optimum mulch is relatively coarse-textured with a low water-holding capacity. Because mulches rarely provide complete weed control, pre-emergence herbicides can be applied to improve the level of control.

Perennial weeds such as bindweed, oxalis and plantain often have sufficient root reserves to penetrate even thick mulch layers. Even annual weeds can grow through mulches or germinate on top of a mulch as it decomposes. Weeds with wind-borne seeds such as horseweed, common groundsel and dandelion are most likely to become established in the mulch.

**Weed barriers can improve the weed control obtained with mulches.** Solid black plastic under a mulch dramatically improves weed control compared to mulch alone. Black plastic has been used for years and provides excellent control of annual weeds and suppression of perennials. However, nonporous black plastic restricts water penetration and air exchange; thus, it is not recommended for long-term use in landscape plantings.

Porous, black landscape fabrics (geotextiles) have been developed to replace black plastic in landscapes. Landscape fabrics form a barrier and block sunlight from reaching weed seeds, but allow water and gas exchange necessary for plant health. However, weed shoots can penetrate up through any openings in the fabric and grass roots can penetrate down through openings in the fabric if they are allowed to germinate on the surface of the mulch. Therefore, the fabric should be free of rips, tares and other open spaces for maximum weed control. A key to the successful use of fabrics is maintaining the mulch layer free of weeds, either by hand weeding or the use of herbicides. Some brands of fabric, such as Biobarrier II, contain a pre-emergence herbicide. Although relatively expensive and labor intensive, landscape fabrics are cost-effective if the planting is to remain in place for several years.

Landscape fabrics are most useful for long-term weed control around trees, shrubs and woody ornamental plantings, but not for annual flower beds that are replanted periodically or where a fabric could inhibit rooting and spread of ground covers. Landscape fabrics can eventually be damaged by tree and shrub roots, and pulling up a fabric may be difficult due to root growth within the material.

When installing a fabric, first remove existing weeds and stones. Cut the fabric to fit snugly around tree trunks and shrubs. For unplanted beds, cut an "X" in the fabric for each planting hole. Avoid leaving soil from the planting hole on top of the fabric since this will serve as a source of weed seeds.

After planting, fold the fabric back down to keep the sheet as continuous as possible and secure to the rail with U-shaped pegs. Apply a thin layer of organic or rock mulch on top of the fabric to prevent its destruction by UV light (photo-degradation). Remove any weeds that grow into or through the fabric when they are small to prevent holes from forming in the fabric.

**Landscape managers often use mulches in combination with herbicides to improve the efficiency of weed control.** Some factors to consider before selecting a herbicide are:

1. What weeds are present and what weeds are expected to emerge? Are the grassy weeds annual or perennial? Choose a herbicide or combination of herbicides that will be effective on these weeds.
2. What ornamental species are present in the planting? Is it safe to over-spray a grass herbicide? Be sure the herbicide is registered for use on these species.
3. How close are susceptible ornamentals and turf, and what is the risk that they will be injured by the herbicide?
4. What is the potential for residual effects of the herbicide on subsequent plantings, especially those containing annual flowers?
5. What precautions need to be taken to protect the applicator and property owners?
6. What method will be used to apply the herbicide (granular or spray formulation)?
7. How much will the treatment cost?
8. How long will it take for the treatment to be effective and how long will it last?

Herbicides are classified according to their mode of action and the kinds of weeds they control. Some classes of herbicides are effective either on grasses or broadleaf weeds but not both. Many herbicides that are effective on grasses or broadleaves are not at all effective on sedges.

Therefore management strategies can be very different depending on the species of weeds present and their location within the landscape bed.

### Pre-emergence herbicides.

Preemergence herbicides affect germinating seeds and are generally used to control annual grasses and many broadleaf weeds. To be effective, this type of herbicide should be applied several weeks before weed seeds would normally germinate. In Hawaii, seeds are continually being disbursed and germinating, necessitating a periodic application of preemergents throughout the year. Preemergence granular materials may be applied with a fertilizer spreader. The spreader must be calibrated to apply recommended rates. Compressed air sprayers or sprayers attached to a garden hose are effective for liquid applications. Preemergence herbicides differ in the length of the residual effect and should be reapplied accordingly. Some preemergence formulations are very volatile and must be watered or cultivated into the soil for maximum effectiveness. Others are ineffective if the soil is disturbed after application. Generally, herbicides degrade faster under wet, warm conditions than under dry, cool conditions.

The dinitroanilines, a group of preemergence herbicides including Treflan® (trifluralin), Surflan® (oryzalin), Pendulum® (pendimethalin), Barricade® (prodiamine), and TeamPro® (trifluralin+ benefin) inhibit root development in germinating seedlings. They are most active on annual grasses, but also prevent the emergence of some broadleaf weeds. Other preemergence herbicides for landscapes are Devrinol® (napropamide), Pennant® (metolachlor), and Dacthal® (DCPA), all of which prevent the emergence of annual grasses and some broadleaf weeds. Pennant, in addition, has pre-emergence activity on yellow nutsedge. Others are Gallery® (isoxaben), which controls a wide spectrum of broadleaf weeds, and Goal®(oxyfluorfen) that has greater pre-emergence activity on broadleaf weeds than grasses.

Additional choices are available for annual grass and broadleaf control in woody ornamental plantings. In addition to all the other preemergents, Casoron® (dichlobenil) and Ronstar® (oxadiazon), and the combination products O-O®, RegalStar®, Rout®, OHII®, and Snapshot® also control annual grasses. These products are best for woody ornamental plantings because of their potential for injuring herbaceous plants. Ronstar has greater pre-emergence activity on broadleaf weeds than grasses.

Casoron controls annual weeds and also certain perennial grasses such as quackgrass and tough-to-control

weeds like thistle, horsetail, oxalis, wood sorrel, and plantain. It can be used around established woody ornamentals such as yews, arborvitae, and juniper, but not around firs, spruces, or hemlocks. Casoron should be applied during cooler weather and covered with mulch or watered in soon after application. Of the herbicides registered for landscapes, Casoron is one of the best for pre-emergence control of biennials and perennial weeds. Because Casoron affects some turfgrasses, care must be taken to prevent the granules from reaching turf areas when applying it to ornamental beds. Also, Casoron and Ronstar should not be used in herbaceous ornamental beds.

Use the information contained in herbicide labels and from your Cooperative Extension Service to determine tolerance of ornamental plants to a given herbicide. Match herbicides with weeds present and consider using herbicide combinations. Combinations of herbicides increase the number of species of weeds controlled and provide effective control of grasses and many broadleaf weeds. Commonly used combinations include tank mixes of the materials discussed above in addition to oxyfluorfen/pendimethalin (Ornamental Herbicide II), oxyfluorfen/oryzalin (Rout), and oryzalin/benefin (XL).

