Fall 1995 Volume 1.4

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

CO-HORT

A NEWSLETTER FOR TURFGRASS, LANDSCAPE, AND NURSERY ISSUES.

TURFGRASS TURNINGS

by Victor A. Gibeault

NATIONAL TURFGRASS EVALUATION PROGRAM

The National Turfgrass Evaluation Program (NTEP) is a not-for-profit organization that provides leadership in turfgrass cultivar evaluation and improvement by linking the public and private sectors of the industry through their common goals of grass development, improvement, and evaluation. Its mission is to provide a mechanism for uniform evaluations; to advance the science of species and cultivar evaluation; to collect and disseminate performance information; and to enhance the transfer and use of information and technology relating to turfgrass improvement and evaluation. Structurally, NTEP is a cooperative effort of the United States Department of Agriculture (at Beltsville, MD) and the Turfgrass Federation, Inc.

The clientele of NTEP are diverse, with varying interests and expectations. To be clientele sensitive, NTEP has identified the following categories of interest groups that interact and benefit from the activities of the program: public and private turfgrass plant breeders; public and private sector researchers; seed distributors; technology transfer educators such as cooperative extension educators and industry technical representatives; other professionals such as seed producers, sod producers, golf course superintendents, grounds managers, sports turf managers, lawn care service operators, landscape contractors, landscape architects and consultants. Homeowners indirectly are influenced by NTEP because the turfgrasses they buy have been tested for performance characteristics in their climate zone.

Most cultivar evaluations are conducted by university turfgrass research and extension programs, but modified studies by private plant breeders are also undertaken. Seed or vegetative material of a turfgrass species is accumulated by the program and sent to cooperating researchers where replicated trials are established. Somewhat standardized establishment and cultural practices are used and they are reported for each site. Data collected on a monthly basis during the growing season are also standardized and usually include a turfgrass quality rating.

INSIDE THIS ISSUE

TURFGRASS TURNINGS

National Turfgrass Evaluation Program 1
UCR Turf Mission 2
Turfgrass Sodding Guidelines 2
New Bermudagrasses 3

NURSERY NOTES

Characteristics of California Wholesale Nurseries 3

LANDSCAPE LESSONS

Updates on the Eucalyptus Long-Horned Borer and Eucalyptus Snout Beetle 5
Summary of Irrigation Management Studies on Groundcovers 6
Nutritional Needs of Palms 7
Herbaceous Perennials and Their Performance Under Increasing Levels of Water Stress 7
Wildflower Weed Management 8
Water Use of Two Landscape Trees in Containers 8

CALENDAR 10

Other specific characteristics such as color, texture, spring green-up, density, drought tolerance and disease or weed activity are rated when appropriate. Data are sent to NTEP on an annual basis, statistical analyses performed and annual results are reported by species. Those reports are used as a basis for information transfer to interested clientele.

In California, NTEP studies of the commonly used warm- and cool-season turfgrass species are usually conducted at the UC Riverside Turfgrass Research Facility, at the UC South Coast Research and Extension Center in Irvine, and at the UC Bay area Research and Extension Center in Santa Clara. At Riverside, as an example, we have 96 tall fescues, 28 zoysiagrasses, 27 bermudagrasses, and 22 buffalograsses under study. The grasses are mowed weekly during the growing season, fertilized on a regular, moderate program and irrigated to replace water used as calculated from a CIMIS automated weather station. Results of the studies are released during field days and field tours, in proceedings and more formal reports in publications such as *California Turfgrass Culture.*

In the subject area of turfgrass management, one of the important decisions that must be made is the selection of turfgrass to be established. For most, the decision is influenced by the use the facility will receive, the cultural level that will be practiced, and the environmental conditions of the site (both climate and soil). Mistaken grass selection will haunt the turfgrass manager for the life of the sward. Fortunately, the National Turfgrass Evaluation Program provides sound information on which in-part to base grass selection decisions.

UCR TURF MISSION

Recently, the UC Riverside Turfgrass Facility and program personnel adopted a mission statement for the core activities of the Facility and program. It is intended to reflect a commitment to the California turfgrass industry, which is very large in individuals involved, acreage, and economic activity.

