WINTER 1998 VOLUME 4.1

COOPERATIVE EXTENSION • DEPARTMENT OF BOTANY AND PLANT SCIENCES • UNIVERSITY OF CALIFORNIA, RIVERSIDE

# CO-HORT

A NEWSLETTER FOR TURFGRASS AND LANDSCAPE ISSUES.

## LANDSCAPE LIBRARY

*by Dennis R. Pittenger*

*The following are summaries of reports included in the proceedings of the 1997 Landscape Management Research Conference and Field Day Program at UC Riverside on Sept. 18, 1997. Questions and requests for additional information should be addressed to the senior author of the report.*

### OVERVIEW OF OLEANDER LEAF SCORCH RESEARCH

**Michael J. Henry**
*University of California Cooperative Extension*
*Riverside and Orange Counties*
*21150 Box Springs Road, Moreno Valley, CA 92557*

A lethal "leaf scorch" disease of oleander (*Nerium oleander* L.) has been confirmed in the Palm Springs area, Orange County, western Riverside County and is continuing to spread to other parts of southern California. Estimated economic impact of the loss of oleanders on State highways alone is $75 million, with plant replacement adding another $50 million (replacing with concrete medians would cost $52 million). Replacement costs in residential landscapes in the Los Angeles basin could run between $55 and $100 million. The combined efforts of the investigators and collaborators working on this project have resulted in a number of significant findings and a substantial beginning of longer-term studies.

The bacterial pathogen, *Xylella fastidiosa*, has been confirmed as the causal agent. It is a new strain of the bacteria which is distinct from the strains that cause disease in grape, peach, plum, almond, and oak. In greenhouse studies, this new strain is also capable of infecting Madagascar periwinkle (*Catharanthus rosea* [L.] G. Don) and periwinkle (*Vinca major* L.), but field observations have yet to find these two common ornamentals to be infected. The oleander strain of the *Xylella fastidiosa* had an incubation period between inoculation and first symptoms from 5 to 13 months in the greenhouse.

The bacteria are spread by native and introduced species of sharpshooter insects. *Homalodisca coagulata*, the glassy-winged sharpshooter, is the species recently introduced from the southeastern United States. The two graphs below show its 1996 population fluctuation at two locations.

These insects are susceptible to endemic egg parasitic wasps and are potentially susceptible to egg parasites from Louisiana and Florida. While biological control of the bacteria-carrying insects will not be capable of controlling the disease, it may serve as

## INSIDE THIS ISSUE

a component in an overall integrated pest management (IPM) strategy to slow the disease's progress.

To date, no curative or protective treatment is available for controlling any strain of *Xylella fastidiosa*. Work continues to identify possible cultural control methods, plant species that are resistant and susceptible to this new strain, and insecticides that may be effective against the sharpshooter insects.

This report is based on the work of the following project researchers: Mathew Blua, Post Doctoral Researcher, U.C. Riverside; Marcella Grebus, Coop. Ext. Specialist, U.C. Riverside; Lawrence Hanks, Post Doctoral Researcher, U.C. Riverside; Janet Hartin, Farm Advisor, San Bernardino County; Michael Henry, Farm Advisor, Riverside County; Lori Lynch, Graduate Student, Economics Dept., U.C. Berkeley; Timothy Paine, Professor, U.C. Riverside; Dennis Pittenger, Area Farm Advisor, Southern Region; Alexander Purcell, Professor, U.C. Berkeley; Richard Redak, Assistant Professor, U.C. Riverside; Ursula Schuch, former Coop. Ext. Specialist, U.C. Riverside; Serguie Triapitsyn, Principal Museum Scientist, U.C. Riverside; Cheryl Wilen, Area IPM Advisor, Southern Region; David Zilberman, Professor, U.C. Berkeley.

Collaborators: Heather Costa, Coop. Ext. Specialist, U.C. Riverside; Phil Phillips, Area IPM Advisor, Ventura County; Fred Roth, Horticulture Professor, Cal Poly Pomona; Ann Gabric, Soil & Plant Laboratory, Orange, CA.