**Mulches can interact with herbicides.** The placement of an herbicide in relation to an organic mulch can affect the herbicide's performance, especially the preemergents. In addition, the specific characteristics of the organic mulches can affect how herbicides work. A mulch that is primarily fine particles can reduce the availability of some herbicides. The finer the organic material (peat moss or manure, compared to bark), the greater the binding of the herbicide. Most herbicides are tightly bound by soil organic matter, less with mulches, and although the binding may minimize leaching, it can also minimize the activity of the herbicide. Mulch that is made up of larger, coarse particles will have little effect on the herbicide activity.

A more important factor is the depth of the mulch. An herbicide applied on top of a thin mulch may be able to leach through to where the weed seeds are germinating, but when applied to the top of a thick layer of mulch it may not get down to the zone where the seeds are germinating. Products like oxadiazon (Ronstar) and oxyfluorfen (Goal) that require a continuous surface layer must be placed on the soil surface under the mulch. Most preemergence herbicides work best when applied underneath the mulch layer. Such placement is possible only if the herbicide is applied before the mulch is deposited or if additional mulch is spread after herbicide

application. Another reason to apply herbicides under mulch is to reduce volatilization losses.

In general, the pre-emergence products listed above, with the exception of Casoron, do not control established perennial grasses. Preemergence crabgrass herbicides do control perennial grasses germinating from seed, and some inhibit pegging down of creeping perennials. However, to effectively control perennial grasses in landscape beds, postemergence herbicides should be used.

### **Postemergence herbicides.**

Post-emergence herbicides are used to kill weeds after the plants are up and growing. To be effective, most postemergence herbicides must be absorbed through the leaves, therefore liquid sprays generally work better than dry granular materials. However, granular formulations may be the most practical way for homeowners to apply these materials. Postemergence herbicides are effective against perennial grasses and all broadleaf weeds. They are most effective when applied to young and vigorously growing weeds. Post-emergence herbicides generally provide minimal residual weed control, they are either inactivated by binding to soil particles or rapidly degraded by soil microorganism. The post-emergence products that are available for control of perennial grasses and broadleaf weeds include both selective and non-selective materials. Non-selective herbicides kill all plants, including desirable ornamentals and turfgrasses, so extreme care should be used when applying them. Selective post-emergence products carry less risk of injury to desirable plants, and many can be applied directly over the top of ornamentals and turf.

### **Selective postemergence herbicides.**

The selective grass-control products, generally referred to as post-emergence grass herbicides, are the compounds of choice in broadleaf ornamental beds due to their high degree of safety to desirable plants. This group of selective herbicides includes Poast® /Vantage® (sethoxydim), Fusilade®/Ornamec® (fluazifop), Acclaim® (fenoxaprop) and Envoy® (clethodim). These products are systemic, meaning they are taken up into the plant's system and affect the rhizomes and stolons of perennial grasses. Repeat treatments are usually necessary for long-term control of established grasses. Members of this class of herbicide only control grasses and have basically no effect on most broadleaf weeds, sedges such as nutgrass and kyllinga, and other non-grass monocots like wild onion and wild garlic. These herbicides must not be applied over the top of ornamental grass or on many of the turfgrasses and care should

be taken to prevent drift into these areas when applying them to ornamental beds.

Poast/Vantage and Fusilade/Ornamec have been used extensively for annual and perennial grass control in a wide range of herbaceous and woody broadleaf ornamentals. These two herbicides are commonly used to control established Johnsongrass, bermudagrass and quackgrass, tenacious weeds with few control options when growing among ornamentals.

Acclaim effectively controls annual grasses, with suppression of certain perennial grasses. Envoy is the newest compound in this group, and less is known about ornamental tolerances. However, it does control both annual and perennial grasses.

Sedges such as nutgrass (purple nutsedge) and green and white kyllinga are perennials that present their own special problems. They are not affected by most of the grass or broadleaf herbicides, although the preemergent Pennant will control yellow nutsedge. The most effective control for most sedges is with the postemergents Image (imazaquin) and Manage (halosulfuron). Both can be applied over broadleaf ornamentals and turf areas.

Herbicide combinations increase the weed control spectrum. Applicators may mix two of the "grass" and "broadleaf" herbicides listed above or use one of the following granular herbicide combinations: Rout® (oxyfluorfen + oryzalin), Ornamental Herbicide2® (oxyfluorfen + pendimethalin), Snapshot TG® (isoxaben + trifluralin), Team or XL® (oryzalin + benefin). Product labels must be checked carefully for lists of registered ornamental species.

### **Non-selective post-emergence herbicides.**

Roundup Pro® (glyphosate), Finale® (glufosinate), Reward® (diquat) and Scythe® (pelargonic acid) are non-selective herbicides which kill any plant they contact. All must be applied only as directed or used as spot treatments in which ornamentals and turf are not contacted. Reward and Scythe rapidly "top-kill" all vegetation contacted by their spray, but perennial weeds can re-grow. Finale is primarily a contact herbicide, with limited translocation into the plant. Roundup Pro, a slower acting herbicide, is readily translocated to roots and growing points of plants, whereby it kills both annual and perennial plants. Due to the potential for non-target injury, with any of these products but especially those that translocate, extreme care must be taken when applying them around desired plants. Shielded sprays minimize the potential for systemic injury.

It is important to identify grassy and broadleaf weeds that infest the landscape beds you maintain. Determine

if they are annual or perennial and then develop a control strategy that accommodates the ornamentals being maintained and the weeds that need to be controlled. Depending on the situation, you may need cultural, chemical or a combination of methods to control your weed problems.

**Herbicide injury** to established plants from soil-applied chemicals is often temporary, but can cause serious growth inhibition to newly planted ornamentals. Herbicides that contain oryzalin or isoxaben are more likely to cause injury. There are some methods available to remove herbicides from the soil, but usually it just takes time for the herbicide to completely degrade. To speed degradation, supplement the organic content of the soil and keep it moist but not wet during periods of hot weather. Herbicide injury symptoms vary according to plant species and the herbicide and can include yellowing (chlorosis) and/or bleaching, root stunting, distorted growth, and death of leaves.

#### Sources

"Weed control in landscape beds," Todd L. Mervosh, (Connecticut Agricultural Experiment Station, Windsor)  
 "Manage grassy weeds in landscape beds," Jeffrey Derr (Virginia Polytechnic Institute and State University)  
 "Weed Management in Landscapes" University of California Weed Management Guidelines, 1997

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## Computer Use In The Green Industry

With only 12.9 percent of today's green industry professionals not using a computer in their business, computer technology is becoming a daily element in landscape contractors' jobs and these machines are serving a wide range of functions.

In a survey of Lawn & Landscape readers, accounting and billing functions took the No. 1 spot in 1998, with 77.5 percent of those surveyed stating this as their purpose for computer use. At a fairly close second is word processing (64.0 percent), with estimating coming in third at 44.9 percent.

Internet use is one computer function for 41.6 percent of respondents, while landscape design use was noted by 35.7 percent. Inventory and scheduling/routing finished at 27.2 percent and 25.8 percent, respectively, and purchasing was the least reported purpose with 15.2 percent.

## Irrigation Short Course to be Offered in March

Tim Wilson, from The Irrigation Association out of Fairfax VA, will once again give a series of workshops on landscape irrigation. The series will cover individual sessions on Installation and Maintenance, Hydraulics, Sprinkler System Scheduling, and Drip Irrigation. This will be the fifth time that Tim has come to Hawaii to conduct this very informative program.