The UCR Turfgrass Research Facility and program is involved with problem-solving applied and fundamental research and educational activities that are directed toward the functional, recreational and aesthetic uses of turfgrasses in man's planned landscape. The activities are primarily structured to assist members of the Environmental Horticulture industry that work with the design, establishment, maintenance and sale of turfgrass and turfgrass related products that ultimately benefit the general California population and the state's urban/suburban/rural environments. In support of this, the program focuses on current problems and issues facing the turfgrass industry such as:

- Resource efficiency in the areas of water, nutrition, pest management, energy and labor input in such uses as lawns, golf courses, parks and grounds, etc.;
- Environmental enhancement for our urban and suburban areas; and
- Turfgrass persistence and performance with increased traffic and use on such areas as sports fields.

The central theme of the activities at Riverside encompasses plant material evaluation and development, turfgrass management and fundamental turfgrass physiology. Specific project areas include cultivar performance characterization, including the development and screening of new grasses for California; the determination of water requirements and irrigation strategies of the important California turf species and cultivars; the study of grasses and cultural practices under simulated traffic, such as occurs on sports fields; the evaluation of nutrient requirement and fertilizer performance and other primary management practices such as mowing, thatch control and aerification when appropriate; the management of pests, including weeds, insects, diseases and nematodes of turfgrasses; and environmental impact studies of turfgrasses and their culture. Facilities include several acres of small-plot field maintained cool- and warm-season turfgrasses, field and campus laboratories, dedicated greenhouses and all necessary specialized equipment.

TURFGRASS SODDING GUIDELINES

Turfgrass Producers International (TPI) has prepared, and recently released, guideline specifications for soil preparation, turfgrass sodding and post-installation maintenance to provide architects, landscape contractors, builders and owners the information they need to achieve their objectives. The specifications are presented in six sections, each of which can stand alone or be incorporated into an overall set of specifications for a turfgrass sodding project. The categories are:

Section 1. Specifications for subsoil preparation
Section 2. Specifications for topsoil material
Section 3. Specifications for fertilizer pH correction
Section 4. Specifications for turfgrass
Section 5. Transplanting and installing turfgrass sod
Section 6. Specifications for maintenance of transplanted turfgrass sod

The 20-page booklet, *Guideline Specifications To Turfgrass Sodding*, is available from Turfgrass Producers International, 1855-A Hicks Road, Rolling Meadows, Illinois 60008; Tel. 800-405-8873.

NEW BERMUDAGRASSES

Two vegetatively propagated bermudagrasses have been released and registered by Mississippi State University.

'MS-Choice' is a selection characterized by high shoot density, dark-green color, and low seedhead density. Collected from a fairway of an unirrigated golf course following extensive drought, the grass was tested in the NTEP bermudagrass-1986 studies as MSB-30. It ranked sixth in overall quality for the 28 bermudagrasses tested. In California, it scalped less than many other bermudagrasses and had more thatch accumulation. 'MS-Choice' is a tetraploid (2n=4x=36).

'MS-Pride' was developed from the same selection program as 'MS-Choice' and was also tested in the 1986 NTEP Bermudagrass studies. The experimental designation was MSB-10. 'MS-Pride' displayed dark-green color, fine leaf texture, high shoot density, good fall and winter color retention, and low seedhead density. It ranked second overall among the 28 lines tested. 'MS-Pride' is a triploid (2n=3x=27).

From: Crop Science 35:1506, 1995.