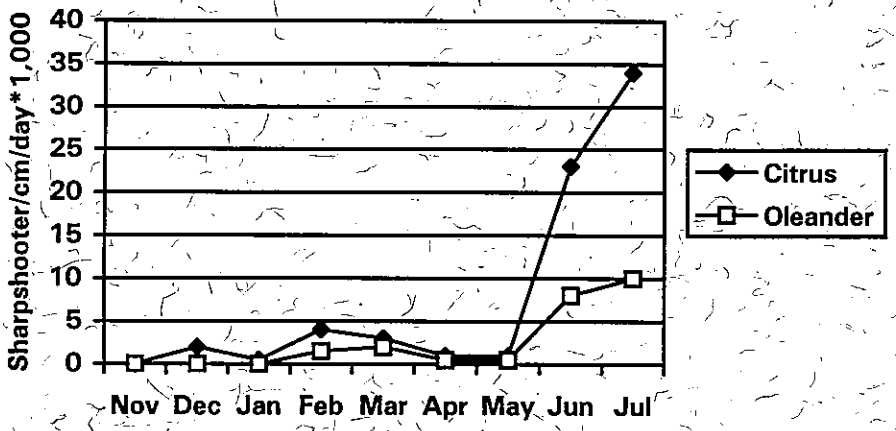



**Figure 1. Seasonal yellow sticky trap catches of *Homalodisca coagulata* on Citrus and Oleander in Irvine, CA.**

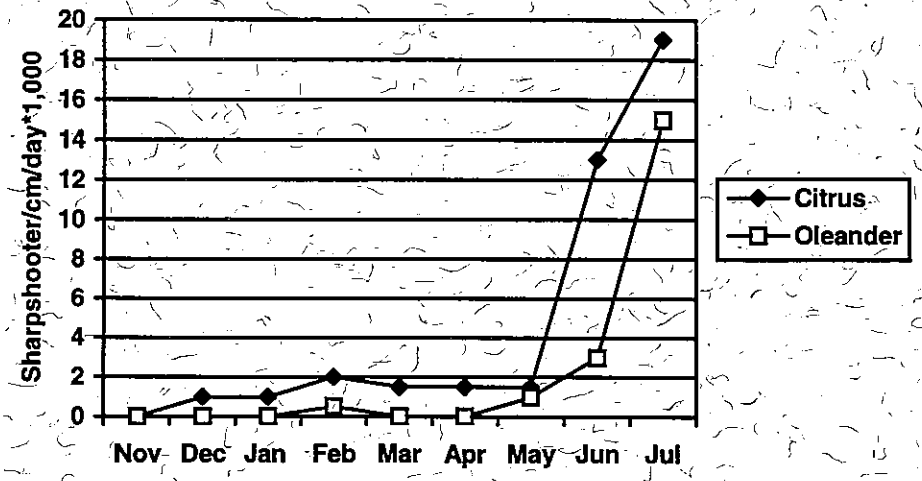



**Figure 2. Seasonal yellow sticky trap catches of *Homalodisca coagulata* on Citrus and Oleander in Riverside, CA.**

## BIOLOGY AND MANAGEMENT OF NUTSEDGE

**Jodie S. Holt**
*Dept. of Botany and Plant Sciences, University of California, Riverside, CA 92521*

Yellow nutsedge (*Cyperus esculentus*) and purple nutsedge (*Cyperus rotundus*) are regarded as two of the world's worst weeds. Both species are abundant in the warm regions of the world, but yellow nutsedge is more widespread than purple nutsedge in temperate zones due to its greater tolerance of cold temperatures. Yellow nutsedge is widely scattered throughout California, while purple nutsedge is more restricted in distribution. Purple nutsedge is more prevalent in southern than northern California and is scattered in central California, as well.

Both of these species are perennial sedges that resemble grasses, with triangular flowering stems. Leaves originate from the base of the stems, while at the ends of the stems long leaf-like bracts radiate out from a common point just below the umbrella-like flower clusters (spikelets). Yellow nutsedge is 6 to 30 inches tall and can reproduce by seeds (uncommon) or by underground tubers, which are hard, brown, round, and ½ to ¾ inch long. Purple nutsedge leaves are 2 to 6 inches long, while flowering stems are 12 to 24 inches tall. Purple nutsedge reproduces only by tubers, which are oblong, covered by reddish scales, and often formed in chains.

Tubers of yellow and purple nutsedge are produced along underground stems, or rhizomes, and may remain dormant in soil until conditions are right for sprouting. The tubers are the only vegetative part of the plant that overwinters, and can survive for several years in soil. Buds on tubers sprout under suitable conditions, generally in early spring, and produce new aboveground shoots and more rhizomes. New tuber formation begins 4 to 6 weeks after a new shoot emerges. Most tubers are produced in the upper 6 inches of soil. Without competition, yellow and purple nutsedge can produce 4 to 12 million tubers per acre. Both species are sensitive to low light, so competition can reduce their growth. However, shade does not inhibit tuber production so is not sufficient alone as a weed control measure.

Both yellow and purple nutsedge reproduce primarily by vegetative means (tuber sprouting) rather than by seeds, so control should be directed at interfering with tuber production. Cultural methods that delay emergence can give new landscape plantings an early advantage. Recent research at UCR to develop degree-day models for yellow nutsedge phenology shows promise for improving our ability to predict the timing of emergence of this weed. Cultural methods used successfully on these species in small areas are mulches and geotextiles, solarization, and hand removal. The best method is a combination of prevention plus maintaining a healthy coverage of desirable landscape plantings to shade and compete with the nutsedge species.

Only a few herbicides are registered for control of yellow and purple nutsedge in landscape and nursery situations. Success has been achieved with bentazon (Basagran), MSMA, metolachlor (Dual), glyphosate, and pelargonic acid. More recently, Manage has provided excellent control in turf.

## PALM ROOT REGENERATION STUDY

**Donald R. Hodel[1], James A. Downer[2], and Dennis R. Pittenger[1, 3]**
*[1]Univ. of Calif. Coop. Ext., Los Angeles County*
*2 Coral Circle, Monterey Park, CA 91755*
*[2]Univ. of Calif. Coop. Ext., Ventura County*
*669 County Square Dr., Ste. 100, Ventura, CA 93003*
*[3]Univ. of Calif. Coop. Ext., Southern Region*
*Dept. of Botany & Plant Sci., Univ. of Calif., Riv., CA 92521*

