Proceedings:

TURFGRASS RESEARCH CONFERENCE AND FIELD DAY

September 17, 1996

LANDSCAPE MANAGEMENT RESEARCH CONFERENCE AND FIELD DAY

September 18, 1996

University of California, Riverside
Cooperative Extension
Botany and Plant Sciences
Agricultural Operations

TURFGRASS RESEARCH CONFERENCE AND FIELD DAY

TUESDAY, SEPTEMBER 17, 1996

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Southwest Consortium on Plant Genetics and Water Resources
Greener Pastures Inc.
Rain Bird Preferred by Professionals Worldwide
The Council for a Green Environment

CHEMICAL EDGING OF HYBRID BERMUDAGRASS

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Aggressive, stoloniferous grasses such as bermudagrass, kikuyugrass, zoysiagrass and St. Augustinegrass often extend their growth into ornamental beds, tree wells, and sidewalks within landscaped areas. This requires repeated mechanical edging or hand removal during the growing season. These procedures are time-consuming and often costly. Chemical edging has been an alternative to the drudgery of mechanical and hand removal. Cacodylic acid, diquat, and weed oil were used in the past for short-term chemical edging. When glyphosate (Roundup) was introduced, it replaced much of these usages, however, because of its systemic nature in these stoloniferous grasses, the effects of the glyphosate often extend beyond the edges into the desirable turf areas. Two newer chemicals have been introduced which may be useful as chemical edgers, glufosinate (Finale) and cimectacarb (Primo). Glufosinate is a rapid acting "contact" foliar herbicide which is not yet registered in California while cimectacarb is a turf growth regulator.

A trial was established at the University of California, Riverside Experimental Turf Farm on an eight-year-old, vigorous stand of 'Santa Ana' hybrid bermudagrass, on September 28, 1995, one day after the turf had been uniformly mowed to a height of 0.75 inches. Treatment bands 10 inches wide and 15 ft long were applied to the turf. Treatments consisted of the commonly used rates of diquat, cacodylic acid, glyphosate, glufosinate, and cimectacarb. Phytotoxicity (burn back) ratings were made regularly over a 50-day period. In addition light reflectance from the turf surface was measured with a line quantum sensor. Reflectance correlated closely with the phytotoxicity ratings as the desiccated tissue from the most severely affected treatments reflected more light than the green, healthy tissue in the untreated and cimectacarb plots.

Diquat (Figure 1) desiccated the turf within 2 days. Cacodylic acid required 5 days to reach maximum effect. Regrowth of the turf then occurred and diquat and cacodylic acid had lost their effect by 19 and 26 days, respectively. Glufosinate reached its maximum effect in 5 days with the effects persisting for 45 days. Glyphosate (Figure 2) required 14 days to reach its maximum effect, however the turf remained desiccated throughout the 50-day evaluation period, although regrowth from the edges of the band was in evidence at the end of the evaluation period. Cimectacarb stopped growth of the turf and caused only a slight yellowing of the turf, its growth reducing effects were evident throughout the 50-day period.

Glufosinate was quicker acting than glyphosate and longer lasting than diquat or cacodylic acid. Cimectacarb stopped turf growth with little discoloration. It appears that both of these products may have a place in chemical edging. Glufosinate for a quick burn back and cimectacarb after mechanical edging to slow regrowth and the need for a second mechanical edging.

FIGURE 1. EDGING TRIAL, CONTACT HERBICIDES

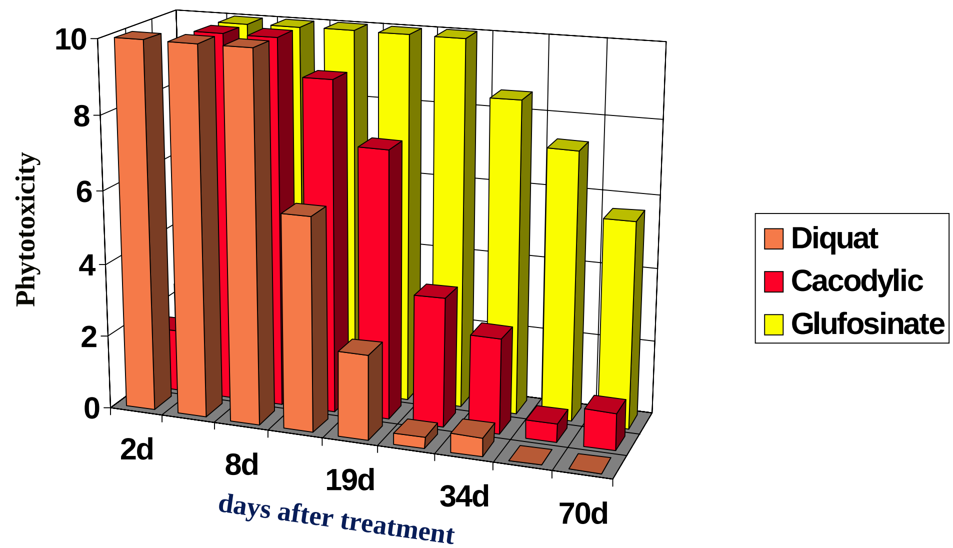
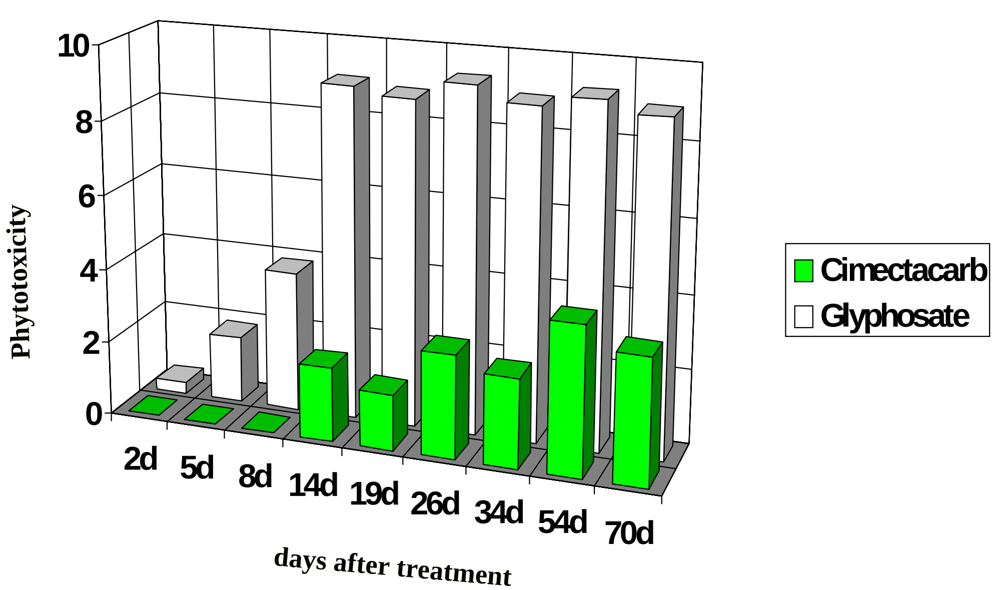


FIGURE 2. EDGING TRIAL, GLYPHOSATE AND CIMECTACARB



BLACK TURFGRASS ATAENIUS: A PROBLEM IN THE LOWER DESERT OF CALIFORNIA

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History

The black turfgrass ataenius (BTA), *Ataenius spretulus* (Haldeman), is a problem to golf course turfgrass in the lower desert region of California. The BTA is native to North America, and the first description of turfgrass damage was recorded from Minnesota in 1932 (Hoffman, 1935). Subsequent reports of damage to turf have been made from 23 states in the United States and the province of Ontario in Canada by the 1970's (Cartwright, 1977; Niemczyk and Wegner, 1979). The first reported injury to turf in California was from golf courses in the Coachella Valley in the lower desert region in 1987. Courses in this region continue to suffer injury caused by the insect. Damaging populations of BTA have now been reported from all southern and three central California counties.

Description of Insects

The mature adult beetle is a small reddish-brown to shiny-black beetle with a mean length of 4.9 mm and a mean width of 2.2 mm. BTA eggs, shiny white and difficult to see, are deposited in clusters of 11-12 within a cavity formed by the female in the soil (Wegner and Niemczyk, 1981). The eggs hatch and the immature insects go through three larval or white grub instars which are the damaging stages. The larvae feed on roots of grass plants, reducing the total amount of root surface and limiting the ability of the turf to absorb water and maintain an adequate moisture balance under stressful conditions.

Seasonal Cycle and Generations

There appears to be two and possibly three generations each year of BTA in the desert region. The temperature determines the number of generations and development rate of the insect. If winter temperatures are warm, hibernating adults will emerge early and lay eggs in golf course turf. Therefore, the first generation can appear as early as April. Cooler winter temperatures may result in a first generation appearing during late June.