NURSERY NOTES

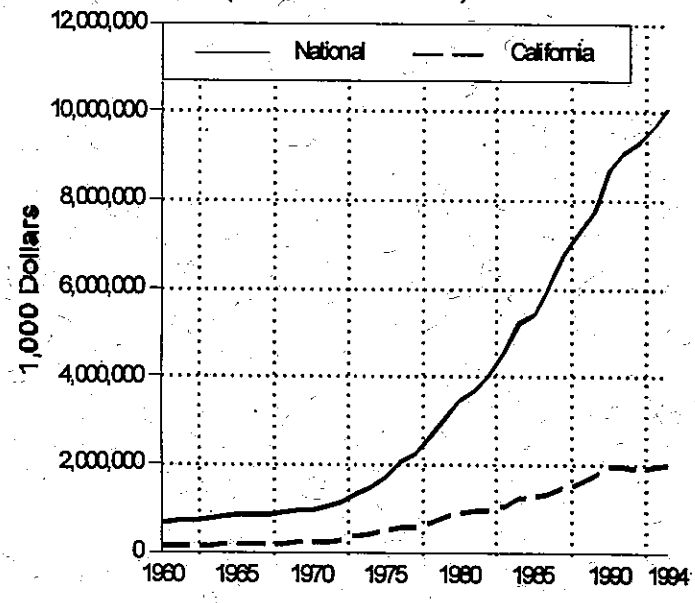
by Ursula K. Schuch

CHARACTERISTICS OF CALIFORNIA WHOLESALE NURSERIES

Ursula K. Schuch and Grant J. Klein

The California greenhouse and nursery industry is the second most important agricultural commodity in the state and the leading producer in the nation. This industry leads the nation's production with an income of $1.9 billion in 1993. The value of cash receipts has steadily increased for two decades starting from the 1960's, but more than doubled for the California industry from 1980 until 1990 (Fig. 1). Sales then slightly decreased, but leveled off in 1993. California's contribution to the national cash receipts accounted for 25% from 1971 to 1981, and maintained 23% until 1990.

Figure 1. Value of cash receipts for greenhouse/nursery products.
(Source: USDA Statistics)



California is also the headquarters for the nation's three largest nurseries based on recent years' sales. Leading counties in nursery valuation in 1993 as reported by the County Agricultural Commissioners are:

1.	San Diego	($553,277,700)
2.	San Mateo	($162,569,000)
3.	Los Angeles	($145,594,000)
4.	Orange	($116,459,600)
5.	Monterey	($116,341,000)
6.	Ventura	($104,648,000)

Following are the California results of a survey that was conducted in 1989 and 1994 to determine trade flows and marketing practices within the United States wholesale nursery industry. In California, questionnaires were sent out by the California Association of Nurserymen to their members that operated wholesale nurseries. Surveys were sent out in the spring of 1989 and 1994 and asked questions regarding business practices during the previous year.

Questionnaires were mailed to 450 nurseries in both years and 131 responses were returned in 1989 and 52 in 1994. Because the following results represent a small section of the wholesale nursery industry, they have to be interpreted with caution.

Nurseries that responded to the survey were grouped into three distinct categories based on gross value of product sales. Small nurseries had a sales volume up to $99,999, medium nurseries between $100,000 and $999,999, and large nurseries had a sale volume of $1,000,000 or more per year. In 1989 nurseries were well represented in each size category, 45 small, 43 medium, and 43 large. The lower response rate in 1994 provided less balance with only 9 small, 23 medium, and 20 large nurseries.

BASIC CHARACTERISTICS OF THE NURSERIES

Age. The age of the nurseries was determined by asking the year when their firm was established. Sorting nurseries by age groups, one third or more of the respondents represented nurseries 6-15 years old. The remaining categories accounted for roughly 18-26% of the respondents, with the exception of the 0-5 age group in 1993, which accounted for only 12%.

These data show a decline in the establishment of new nurseries between the two surveys, reflecting the relatively strong national economic conditions from 1983-1988, when more new businesses were started, as opposed to the 1988-1993 period, which included a lengthy recession and extremely slow recovery. Responses from other states also indicated a general trend of considerably fewer new nurseries during the five years preceding the 1994 survey compared to the 1988 survey.

Employees. California nurseries surveyed in 1989 had an average staff of 53, almost three quarters of which were permanent and just above one quarter of which were temporary or part-time employees. In the 1994 survey, the average staff was significantly lower at 33, and only 59% of these employees were permanent staff members.

PRODUCT INVENTORY

Plant Categories. Results for both years indicated that herbaceous perennials, broad-leaf evergreen shrubs, and evergreen trees were in high demand, accounting for about one third of all plants (Table 1).

Herbaceous perennials had the largest increase of all plant categories in sales accounting for 10% more sales for large nursery over the five-year period. Medium nurseries were selling the same percentage of herbaceous perennials, and sales declined slightly for small nurseries from 1988 to 1993. Herbaceous perennials accounted for the fastest growing segment of nursery sales nationwide. The percentage of total sales accounted for by these plants in California was the fourth highest in the nation in 1993, following Connecticut, Maryland, and Georgia. Sales of herbaceous perennials in California more than doubled from $10.4 million in 1992 to $22.4 million in 1993.