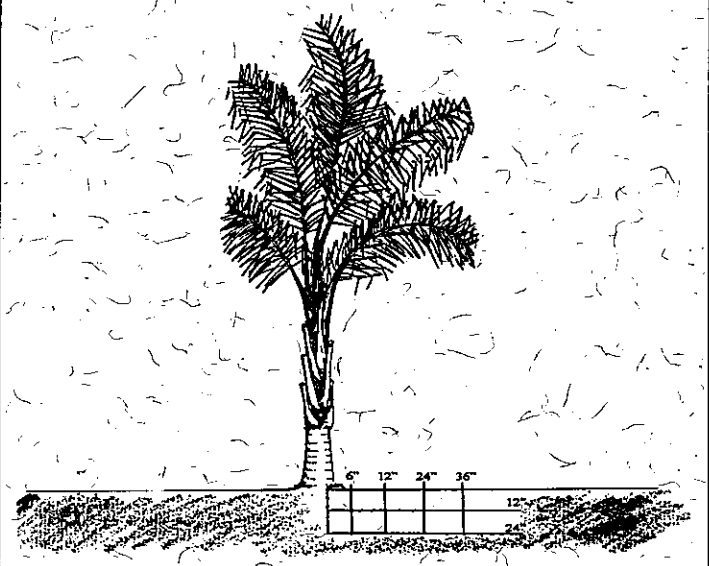
Large palms are a conspicuous and important element of the southern California landscape. They are the signature plant material and emblematic of the much popularized southern California lifestyle. Because of their woody, monocotyledonous nature, characterized by the production of fibrous, adventitious roots from the base of the stem, even large specimens usually can be transplanted successfully with relative ease and with a small root ball. This relative ease of transplanting gives them a distinct

economic advantage in landscape development and installation over conifers and large, woody, broad-leaved, dicotyledonous trees characterized by a branched, woody root system. Unfortunately, many large palms do not survive transplanting or require an inordinately long time to reestablish. Little is known about palm root distribution and growth and how they may affect survivability and reestablishment of large specimens in the landscape. In June 1997, we initiated a project at The Arboretum of Los Angeles County in Arcadia to study root distribution and growth in large specimen palms. A narrow trench six inches wide, 24 inches deep, and 36 inches long was dug at the base of three specimens each of 16 species (see below). The side of the trench facing the palm was divided into 6-, 12-, 24-, and 36-inch distance zones from the trunk. Each distance zone was subdivided into two depth zones of 12 and 24 inches, giving a total of eight zones in which to quantify root distribution (see Figure 1 on the following column). The trench was then back filled with perlite. The palms are irrigated at 100% of reference evapotranspiration. At three-month intervals for 15 months, each trench will be re-excavated and the roots counted, harvested, and weighed in each of the eight zones. We will correlate root distribution and growth with daylength, soil temperature, and distance from the trunk over a one-year period, hopefully enabling us to make recommendations about optimal root ball size and time of year for successful transplanting and rapid reestablishment.

**Species**

*Archontophoenix cunninghamiana* king palm
*Brahea edulis* Guadalupe palm
*Butia capitata* pindo palm
*Caryota mitis* fishtail palm
*Chamaerops humilis* European fan palm
*Livistona chinensis* Chinese fan palm
*Livistona decipiens* ribbon fan palm
*Phoenix canariensis* Canary Island date palm
*Phoenix reclinata* Senegal date palm
*Rhapidophyllum hystrix* needle palm
*Sabal minor* dwarf palmetto
*Serenoa repens* saw palmetto
*Syagrus romanzoffiana* queen palm
*Trachycarpus fortunei* Chinese windmill palm
*Trachycarpus wagnerianus* windmill palm
*Washingtonia robusta* Mexican fan palm

**Figure 1. Zones for Quantifying Palm Root Regeneration.**




## DISEASE SUPPRESSION WITH MULCHES

**James A. Downer**
*Univ. of Calif. Cooperative Extension, Ventura County*
*669 County Square Dr., Ste 100, Ventura, CA 93003*

Root rot of many ornamental trees, shrubs and herbaceous plants is caused by the fungus *Phytophthora cinnamomi* (Rands.). The fungus was probably introduced into California in the late 1800's (10) and has spread rapidly with nursery stock as gardens were planted throughout the state (9). The fungus is microscopic--not visible, even with a hand lens. Diagnosis of Phytophthora root rot (PRR) is achieved with visual examination of roots for symptoms of root rot, and isolation of the fungus from the roots. Monoclinal antibody test kits can also detect the presence of *Phytophthora* in roots (5). There are relatively few fungicides that provide effective control of the disease. Subdue (metalaxyl, Novartis) and Chipco/Aliette (Rhône-Poulenc) both give good disease control on various hosts/crops. Unfortunately, some *Phytophthora* species have developed resistance to metalaxyl, and few new fungicides are

available because of the high costs of pesticide registration.

Alternative methods of controlling the disease are helpful. Biological control of PRR has been studied for many years (3). Coffey (1984) proposed an integrated method of controlling root rot in avocado, which involved chemical and physical treatments and resistant rootstocks. The discovery that mulches are useful was made in Australia about 40 years ago (1). Applying high rates of calcium (as lime) and mulches (as manures, cover crops, or chopped tree trimmings) controlled PRR. Guy Ashburner empirically developed this system of controlling PRR in an attempt to recreate the rainforest litter/mulch layers in his grove. The Ashburner method is widely cited in the literature as a successful example of biological control of PRR. Recent attempts to recreate the Ashburner system in California have been limited to avocado orchards. Although the system has not been studied in landscapes, some of the basic findings are directly applicable to landscape situations.

Cook and Baker (3) stated, "A program for disease control, by whatever means, must fit into cultivation practices or the practices must be modified before the control program can be adopted." This is a wise precept for growers or landscape managers to understand. The Ashburner system has been successfully recreated by Menge in Somis, CA (7). Mulches promoted growth and reduced disease in avocado plantings (Menge, personal communication). In another study, opposite findings were observed. Both groves were in Somis with similar soil types planted to avocados. The grove in which disease was reduced was under irrigated. Where trees are water stressed, mulch treatments promote growth in a young orchard. No amount of biological control or even chemical control can save trees from the combination of excessive moisture and *Phytophthora cinnamomi*. Therefore, soil moisture levels must be monitored if mulching is to be used successfully in landscapes or orchards for control of root diseases.