Threshold Level

The threshold levels for damaging populations of BTA on golf courses in the low desert region of California were 5-7 larvae per sq. ft. The level was much lower than other parts of the country, which are in the range of 40 larvae per sq. ft. This may be related to the extremely stressful condition of the desert in mid-summer and the limited ability of the plant to acquire the moisture it needs with insect damaged roots. The level was established for bentgrass turf and not bermudagrass. Bermudagrass was able to tolerate a higher level because of the root structure make-up and ability to grow under extreme temperature and humidity stress.

Control

To control BTA and minimize damage, good cultural management practices and proper use of selected insecticides in combination are essential. Early detection and control can reduce damage from early larvae feeding. Early control is very vital in the desert region because of the additional stress from heat and low relative humidity.

References

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PERSPECTIVE ON TURFGRASS DISEASES IN SOUTHERN CALIFORNIA

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Most of the serious turfgrass diseases in Southern California are caused by fungal plant pathogens. Diseases common in this part of the country include: anthracnose (*Colletotrichum graminicola*), dollar spot (*Sclerotinia homoeocarpa*), fairy ring (*Lepiota* spp., etc.), melting out (*Helminthosporium sorokinianum*), Pythium blight (*Pythium aphanidermatum*), Rhizoctonia blight (*Rhizoctonia solani*), and rust (*Puccinia striiformis*, *P. graminis*, and *P. coronata*).

Basic principles for managing turfgrass to minimize damage caused by these and other fungal pathogens include: (1) Plant disease-resistant species and cultivars; (2) Fertilize properly, using a balanced N-P-K fertilizer at the appropriate times; (3) Maintain a high mowing height within a species' adapted range to reduce environmental stress and disease outbreaks; (4) Avoid mowing turf when leaves are wet and foliar mycelium is evident; (5) Irrigate deeply to wet soil to a depth of 4-6 inches when turf first exhibits signs of wilt; (6) Test soil every 2-3 years for phosphorus and potassium levels as well as soil pH; (7) Avoid application of broadleaf herbicides or plant growth regulators when diseases are active; (8) Control soil compaction and thatch through core cultivation, verticutting, or both; (9) Overseed or renovate chronically damaged sites with disease resistant species and regionally adapted cultivars.

On greens, mechanical approaches to minimizing disease include: (1) Irrigate at dawn to remove leaf surface exudates and physically knock down mycelium of some pathogens; (2) Remove dew and leaf surface exudates to speed leaf drying by dragging; (3) Avoid mowing wet foliage when foliar mycelium is evident; (4) Keep mowers adjusted and blades sharp; use walk-behind greensmowers and increase the height of cut whenever possible; (5) Core cultivate or verti-drain compacted sites; (6) Employ water injection or core cultivation in combination with wetting agents to alleviate localized dry spots of fairy ring damage; (7) Remove trees and brush to improve air movement and sunlight penetration; electric fans may improve air movement in some situations; (8) Prune tree roots around greens to reduce competition for water and nutrients.

In addition to maintaining turf vigor through sound cultural practices and planting disease resistant cultivars, enhancing soil microbial activity can be an effective means of biologically reducing turfgrass disease. Application of composted biosolids, manures, and agricultural amendments provide organic matter and nutrients which encourage the growth and proliferation of soil microorganisms. These microorganisms may compete with or otherwise antagonize and reduce the activity of plant pathogens in the soil as well as form beneficial relationships (e.g. mycorrhizae) with plants.

Chemical pesticide application can further reduce disease problems, both as a preventative measure and to control outbreaks. Proper diagnosis of the disease problem is critical for effective use of pesticides. Diagnostic laboratories, public or private, can offer assistance in identification of pathogens. When sending samples to a diagnostic laboratory, it is essential that samples are properly collected and shipped. Samples should be collected while the disease is active (not after disease has subsided), and must be transported as rapidly as possible, and should arrive at the lab in good condition. Samples should be clearly marked on the outside of the packaged soil or turf plugs, and should be accompanied by a letter providing the following information: (1) Turf species and site affected; (2) Symptoms and environmental conditions; (3) Cultural and chemical treatments applied; (4) Polaroid photographs.

A COMPARISON OF ACTUAL AND PREDICTED PESTICIDE FATE

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Previous USGA-funded research at the University of California, Riverside (UCR) indicated that less than 0.1% of the applied carbaryl was lost by volatilization and leaching through the putting green plots. More of the applied 2,4-D could be accounted for: approximately 1% volatilized into the atmosphere, and approximately 5% leached through the soil. However, in both cases, more than 90% of the applied compound was not accounted for. In this project, we are performing a more detailed analysis of the fate of pesticides in the field plots to enable a determination of the mass balance.

The purpose of this research project is to conduct a mass balance assessment of turfgrass pesticides in field plots and use the data obtained in the assessment to test and modify a pesticide transport model. The specific objectives of the project are to: a) determine the partitioning of commonly-used turfgrass pesticides among the components of a turfgrass system including the atmosphere, soil, soil-water, leachate, thatch, verdure, and clippings; b) assess the ability of mathematical models, such as CHAIN_2D and PRZM2, to accurately predict pesticide movement in a field-plot-scale turfgrass system; and c) modify the mathematical model and/or change the data collection protocol as necessary to improve the accuracy of model predictions.

The pesticides used in the first experiment were chlorothalonil (Daconil 2787®) and metalaxyl (Subdue®). The chlorothalonil was applied at a rate of 8 oz/1000 ft^2 (500 g active ingredient per liter). The total mass of chlorothalonil applied to the lysimeter area of each plot (approximately 1.22 m^2) was 1.55 g. The metalaxyl was applied at a rate of 2 oz per 1000 ft^2 (2 lb. active ingredient per gallon). The total mass of metalaxyl applied to the lysimeter area of each plot was 0.186 g. The pesticides were applied by a certified pesticide applicator on September 27, 1995 at approximately 8:00 a.m.

Samples of drainage water were collected from each of the test plots on a daily basis. Drain volumes were measured and recorded daily, allowing a calculation of the mass of pesticides leaching from the plots. Samples of the turfgrass clippings were taken from each of the experimental plots one day prior to pesticide application to determine any background concentrations. Clippings samples were also taken on days 1, 3, 5, 7, 9, and 12. Sampling of the clippings will continue until concentrations are below detection limits. The volatilization of the pesticides into the air was measured using a volatilization flux chamber placed directly on the turf in each of the designated plots. Soil samples were obtained from the entire soil profile (47 cm) using a handheld coring device. The soil was divided into five increments (0-2, 2-7, 7-17, 17-32, and 32-47 cm) prior to analysis to permit a determination of the depth distribution of the pesticides in the profile. Soil samples were taken prior to the pesticide application, and on days 0, 2, 7, 15, 30, 60, 90, 120 and 150 after pesticide application.

The measured partitioning of each of the chemicals into the various environmental compartments (soil, water, air, and tissue) has been compared to that predicted by a mathematical transport model, CHAIN_2D. While the model predicts comparable behavior to what was actually measured, it is obvious that refinements will be necessary before accurate predictions can be made.

Because of the vast number of combinations of pesticides, soil types, cultural practices, and environmental conditions, it is not practical to experimentally evaluate each of these combinations to determine potential environmental impacts. The use of computer models can substitute for experimental data if they are found to be accurate in their predictions. However, the models that are currently in use haven't been developed for turfgrass systems. This project is identifying the flaws in the predictive capabilities of computer models and attempting to refine them so that they can make accurate predictions. The ultimate goal of using a computer model would be to assist the turfgrass manager in identifying potential site-specific problems with environmental contamination so that measures to avoid those problems can be taken.

SUMMER CULTIVATIONS ON CREEPING BENTGRASS/ANNUAL BLUEGRASS PUTTING GREENS

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Summer bentgrass/annual bluegrass decline is one of the more common concerns of golf course superintendents in Southern California. It is a complex of plant stresses, which may include climate, soil, pests, traffic, and others. Though the successful management of creeping bentgrass/ annual bluegrass putting greens during the summer involves numerous aspects of the annual cultural program, the focus of this presentation and associated research is on the summer cultivation aspect.

Summer cultivations of creeping bentgrass/annual bluegrass putting greens are needed to 1) reduce soil surface compaction and hardness due to increased summer-time traffic and/or sodium, 2) maintain soil water infiltration and percolation which are especially critical for roots subjected to high soil temperatures and/or salts during the summer, and 3) maintain soil gas exchange which also is especially critical for roots subjected to high soil temperatures during the summer. In brief, prolonged high soil and air temperatures are probably the most limiting factor for bentgrass/annual bluegrass growth during the summer. Soils with limited soil gas exchange, limited soil water infiltration and percolation, and high concentrations of salts compound the detrimental effects of prolonged high temperatures. Maintaining good soil physical characteristics is a major key for successfully maintaining bentgrass/ annual bluegrass putting greens during the summer in Southern California.