The Oahu multi-session program will be held at The Pacific Beach Hotel and is co-sponsored by Professional Grounds Maintenance Society-Hawaii Branch (Crispin Bergantinos, Jr., president) and Landscape Industry Council of Hawaii (John Wilkinson, president). Neighbor island sessions will also be scheduled depending upon demand.

The exact date has not been set, but will be sometime in March. Look for future announcements in this news letter and also in Hawaii Landscape Magazine.

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## Crew Size Significance

Crew size affects productivity, and productivity affects pricing. An efficient crew size often determines the company's bottom line down the road. Many contractors have the exact crew chosen when they are giving the bid, while others wait until they have the work.

"We solicit the work then react to what we get," stated Tim Caw, president, Cardinal Lawn & Landscape, Rochester, N.Y. "We use two-man crews the majority of the time. For larger projects, sometimes the crews will merge."

Dennis Barriball, president, Hemlock Landscapes, Chagrin Falls, Ohio, explained that even if they do have a crew in mind at the time of the estimate, it wouldn't make a difference, "We run three maintenance crews, but our quality doesn't change with the face of the crew. He added that they use two-man crews because it is more efficient, "The market won't bear a supervisory position on a crew, a third person isn't economical," "We have different crew structures for different jobs," commented Ray Bradley, president, Raymow Enterprises, Oldsmar, Fla. "I never run more than a three-man crew. Sometimes with large properties, I may divide it in sections for different crews to get it done in a timely fashion."

*From: Lawn and Landscape Magazine, April 1999*

## Preventative Maintenance For Ponds

There are certain steps a landscape contractor should take when building a water feature to ensure it gets a clean start and to act as good preventative maintenance practices.

### Nutrient and Silt Control

Do not fertilize grounds sloping toward the water. Fertilizer may eventually end up in the pond.

Dispose of wastes (leaves, grass, fish, entrails, garbage, ashes, etc.) away from the water. All of these materials can serve to increase the nutrient concentrations.

Allow a "buffer zone" (strip of grass or natural vegetation) to grow around the shoreline. This will help stabilize banks, reduce erosion, provide an aesthetically pleasing landscape, and retain some nutrients that would otherwise enter the water.

### Shoreline Management

Plant native vegetation that blends in with the surrounding to encourage a diversity of wildlife.

Protect shorelines from erosion and undercutting. Use rock lining, terracing or seawalls,

Fence out livestock or pets to prevent them from entering the water.

### Fish Management

Never randomly stock fish. Introduction of fish should be carefully planned in terms of species, sizes and numbers according to the size, water quality and production potential of the pond.

Do not introduce rough fish (carps, suckers, etc.). Never discard unused minnows or certain aquarium fish into the water. Watch for signs of unbalanced fish populations such as overabundant small fish, too many fish of one size class or under-nourished fish.

Do not over feed fish if a supplemental feeding program is used.

*Excerpted from How to Identify and Control Water Weeds and Algae, a 5" edition, revised 1998, produced by Applied Biochemists, Milwaukee, Wis.*

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## Web Access to Information from CTAHR

*Dale Evans  
Editor, CTAHR Publications  
and Information Office*

UH-Manoa's College of Tropical Agriculture and Human Resources offers a wealth of information on its Web site, <[www2.ctahr.hawaii.edu](http://www2.ctahr.hawaii.edu)>.

Many current CTAHR publications are obtainable directly from the Web site as Acrobat PDF files at <[www2.ctahr.hawaii.edu/oc/freepubs](http://www2.ctahr.hawaii.edu/oc/freepubs)>. Most of these free publications are also available in printed form by contacting the CTAHR Publications and Information Office (call 808-956-7046 to record a publication request, or send e-mail to <[ctahrpub@hawaii.edu](mailto:ctahrpub@hawaii.edu)>). Some of the publications in print can also be obtained from Cooperative Extension Service county offices (call the nearest one for assistance).

Some current CTAHR publications that are expensive to produce are offered for sale in a cost-recovery program. You can find these listed at <[www2.ctahr.hawaii.edu/oc/forsale](http://www2.ctahr.hawaii.edu/oc/forsale)>, where you can also download descriptive fliers and order forms for them. Recent titles include "Growing Dendrobium Orchids in Hawaii," "Hawaii Plant Source Guide 1998-1999," and "Hawaiian Islands Air Cargo Resource Book 1999-2000." An upcoming title is "Growing Coffee in Hawaii," and later this year CTAHR will publish a guide to growing 85 plants that provide lei materials. These new releases will be posted on the site as they become available.

### Publications databases

UH's agriculture college and experiment station have been publishing for almost 100 years, and the CTAHR Web site has a comprehensive database of that work at <[www.ctahr.hawaii.edu:591/index.htm](http://www.ctahr.hawaii.edu:591/index.htm)>. There are three parts to the database. In one, you can find any thesis or dissertation written by graduate students in the college's various departments since advanced degrees were first granted in 1913. While these documents were not published in the usual sense of the word, they are available in UH-Manoa's Hamilton Library.

In the second database are found titles of research articles published by the college faculty. These articles were published not by the college but in various books and academic journals, but each was given a college "journal series" number and recorded by the college.

... continued on page 18

## Detection, Transmission, and Management of Orchid Viruses in Hawaii

Dr. John Hu  
Dept. of Plant Pathology, CTAHR

More than 20 plant viruses infect orchids. The most prevalent and economically important viruses infecting orchids worldwide are Cymbidium mosaic virus (CyMV) and Odontoglossum ringspot virus (ORSV). They occur wherever orchids are cultivated as ornamentals and have been detected in most genera tested. The virus infections cause a reduction in the quality and quantity of flowers produced, resulting in economic losses. Infected orchid flowers are smaller and fewer in number and may be deformed. Control of ORSV and CyMV infections in orchids is difficult because the viruses are very stable and mechanically transmitted between plants during handling and harvesting.

The Hawaiian orchid industry is an important segment of the exotic, tropical, cut-flower industry, playing a significant role in the diversity of Hawaiian agriculture. In Hawaii, seed propagated hybrid seedlings of *Dendrobium* orchids produced at the University of Hawaii (*Dendrobium* UH hybrids) comprise about 75% of State's propagated orchids. Effective control of CyMV and ORSV in orchids will allow growers to improve the quality and quantity of orchid production. Orchids are also popular in home gardens in Hawaii; orchid viruses are concerns for orchid hobbyists.

The objectives of this collaborative project with Dr. Steve Ferreira, Dept of Plant Pathology, and Dr. Heidi Kuehnle, Dept of Horticulture, at the University of Hawaii are (1) to develop rapid and sensitive assays for the detection of orchid viruses; (2) to study the transmission, movement, and management of CyMV and ORSV; (3) to develop resistant transgenic orchids for control of CyMV and ORSV; and (4) to characterize other orchid viruses in Hawaii.