Organic mulches promote rooting of avocado, but are less effective in citrus. Similarly, many ornamental plants will produce roots in mulch layers. The interface of mulch and soil is the zone where disease is suppressed. It is also an area of high biological activity, increased diversity of fungal organisms, and increased enzyme activity. *Phytophthora* is eaten, dissolved and starved in this part of the soil and is thus rarely found here. Healthy roots predominate. Three to six inches deeper in the same soil, roots rot from PRR. Mulch quality is important. Healthy, freshly fallen avocado leaves are very favorable to the growth of *Phytophthora cinnamomi* and these leaves are often used to bait the fungus from soil. Leaves lose their attraction with age (8). We have found that yardwaste mulches with copious quantities of undecomposed wood are effective in suppressing PRR.

Ashburner also added calcium (as lime) to his grove to promote the suppressive conditions necessary for PRR control. There are many reasons why lime may promote disease suppression. Since PRR can develop over wide pH ranges, pH effects are probably not that important. A more likely hypothesis is that populations of fungal/bacterial antagonists are stimulated by the pH changes. Broadbent and Baker suggested that biocontrol bacteria were stimulated at the increased pH levels. Recent work by Messenger suggests that calcium ions are fungicidal to *Phytophthora cinnamomi*. Sporangia, which produce the primary infective propagule (zoospores), are reduced in size and numbers by high calcium levels in soil. In California trials, we have used gypsum (calcium sulfate) as the calcium source for the Ashburner system. Unlike tropical Australia, California soils do not need pH correction. Gypsum does not affect soil reaction in most California soils. Even though many of our soils and waters are already calcic, we have found that gypsum mulches do have an effect on soil moisture tension and growth of the trees (Table 1). Gypsum treatments also appear to have a disease retarding effect in our field trials. Gypsum affects the soil matric potential making the soil environment less conducive to PRR (Figure 1). It is uncertain whether moisture effects or direct effects on the fungus are most important. It is certain that wet soil conditions favor PRR, mostly because increased soil matric potentials result in production of sporangia as well as release and swimming of zoospores of *Phytophthora* (4).

*Phytophthora cinnamomi* is a water mold. This common name for the fungus is a good one as it indicates the vital link that *Phytophthora cinnamomi* has with free water. Management of PRR must rely not only on biological or chemical methods but also on a good understanding of soil and plant-water relations and the cultural conditions that manipulate

the soil-plant-water environment. Poor management of plantings under mulch can exacerbate root rot diseases.

## References


1 Broadbent, P. and K.F. Baker. 1974. Behavior of *Phytophthora cinnamomi* in soils suppressive and conducive to root rot. Australian J. Agric. Res. 25:121-137.

2 Coffey, M.D. 1984. Phytophthora root rot of avocado. Avocado Grower 8:19-25.

3 Cook, J.R. and K.F. Baker. 1983. The nature and practice of biological control of plant pathogens. The American Phytopathological Society, St. Paul, Minnesota 539pp.

4 Duniway, J.M. 1979. Water relations of water molds. Ann. Rev. Phytopathol. 17:431-460.

5 MacDonald, J. D., J. Stites, and J. Kabashima. 1990. Comparison of serological and culture plate methods for detecting Phytophthora, Pythium and Rhizoctonia in ornamental plants. Plant Disease 74:655-659.

6 Messenger, B. 1996. Effects of gypsum soil amendments on Phytophthora root rot of avocado. Ph.D. dissertation, University of California, Riverside.

7 Menge, J.A. 1997. Professor, University of California Riverside, Department of Plant Pathology, personal communication.

8 Pegg, K.G. 1977. Soil application of elemental sulfur as a control of Phytophthora cinnamomi root and heart rot of pineapple. Austral. J. Exp. Agric. Anim. Husb. 17:859-865.

9 Zentmeyer, G.A., K.F. Baker, and W.A. Thorn. 1952. The role of nursery stock in the dissemination of soil pathogens. Phytopathology 42:478-479.

10 Zentmeyer, G. 1982. Is Root Rot Native in California? Avocado Grower 6:10-12.

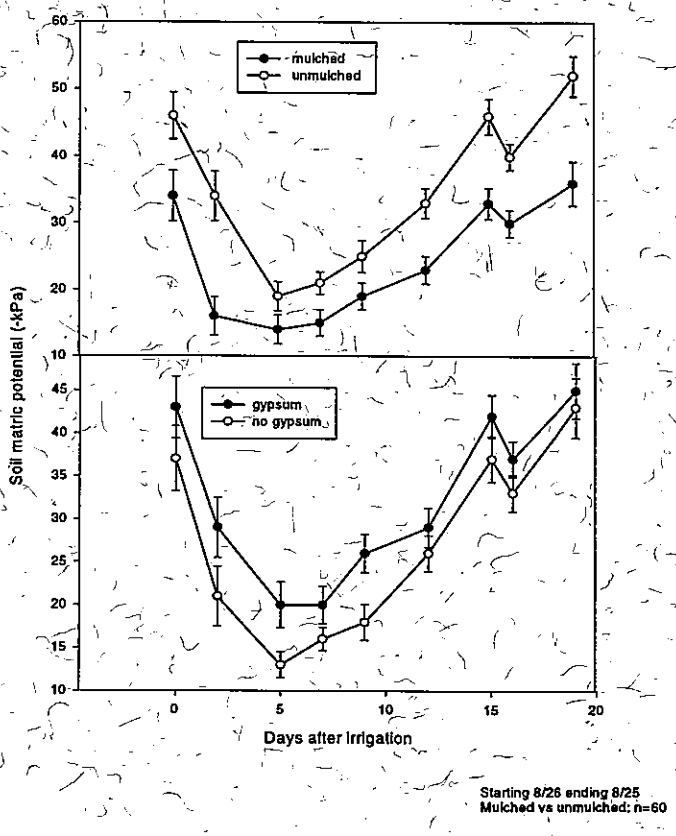

*Use of trade names does not imply a product preference by the author, nor does absence of other product names imply lack of efficacy of those products.