The maintenance of proper soil physical characteristics is a 12-month process, and it involves a proper soil cultivation and topdressing program during the spring and fall. Actually, the cultivation/topdressing programs in the spring and fall may be the most important step in successfully dealing with summer bentgrass/annual bluegrass decline, at least from a soil physical aspect. These activities are more long term solutions for increasing soil water infiltration rates and soil aeration porosity. However, our current focus is on soil cultivations during the summer when bentgrass/annual bluegrass is not under optimal growing conditions. Due to the environmental stress of the summer and the stress associated with increased traffic, less plant-stressful techniques of soil cultivations are practiced during the summer and have included spiking and coring with relatively small-diameter, solid tines. A more recent technique involves using high pressure water injection via a Toro HydroJect or similar equipment. This technique uses short bursts of high velocity streams of water to cultivate the soil while minimizing surface disruption.

We are currently involved in a two-year project at Industry Hills Golf Course. The major objective is to study cultivation methods for maintaining putting green soil aeration and leaching capability during the summer. This study will be discussed, so a brief study outline has been included in this report.

A special thanks are given to Mr. Bert Spivey, CGCS, and his staff for their diligent care of the research plots. Also, thanks are given to The Toro Company for partially funding this research project.

1996-98 TORO PROJECT
Maintaining Putting Green Soil Aeration and Leaching Capability During the Summer with a Toro HydroJect

R. Green, L. Wu, J. Evans, F. Merino, B. Spivey, and J. Hartin

I. OBJECTIVES

Study summer cultivation techniques on an in-use creeping bentgrass/annual bluegrass putting green to achieve the following:

- Maintain soil aeration, especially O_2 status
- Maintain soil infiltration and percolation
- Maintain leaching capability to manage salts
- Maintain rooting
- Maintain a desirable putting green surface

II. LOCATION

Industry Hills Golf Courses
Eisenhower Practice Putting Green

- This practice putting green was constructed to USGA specifications in 1978. Currently, the putting green is approximately 80% annual bluegrass and 20% creeping bentgrass
- Last cultivation prior to current study was a vertidrain operation in July 1995
- Average field infiltration rate in summer 1995 = 0.78 inches/hr.
- Average bulk density in summer 1995 = 1.43 g/cm^3
- Average total porosity in summer 1995 = 46.25%
- Average air-filled porosity in summer 1995 = 24.05%
- Water analysis (approximate): pH = 6.9-7.1; EC = 1.08 mmhos/cm; soluble salts = 691 ppm; sodium 146 ppm; SAR 2.93 Meq/L; SAR adj. = 6.75 Meq/L; exchangeable sodium percent 2.98 Meq/L

III. EXPERIMENTAL DESIGN, PLOT SIZE, AND STUDY DURATION

- Experimental design is a randomized complete block design with four replications of each treatment
- Individual plot size is 6.0 x 20.0 feet
- This is a two-year study with measurements being taken for not less than 16 to 20 consecutive weeks within each year

IV. TREATMENTS (frequency)

1. Check (NA)

2. HydroJect[z] Lowered (21 days)
3. HydroJect[y] Raised (21 days)
4. HydroJect[z] Lowered (14 days)
5. Spiking (14 days)[x]

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[z]HydroJect 3000, #53 nozzles with 11 nozzles operating, HydroJect set for the greatest hole density, full throttle, and hand-bar completely depressed. These settings deliver a hole spacing of approximately 1.75 x 3.0 inches with holes approximately 3.0 to 3.5 inches deep and 1/16 inch diameter.

[y]Same equipment as footnote (z) except the HydroJect is operated in the raised, transport position, set at the second greatest hole density, full throttle, and hand-bar partially depressed. These settings deliver a hole spacing of approximately 3.0 x 3.0 inches with holes deeper than 4.0 inches and 1/8 inch diameter.

[x]Toro Greens Aerator, with Spiker Kit, with solid tines, 0.25 inch diameter x 3.5 inches long. Aerator operated at full throttle and low gear with end of adjustment bolt 1-7/16 inches from aerator frame. These settings deliver a hole spacing of approximately 2.5 x 2.5 inches with holes deeper than 3.0 inches and 0.25 inch diameter.

V. MEASUREMENTS

1. <u>Soil EC</u> two days before and after a leaching event. Three depth intervals: 0 to 1.0 inch; 1.0 to 3.0 inches; and 3.0 to 6.0 inches. Measurements taken before and after two of the once/month leaching events.
2. <u>Field infiltration rates</u> 8 to 9 days post cultivation treatments. Measurements taken mid and late study.
3. <u>Soil bulk density, total porosity, air-filled porosity, field capacity volumetric water content and plant-available water content</u>, 8 to 9 days post cultivation treatments. Two depth intervals: 1.0 cm to 6.0 cm (0.4 to 2.4 inches) and 6.0 cm to 11.0 cm (2.4 to 4.3 inches). Measurements taken mid and late study.
4. <u>Oxygen diffusion (ODR)</u> as a time sequence after an irrigation event. Measurements collected at the 1.0 inch depth, 8 to 9 days post cultivation treatments. Measurements taken mid and late study.
5. <u>Root mass density</u>. Two depth intervals: 1.0 to 3.0 inches and 3.0 to 6.0 inches. Measurements taken mid and late study.
6. <u>Visual turfgrass quality</u>. Once a month or as needed.

OTHER MEASUREMENTS

1. Complete chemical and salinity analysis of soil before and after study.
2. Irrigation water EC. Samples collected biweekly during study.
3. Total amount of irrigation water applied, and therefore total salts applied via irrigation water.

CHARACTERIZATION OF MARKERS FOR LEAF FIRING RESISTANCE AMONG TURF-TYPE BERMUDAGRASSES

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The amount of water utilized for turfgrass and landscape irrigation can be substantial and may increase as urbanization continues. The most effective way to save landscape irrigation water is to irrigate the entire depth of the root-zone soil and maintain the maximum amount of time between irrigation events. The most important turfgrass phenotype that will enable irrigation water savings is leaf firing resistance (LFR), the ability of the turfgrass sward to remain turgid and green during the time between irrigation events. It should be noted that heat tolerance may be coupled with LFR, and that adverse soil-related issues can be more limiting to successful irrigation water savings than genotype issues. Previous work has shown that considerable variation for LFR exists among the turf-type bermudagrasses, and that root mass at various depths is significantly correlated to LFR. Also, we have found no reports concerning the dehydration tolerance characteristics among the turf-type bermudagrasses. The primary objective of this research is to identify molecular, cellular, physiological, and whole-plant markers that are closely associated with LFR, and to begin investigation of possible mechanisms for LFR. Results obtained from this research will help to identify the relative importance of traits that could be utilized to select for LFR bermudagrasses. We are testing three high-LFR genotypes (FloraTex, Midiron, and Texturf 10) and three low-LFR genotypes (Tifway, Tufcote, and Vamont) under a range of soil moisture conditions in three different environments: plastic pots, 20.3-cm diameter x 40.6-cm deep (8.0 inch diameter x 16 inch deep), maintained in a glasshouse; PVC cylinders, 15.2-cm diameter x 213.4-cm deep (6 inch diameter x 7.0 feet deep), maintained outdoors; and in the field where individual turfgrass plots are 1.82 x 2.89 m (6.0 x 9.5 feet). Considerable effort and care has been placed in developing the three environments so that we can study realistically a perennial grass that may require time to express whole-plant traits that may be important in conferring LFR. A similar set of measurements are being collected in all the studies and they will be used to compare pot and field performance. These measurements include shoot apex dehydrin (LEA group 2) expression by Western blot, and ABA content; leaf relative water content, water content, and chlorophyll content; visual estimates of the percentage of leaf firing, clipping yields, and root mass at various depths. In the fall of 1995 we conducted the first glasshouse study to assess the methodologies for our measurements and to begin to collect data that could be compared to data collected from the field. Results showed significant differences among the genotypes, irrigation treatments, and sample dates for dehydrin expression; leaf relative water content, water content, and chlorophyll content; leaf firing, and clipping yields. However, these results generally were not consistent with the known LFR phenotype of the six genotypes, which may suggest that assessments in pots and possibly assessments conducted in the late fall are not representative of actual field performance. Measurements are currently being initiated for the cylinder study, an environment with non-limited root expression.

GETTING READY TO PUT TURFGRASS IN A RETRACTABLE-ROOF STADIUM THE FIRST TIME

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In 1995, a major league baseball franchise was awarded to a group representing the Phoenix area. A new stadium, the Bank One Ballpark, is to be built to house the Arizona Diamondbacks. The facility will have a retractable roof to provide an open air stadium in spring and fall and during home stands in the hot Arizona summer air conditioning will be required for spectator comfort and the roof will be closed. The commitment was made to have natural grass as the playing surface. Researchers at UCR were asked to figure out how to do it.