**Detection.** Sensitive, rapid, and reliable ELISA assays were developed for detection of CyMV and ORSV. An indexing system for CyMV and ORSV has been established in Agricultural Diagnostic Service Center, University of Hawaii (808-956-8053). A statewide survey was conducted to determine the incidence and distribution of orchid viruses in nurseries and farms in Hawaii. Approximately 3,600 orchid plants representing 44 genera from three orchid collections, twenty-two commercial farms, and six nurseries on the islands of

Oahu and Hawaii were surveyed. CyMV was detected in 61% and ORSV was detected in 25% of 44 orchid genera surveyed. Double infection with both viruses occurred in 20% of the genera. CyMV and ORSV were detected in 29 and 7 of the 31 sites surveyed, respectively. When 330 cloned orchid samples were tested, CyMV and ORSV were detected in 45% and 9% of the clones, respectively. With *Dendrobium* UH hybrid seedlings, only 4% of the 758 samples less than three years old tested were infected by CyMV. Of 2381 UH *Dendrobium* hybrids more than three years old, CyMV was detected in 94% of the samples in some farms, but only 2% of the samples from other farms, suggesting that clean plant sources and sanitation approaches could be used to successfully manage CyMV. ORSV was not identified from any of the commercially grown *Dendrobium* UH hybrids.

Recently, we developed immunocapture polymerase chain reaction (IC-PCR) assays for detection of CyMV and ORSV. These assays are much more sensitive than the ELISA assays.

**Transmission.** In order to develop strategies for management of orchid viruses, we conducted transmission and movement studies of CyMV and ORSV. Transmission of CyMV and ORSV to *Dendrobium* UH hybrids occurred readily. CyMV and ORSV were detected from inoculated leaves as soon as 3 days after inoculation. CyMV moved systemically from inoculated leaves to the entire plants within a month. However, ORSV did not move systemically beyond the inoculated leaf. This observation could account for our failure to detect ORSV from the UH hybrids surveyed. Porter and Kuehnle at UHM found that CyMV was not transmitted from CyMV-infected pod and pollen parents to 7,050 seedlings of *Dendrobium* UH hybrids (UH232 and UH503) and concluded that CyMV is not seed transmitted.

**Management.** We evaluated the following seven compounds for their effectiveness of inactivation of CyMV and ORSV for disease control: skim milk, Ivory liquid detergent, sodium hydroxide (NaOH), Clorox (5.25% sodium hypochloride), Physan, Agribrom, and ethanol. Skim milk, Ivory liquid detergent, Physan, Agribrom, and ethanol were ineffective for inactivation of CyMV. NaOH at 1% concentration inactivated both CyMV and ORSV and did not cause phytotoxic damage. Therefore, NaOH at 1% concentration can be used to sterilize pruning tools to inactivate viruses.

**Genetic Engineering.** We cloned CyMV and ORSV and obtained the coat protein and movement protein genes of CyMV and the coat protein and the 54 kDa

putative replicase genes of ORSV. We introduced the genes by the biolistic gene transfer technique into leaf tissue of *Nicotiana benthamiana* and into protocorms and protocorm-like bodies of *Dendrobium* orchids. Transgenic orchid and tobacco plants were produced and are being characterized.

**Other Orchid Viruses.** *Dendrobium* mosaic virus (DeMV) was first described in Hawaii 40 years ago. The virus induces chlorosis, mosaic, and distortion of leaves and color-breaking and distortion of flowers in *Dendrobium superbium* Reichb. (known in Hawaii as the honohono orchid). Using a polyclonal antiserum produced in this study against purified DeMV particles, we found that DeMV is widespread in honohono orchids in Hawaii but not in any other orchids. We cloned DeMV and obtained DeMV-specific cDNA clones. Sequence comparisons of the coat protein amino acid sequence and 3' untranslated region showed that DeMV shares 88–91% and 85–95% identity with those sequences of bean common mosaic virus (BCMV) subgroup members, respectively. Results from our host range studies suggest that DeMV is similar to other potyviruses in the BCMV subgroup such as azuki bean mosaic virus and blackeye cowpea mosaic virus. Based on these information, DeMV is now considered a member of the BCMV subgroup.

We found TSWV-infected orchids (*Oncidium* cv. 'Gower Ramsey') in a nursery on Oahu. We discovered that the TSWV infection was localized to symptomatic tissues only. The growers were able to contain the infection by removing the infected leaves from approximately 8,000 *Oncidium* plants rather than destroying them, thereby reducing economic losses.

In summary, CyMV is very widespread in *Dendrobium* UH hybrid orchids in Hawaii, but ORSV is not. Both CyMV and ORSV infect inoculated leaves well, but only CyMV causes systemic infection on *Dendrobium* orchids. CyMV is not transmitted by seeds. Skim milk is ineffective to prevent CyMV infection in *Dendrobium* orchids. It is recommended to use virus-free orchid plants (either *Dendrobium* UH hybrid seedlings or indexed mericlones) to initiate a new orchid nurseries or to replace old orchid plants, and to use sanitation practice (e.g. use of NaOH at 1% concentration or flame to sterilize pruning tools) in handling orchid plants. TSWV and DeMV were found in orchids in our survey.

#### Acknowledgments

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*Dr. John Hu is associate plant pathologist, Dept of Plant Pathology, College of Tropical Agriculture and Human Resource, University of Hawaii at Manoa*

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## Effects of Ethrel and Gibberellin on Impatiens Plants

*G Tamari, L Pappa, T Zered and A Borochoy.  
Scientia Horticulturae 76: 29-35, 1998*

In many locations, impatiens (*Impatiens balsamina*) flowers year round and maintaining stock plant quality for cutting production requires techniques to inhibit flowering without adversely effecting the number, length or rooting capacity of the cutting material. In this study, combined treatments of ethrel and gibberellin were applied to two impatiens cultivars - 'Tempo Pink' and 'Aruba' - in winter and in spring to see if the cutting quality of the stock plants would be improved. Ethrel was applied at a variety of concentrations ranging from 200 to 800 ppm and gibberellin was applied at 25 ppm. The treatments were made as canopy sprays in the afternoon. In the ethrel treatments for both cultivars, the number of cuttings increased as the concentration increased with double the crop at the highest concentration (800 ppm). However, the cuttings from the ethrel treated plants were shorter than those from the untreated plants. Addition of the gibberellin treatment increased the length of the harvested cuttings without increasing the number of flowers. Bi-weekly treatments of ethrel combined with gibberellin produce good quality, non-flowering impatiens stock plants. Cuttings should not be harvested in the 3 days following the treatments since large amounts of ethylene are produced during that period and this might be detrimental to the post-harvest quality of the cuttings.

## Encouraging Water Conservation Through the Principles of Xeriscaping

*Ginny Meade*

Water is the essence of life—it is our most important resource. World water supplies are being increasingly contaminated with chemicals and waste as the world's population continues to increase. Changes in climactic conditions, brought about by ozone layer depletion, global warming, and weather phenomenon like El Nino, are affecting percentages of precipitation worldwide. As a result, the amount of useable water is rapidly diminishing.