**Table 1. Growth of avocado under various mulch environments.**

| Treatment | | Plant Volume ($m^3$) 1996 | 1997 |
|---|---|---|---|
| Wood Chip Mulch | | | |
| | yes | 3.79 | 11.9 |
| | no | 4.33** | 12.5** |
| Gypsum | | | |
| | yes | 4.30 | 13.2 |
| | no | 3.81** | 11.1** |
| Aliette fungicide | | | |
| | yes | 4.57 | 13.4 |
| | no | 3.54*** | 10.9*** |

**, and *** refer to the probability of difference (P = .001 and .0001, respectively) for within treatment category comparisons of various means.

**Figure 1. Soil moisture tension in mulched trees.**



## BAITS FOR ANT CONTROL

**John Klotz**
*Dept. of Entomology, University of California, Riverside*

Argentine ants and California fire ants are two of the most common urban ant pests in southern California. Currently, insecticide sprays are the most common treatment for infestations of these ants, but effective baits will soon be available.

Baits are target-specific, and use less insecticide. In comparison with sprays, baits offer distinct advantages. First, very little insecticide is required, and consequently, baits are safer for the environment and the user. Second, baits eliminate the necessity of finding the nest, usually a labor-intensive procedure because of the cryptic nesting habits of many pest ants. And third, baits capitalize on the social behavior of ants, whereby scout ants recruit nestmates to a newly discovered bait, and these recruited ants return to a centrally located nest to share the bait with the rest of the colony.

A good ant bait should be highly attractive, nonrepellent and slow-acting. Many ants feed primarily on honeydew and are therefore attracted to sweets. Others prefer oils or fats. Ant baits often use one or the other or both as food attractants. The bait toxicant should be nonrepellent and slow acting to ensure that it is collected and then passed around to the entire colony before taking effect.

Our research with Argentine ants has demonstrated that a low concentration of boric acid mixed with sugar and water is an effective slow-acting bait. Some of the advantages of this bait include the delayed toxicity and water solubility of boric acid at low concentrations. Additionally, the water carrier and sugar attractant meet the requirements of ants for moisture and carbohydrates. This bait is an integral component of our pest management program for Argentine ants.

Amdro is a granular ant bait that will soon be commercially available in California. It is effective against California fire ants, Argentine ants, and harvester ants. Amdro uses hydramethylnon as the toxicant dissolved in soybean oil on a corn grit base. Hydramethylnon is a metabolic inhibitor, which is slow acting.

## GROWTH OF LANDSCAPE TREES PLANTED FROM THREE CONTAINER SIZES

**Janet S. Hartin[1] and Dennis R. Pittenger[2]**
*[1]University of California Cooperative Extension, San Bernardino and Los Angeles Counties*
*777 E. Rialto Avenue, San Bernardino, CA 92415*
*[2]University of California Cooperative Extension, Southern Region and Los Angeles County*
*Dept. of Botany and Plant Sciences, University of California, Riverside, CA 92521*

Fifteen *Quercus agrifolia* and fifteen *Magnolia grandiflora* container-grown trees were planted at the University of California, Riverside in June 1992. The planting is a completely random experimental design with five replications. Five trees of each species were transplanted from 5-gallon containers, five were transplanted from 15-gallon containers, and five were transplanted from 24-inch boxes directly into the field. The objective of the study was to determine the relationship of container size to future growth of each species.

Trees were planted on a 20 x 20 feet spacing, and irrigated based on reference evapotranspiration ($ET_o$) from the on-site California Irrigation Management Information System (CIMIS) weather station. Soil moisture was not a limiting factor. Trees were fertilized in 1993 and 1994 at 3 lb N/1000 $ft^2$ of drip line area. Weeds have been managed with a combination of preemergent herbicide (Surflan), hand weeding, and contact herbicide.

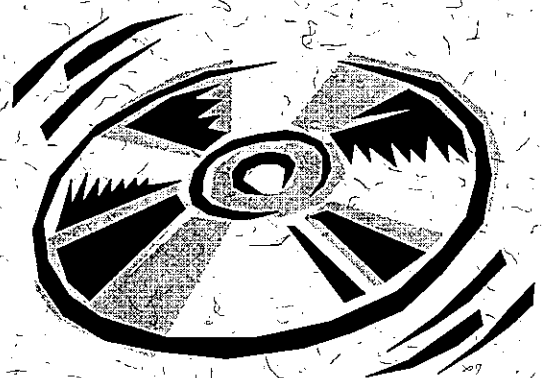
Semiannually, trunk circumference at six-inches above the soil level was measured. Between 1992 and 1994, there were significant differences between trunk circumference and container size for both *Quercus* and *Magnolia*. In both cases, trunk circumference was positively correlated with container size. Between May 1994 and August 1997, there was no significant difference among trunk circumference of the *Quercus*, regardless of container size while there continued to be a significant difference between Magnolia trunk circumference and container size.