A literature review was conducted to determine what was already known about light, air movement, evapotranspiration, and the plant response. Based upon the review a series of experiments were conducted with the purpose of answering questions to meet the requirements of the stadium.

- How much light is required for turfgrass used for sports?
- Can the light be supplemented? Artificial? Reflected?
- Is there a low light turfgrass suitable for a sports field? Warm season? Cool season?
- Will the grass make an adequate baseball infield? What is the traffic tolerance?
- Can the roof be closed for home stands? For how long? What happens to the grass?
- If air movement is required for grass growth, how much air?
- How can recovery from injury be enhanced?
- How long will it take to root sod in the spring?

The first experiments showed that zoysiagrass would have the adaptability to low light while having good traffic tolerance. 'DeAnza' zoysiagrass, a new patented release from UCR, was selected. As well as low light adaptability, 'DeAnza' has a rapid rate of growth to provide quick establishment and recovery from injury.

The next experiments are designed to investigate the light requirements and if artificial light and reflected light can be used. Air movement requirements are being investigated in separate studies. A field structure has been built to provide the same shade restrictions as the stadium with tenebrous periods representing homestands for a simulated baseball season. Most of the questions are expected to be answered before the field is installed.

NEW TURFGRASSES FOR SOUTHERN CALIFORNIA AND THEIR PERFORMANCE

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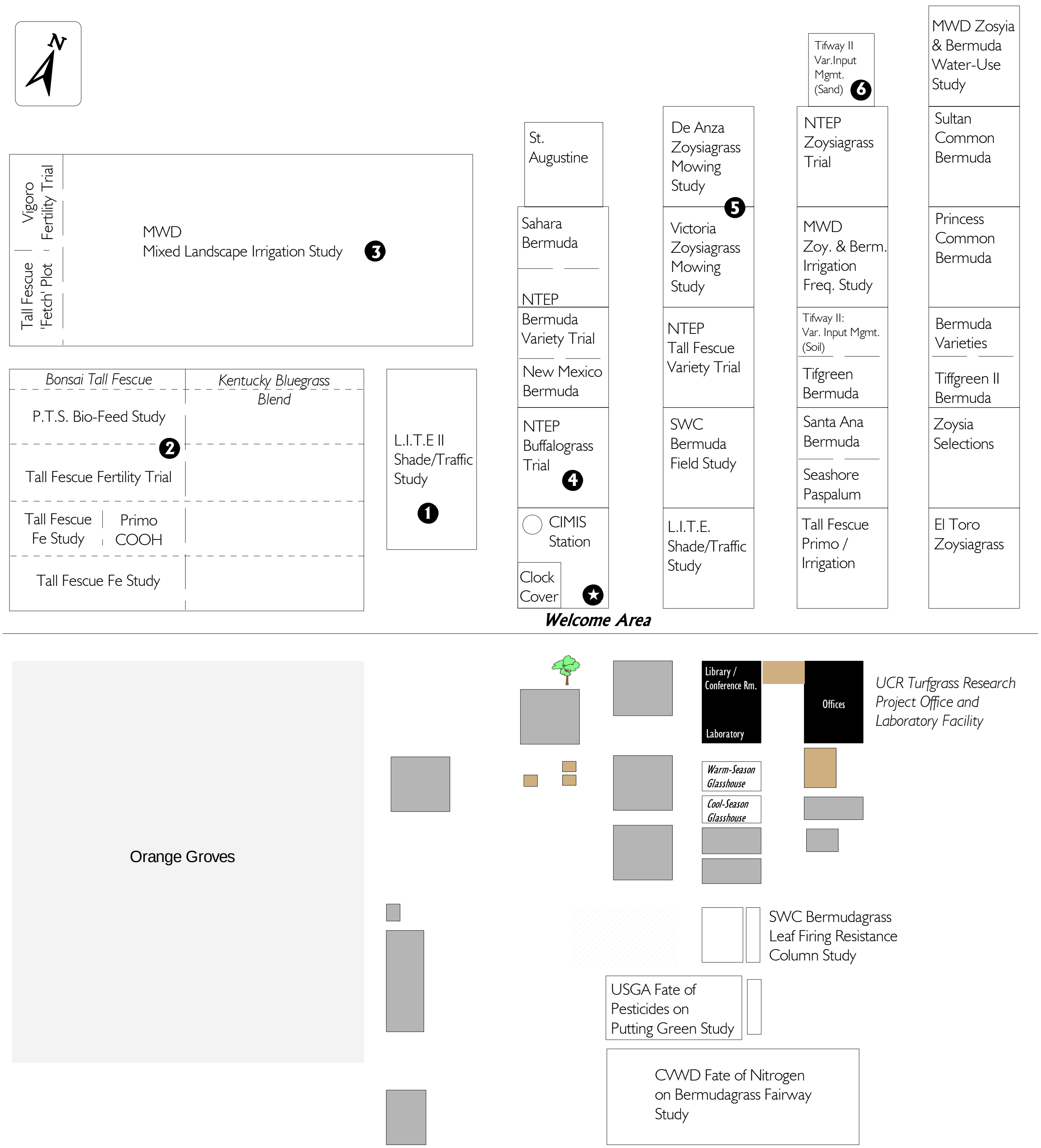
The performance of turfgrasses in a given area is dependent on the *adaptation* of the grass to the climate and soil of the site, to the intended *use* for the turfed site, and to the *level of culture* that will be provided. Both warm- and cool-season turfgrasses may be used in Southern California when these criteria are considered. Coastal Southern California is often thought of as a transitional turfgrass zone, where both warm- and cool-season turfgrasses give good performance while inland sites, with more extreme summer temperatures, offer a climate where warm-season turfgrasses may be better adapted.

Within the cool season category of turfgrasses, Southern California lawns and specialty use facilities have benefited from turfgrass breeding programs in Kentucky bluegrass, perennial ryegrass, tall fescue, and creeping bentgrass. The newer cultivars have been selected for better color, texture, density, uniformity, and pest resistance, and in the more recent past, characteristics such as the ability to give a good quality surface with less input of fertilizer, mowing, pesticides and general maintenance requirements. Notable progress has been made especially with tall fescue and creeping bentgrass. Newer tall fescue cultivars are generally deeper green, denser, lower-growing, and of finer texture. Their overall turfgrass performance is superior to the earlier turf-type tall fescues and vastly superior to the older pasture-type tall fescues. Similarly, the newer creeping bentgrasses provide better quality characteristics for close-mown golf putting greens and other specialty turfed sites such as lawn bowling greens in high summer temperature areas.

Southern California turfed sites also benefit from the improvement in the warm-season turfgrasses, especially common bermudagrass, zoysiagrass, buffalograss and, in the future, Seashore Paspalum. New cultivars of common bermudagrass have been released over the past several years that have better color, finer texture, and shorter and more compact internodes with resulting higher density. Two new zoysiagrasses released from the University of California at Riverside turfgrass program have the ability to retain a green color throughout the winter months, or have a reduced dormancy period during abnormally cold winters. Likewise, new buffalograsses are now available by seed or as vegetative material where minimum maintenance conditions require low water, nutrition and mowing input. Both zoysiagrass and buffalograss breeding programs are in the early stages of development; our turfgrass industry in Southern California will continue to benefit from these research activities as new grasses are released for use in this area.

Research at UC Riverside continues to be involved in evaluating the performance of new adapted grasses through association with the National Turfgrass Evaluation Program. Performance results of these studies are presented in this proceedings under the title of An Overview of Cultivar Performance.



UCR Turfgrass Field Station Map

Field Day September 17, 1996

UCR TURF

LIGHT RESTRICTED TRAFFIC RESEARCH

Stephen T. Cockerham[1] and J. Michael Henry[2]
[1]*Agricultural Operations, University of California, Riverside, CA 92521*
[2]*University of California Cooperative Extension, Riverside and Orange Counties*
21150 Box Springs Road, Moreno Valley, CA 92557

Remote data acquisition: PPFD (photosynthetic photon flux density); temperature; relative humidity

I. Cultural practices for light restricted turf

Turf: 'DeAnza' zoysiagrass, sodded 6/96
Light restriction: louver shading
PPFD 4.5 hours full Spring/Fall
6.5 hours full mid-Summer
Maintenance: irrigate non-limiting; mow 5/8"
Treatments:

Nutrition
- 0.5 #N/M/mo
- 0.25 #N/M/mo
- 0.5 #N/M/mo + Fe
- 0.25 #N/M/mo + Fe
- 0.5 #N/M/mo + 0.5 #K/M
- 0.25 #N/M/mo + 0.5 #K/M
- 0.5 #N/M/mo + 0.5 #K/M + Fe
- 0.25 #N/M/mo + 0.5 #K/M + Fe
- No treatment

Split strip treatments
- Vertical mowing monthly
- Vertical mowing weekly
- No vertical mowing