Overall, the percent sales of only three plant categories declined between 1988 and 1993: vines and groundcovers, narrow-leaved evergreen shrubs, and broad-leaved evergreen shrubs. In 1988, the first two of these categories were between 8% and 10% overall, but five years later they accounted for only 3%-5% of overall sales, not far from the lowest percentages of all plant categories. Broad-leaved evergreen shrubs declined 3%-4% in sales for small and medium, and 7% for large nurseries.

Table 1. Percent of total sales for various plant categories.

Plant category	1989 survey percent response	1994 survey percent response
Christmas trees	17.7	n/a
Broad-leaved evergreen shrubs	17.1	11.5
Evergreen trees	10.8	11.1
Herbaceous perennials	10.0	12.6
Vines and ground cover	9.6	4.8
Deciduous shade/flowering trees	8.7	9.0
Narrow-leaved evergreen shrubs	8.1	3.8
Propagating material	5.3	7.2
Fruit trees	4.5	5.6
Roses	4.4	4.9
Deciduous shrubs	3.7	2.1
Small fruits	0.1	0.0
Foliage	n/a	6.4
Other	n/a	21.1

The surveys reflect the diversity of the California nursery industry which produced a wide range of landscape plant categories, each of which accounted for 18% or less of overall sales. The plant categories listed in the surveys failed to cover the whole spectrum of plants that are produced in California, as indicated by the large percentage of the "other" category in the 1994 survey and the necessity for nurseries to write in significant percentages for Christmas trees as a separate category in the earlier survey.

Production Methods. California's role among the nation's leaders in container production is reflected in the survey results, accounting for 87% and 80% of the production from all nurseries surveyed in 1989 and 1994, respectively. Bare root production was the only other consistently significant method of production for the nurseries, accounting for 8% of sales in both years.

California is among the states where the majority of nursery stock is produced in containers. The mild climate in the coastal areas, where most nurseries are located, allows plants to grow almost year-round with little necessity for winter protection. Container plants allow for easy transportation due to the low weight of the media, and have a year-round marketing and planting season. In 1993, containers were the most popular production type in all states except for Oregon and Washington, which produced roughly 40% bareroot plants, and Idaho, Illinois, Kentucky, New Jersey, Ohio, and Tennessee, which sold more than one third of the nursery stock balled and burlapped.

LANDSCAPE LESSONS

by Dennis R. Pittenger

The following items are summaries of research reports provided at the September 13, 1995, Landscape Management Research Conference at UC Riverside and the October 5-8, 1995, Western Region Coordinating Committee-58 Meeting at Salt Lake City, Utah, on production, handling, re-establishment of perennial nursery stock. If you would like further details on any report, please contact me or the original author.

UPDATES ON THE EUCALYPTUS LONG-HORNED BORER AND EUCALYPTUS SNOUT BEETLE

Lawrence M. Hanks, Timothy D. Paine, and Jocelyn G. Millar, *Department of Entomology, University of California, Riverside*

Managing Eucalyptus Insect Pests Through Irrigation

Eucalyptus are ubiquitous trees in urban and rural landscapes of California where they serve a vital role as shade, wind row and ornamental trees. A severe pest of these Australian trees, the eucalyptus long-horned borer (*Phoracantha semipunctata* F.), was first identified in California in 1984. *P. semipunctata* is also native to Australia, and one of a suite of borer species whose larvae feed under the bark of eucalyptus. In Australia, this large beetle is uncommon and of only minor economic significance, its hosts being limited to downed or unhealthy trees. However, in nearly every region in the world where *Eucalyptus* has been introduced (e.g., Israel, Spain, Portugal, Italy, Tunisia, Egypt, and South Africa), the beetle kills apparently vigorous trees with serious economic consequences. *P. semipunctata* rapidly established and spread in California, and is killing trees by the thousands.