In Hawaii, water supply is an especially fragile commodity. While we have abundant rainfall in some places, the total area is small, thus limiting the total amount of fresh water. Because of the porosity of the volcanic rock that makes up most of our land mass, damming streams and rivers would be pointless; the water would simply drain away. However, we do have a supply of fresh water underground, due to a phenomenon known as the Ghyben-Herzberg Principle. The slightly lower density of fresh water causes it to float on top of salt water. When rainfall seeps into the porous volcanic ground, it forms a lens of fresh water beneath the islands. Some of this fresh water is lost through leakage into the ocean. Fortunately, most is dammed by underground volcanic dikes, which flow vertically into the ground and hold water in the areas of the lens. The amount of annual rainfall, critical for the constant renewal of our fresh water supply, has been decreasing in recent years.

Hawaii's landscape is made up of many microclimates and soil types. Many of these areas are extremely arid. What makes a locale arid is not how much rain falls, but how much accumulates in the soil. In developed and populated areas, where native growth has been removed or reduced, landscaping and gardening are important for water conservation. Intelligent and creative landscaping techniques can not only increase the amount of water seeping into our water table, but can also reduce the operational costs and consumption of water through the use of mulches, low-water use plantings, and limiting of turf areas. Attractive landscaping is an essential element for both property value and aesthetic appeal.

A water-thrifty idea that has developed over the past ten years is the concept of xeriscaping, which is defined as "water conservation through creative landscaping."

It is important to fully understand the concept in order to sell it to the general public.

Although the idea has been around for a few years, xeriscaping is not yet a readily accepted concept. In spite of growing water shortages and rising rates, investment of time or capital on water conservation is "a tough sell." The word conjures up visions of dry, dusty cactus and rock landscape, while most property owners prefer lush and green. But wise water use doesn't have to mean brown. One effective method for "selling" the idea is to produce a list of drought-tolerant and low water use plants. Many of the plants on such a list may come as a surprise to the uninitiated. It is equally important to make sure that the client understands the plants that will work in a xeriscape. One suggested way to describe them is to use the terms "water spenders," "water savers," and "drought avoiders." Keeping the vocabulary clear will not only help the client understand how the plants work, but will also avoid future misconceptions regarding specific plant performances.

The term Xeriscape has been adopted nationwide, and a concise set of principles has been devised:

- Start with a good design
- Improve the soil
- Use mulch
- Limit lawn area
- Irrigate efficiently
- Choose appropriate plants for the area
- Practice good maintenance

The key to a satisfying xeriscapic garden is planning and evaluation of existing conditions. For a new installation, a design should work best with wind, sun, rain, and topographical conditions in the area. Before making any plans, it is wise to tour the neighborhood. Note which plants are working well in the area, and which are not. Observe how much time surrounding properties require for maintenance, and determine how much the prospective client is willing and able to spend. Consider the path of the sun over the area, and any existing structures that cast a permanent shadow. Windows reflect sunlight and heat. Existing trees create shady areas where only shade-loving plants will flourish. Trying to change the natural inclination of a plant often leads to frustration and failure.

Wind plays an important role in plant growth and development. Air movement is required for healthy conditions, but high winds will tear large-leaved vegetation, and cause rapid evaporation of water. In high wind areas, plant either low-growing varieties or deep-rooted trees and shrubs whose roots can obtain water from lower

soil levels. Small-leaved allspice trees and mock orange hedges work well, and can form a windbreak for other plants. Use natural hills and berms for interest, or consider creating such areas by moving earth or rocks into place.

Soil pH, soil texture and nutrient content must be determined before any work is begun. Appropriate amendments should be made before planting, and may often affect plant selection.

Use of the planted areas should be considered. For residential areas in particular, if children or pets require a turf area for play, choose only as much area as is necessary. Lawn grasses and turf require high water usage for irrigation, and a controversial but persistent viewpoint is that they should be limited or entirely eliminated whenever possible. There are many other interesting and attractive ways to cover ground that is not planted with trees, shrubs, or flowers. During the six-year drought in the Western U.S., many homeowners made drastic changes in their gardening practices, such as replacing the back lawn with a patio of flagstone and cobbles that proved to be a big water saver. Many types of turf require more water per square foot than other landscape plants. When the lawn is kept appropriately small, water usage often drops dramatically. When selecting turf, choose appropriate varieties, drought tolerant when suitable, and investigate wearability and maintenance requirements as well. Core aeration and slow release nitrogen fertilization will also enhance water conservation in turf areas.

If the area must have turf, plan a mini-oasis close to the house, surrounding the lawn area with the plants of the highest water use, then graduating away from the area through transitional plantings with lower water requirements. The areas farthest from the mini-oasis should be of the low water use varieties.

Irrigation can then be designed for each area, plants with the same requirements occupying the same areas. New installations of irrigation systems will be water efficient, and existing irrigation methods can be inexpensively adapted for lower water consumption. Wherever possible, drip irrigation should be utilized. However, it is not a panacea for water consumption and many facets of the system and the plant needs should be considered. Most often, a combination of systems will perform the most efficiently.

Mulches are another solution to the bare ground question. Gravel of various colors and sizes can be used in lieu of grass. Light colored stones reflect heat, so keep them away from living areas, but use them in driveways and other areas to keep the ground cooler. The ideal color

for gardens is terra cotta or brown. Designs that mix light and dark gravel or coral in a pattern can be very attractive between plants, or along walkways. Keep the size of the stones or gravel down to chip size, as fist-size and above does not act as mulch, but rather gives a safe harbor to slugs, snails, and other garden eaters. Wood chips, clippings, nutshells, and compost are also good mulches. Weave paths between fruit trees paved with crushed shells or coconut husks for a good-looking landscape effect. Mulch around trees and shrubs should be three to four inches deep, to inhibit weed growth and reduce evaporation—both of which save water. An added benefit is the protection of stems and trunks from weed-eaters and mowing machines.

For areas that do not get foot traffic, many low ground covers are virtually maintenance free, and produce a lush green carpet with little water usage. Hearts and Flowers, a succulent with fleshy, small leaves and brilliant red blossoms, will cover bare ground in no time. It also creeps onto walls and cement, so some edging may be in order. Once established, it grows well on its own and holds moisture on the soil surface with its dense coverage. Ice Plant, another exotic succulent, grows about eight inches high, but spreads out many feet from each plant. Its thick leaves glisten in the sunlight.

Be aware, however, that many of the drought tolerant plants go through a period of dormancy when the plants are forced to use water very efficiently, folding their leaves and appearing sparse and withered. This is the same response that some turf grasses have to drought, and both will become rejuvenated with rainfall. It is at this point that the irrigation methods and techniques can be adjusted if desired.

Sometimes, native plants will be the most effective water savers. However, the cultivated environment is usually drastically altered from the original natural environment, and natives growing in an altered ecosystem will not always work well. The important point is to know the plant, understand its needs, and put it where it will perform best. Natives in the landscape are an interesting new trend, but careful thought, research when necessary and planning are the best tools for a successful design.