II. Cultural practices for light restricted trafficked turf

Turf: Manhattan II perennial ryegrass, sodded 2/95
Maintenance: irrigate non-limiting; NPK 15-15-15 @ 1#N/6 wks; mow 1 1/4"

Light restriction: Full sun
30% PPFD reduction
55% PPFD reduction
73% PPFD reduction

Treatments:

Culture
- Aerify once/mo
- Aerify once/mo + PGR
- Aerify once/mo + biostimulant
- PGR
- Biostimulant
- No treatment

Traffic
- One game/wk
- Three games/wk

OVERVIEW OF TALL FESCUE FERTILITY PROJECTS AT UCR TURFGRASS FIELD RESEARCH CENTER

Janet Hartin
University of California Cooperative Extension, San Bernardino and Los Angeles Counties
777 E. Rialto Avenue, San Bernardino, CA 92415

Background: Tall fescue (*Festuca arundinacea)* is a cool-season turfgrass that maintains color year around and is used extensively for lawns and recreational areas in Southern California. In fact, due to the popularity of tall fescue in California, it accounts for 70 - 80 percent of the sod industry. Although it prefers temperatures between 60 - 75°F, it possesses a relatively high heat tolerance compared to perennial ryegrass and Kentucky bluegrass. Tall fescue is also more drought resistant than other cool-season turfgrasses due to its relatively deep root system. Because tall fescue is a bunch-type turfgrass, it will not spread into neighboring plantings and can readily be maintained with a rotary mower.

Tall fescue, like all other turfgrasses, requires 16 essential plant nutrients for growth and development. Of these, the application of nitrogen (N), phosphorus (P), potassium (K), sulfur (S) and iron (Fe) are the most common. When developing a fertilizer program for tall fescue, the following need to be considered: desired level of performance and appearance, chemical and physical properties, influence and timing of cultural practices, and available resources.

Of the nutrients required by tall fescue for growth and development (excluding carbon, hydrogen and oxygen which are supplied by air and water) nitrogen is needed in the greatest quantity. It is a vital constituent of chlorophyll, amino acids, proteins, nucleic acids, enzymes, and vitamins, and is important for optimum color, density, shoot growth, root growth, recuperative ability, and resistance to certain diseases and environmental stresses.

In general, 6.0 pounds of N/1,000 ft^2 are required annually for maintaining the highest quality and most visually pleasing tall fescue lawns, parks, recreational fields, and commercial areas. While annual applications of 3 to 4 pounds of N/1,000 ft^2 result in acceptable quality tall fescue, the aesthetic appeal is reduced.

Both quickly and slowly available nitrogen forms may be applied to tall fescue. Seasonal differences and the skill of the workforce largely determine which form to use. While quickly available sources of N are inexpensive and result in a rapid turfgrass response that is less temperature dependent than slow release forms of N, a higher level of skill is necessary to avoid uneven application and foliar burn. Slow release products are costlier but result in a longer, more even supply of N. Slowly available N carriers include natural and synthetic organics, and coated products.

Iron (Fe) is commonly deficient in turfgrass. Often, the deficiency is the result of insolubility rather than an elemental absence of soil iron. Deficiencies are common in alkaline soils, soils high in phosphates, manganese and zinc, and soils high in organic matter, heavily thatched or waterlogged. Fe is absorbed in the ferric (Fe^{+++}) or ferrous (Fe^{++}) ions, although it is physiologically active only in the ferrous state. Fe is required for chlorophyll synthesis and is a constituent of certain enzymes in respiratory systems. Turfgrass color is related to the amount of Fe available to the plant. Turfgrass discoloration occurs when there is an Fe deficiency. Fe is relatively immobile in a plant and can be inactivated by excess manganese. Fe applications in combination with N have been found to enhance appearance, chlorophyll content, and early spring growth of bentgrass compared to nitrogen applications alone. However, Fe deficiency may be accentuated by high growth rates caused by N applications.

Three projects involving tall fescue fertility that are currently being conducted at UCR and that will be discussed at the 1996 UCR Turfgrass Field Day include the 1996-97 evaluation of slow-release and fast-release N fertilizers over a two year period, the tall fescue Fe study, and the Pacific Technical Services project on tall fescue evaluating the efficacy of several biological products. Project overviews, protocols, and plot plans for these projects follow.

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Beard, J.B. 1973. *Turfgrass: Science and Culture*. Prentice-Hall, Englewood Cliffs, NJ

Green, R.L. 1996. Personal Communication. Department of Botany & Plant Sci. UC Riveride

Richie, W. E. 1996. Developing and Irrigation Program for Tall fescue. *Turf Tales Magazine*, Summer '96.

Waddington, D.V, R.N. Carrow, and R.C. Shearman, editors. 1992. *Turfgrass.* The American Society of Agronomy, Inc., Crop Science Society of America, Inc., and Soil Science Society of America, Inc. publishers, Madison, WI

Influence of temperature on the growth of tall fescue.

Characteristics	Temperatures (ºF)	Season
Temperature optimum for root growth	50 to 64	Fall Spring
Temperature optimum for shoot growth	60 to 75	Fall Spring
Freezing stress (kill)	11 and below	Winter
Chilling stress and growth reduction	≈45 and below	Winter
Heat stress		
Root growth	70 and above	Summer
Shoot growth	85 and above	

(Shoot growth range = 45 to 85) (Root growth range = 45 to 70)

Seasonal and growth-rate considerations for choosing fertilizers for tall fescue.

Season	Desirable Temperatures for Growth	Desired Growth Rate for Shoots and Roots	Fertilizer needs, especially nitrogen
Early spring	High	Moderate	1. Quick release 2. Complete fertilizer 3. Slow release
Late spring	Medium	Moderate to low	1. Slow release 2. Quick release
Summer	Medium	Moderate to low	1. Slow release
Early fall	High	Moderate	1. Quick release 2. Complete fertilizer 3. Slow release
Late fall	Medium	Moderate to Low	1. Quick release 2. Slow release
Winter	Medium-Low	Low	1. Quick release

A soil test for P, K, pH, EC, and SAR should be taken once every on or two years.

1996-97 EVALUATION OF SLOW-RELEASE AND FAST-RELEASE NITROGEN FERTILIZERS APPLIED TO TALL FESCUE THE FINAL YEAR OF A TWO-YEAR STUDY

G. Klein, J. Hartin, E. Baltazar, S. Blackwood, R. Green
University of California, Riverside

Objectives:
To evaluate the performance of nitrogen fertilizers applied to established tall fescue (*Festuca arundinacea*) the final year of a two-year study.

Cultivar:
'Bonsai' tall fescue.

Experimental Site:
A mature plot established at the UCR Turfgrass Field Research Center, Riverside, CA on September 28, 1993. The root zone is a native soil which is classified as a Hanford fine sandy loam; pH = 7.4; Olsen-P = 17ppm; Extractable K = 75ppm as of March 1995.

Experimental Design:
Randomized Complete Block design with four replications. Plot size 4.5 x 6.0 ft.

Mowing:
Once per week with a walk-behind rotary mower set at 1.5 inches. Clippings collected.

Irrigation:
Plots irrigated to prevent visual drought symptoms and overwatering.

Fertilizer Treatments *(see Treatment Table)*:
- Annual N rate set at 6 pounds / 1000 ft^2 (except for selected Itronics *Gold'n'Gro* treatments.
- Test runs March 1996 to March 1997.

Measurements:
Visual turfgrass quality ratings are estimated once every two weeks beginning two weeks after initial treatment applications, using a 1 to 9 scale (1=poorest, 5=acceptable, 9=best tall fescue).

Clipping yields are collected every two weeks beginning three weeks after initial treatment applications. Yields include seven days of growth, and are collected with the same mower used for routine mowing. Clippings are dried for 48 hours in a forced-air oven maintained at 60 ºC. Clippings collected represent a 27% subsample of the 27.0 ft^2 plot.