## A PHOTO CD OF HERBICIDE DAMAGE SYMPTOMS ON ORNAMENTALS

Purdue University has released a photo CD, titled "Picture the Damage!" ($39.95), of foliar damage on selected trees, shrubs, groundcovers, and herbaceous perennials caused by misapplication of herbicides. Damage on 21 plant species (6 trees, 7 shrubs, 6 groundcovers, and 2 herbaceous perennials) is presented in 500+, high quality, four-color images that are categorized by plant and herbicide. The CD is a Kodak Portfolio that can be viewed from a CD-Rom equipped computer (either MAC OS or Windows) or from an ordinary TV screen equipped with a Kodak Photo CD player.

The layout is very simple. A user must first select the plant species they want to see, then choose the herbicide suspected (from 5 to 11 depending on species) to have caused the damaged suspected. If the pictures do not match the damage seen, the user can go back to the main menu for another try.

Unfortunately, the limited number of plant species are not commonly found in California landscapes, and nearly all of the herbicides included are post-emergent materials. While this CD may not be very helpful in diagnosing herbicide damage problems in California, it may be of interest to anyone thinking of developing a similar product. Further information can be obtained by contacting the lead author; Dr. Michael Dana, Dept. of Horticulture and Landscape Architecture, Purdue University, e-mail: dana@hort.purdue.edu., Phone (765) 494-5923.



## TURFGRASS TIMES

*by Victor A. Gibeault*

*The following releases are from the November 1997 issue of "Better Turf Thru Agronomics," which is an activity of the University of California Turfgrass Research Advisory Committee. The newsletter was written by Deborah Silva and edited by Victor A. Gibeault.*

### Reducing Yard Waste in California: Grasscycling May Have an Important Role

*Grasscycling reduces solid waste going to landfills and helps to reach the goals of the state's Integrated Waste Management Act.*

California's Integrated Waste Management Act mandates a 50 percent reduction in waste that each county and city send to landfills by the year 2000, using 1990 as the base year.

If widely adopted by homeowners, grasscycling could reduce California's urban solid waste by 5 to 10 *percent - a* significant drop - since 20 percent of solid waste dumped in landfills is estimated to be yard (green) waste, say UC turfgrass researchers.

Grasscycling (returning clippings to the turf after mowing) has been practiced by parks and golf courses for years, but home owners seeking a manicured lawn usually bag and dump clippings at landfills.

Grasscycling is not recommended when an exceptionally uniform surface is required, such as putting greens, sod farms, major league sports fields, and other athletic facilities, but it is practical for home lawns and has environmental and financial benefits:

- Saves time and energy. No need to bag, remove, or haul clippings.
- Saves landfill space. Could reduce statewide yard waste by 5-10%.

- Encourages healthier grass stand. Decomposing clippings release nutrients to soil and may enhance soil microbial activity.

- Saves money. Reduces need for nitrogen fertilizer by 20-30% due to nitrogen returned to soil from decomposing clippings.

Grasscycling is possible with any type of mower, but the most effective are mulching (also called recycling) mowers, which have an enclosed housing where clippings are reduced in size and chipped to fine debris before discharge beneath the mower. Recycling mowers facilitate the disappearance of clippings into the turf canopy to mulch the soil and aid or enhance the decomposition of clippings due to their smaller size.

Once-a-week mowing is frequent enough for successful grasscycling, and the "1/3 rule" should be followed: Turf should be mowed often enough that no more than 1/3 of the length of the grass blade is cut in any one mowing. When this rule is enforced, short clippings will fall through the canopy to decompose and will not cover the lawn surface. Homeowners concerned about thatch buildup and an unsightly lawn appearance should consider switching to recycling mowers to help reduce solid waste volume while maintaining a manicured look to the yard.

## Nitrogen Fertilizers Evaluated on Tall Fescue for Two Years

*At equal annual nitrogen (N) rates, the N source, and number of applications significantly affected fertilizer performance. On tall fescue, an annual rate of 6.0 lb N/1000 ft$^2$ resulted in good quality turf during the two years of study.*

Results of two one-year nitrogen (N) fertilizer studies on a mature stand of 'Bonsai' tall fescue at UCR showed that at equal annual nitrogen (N) rates, the type of N source and the number of applications significantly affected visual turfgrass quality ratings of fertilizer performance. Fast- and slow-release products were evaluated and performed well in both studies.

Tall fescue *(Festuca arundinacea)*, a heat- and drought-tolerant, cool-season turf with good color year round, is used widely in southern California.

An annual rate of 6.0 lb N/1000 ft$^2$ produced good quality tall fescue, receiving an average visual quality rating of 6.4 on a scale of 1-9, with 1=poorest, 5=minimally acceptable, and 9=best tall fescue. Ratings were taken biweekly.

"Tall fescue nitrogen fertilizer strategies should be developed in consideration of seasonal growth patterns, once the annual nitrogen rate has been defined," concluded the UCR researchers, since environmental conditions, particularly seasonal temperatures, influenced visual quality and clipping yield measurements.

The two one-year studies had 16 and 12 N treatments, respectively, with 8 N treatments in common, permitting two-year comparisons, which are summarized in Table 1 on the following page.

Results showed that clipping yields are a good indicator of turf quality. Treatments with the highest annual visual turfgrass quality ratings on average also had the greatest annual accumulative clipping yields. Clipping yields are an indirect indicator of the amount of nitrogen released by a fertilizer and absorbed by the turf.

Granular fertilizers were applied quarterly to bimonthly at rates ranging from 1.0 to 2.0 lb N/1000 ft$^2$ per application. Spray-applied treatments were applied monthly, bimonthly, or quarterly at a total annual rate of 2.0 to 7.7 lb N/1000 ft$^2$.