To entice the property owner into xeriscaping, offer Juniper species, Plumerias, Jasmynes, Magnolias, and Bougainvillea. Many Gardenia and Hibiscus species are all relatively low-water use plants. The Bird of Paradise can grow up to six feet tall, and requires little water. For large trees, the Ironwood, Date Palm, Fan Palm, and Wili Wili are all suitable. Citrus trees can provide fragrance, shade, and edible fruits. Herbs can provide interest, fra-

grance, hedges and ground cover, and culinary variety. Basil, rosemary, and dill require very little attention after establishment, and some varieties can last for many years in Hawaii's climate. Extensive plant lists have proliferated since xeriscaping was introduced, and a compendium of tropicals suitable for Hawaii would be a welcome addition.

Xeriscaping is an essential concept that should be considered in all design projects. Water conservation needs begin with the initial planning stage, and carry through to installation and continued maintenance. Regardless of the area to be landscaped, moist or dry climate, large or small area, the basic principles of xeriscape will provide savings in water and improved use of the land

*Ginny Meade is a 1997 graduate of the University of Hawaii (B.S. in Horticulture). This article was adapted from a term paper she wrote for Hort 350.*

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## Nitrogen Leaching in Golf Course Putting Greens

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The fate of nitrogen (N) applied to turfgrass is a concern of both turfgrass professionals and the general public in the surrounding communities. This is primarily because of the unique combination of climate, hydrology, soils, mobility of soluble N, and management conditions when turfgrasses (particularly sports turfgrass) are located in public areas. For a number of years researchers in Florida have been investigating the fate of N and other agrichemicals applied under an array of controlled management conditions. As a result, they have developed "Best Management Practices" to minimize any potential adverse impacts. Practical N management techniques such as the use of controlled-release fertilizers, fertigation, and irrigation management have been shown to provide quality turfgrass with little N leaching.

As a part of these studies, a leachate collection system was installed in re-constructed USGA type greens at an existing golf course in south Florida in order to assess agrichemical mobility under "real-life" play and

management conditions. The initial objective of this study was to monitor the mobility of N, the major agrichemical used during grow-in, during the establishment/maturation phase of newly sprigged bermudagrass greens. They also hoped to illustrate the usefulness of these monitoring systems for assessing agrichemical and water management of golf course putting greens.

The leachate collection system was composed of modified stainless-steel lysimeters installed in three greens that were under re-construction. The lysimeters were fitted with bottom drain lines to permit passive drainage from the bottom of the collection chamber to a percolate-collection station on the back or side slope of each green. The "rooting mix over gravel" greens-construction combination in use at each location was reproduced in each lysimeter, thereby preserving the hydrological integrity of the percolate-collecting system. Lysimeter installation did not cause any serious disruption of the commercial greens installation. The lysimeters have no adverse impact on the management or use of the greens. Collection of percolate water by golf course personnel was initiated during grow-in and continued until the greens were in play and receiving routine management. The water samples were analyzed for  $\text{NH}_4\text{-N}$ ,  $\text{NO}_3\text{-N}$ , P and K. Only the data for  $\text{NO}_3\text{-N}$  is considered in this article.

Because superintendents are often under extreme pressure to get their respective courses back in play, it is a well-recognized practice to facilitate grow-in of bermudagrass through the use of frequent and/or large application of soluble N initially after sprigging. However, soluble N applied to sand soils is prone to leaching, especially when the turfgrass does not have complete cover with extensive rooting for nutrient retrieval. Therefore it was not surprising to see relatively high concentrations of nitrate-N being found in the percolate from each green when soluble N was applied to immature bermudagrass early on during the study. Throughout the establishment phase, the concentration of N in percolate was high and above the current drinking water standard. At the end of the establishment period, there was a switch to slow-release N sources and, as the greens matured, there was greater nutrient retrieval capacity. The nitrate-N levels began to approach and dip below 10 mg/L in all three greens and stayed consistently below the current 10 mg/L standard as normal greens fertility maintenance was adopted. However, nitrate-N levels rose again when one of the greens was later overseeded and supplied with high levels of soluble N and water to encourage germination. As the over-seeding period ended and a change over to routine fertilization

was resumed, the nitrate-N concentrations in percolate fell off sharply and below the 10 mg/L standard.

Several concluding points can be drawn from this field monitoring study. First, leaching of N with percolate can occur during establishment period. While the superintendent's main concern during this period will be for the well-being of the grass, N leaching should be considered as well, and can be reduced by the inclusion of prudent management such as the use of slow release fertilizers and efficient irrigation. Secondly, the use of conservative strategies of slow release N fertilizers under routine management, effectively reduced N leaching in actual golf course management conditions. These field observations verified the many years of research on ways to minimize N leaching from turfgrass and the development of BMP's by the University of Florida turfgrass faculty. Finally, this study demonstrated the usefulness of the field monitoring system as an additional tool for management decisions for both nitrogen fertilization and irrigation. Managers could use the data from these lysimeters to evaluate the environmental effect of fertilization rates and methods, and make modifications where appropriate. In addition, just knowing the amount of percolate collected can be very useful. Such measurements can be used to determine whether irrigation is excessive. Clearly, there would be no N losses when no percolate is observed. Obviously, with occasional heavy rains and irrigation inefficiencies, a situation of no percolate is unrealistic. However it is realistic to avoid over-irrigation and a waste of valuable nutrient elements. It's also economically and environmentally friendly.

*Adapted from an article by George H. Snyder and John L. Cisar, University of Florida*

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## Greenhouse Conditioning Affects Landscape Performance of Bedding Plants

*JG Latimer and RD Oetting  
Journal of Environmental Horticulture  
16(3):138-142. 1998.*

Cultural practices and/or chemical growth regulators are commonly used during greenhouse production to control bedding plant height. The ultimate goal is to control plant growth and condition the plant to tolerate the

stresses of shipping, marketing, and landscape establishment. The carryover effects of these practices on landscape performance are seldom examined even though landscape performance affects customer satisfaction. The objective of this research was to evaluate the effect of individual cultural or chemical methods of growth regulation on greenhouse growth and landscape performance. The treatments included: two fertilization rates, two irrigation treatments, two plant growth regulators, and mechanical conditioning. The two water soluble fertilizer treatments were 50 ppm nitrogen three times per week (Low N) and 500 ppm nitrogen three times per week (High N). The two irrigation treatments were ebb-and-flow irrigation and drought stress to wilt point for 2 hours. Chemical growth regulator treatments were single applications of 500 ppm B-Nine (daminozide) or of 45 ppm Bonzi (paclobutrazol). Mechanical conditioning was applied by brushing the top one-third of the plants with a wooden bar for 40 strokes twice a day. These treatments were applied to columbine (*Aquilegia x hybrida* 'McKana Giants'), New Guinea impatiens (*Impatiens x hybrida* 'Agadoo'), marigold (*Tagetes erecta* 'Little Devil Mix'), and ageratum (*Ageratum houstonianum* 'Blue Puffs'). In all four species, the plants in the Low N treatment required more time to reach acceptable size or quality. On the other hand, only the New Guinea impatiens had improved performance with the High N treatment. Drought stress reduced the quality of marigold and ebb-and-flow irrigation produced very succulent plants susceptible to transplant shock. Mechanical conditioning reduced height and the reduction did not persist in the landscape, but the brushing often produced unacceptable levels of damage to leaves and flowers. The B-Nine application produced moderately shorter plants without adverse impact on landscape performance in columbine and marigold; the treatment was ineffective on New Guinea impatiens and persisted after planting in ageratum. The Bonzi application caused persistent excessive height reduction in New Guinea impatiens. Conditioning treatments such as drought or low nitrogen which produce physiological stress had the greatest negative impact on subsequent landscape performance. Rates of chemical plant growth regulators (PGRs) must be carefully selected to avoid persistent growth reduction in the landscape. Management of cultural conditions to produce healthy vigorous bedding plants in the greenhouse provides the best plants for optimum landscape performance.