Year Two: Two-Year Fertilizer Programs for Tall Fescue in Riverside, CA: March 15, 1996- March 14, 1997

TRT	Company	Fertilizer Program: Product (lb N / 1000 ft²)						Tot. lb N / 1000ft² / 12 months
Application Dates →		Once every month, alternating between 20-1-7 (one month) and Iron treatements (two months)						
1	ITRONICS	Gold'n'Gro 20-1-7 (W/V) at 0.5 N/1000ft²; Gold'n'Gro Iron 5-0-0 (5% iron, 3% sulfur [W/V]) at 8 fl.oz./1000ft²: 3/96 (20-1-7), 4/96 (Iron), 5/96 (Iron), 6/96 (20-1-7), 7/96 (Iron), 8/96 (Iron), 9/96 (20-1-7), 10/96 (Iron), 11/96 (Iron), 12/96 (20-1-7), 1/97 (Iron), 2/97 (Iron) *[plots originally the Scotts treatment]*						2.2
Application Dates →		March 11	May 6	July 8	September 9	November 8	N/A	
2	Sea Source	Turf Rally 16-4-8 (1.5)	Turf Rally 16-4-8 (1.0)	Turf Rally 16-4-8 (1.0)	Turf Rally 16-4-8 (1.0)	Turf Rally 16-4-8 (1.5)	--	6.0
Application Dates →		March 11	May 20	August 19	October 21	N/A	N/A	
3	J.R. Simplot	Polyon 43-0-0 (1.5)	Polyon 42-0-0 (1.5)	Polyon 42-0-0 (1.0)	Polyon 43-0-0 (2.0)	--	--	6.0
Application Dates →		N/A						
7	Check	N/A [*formerly the N Humate/ IBDU treatment]*						0.0
Application Dates →		Once every month, every second month, or every third month as indicated.						
8	ITRONICS	Gold'n'Gro 20-1-7 (W/V): Sprayed at 0.5 each month: 3/96, 4/96, 5/96, 6/96, 7/96, 8/96, 9/96, 10/96, 11/96, 12/96, 1/97, 2/97						6.0
9	ITRONICS	Gold'n'Gro 20-1-7 (W/V): Sprayed at 0.5 every second month: 3/96, 5/96, 7/96, 9/96, 11/96, 1/97						3.0
10	ITRONICS	Gold'n'Gro 20-1-7 (W/V): Sprayed at 0.5 every third month: 3/96, 6/96, 9/96, 12/96						2.0
Application Dates →		March 11	June 10	September 9	November 12	January 13	N/A	
11	J.R. Simplot	Re-Gain 16-3-7 (1.5)	Re-Gain 17-1-4 (1.5)	Turf Supreme 16-6-8 (1.0)	Nitra King 22-3-9 (1.0)	Nitra King 22-3-9 (1.0)	--	6.0
Application Dates →		March 11	May 6	July 8	September 9	November 8	N/A	
12	Greener Pastures	Greener Pastures 15-1-15 (1.5)	Greener Pastures 15-1-15 (1.0)	Greener Pastures 15-1-15 (1.0)	Greener Pastures 15-1-15 (1.0)	Greener Pastures 15-1-15 (1.5)	--	6.0
Application Dates →		March 11	July 26	September 15	November 15	N/A	N/A	
13	United Hort. Supply	Turfgo 25-5-16 (2.0)	Turfgo 25-5-16 (1.25)	Turfgo 25-5-16 (1.5)	Turfgo 25-5-16 (1.25)	--	--	6.0
Application Dates →		March 11	May 20	July 29	October 7	November 15	January 31	
14	United Hort. Supply	Turfgo 20-5-10 (1.0)	Turfgo 20-5-10 (1.0)	Turfgo 20-5-10 (1.0)	Turfgo 20-5-10 (1.0)	Turfgo 20-5-10 (1.0)	Turfgo 20-5-10 (1.0)	6.0
Application Dates →		March 11	May 13	July 8	September 9	November 12	January 13	
15	UCR	Turf Supreme 16-6-8 (1.0)	Turf Gold 21-3-5 (1.0)	Poly Supreme 23-5-10 (1.0)	Turf Supreme 16-6-8 (1.0)	Nitra King 22-3-9 (1.0)	Nitra King 22-3-9 (1.0)	6.0

Year Two: One-Year Fertilizer Programs for Tall Fescue in Riverside, CA: 3/15/96 - 3/14/97

G. Klein, J. Hartin, E. Baltazar, S. Blackwood, R. Green
University of California, Riverside

I	14 1	15 2	9 3	11 4	13 5	2 6	1 7	8 8	3 9	10 10	-- 11	-- 12	-- 13	7 14	12 15	-- 16
II	-- 17	13 18	1 19	14 20	-- 21	-- 22	9 23	-- 24	15 25	11 26	3 27	12 28	10 29	2 30	8 31	7 32
III	11 33	-- 34	2 35	15 36	10 37	12 38	1 39	7 40	-- 41	3 42	9 43	8 44	-- 45	13 46	14 47	-- 48
IV	3 49	15 50	11 51	-- 52	13 53	-- 54	14 55	7 56	-- 57	1 58	9 59	-- 60	8 61	12 62	10 63	2 64

TREATMENTS

1. Gold'n'Gro / Iron
2. Turf Rally 16-4-8
3. Polyon 43-42
7. Check
8. Gold'n'Gro 20-1-8 (6)
9. Gold'n'Gro 20-1-8 (3)
10. Gold'n'Gro 20-1-8 (2)
11. Re-Gain
12. Greener Pastures
13. Turfgo 25-5-16
14. Turfgo 20-5-10
15. UCR Check

N

1996-97 TALL FESCUE IRON (Fe) STUDY

G. Klein, J. Hartin, E. Baltazar, S. Blackwood, R. Green
University of California, Riverside

Objectives:
To evaluate the performance of iron treatments when applied to tall fescue fertilized at three different nitrogen levels.

Duration of Study: One year.

Cultivar:
Bonsai tall fescue.

Experimental Site:
A mature plot established at the UCR Turfgrass Field Research Center, Riverside, CA on September 28, 1993. The root zone is a native soil which is classified as a Hanford fine sandy loam; pH = 7.0; P-Bic = 38 ppm; Extractable K = 123 ppm; Fe = 67 ppm, as of April 1996.

Experimental Design:
Split plot design with N treatments forming main plots and Fe treatments forming subplots. Main plots = 27 ft x 6 ft.; subplots = 4.5 ft. x 6 ft. Treatments arranged in a randomized complete block design with three replications.

Mowing:
Once per week with a walk-behind rotary mower set at 1.5 inches. Clippings collected.

Irrigation:
Plots irrigated to prevent visual drought symptoms and overwatering.

Fertilizer Treatments *(see protocol for specific dates)*:
- Annual N rates: 6.25, 3.25, and 0.25 pounds / 1000 ft^2.
- Annual iron rates range from 0.08 to 3.3 pounds Fe / 1000 ft^2.
- Test runs from April 1996 through March 1997.

Measurements:
Visual turfgrass quality are estimated once every two weeks beginning two weeks after initial treatment of all iron applications using a 1 to 9 scale (1=poorest, 5=acceptable, 9=best tall fescue).

1996-1997 Tall Fescue Fe Study

Treatment	Program: Nitrogen Product (lb N / 1000 ft^2) or Fe Product (lb Fe / 1000 ft^2)													Tot. lb N or Fe / 1000ft^2 / 12 months
MAIN PLOT FACTOR = N														
Nitrogen applications	**Turf Supreme 16-6-8**			**Urea 46-0-0 at 0.5 lb N / 1000 ft^2 and Ammonium Nitrate 34-0-0 at 0.5 lb N / 1000 ft^2 for a total of 1.0 lb N / 1000 ft^2 per app.**										
	Apr '96	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan '97	Feb	Mar	Apr	
A	1.0	0.25	1.0	--	1.0	--	1.0	--	1.0	--	1.0	--	--	6.25[z]
B	1.0	0.25	--	--	1.0	--	--	--	1.0	--	--	--	--	3.25[y]
C	--	0.25	--	--	--	--	--	--	--	--	--	--	--	0.25[x]
SUB-PLOT FACTOR = FE														
Ironite 2-0-0-11% Fe applications	Apr '96	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan '97	Feb	Mar	Apr	
A	--	--	--	1.650	--	--	1.650	--	--	--	--	--	--	3.300
B	--	--	--	0.825	--	--	0.825	--	--	--	--	--	--	1.650
Gold'n'Gro Iron 5-0-0-5% Fe (w/v) applications	Apr '96	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan '97	Feb	Mar	Apr	
A	--	0.0147	--	0.0147	--	0.0294	--	0.0294	--	0.0294	--	0.0294	--	0.1470
B	--	0.0056	0.0056	0.0056	--	0.0112	0.0112	0.0112	--	0.0112	0.0112	0.0112	--	0.0840
Vigoro 4-0-0-21% Fe applications	Apr '96	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan '97	Feb	Mar	Apr	
A	--	--	--	1.650	--	--	1.650	--	--	--	--	--	--	3.300
B	--	--	--	0.825	--	--	0.825	--	--	--	--	--	--	1.650

[z] Fe applied from Turf Supreme applications: 0.21 lb Fe / 1000 ft^2.
[y] Fe applied from Turf Supreme applications: 0.12 lb Fe / 1000 ft^2.
[x] Fe applied from Turf Supreme applications: 0.02 lb Fe / 1000 ft^2.

Evaulation of Iron Applications on Tall Fescue

Block 1

C	1 3	2 1	3 2	4 4	5 6	6 5
B	7 4	8 3	9 1	10 2	11 5	12 6
A	13 6	14 5	15 2	16 1	17 3	18 4

TREATMENTS

Nitrogen (total N per study):
A - 6.0 lb N/M
B - 3.0 lb N/M
C - 0.0 lb. N/M
(all N treatments in 1.0 lb N/M apps.)