The studies were sponsored by Itronics Metallurgical, Inc.; Greener Pastures, Inc.; Sea Source, Inc.; J. R. Simplot Company; United Horticultural Supply; the Scotts Company; IMC Vigoro; CIC Canola; Pursell, Inc.; and the UCR Turfgrass Research Program.

Investigators included **Robert Green**, UCR Turfgrass Research Agronomist; **Grant Klein**, UCR Staff Research Associate; **Janet Hartin**, Environmental Horticulture Advisor for San Bernardino and Los Angeles Counties; and **Eliseo Baltazar**, UCR undergraduate Student Research Assistant.

Table 1. Visual Quality Scores for Two-Year Fertilizer Treatments on Tall Fescue.

| Product ($N$-$P_2O_5$-$K_2O$) | Consistency Score[a] | Overall Visual Quality Rating (1-9)[b] | lb N/1000 ft² per 12 months Yr. 1 | Yr. 2 | Number of Applications Yr. 1 | Yr. 2 |
|---|---|---|---|---|---|---|
| Gold'n'Gro 20-1-7 | 126 | 6.8 | 7.7 | 6.0 | 12 | 12 |
| Greener Pastures 15-1-15 | 123 | 6.6 | 6.0 | 6.0 | 5 | 5 |
| Turf Rally 16-4-8 | 122 | 6.6 | 6.0 | 6.0 | 5 | 5 |
| UCR Check[c] | 117 | 6.5 | 6.0 | 6.0 | 6 | 6 |
| Polyon 43/42-0-0 | 116 | 6.6 | 6.0 | 6.0 | 4 | 4 |
| Turfgo 25-5-16 | 114 | 6.4 | 6.0 | 6.0 | 3 | 4 |
| Gold'n'Gro 20-1-7 | 107 | 6.2 | 3.9 | 3.0 | 6 | 6 |
| Gold'n'Gro 20-1-7 | 88 | 5.6 | 2.5 | 2.0 | 4 | 4 |

[a] Scores for 8 two-year treatments based on number of rating dates (50 total) that visual quality was ranked in one of three categories: 3 points for high ratings (≥ 6.8); 2 points for medium ratings (5.4 – 6.7); 1 point for low (≤ 5.3).
[b] For meaning of visual quality ratings, see text. Least significant differences (LSD) for overall quality ratings = 0.1 at a probability of 5% (P 0.05).
[c] Turf Supreme, 16-6-8; Turf Gold 21-3-5; Poly Supreme, 23-5-10; and Nitra King, 22-3-9.

## Evaluation of 23 Slow- and Fast-Release Nitrogen Fertilizers on Overseeded Common Bermudagrass in the Cool Season

*On overseeded common bermudagrass maintained similarly to fairway conditions, 4.0 lb N/1000 ft² yielded good turf color during the 1996-1997 cool season.*

Results of a one-season study to evaluate the performance of 23 nitrogen (N) fertilizer treatments applied on a mature stand of overseeded 'Arizona common' bermudagrass maintained similarly to fairway conditions during a five-month cool season from November 1996 to April 1997 have shown that a rate of 4.0 lb N/1000 ft² gave good turf color with an average rating of 6.6 on a scale of 1-9, with 1 = brown, 5 = minimally acceptable and, 9 = darkest green overseeded bermudagrass.

Table 1 on the following page summarizes results. Slow- and fast-release products performed well. Seasonal application rates, N source, and number of applications significantly affected visual turf color ratings.

These findings suggest that if N leaching is a concern, then there are products available with various amounts of slow-release N that should reduce the potential for N leaching.

Additional research is needed to confirm the results reported here for the 1996-1997 cool season.

The study was sponsored by Bandini Fertilizer Co.; Hydro Agri North America, Inc.; IMC Vigoro; J. R. Simplot Co.; The Scotts Co.; Sea Source, Inc.; Target Specialty Products; Tessenderlo Kerley; United Horticultural Supply; Vicksburg Chemical Co.; and the UCR Turfgrass Research Program.

Investigators were **Robert Green, Grant Klein, Janet Hartin, and Eliseo Baltazar.**

Table 1. Visual Color Scores for Nitrogen Fertilizer Treatments Applied on Overseeded Common Bermudagrass.