Eucalyptus species show great variability in their susceptibilities to attack by *P. semipunctata*. Low resistance to the borer is primarily due to eucalyptus trees being planted in environments to which they are poorly adapted. Those species that can maintain bark turgidity under drought conditions are better able to resist attack by *P. semipunctata;* turgid bark acts as a physical barrier, preventing larvae from penetrating to the cambium. In California, *Eucalyptus* species that are especially vulnerable to borer attack appear to be those that are intolerant of drought in Australia. However, even trees of resistant species may be rendered vulnerable to attack by poor soil quality or water deficit. Subtle slope and irrigation effects that determine soil moisture patterns also have an impact on the survivorship of eucalyptus trees.

Eucalyptus Snout Beetle Update

In March 1994, a new and serious pest of eucalyptus trees was discovered in Ventura County, California: the eucalyp-

tus snout beetle (ESB), *Gonipterus scutellatus* Gyll. This defoliating weevil has a long history as a pest of eucalyptus in other regions where it has been accidentally introduced. Both ESB adults and larvae feed on the leaves, buds, and shoots, and this damage retards growth, causes malformations of the branches, and eventually kills branches and entire trees.

Fortunately, there is a very selective and effective biological control agent for ESB. The egg parasitoid, *Anaphes nitens* Siscaro, has been introduced in nearly every country where the weevil has appeared. There, this minute parasitoid (< 1 mm in length) has brought weevil populations under control so rapidly and effectively that damage was reduced to insignificant levels within a few year's time. We imported this parasitoid and began releasing it in Ventura County in fall 1994.

Survey of the distribution of ESB has revealed that the weevil is already widely distributed throughout Ventura County. In many of the citrus growing areas, weevil populations have reached high densities and have inflicted severe defoliation. Parasitoids successfully overwintered at their release site and were parasitizing nearly 100% of the weevil eggs by spring 1995. As a result of this high parasitism rate, weevil larvae virtually disappeared during the summer. Parasites have already spread to neighboring eucalyptus windrows. It appears that *A. nitens* will quickly bring the spreading weevil population under control, nipping the ESB threat in the bud.

SUMMARY OF IRRIGATION MANAGEMENT STUDIES ON GROUNDCOVERS

W. E. Richie, D. R. Pittenger, D. R. Hodel, D. A. Shaw, and D. B. Holt, *University of California, Riverside and Cooperative Extension, Los Angeles and San Diego Counties*

Previous field research with six species of groundcovers showed that four species, representing a range of plant forms and origins, maintained aesthetically acceptable performance when irrigated at 30% ET_o while two species apparently have irrigation requirements greater than 50% ET_o. (ET_o, or reference evapotranspiration, is an estimation of the combined value of a reference pasture grass water-use and soil evaporation. Daily ET_o values can be obtained from CIMIS -- California Irrigation Management and Information Service -- via modem). In that study irrigations of 1.5 in. were scheduled when percentages of cumulative ET_o totaled 1.5 in. Treatments were 50%, 40%, 30%, and 20% ET_o. Thus, each irrigation applied the same amount of water and the soil was rewetted to the same depth at each irrigation, but seasonal total amounts of water varied because the number of irrigation events per treatment varied.

These schedules provided water very infrequently, even in the wettest treatment, and tested the drought resistance capabilities of the species involved. The question remained whether or not groundcover performance under a low total amount of irrigation (30% ET_o) could be improved by small amounts of water applied frequently rather than large amounts of water applied infrequently. Frequent irrigation of small amounts of water result in more shallow penetration of water into the soil and thus may rewet only a portion of the root system. However, shallow frequent irrigation may reduce heat and drought stress on plant material.

The primary objective of recent studies was to determine, under deficit irrigation, if frequent, shallow irrigation or infrequent, deep irrigation resulted in differences in groundcover quality when the total water applied is equal. Six species of groundcover (*Baccharis pilularis* 'Twin Peaks'; *Drosanthemum hispidum*, *Vinca major*, *Osteospermum fruticosum*, *Potentilla tabernaemontanii*, and *Hedera helix* 'Needle point') were grown in 12 ft x 15 ft plots. Plots were treated with four irrigation schedules: three times per week, once per week, once every two weeks, and once every four weeks. The amount of water applied at each treatment was 30% of CIMIS ET_o accumulated since the previous irrigation, minus any precipitation. Groundcover performance and density was measured monthly by a three-member panel using a 1 to 9 rating scale (9 being optimum). Soil moisture was measured monthly to five depths (9, 18, 24, 36, and 48 inches) using a neutron probe. Gypsum blocks located in selected plots at 12 and 24 inches enabled daily monitoring of soil moisture. Gravimetric soil sampling also provided moisture data on a periodic basis. Two years of data were collected, terminating in October 1994.