Iron applications (total Fe for study):
1. Ironite 2-0-0-11% Fe (3.6 lb Fe/M)
2. Ironite 2-0-0-11% Fe (1.8 lb Fe/M)
3. Gold'n'Gro 5-0-0-5% Fe (0.15 lb Fe/M) [w/v]
4. Gold'n'Gro 5-0-0-5% Fe (0.08 lb Fe/M) [w/v]
5. Vigoro 4-0-0-21% Fe (3.6 lb Fe/M)
6. Vigoro 4-0-0-21% Fe (1.8 lb Fe/M)

N

Block 2

B	19 1	20 4	21 3	22 2	23 5	24 6
A	25 5	26 4	27 1	28 3	29 6	30 2
C	31 2	32 5	33 3	34 6	35 4	36 1

Block 3

37 5	38 1	39 4	40 3	41 2	42 6	A
43 3	44 4	45 2	46 1	47 6	48 5	C
49 2	50 5	51 3	52 6	53 4	54 1	B

1996-97 PACIFIC TECHNICAL SERVICES PROJECT ON TALL FESCUE

G. Klein, J. Hartin, E. Baltazar, F. Merino, S. Blackwood, R. Green
University of California, Riverside

Objectives:
To evaluate the performance of Bio-Feed fertilizer when applied to tall fescue for one year, in terms of visual quality ratings, clipping yields, clipping chemical element analysis, root mass density, and soil chemical element and physical analysis.

Cultivar:
Bonsai tall fescue.

Experimental Site:
A mature plot established at the UCR Turfgrass Field Research Center, Riverside, CA on September 28, 1993. The root zone is a native soil which is classified as a Hanford fine sandy loam; pH = 7.0; P-Bic = 38 ppm; Extractable K = 123 ppm as of April 1996.

Experimental Design:
Randomized Complete Block design with four replications. Plot size 6.5 x 10.0 ft. with 21-inch borders.

Mowing:
Once per week with a walk-behind rotary mower set at 1.5 inches. Clippings collected.

Irrigation:
Plots irrigated to prevent visual drought symptoms.

Fertilizer Treatments *(see protocol for specific dates)*:
- Annual N rate set at 6 pounds / 1000 ft^2.
- Test runs May to May.

Measurements:
Visual quality turfgrass ratings are estimated once every two weeks beginning two weeks after initial treatment applications, using a 1 to 9 scale (1=poorest, 5=acceptable, 9=best tall fescue).

Clipping yields are collected once every two weeks beginning three weeks after initial treatment applications. Yields include seven days of growth, and are collected with the same mower used for routine mowing. Clippings are dried for 48 hours in a forced-air oven maintained at 60 °C. Clippings collected represent a 27% subsample of the 65.0 ft^2 plot.

Clipping tissue analysis will be determined on selected dates (see measurement protocol). Analysis of total S, Na, Ca, Mg, Cu, Fe, Mn, N, P, Mo and Zn will be reported.

Root mass density will be determined on selected dates (see measurement protocol) from four cores per plot and two depths. Core diameter is 5.8 cm; depths are 0-7.6 cm and 7.6-15.2 cm.

Soil analysis will be determined on selected dates (see measurement protocol) from four cores per plot. Core diameter is 5.8 cm; depth at 0-7.6 cm (total volume of sample 803 cm^3). Analysis of pH, SAR, EC, ESP, particle size analysis, OM, CEC, soluble Ca, Mg, Na, B, Cl, HCO_3, CO_3, and exchangeable potassium, calcium, magnesium, and sodium, and Olsen-P.

PROTOCOL FOR THE 1996-97 PACIFIC TECHNICAL SERVICES PROJECT ON TALL FESCUE

G. Klein, F. Merino, J. Hartin, S. Blackwood, E. Baltazar, R. Green
University of California, Riverside

FERTILIZER APPLICATIONS

Treatments	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total N/ 1000ft^2/ year
Bio-Feed *Combinations applied first of month*[z] (lb. N/1000ft^2)	Soil+ Turf+ Iron+ Ferta+ (0.5)	Soil+ Turf+ Iron+ Ferta+ (0.5)	Soil+ Turf+ Iron+ (0.5)	Soil+ Turf+ Iron+ (0.5)	Soil+ Turf+ Iron+ Ferta+ (0.5)	Soil+ Turf+ Iron+ Ferta+ (0.5)	Iron+ Ferta+ (0.5)	Iron+ Ferta+ (0.5)	Iron+ Ferta+ (0.5)	Iron+ Ferta+ (0.5)	Soil+ Turf+ Ferta+ (0.5)	Soil+ Turf+ Iron+ Ferta+ (0.5)	6.0
UCR Check A[y] (lb. N/1000ft^2)	5/1/96 Turf Supreme (1.0)	--	7/1/96 Turf Supreme (1.0)	--	9/1/96 Turf Supreme (1.0)	--	11/1/96 Nitra King (1.5)	--	--	2/1/97 Nitra King (1.5)	--	--	6.0
UCR Check B[x] (lb. N/1000ft^2)	5/1/96 TriKote (1.5)	--	7/15/96 TriKote (1.5)	--	--	9/15/96 Par EX IBDU (2.0)	--	--	1/15/97 Par Ex IBDU (1.0)	--	--	--	6.0
Check													0.0

[z] Soil+ = 6-0-0; Turf+ = 16-4-4; Iron+ = 10-0-0-6 Fe; Ferta+ = 8-10-5 (all analyses w/v).
[y] Turf Supreme = 16-6-8; Nitra King = 22-3-9.
[x] TriKote = 42-0-0; Par Ex IBDU = 18-3-18.