| Product ($N$-$P_2O_5$-$K_2O$) | Consistency Score[a] | Overall Visual Color Rating (1-9)[b] | lb N/1000 ft² per 5 months | Number of Applications[c] | %N Slow Release | %N Fast Release |
|---|---|---|---|---|---|---|
| Bandini 28-4-6 | 27 | 6.9 | 4.0 | 4 | 53 | 47 |
| Multicote 12-0-43 | 26 | 7.0 | 4.0 | 2 | 100 | 0 |
| ProLong 21-4-6 | 26 | 6.9 | 4.0 | 4 | 39 | 61 |
| Bandini 22-4-22 | 26 | 6.9 | 4.0 | 4 | 36 | 64 |
| Turf Royale 21-7-14 | 26 | 6.9 | 4.0 | 5 | 0 | 100 |
| K-Power 13.7-0-44.5 | 26 | 6.8 | 4.0 | 10 | 0 | 100 |
| Multicote 40-0-0 | 26 | 6.6 | 4.0 | 2 | 100 | 0 |
| Nitra King 22-3-9 | 25 | 6.6 | 4.0 | 5 | 0 | 100 |
| Re-Gain 16-3-7/6-2-6 | 25 | 6.4 | 4.0 | 5 | 66 | 34 |
| ProBalance[d]/Nitra King | 24 | 6.7 | 4.0 | 4 | 0 | 100 |
| Turfgo 23-5-10 | 24 | 6.7 | 4.0 | 4 | 68 | 32 |
| Turf Rally 6-10-10/16-4-8 | 24 | 6.6 | 4.0 | 5 | 97 | 3 |
| Classic Royale 15-15-15 | 24 | 6.6 | 4.0 | 5 | 0 | 100 |
| Turfgo 16-23-16 | 24 | 6.5 | 4.0 | 4 | 44 | 56 |
| Scotts 16-25-12/30-3-9 | 23 | 6.6 | 4.0 | 4 | 34 | 66 |
| HydroPrill 16-15-15 | 23 | 6.5 | 4.0 | 5 | 0 | 100 |
| ParEx 24-4-12/10-22-22 | 23 | 6.4 | 4.0 | 3 | 44 | 56 |
| Endure/Polyon/Turf Gold[d] | 22 | 6.3 | 4.0 | 4 | 66 | 34 |
| ParEx 28-3-10/10-22-22 | 22 | 6.1 | 4.0 | 3 | 62.5 | 37.5 |
| Trisert KS[e] 15-0-12 | 21 | 6.5 | 4.0 | 5 | 45 | 55 |
| N-Sure Lite[e] 30-0-0 | 21 | 6.3 | 4.0 | 5 | 37 | 63 |
| K-Power 13.7-0-44.5 | 20 | 6.1 | 2.5 | 10 | 0 | 100 |
| 6-20-20/IBDU[d] | 20 | 6.0 | 4.0 | 3 | 67.5 | 32.5 |
| Check | 10 | 4.7 | 0 | 0 | 0 | 0 |

[a] Scores for 23 N fertilizer treatments based on number of rating dates (10 total) that visual color was ranked in one of three categories: 3 points for high rating (≥ 6.8); 2 points for medium rating (5.4 – 6.7); 1 point for low (≤ 5.3).

[b] For meaning of visual color ratings, see text. Least significant difference (LSD) for overall color ratings = 0.1 at a probability of 5% (P 0.05).

[c] Application rates ranged from 0.25 to 2.0 lb N/1000 ft².

[d] Analyses of ProBalance, Endure, Polyon, Turf Gold, and IBDU are 15-15-15, 15-15-15, 43-0-0, 21-3-5, and 31-0-0, respectively.

[e] Two treatments were spray-applied and received 0.75 lb N/1000 ft² per application following a granular application of 6-20-20 at 1.0 lb N/1000 ft² in 11/96.

## UCR Extension Develops Certificate Program In Turfgrass Management

With advice from members of the UC Riverside Turfgrass Research Advisory Committee (UCRTRAC) and other turf leaders in southern California, UCR Extension has developed a Certificate Program in Turfgrass Management that will benefit managers of golf courses, parks, cemeteries, athletic fields, sports complexes, and other turf facilities.

Courses include the latest research findings and technology advancements, providing managers a competitive edge in efficient, environmentally sensitive use of resources and investment protection.

Managers enrolled in the comprehensive certificate program will:

- Learn basic scientific principles of chemistry, soil science, and botany for turf management.
- Develop technical skills in turf selection and maintenance, including pest management, fertilization, and irrigation.
- Understand from an integrated perspective the benefits of fertilizer and pesticide use as well as their potential environmental impacts.
- Explore principles of budgeting, purchasing, and other management functions.

The program offers six required courses and three electives. Required courses are Foundations of Turfgrass Management, Principles of Plant Growth, Turfgrass Species and Applications, Soil Fertility and Fertilizers, Management Skills for Turfgrass Managers, and Turfgrass Irrigation and Drainage. Electives include Turfgrass Pests, Pesticide Use on Turfgrass and Ornamental Plants, and Landscape Plants in a Turfgrass Environment.

Candidates must complete all required classes and two electives (24 units) with a grade of "C" or better to receive the certificate.

The program's Curriculum Development Advisory Committee includes 12 UCRTRAC members: **Tracy Barcelona**, California Golf Course Superintendents Association; **Tim Barrier**, San Diego Golf Course Superintendents Association; **Ty Broadhead** and **Craig Shafer**, Hi-Lo Desert Golf Course Superintendents Association; **Fred Eckert** and **Mark Hodnick**, Southern California Turfgrass Council; **Pat Gross**, United States Golf Association; **John Martinez**, Southern California Golf Association; and **Steve Sinclair** and **Bert Spivey**, Golf Course Superintendents Association of Southern California. University members of UCRTRAC on the committee are **Vic Gibeault**, Extension Environmental Horticulture Specialist and **Steve Cockerham** Superintendent, UCR Agricultural Operations. For more information or to receive a brochure, contact Jon W. Kindschy, director of natural sciences at UCR Extension, at (909) 787-5804.

Victor A. Gibeault
Extension Environmental Horticulturist
Department of Botany and Plant Sciences
University of California, Riverside

Dennis R. Pittenger
Area Environmental Horticulturist
Southern Region and Los Angeles County
University of California

***Co-Hort*** is intended to be a quarterly publication and will be distributed to Farm Advisors, Specialists, and Department Faculty working in areas related to environmental horticulture. This publication is written and edited by Victor A. Gibeault and Dennis R. Pittenger, and prepared by Susana B. Vélez, Administrative Assistant. Please address any correspondence concerning this publication to the editors.

***Co-Hort*** is issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, W. R. Gomes, Director of Cooperative Extension, University of California.