Results:

Potentilla tabernaemontanii could not be sustained under any of the treatments. For the other species there were no season-long differences in a species' performance or density due to irrigation frequency, but there were significant differences among species across irrigation treatments. *Drosanthemum* and *Osteospermum* provided good overall

appearance and density consistently through the season. *Baccharis* maintained acceptable performance most of the irrigation season, while *Vinca* and *Hedera* became unacceptable in appearance in mid-season. Density of groundcovers was slightly better in the once per week and once every two week treatments. Soil moisture content differed among species, but was not consistently different between irrigation treatments.

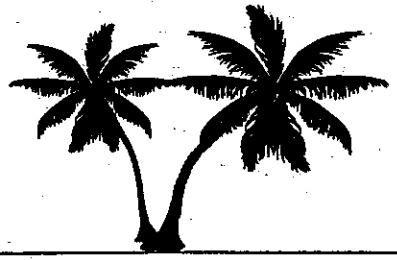
Conclusion:

Under deficit irrigation, irrigation frequency has no effect on the performance of many groundcovers. Intermediate irrigation frequency (once every 7 to 14 days) may enable groundcovers to maintain better density when they are deficit irrigated.

NUTRITIONAL NEEDS OF PALMS

Donald R. Hodel, *University of California Cooperative Extension, Los Angeles County*

Palms require large amounts of nitrogen, potassium, and magnesium, and appear especially sensitive to some micronutrient deficiencies. Macronutrient deficiencies usually occur as a result of insufficient nutrients in the soil. Nitrogen deficiency appears as a general yellowing of all leaves. Potassium and magnesium deficiency appear on the older leaves. Potassium deficiency shows as translucent orange or yellow flecking or speckling, while magnesium deficiency appears as a distinct orangish band around the outside of a leaf. Micronutrient deficiencies are on the newest leaves and are usually the result of environmental factors such as damaged roots or improper soil pH that affect the palm's ability to extract the nutrient from the soil. Iron deficiency shows as chlorosis while that of manganese appears as chlorosis, stunting, and even frizzling. Deficiencies are more easily prevented than corrected by proper fertilization, good soil aeration, proper planting depth, root disease prevention, and proper soil pH. Palms respond best to a fertilizer with the N-P-K ratio of 3-1-3 or 3-1-2, all in slow-release form, and with magnesium and micronutrients.



HERBACEOUS PERENNIALS AND THEIR PERFORMANCE UNDER INCREASING LEVELS OF WATER STRESS

David Hillock and Dr. James E. Klett, *Department of Horticulture, Colorado State University, Ft. Collins, CO 80523*

An experiment is being performed to evaluate the ornamental quality of four herbaceous perennials at increasing levels of drought stress while using a relative standard of reference for irrigation needs. The plants examined in this study are plants often recommended for xeriscape gardening and placed under different watering zones based on observations only.

Drought stress was imposed by irrigation treatments based on % evapotraspiration (ET) (100%, 75%, 25%, and 0%). Data collection consists of a visual rating to determine landscape performance, plant growth measurements (density, height and width), and relative water content. Percent soil moisture is monitored with use of the Time Domain Refletometry (TDR) system.

Questions to be answered from this experiment are: 1. What do high, moderate, and low watering zones mean, and how do the plant species being examined fit into these zones?; 2. How much water do these plants actually need to survive as well as maintain an acceptable level of ornamental quality for the landscape?; 3. What will be the impact of the drought avoidance mechanisms of each plant species in the survival process?; 4. What is the ability of each plant species to tolerate water deficits under increasing levels of water stress as determined by plant growth?; 5. Even though the plant may have the ability to survive a drought, will it be acceptable for use in the landscape by retaining its ornamental qualities?; 6. Is there a relationship between soil moisture calculated with the TDR system, and plant growth and appearance?