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## Research May Prevent Localized Dry Spots in Bentgrass Greens

When built and maintained properly, USGA greens have provided excellent results over a period of many years for golf courses in most regions of the United States and the world. Sports fields have had similar changes.

Nevertheless, through the years, a number of problems and questions have arisen in the course of implementing the method and the way greens and sports fields are maintained. After years of investigation, the USGA Green Section introduced its Specifications for a Method of Putting Green Construction in 1960. The method utilized sand as the principal component of the root zone mix to provide adequate drainage and resistance to compaction, and incorporated a perched water table in the profile to provide a reservoir of moisture for use by the turf.

During the past 10 to 15 years, changes have occurred in the way greens and sports fields are maintained and in the number of products and technologies that have been developed. Play has increased, golfers have demanded closer mowing and perfection in maintenance, new grasses have been developed that have different maintenance requirements, and many more golf courses are using recycled water or poor-quality water sources for irrigation. A wide array of organic and inorganic soil amendments has been introduced, and ideas for new construction methods have been proposed. In addition to astronomic changes, the cost of golf course and sports field construction has increased dramatically.

It has been found that construction of creeping bentgrass golf greens with topsoil mixtures that contain 90 percent or more sand has led to the appearance of irregularly shaped areas of wilted or dead turfgrass known as localized dry spots (LDS). This hydrophobic condition was confined to the top 20 inches of soil in the LDS areas. This peculiar condition coincided with the presence of an organic coating on sand grains that was observed by scanning electron microscopy.

Turf managers from ten golf courses in Georgia completed a 34-question survey pertaining to management practices used on their respective greens. Dry spots occurred at all locations surveyed and no correlation was observed between management practices and the severity of LDS. No differences in soil chemical properties were found, but water droplet penetration time was greater in the LDS areas.

Soil layering affects water retention in sports turf soil profiles. Sports turf areas are often constructed by

placing a root zone soil mixture over coarse-textured layers such as sand or gravel. This soil layering creates a calculated perched water table in the root zone that the grass can use over time, instead of water just draining from the rootzone.

Research was done to determine the degree to which drainage and water retention in soil mixtures were affected by properties of the underlying layers. Water retention in a soil mixture layer was greatest when a gravel sub-layer was used. The next greatest water retention was documented when sand was placed over gravel. Sand and soil sub-layers resulted in the least water retained. The trend in golf greens construction during the past three decades has been towards putting greens with at least 90 percent sand and limited amounts of silt, clay, or organic matter used in the mix. High sand-based systems typically have low cation-exchange capacity (CEC) and high drainage. These systems are prone to nitrate leaching and could possibly contribute to ground or surface water contamination.

Clinoptilolite zeolite has a high CEC and a large affinity for ammonium ions and water. Sand plus this form of zeolite had a lowered concentration of nitrate and ammonium in drainage water while the zeolite doubled the water retention and increased CEC 200 fold. Nitrate and ammonium leaching was 86 and 99 percent lower than un-amended sand. The greatest reduction of nitrogen leaching was found from when the sand was amended with zeolite at the highest rate in the experiment.

The nitrogen fertilizer use efficiency was improved by 16 to 22 percent with the addition of zeolite to sand, depending on nitrogen application rate. Amendment of sandy rooting media with this type of zeolite promoted better fertilizer nitrogen uptake by turfgrass, and reduced nitrogen leaching from a highly leachable sand-based soil system.

*Adapted from an article by Robert L. Morris & Dr. Dale Devitt in Southwest Trees & Turf, Oct. '98*

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## ALCA Announces Sponsorship of Green Industry Web Search Engine WWW.LANDSCAPESEARCH.COM

**Herndon, VA, December 8, 1999** – ALCA recently announced its exclusive sponsorship of a new search engine, [www.landscapesearch.com](http://www.landscapesearch.com), which contains searchable links to thousands of Green Industry related web sites.

The search engine was designed to give individuals searching for green industry related information a resource where they may efficiently search and find the web content they are looking for. The search engine is different from other more general search engines in that only web sites that are related in some way to the green industry are included. This limitation allows for much more efficient searching and alleviates the frustration of retrieving irrelevant web sites.

“ALCA is excited to be the exclusive sponsor of [www.landscapesearch.com](http://www.landscapesearch.com) as we feel that the search engine will truly maximize the internet for our industry by collecting and disseminating information from one central location”, said Debra Holder, ALCA Executive Director.

Green industry related companies may submit their web sites to the search engine free of charge by visiting the site and selecting the “Add Your Web Site” option.

Future plans for the site include several new web-based services geared towards landscape contractors, suppliers and their customers and are slated for release during the course of 2000. Further information will be posted on the site as services are launched.

Advertising opportunities are currently available and green industry related companies who are interested may call the ALCA office at 800/395-2522 or go to <http://www.isproductions.net/landscape/advertising.html> for more information.

ALCA represents approximately 2,000 professional interior and exterior landscape maintenance, installation and design/build contracting firms and suppliers nationwide.

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## Certified Landscape Technician Program Underway on the Big Island

*Jay Deputy  
Education Specialist, CTAHR*

The Hawai'i Island Landscape Association has been awarded a state Employment and Training Fund grant to fund the training and testing of maintenance landscape professionals in Hawaii. The national Certified Landscape Technician program is administered by the Associated Landscape Contractors of America (ALCA). The one-year pilot program, which began May 1, will focus on the Big Island this year before going statewide in 2000. The Program is currently coordinated from the HILA office space in Keahole Ag Park in Kona. Coordinators, Garrett Webb and Diana Duff are available in the office from 9-5 Tuesday through Thursday.

The first round of 12 classes was recently completed. Classes for the fall will be conducted in duplicate afternoon and evening sessions beginning on January 4. Afternoon sessions will be held from 1-4pm at the Mauna Lani Resort, evening sessions will be held from 6-9pm at Kealahou High School. The coordinators are working now to inform the public and those in the landscape industry about the program and preparing a test site for the certification testing next spring.