The plant species being examined in this study include: McKana's Giant columbine (Aguilegia caerulea 'McKana's Giant'), poppy mallow (Callirhoe involucrata), blanket flower (Gaillardia aristata), and Fairy's Pink baby's breath (Gypsophila paniculata 'Fairy's Pink'). Plants were planted June 7-8, 1994. Stress treatments began on August 4, 1994 and continued until October 4, 1994. In 1995 the experimental treatments again were started on June 1, 1995.

Conclusions from the 1994 growing season and observations to date from the 1995 season:

1) columbine should be used in areas with ample moisture though it can survive and still perform well at 50% of ET_0.

2) poppy mallow should be used in areas of moderate to high soil moisture, 75% - 100% ET_o; however, in 1995 these plants have become better established and performance seems to be acceptable even with no supplemental irrigation.

3) blanket flower can grow at 0% ET_o and still survive and perform well, and this trend seems to be continuous for the 1995 season as well.

4) baby's-breath performed best in 1994 at the 100% ET_o; however, in 1995 it seems to be adaptable at lower irrigation levels once the plants have become established.

WILDFLOWER WEED MANAGEMENT

Dr. James Klett and Elizabeth Sears, *Department of Horticulture, Colorado State University, Fort Collins, CO 80523*

The recurring problem with wildflowers in cultivation is the invasion of weeds and the ultimate loss of the "wildflower look" to weeds. This leads to disappointment and frustration of the wildflower grower. Although numerous studies have been done on various aspects of growing wildflowers, none has had weed management as its exclusive focus. There is a need for uncomplicated weed management methods which can be understood and used by those wishing to grow wildflowers.

Outdoor field plots of a wildflower mixture consisting of ten species have been established looking at various weed management techniques. Initially, all growing weeds were killed with two Round Up applications prior to sowing.

1. Soil in one half of the treatments was tilled prior to sowing (marked with white flags), the other half untilled.

2. Half of the plots will receive mowing to a height of 12" midsummer and fall versus no mowing.

3. The preemergent herbicide, Treflan, was applied to half the plots prior to sowing (marked with red flags). Treflan will be applied annually to these plots. Field plots 4' x 6' in size with an 18" buffer around each plot have been established looking at three weed management techniques. This experiment is replicated five times in a randomized complete block design. This experiment will continue for a minimum of two growing seasons.

The project was established in 1993, and data collection began in 1994. A sample plot within each replication is being used for data collection. Data is being collected on numbers and rates of establishment of each wildflower species, initial weed suppression and numbers and types of weeds. Photographs are being taken throughout the duration of the research.

Initial data shows very low numbers of weeds in all plots, suggesting that elimination of weeds prior to sowing is very important. Other observations suggest that the preemergent herbicide Treflan suppresses weed seeds but also suppresses wildflower seeds, although the species of wildflowers used were listed on the Treflan label as safe (as mature plants) for use. It also appears that seeding rate affects weed invasion, although this is not a parameter of the study.

WATER USE OF TWO LANDSCAPE TREES IN CONTAINERS

Dan Levitt, James Simpson, and Jimmy Tipton, *Department of Plant Science, University of Arizona*

There is little information on the water use and requirements of landscape trees. Most of the information available in the Southwest is based on 'low-water-use' plant lists from various organizations. These lists are based on empirical observations and the plant's native habitat due to the lack of data on actual water use. They are also largely based on observations of minimum water requirement and drought survivability rather than actual water use.

Plant water use is highly variable, depending upon species, size, condition, and environment. Evapotranspiration (ET) combines water loss from the soil surface (evaporation) with plant use (transpiration). Systems based on estimating ET have proven very valuable in agriculture. The actual water used by a highly managed reference crop (typically turf) is measured and correlated with weather conditions: temperature, sunlight, wind, and humidity. Subsequently, only the weather conditions are measured and the water used by the reference crop is estimated from these meas-

urements. This estimate of ET is used as a baseline and is called the reference ET (ET_o).

Now the actual water used by the crop in question (i.e. cotton) is measured and related to the water used by the reference crop as a ratio: ET_a/ET_o. Initially the ratio is very variable, but with enough data points, it stabilizes somewhat. It then can be used to schedule irrigations based on the weather measurements. For example, say the ratio is 0.75. This means the test crop uses 75% as much water as the reference crop. If the weather data indicates that the reference crop used 2 inches of water (ET_o) then the test crop used 1.5 (0.75 x 2) inches (ET_a). The problem in applying the technique to xeriscapes is the assumptions required: a homogeneous crop (one species) with an essentially horizontal canopy, 100% groundcover, and water is not limiting. The grower nursery and the urban landscape are heterogeneous with a three-dimensional canopy (many different species of different sizes) and the ground is not always completely covered. In addition, root systems are confined in a container nursery. And, as noted in the first paragraph, many 'low-water-use' trees and plants can survive droughts but may or may not be 'low-water-use' when water is not limiting.

There is also the question of plant size. Water use is, of course, dependent upon the number and size of leaves. Total leaf area (TLA), the sum of the size of all the leaves on a plant, is difficult to measure. So water use is typically related to projected canopy area (PCA), the size of a tree's shadow if the sun were directly overhead. This assumes that for a given size of a given species, the total leaf area would be the same. In other words, the ratio of total leaf area to projected canopy area should be constant. This ratio, called the leaf area index (LAI) is reasonably constant for mature trees in a native stand. However, urban trees are usually modified by pruning which can affect LAI for many years.

In this study we looked at some of these factors and attempted to determine the water use of two popular landscape trees in containers under nonlimiting conditions.

Twelve South American mesquites and eight southern live oaks growing in 15-gallon containers were used in this study. Water use was determined by weighing the trees periodically from July to October 1991. Weather data was measured on site and ET_o calculated based on equations used by the Arizona Meteorological Network (AZMET). Water use was related both to total leaf area and projected canopy area.

Total leaf area, while more difficult to measure, was less subject to error and a better predictor of water use than projected canopy area. Using projected canopy area, the mean ET_a/ET_o ratio for both species was above one. In other words, an area of turf equivalent to the shadow cast by these trees would use less water when water is not limiting.

While the oak is considered a 'low-water-use' species, many would expect the mesquite to use less water. These results indicate that the mesquite used twice as much water on a leaf area basis. This is consistent with previous studies that xeric species, as a rule, are not efficient users of water, either in terms of transpiration or in terms of growth per unit water consumed. Managers who switch from traditional landscape plants to xeric may actually see water consumption increase.

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

Ursula K. Schuch
Extension Ornamental Horticulturist
Department of Botany and Plant Sciences
University of California, Riverside

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, Dennis R. Pittenger, and Ursula K. Schuch, and prepared by Susana B. Denney, 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, Kenneth R. Farrell, Director of Cooperative Extension, University of California.

In accordance with applicable State and Federal laws and University policy, the University of California does not discriminate in any of its policies, procedures, or practices on the basis of race, religion, color, national origin, sex, marital status, sexual orientation, age, veteran status, medical condition, or handicap. Inquiries regarding this policy may be directed to the Affirmative Action Director, University of California, Agriculture and Natural Resources, 300 Lakeside Drive, 6th Floor, Oakland, CA 94612-3560, (510) 987-0097.

C A L E N D A R

MONTH	EVENT AND LOCATION	CONTACT
Dec. 7	Fertilizer Research and Education Program Conference, Kearney Agricultural Center, Parlier, CA	Debbie Scott (916) 653-5340
Dec. 13	Southern Region Environmental Horticulture Planning Meeting--Issues: Identification and Prioritization, UCR	Janet Hartin or Dennis Pittenger (909) 787-3320
Jan. 10	Turfgrass, Landscape and Sports Turf Institute, Sequoia Athletic Club, Buena Park, CA	Pam Pavela (800) 500-SCTC
Jan. 24-25	Western Plan Growth Regulator Society, Sacramento, CA	Wanda Graves (510) 790-1252
Jan. 24-28	Sports Turf Managers Association Annual Conference, Hyatt Regency, Anaheim, CA	STMA Headquarters (312) 644-6610 ext. 3850
Mar. 10-13	Golf Expo VIII, Town & Country Convention Center, San Diego, CA	Ann Ramirez (619) 437-6250

COOPERATIVE EXTENSION
U.S. DEPARTMENT OF AGRICULTURE
UNIVERSITY OF CALIFORNIA
OAKLAND, CALIFORNIA 94612-3560

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

ID. NO. 111