This new program marks the first time that Hawai'i has provided standardized training and testing for gardeners. It is designed to benefit landscape maintenance personnel by increasing their knowledge and skills in the field while establishing standards to strengthen their professional image in the industry and the community. The certification of gardeners will also help employers and consumers evaluate the technical ability of the gardeners they hire. The goals of the program are to develop a highly skilled workforce for the landscape industry trained in practices designed to protect and improve the quality of our Hawaiian environment.

Anyone is welcome to take the training classes, however, certification is only available to those with experience in the field. Certification applicants must be able to verify having at least 2 years field experience in the landscape industry or 1 year of field experience plus successful completion of a training or education program in the landscape field. The Certified Landscape Technician Program is not a state regulation or requirement. Certification is not a substitute for a state land-

scape contractor's license or any state issued pesticide license.

The cost for each class is \$25, except First Aid in the Landscape which is \$35. A package price for all 12 classes is available for \$275. The price of the Certification Test, which will be conducted once a year, is \$150. Classes are taught in classroom situations with outdoor and/or hands-on experience where possible. Students should come prepared to take notes and do some problem solving in class.

A brief description of the 12 classes is provided below.

#### **Plant Identification**

Describes characteristics and growing conditions of 60 landscape plants

#### **Sodding Turf / Tree Planting**

Calculating area for laying sod. Proper grading, preparation and installation of rolled sod. Proper technique for planting trees including guying and staking.

#### **Basic Pruning**

Basics of plant growth. Tools and techniques for pruning shrubs and trees.

#### **Advanced Pruning**

Review of proper cutting procedures. Study of tree systems and techniques for large tree pruning.

#### **Turf Maintenance Equipment**

Review of safe use and maintenance for mowers, riding mowers, front deck mowers, weed trimmers, edgers and blowers.

#### **Irrigation Plan Reading and Parts Identification**

Basics of landscape and irrigation plan reading, parts identification and sprinkler head adjustment.

#### **Irrigation Controllers and Pipe Repair**

Basic irrigation electronics, programming controllers and pipe repair.

#### **Truck & Trailer / Chain Saw Operation Advanced**

Proper techniques for operating a truck and trailer. Safe operation, maintenance and in-depth mechanics of chain saws.

#### **Turf Management – Fertilizing and Aerating**

Developing a nutrient management plan, core cultivation and verticutting turf.

#### **Pesticide Theory**

Review of pesticide safety, reading labels and calculating application rates.

#### **Pesticide Application**

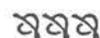
Practice applying pesticides and using proper safety and protection gear.

#### **First Aid for Landscapers**

Red Cross First Aid class with special emphasis on safety and first aid for landscapers. Students can receive a Red

Cross First Aid Certification upon completion of this course by passing the Red Cross test.

Members of the landscape industry interested in registering for certification, working as teachers, judges or volunteers of equipment or time to the program are encouraged to call the HILA office in Kona. Anyone can call for more information about the program at 326-9738 or write the Hawai'i Island Landscape Association, PO 1594, Kailua-Kona, HI 96745, or e mail to: hila@aloha.net.



## **Web Access to Information from CTAHR** *(continued from p. 9)*

Journal Series offprints are stored in Hamilton Library and the archives of the Hawaii State Library System.

While the journal and thesis/dissertation databases are of interest mostly to scientists and other scholars, the third database of the college's publications may well contain "something for everyone." Its 7000-plus entries going back to about 1900 detail generations of research and extension effort by the college's personnel. The database indicates which of the titles are still available in print, and most of those still available can be obtained for free from the CTAHR publications office. The titles that are out of print can be found in Hawaii's libraries.

#### **"Ask the Experts"**

A new, developing feature of the CTAHR Web site is called "Ask the Experts." This is a way to record the knowledge of the college's experts so that people needing answers to "frequently asked questions" (and some not so frequently asked) can get the information without having to obtain a publication or contact the expert in person. CTAHR faculty enter information into the ATE database in the form of questions and answers. Users of the database search for particular terms, and all questions relevant to those words are found.

#### **Other information sources**

While you are at the "information table" at CTAHR's Web site, you may want to check out several other sources available there. Knowledge Master focuses on pests of plants and the home, including insects, plant diseases, slugs&snails-etc., as well as weeds. The

Farmer's Bookshelf contains production information about many fruits, vegetables, and ornamental plants for both professional growers and home gardeners. The Pesticide Information Retrieval System contains information of importance to commercial users of agricultural chemicals.

#### How to get there

Not everyone has a computer with Internet access, but most public libraries have such computers available for the use

of their patrons. You can direct the Web browser software to one of the specific locations given above, but the best way to start may be to go to the CTAHR "home" page, <<http://www2.ctahr.hawaii.edu>>. From there, you can click on "people, publications, and databases" or "extension and outreach" to find the links to reach the resources mentioned here, and much more.

www

## LANDSCAPE & ORNAMENTALS SHORT COURSE PROGRAM

See article on page 1-2

### Tuesday, February 15, 2000

7:30 Registration  
 8:00 Dr. Jerry Quisenberry USDA  
 9:00 Dr. Neil Reimer Hawaii DOA  
 10:15 Dr. Peter Bretting USDA/ARS  
 11:00 Dr. Robert Hollingsworth USDA

Luncheon speaker: Dr. Jim Knauss Scotts Company  
 1:30 Ray Cain Belt Collins  
 2:30 Dr. Bill McElhannon Agrivet Technical Svs  
 4:00 General Discussion

### TOPIC

Welcome and Overview of New USDA Facility in Hilo  
 Plant Pest Quarantine Issues  
 National Program in Floral and Nursery Crops  
 Is Biological Control for Insect and Mite Pests Feasible on Ornamental Crops?  
 Contrast® and Ovation®  
 Golf Course Landscaping with Maintenance in Mind  
 Plant Nutrition in Containers & in the Landscape

### Wednesday, February 16, 2000

7:30 Registration  
 8:00 Dr. Arnold Hara CTAHR  
 9:00 Dr. Janice Uchida CTAHR  
 10:15 Dr. Jim Knauss Scotts Company  
 11:00 Mr. Garrett Webb CLT Program

12:00 Lunch  
 1:30 Dr. Jim Knauss Scotts Company  
 2:30 Mr. Karl Drescher Chem Search/Opti-Gro  
 4:00 General Discussion

Low Risk Pesticides for Alien Pest Control  
 Biology and Control of Powdery Mildew Diseases  
 Diagnosing Plant Diseases  
 Bringing the Certified Landscape Technician Program to Hawaii  
 Plant Nutritional Diagnosis  
 Fertigation for Nursery and Landscape Applications

All inquiries or requests for program registration forms and hotel reservations should be directed to Madeleine Shaw at (808) 951-0055. Deadline for regular registration is Jan.31,2000



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, or to request to be removed from the mailing list, please contact:

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*Mention of a trademark, company, or proprietary name does not constitute an endorsement, guarantee, or warranty by the University of Hawaii Cooperative Extension Service or its employees and does not imply recommendation to the exclusion of other suitable products or companies.*

*Caution: Pesticide use is governed by state and federal regulations. Read the pesticide label to be sure that the intended use is included on it, and follow label directions.*

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

Kenneth W. Leonhardt  
Extension Specialists in Horticulture

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