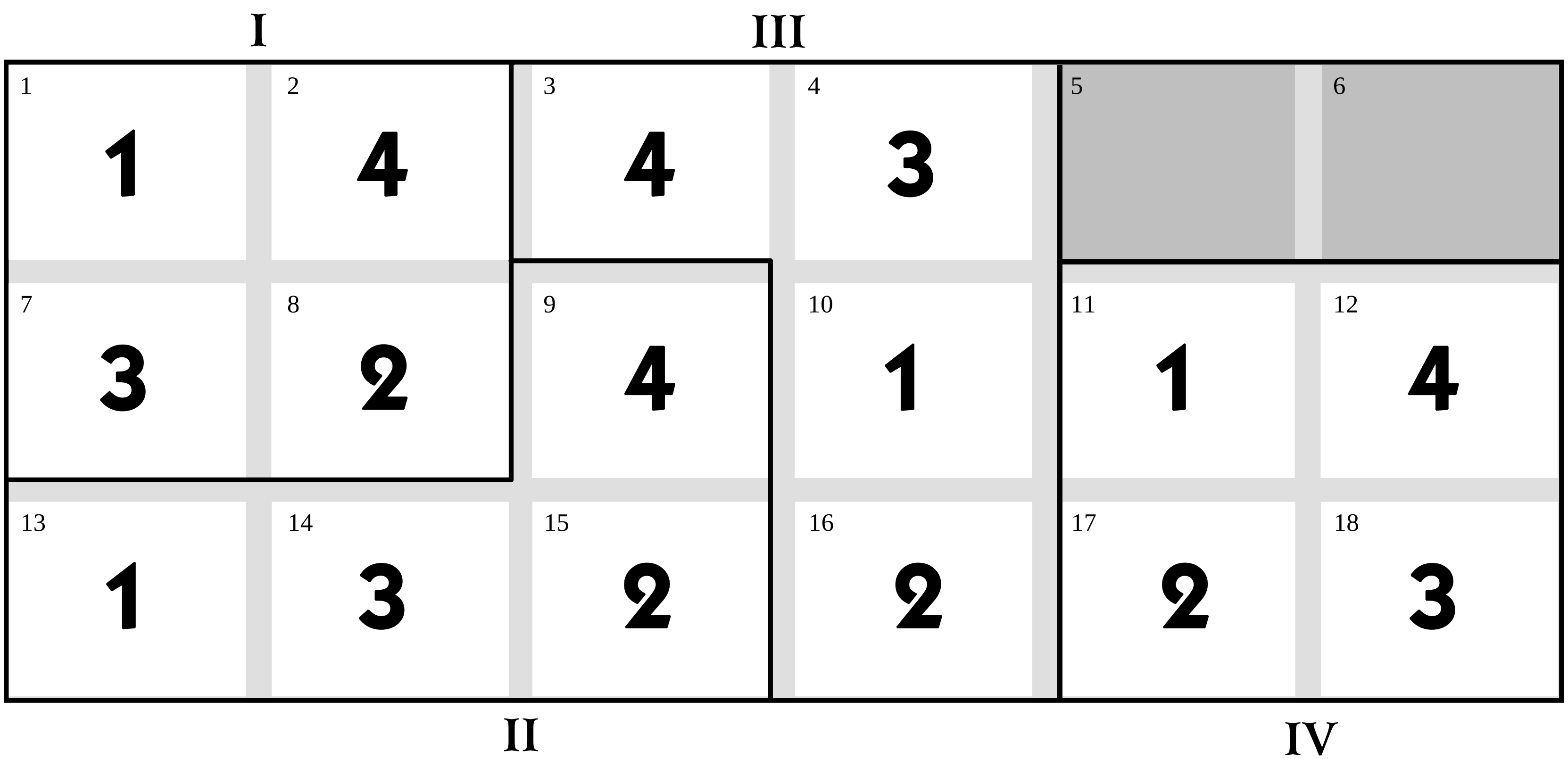
MEASUREMENT PROTOCOL

<table>
<tr><th>Treatments</th><th>Visual Quality; Clipping Yield</th><th>Root Mass Density</th><th>Chemical Analysis of Clippings*</th><th>Chemical and Physical Analysis of Soil**</th></tr>
<tr><td>Bio-Feed</td><td rowspan="4">Every 2 weeks</td><td>5/1/96, 9/1/96, 11/1/96, 5/1/97</td><td>5/1/96, 9/1/96, 11/1/96, 5/1/97</td><td>5/1/96, 9/1/96, 11/1/96, 5/1/97</td></tr>
<tr><td>UCR Check A</td><td rowspan="3">9/1/96, 5/1/97</td><td rowspan="3">9/1/96, 5/1/97</td><td rowspan="3">9/1/96, 5/1/97</td></tr>
<tr><td>UCR Check B</td></tr>
<tr><td>Check</td></tr>
</table>

* Clippings chemical analysis includes: Total S, Na, Ca, Mg, Cu, Fe, Mn, N, P, Mo, and Zn. Analysis will be conducted by the DANR Analytical Laboratory.
** Soil chemical and physical analysis includes: pH, SAR, EC, ESP, particle size analysis, OM, CEC, soluble Ca, Mg, Na, B, Cl, HCO_3, CO_3, and exchangeable potassium, calcium, magnesium, and sodium, and Olsen-P.

Pacific Technical Services Project on Tall Fescue

G. Klein, F. Merino, J. Hartin, S. Blackwood, E. Baltazar, R. Green
University of California, Riverside



TREATMENTS

1. Bio-Feed (Soil Plus, Turf Plus, Iron Plus, Ferta Plus)
2. UCR Check A (Turf Supreme; Nitra King)
3. UCR Check B (TriKote; IBDU)
4. Check

DETERMINING LANDSCAPE WATER REQUIREMENTS

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The Mixed Landscape Study is a key element of the Metropolitan Water District-funded turf and landscape research projects at UC Riverside. Covering some 40,000 square feet, the research facility was constructed and planted in the summer and fall of 1995 and is among the first of its kind nationally. The facility includes plots with trees (Bradford pear), turf (Marathon III tall fescue), and groundcover (potentilla or spring cinquefoil) alone and in combinations (see plot map). Eight individually controlled irrigation systems allow application of two irrigation treatments (80% and 55% ET_0) replicated four times.

The general objective of the mixed landscape study is to determine what impact different landscape plant combinations have on plant water use and which environmental parameters are responsible for this.

Specific objectives of the study are to:

a) Determine if the water requirements of landscape, composed of a mixture of turfgrass, groundcover, and tree species with similar water requirements, is the same as a planting of equal area composed of a single species.

b) Evaluate the appropriateness of the "landscape coefficient method" of estimating water requirements of a landscape.

c) Characterize in quantitative terms the components and factors that determine the water requirements of a newly established landscape.

Baseline data collection (turfgrass clipping yields, stomatal conductance, tree and groundcover leaf water potential, canopy temperature, and various weather parameters) was begun in the spring of 1996. Irrigation treatments will be initiated sometime in the fall of 1996, depending on establishment of the plots.

MWD Mixed Landscape Study

Plot Assignments

N →

II

Tree GC	Tree	GC Turf	Tree GC Turf
Vinca	GC	Turf	Tree Turf
Tree Turf	Tree GC Turf	GC Turf	Tree
GC	Turf	Tree GC	Vinca

IV

Tree GC Turf	GC	Tree Turf	Turf
Vinca	GC Turf	Tree	Tree GC
Tree GC	Vinca	Turf	Tree GC Turf
Tree	GC Turf	Tree Turf	GC

I

Tree	Vinca	Tree Turf	Tree GC Turf
GC Turf	Turf	Tree GC	GC
Turf	GC	Tree GC Turf	Vinca
Tree	GC Turf	Tree GC	Tree Turf

III

Tree GC	Tree Turf	GC Turf	GC
Turf	Tree GC Turf	Vinca	Tree
Turf	Tree Turf	Tree GC Turf	GC Turf
Tree GC	Vinca	Tree	GC

BUFFALOGRASS EVALUATIONS

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New buffalograss [*Buchloe dactyloides* (Nutt.) Endelm.] cultivars have shown improvements over the native or common selections of this 5 to 7 million year old species that is native to the American great plains. Although buffalograss does not match the high quality of some other turfgrass species, it shows great promise as a low maintenance turfgrass. Data on establishment, color, dormancy, and flowering provided from 'variety trials' are useful in the selection of a buffalograss cultivar for turfgrass or landscape applications.

Results from the 1991 National Turfgrass Evaluation Program (NTEP) buffalograss cultivar trials at 19 locations in the United States and detailed results of a similar study at the Torrey Pines Golf Course in San Diego follow this introduction. Currently, a new cultivar evaluation study has been established at U.C. Riverside to look at the next generation of buffalograss selections.

Buffalograss planting and management summary. Detailed information may be found in *California Turfgrass Culture, Volume 45:1&2, 1995.*

Propagation and Planting: Seed, plugs, or sod depending on the cultivar. Seed at 1.5 - 2.0 pounds of hulled seed per 1000 ft^2 in late spring. Plugs, 2-3 inches in diameter can be planted 1-2 feet apart. Sod of some cultivars is available. Soil preparation, fertilization, irrigation, and general care during establishment is similar to other warm season grasses.

Fertilization: Three pounds of nitrogen per 1000 ft^2 per year is recommended divided into one pound applications on May 1, July 15, and September 1.

Irrigation: Success achieved using CIMIS ET data and a Kc of 0.40 with infrequent irrigations.

Salt tolerance: Moderately salt sensitive but a wealth of genetic variation in salt tolerance may allow for development of salt tolerant cultivars.

Mowing: Infrequent. Will tolerate rotary mowers. May be mowed at 1 inch, 2 inches, or left unmowed depending on the appearance desired.

Pests: Weeds are the principle pest. Bermudagrass is the biggest problem since it is competitive and there is no selective chemical control.

Thatch: Not a problem.

NTEP Buffalograss Trial: UC Riverside

(established July 29, 1996)

I	1 5	2 3	3 2	4 1	5 4	6 10	7 9
	8 13	9 6	10 11	11 14	12 8	13 7	14 12
II	15 1	16 2	17 3	18 5	19 4	20 13	21 10
	22 14	23 11	24 8	25 7	26 12	27 9	28 6
III	29 4	30 1	31 5	32 2	33 3	34 11	35 8
	36 10	37 9	38 12	39 6	40 13	41 7	42 14

Varieties:

Seeded	Vegetative	
1. Cody	6. 91-118	11. Stampede
2. Tatanka	7. 86-120	12. UCR-95
3. BAM-100	8. 86-61	13. 609
4. Bison	9. Bonnie Brae	14. 378
5. Texoka	10. Midget	

1991 NATIONAL BUFFALOGRASS TEST

Entries and Sponsors

Entry No.	Name	Sponsor
1	609 (NE 84-609)	Crenshaw/Douget Turfgrass Austin, Texas
2	315 (NE 84-315)	Crenshaw/Doguet Turfgrass
3	NE 85-378	T. Riordan University of Nebraska
4	NE 84-45-3	University of Nebraska
5	NE 84-436	University of Nebraska
6	Buffalawn	Quality Turfgrass Houston, Texas
7	AZ 143	C. Mancino, University of Arizona
8	Highlight 4	River City Turf Farm Sacramento, CA
9	Highlight 15	The Grass Farm Morgan Hill, CA
10	Highlight 25	L. Wu, University of California
11	Prairie	M. Engelke, Texas A&M University
12	Rutger's	D. Huff, Rutger's University
13	Sharp's Improved	Sharp's Brothers Seed Co.
14	Tatanka (NTG-1)	Native Turf Group
15	NTG-2	Native Turf Group
16	NTG-3	Native Turf Group
17	NTG-4	Native Turf Group
18	NTG-5	Native Turf Group
19	Bison	Native Turf Group
20	Top Gun (BAM101)	Bamert Seed Co.
21	Plains (BAM202)	Bamert Seed Co.
22	Texoka	-

Seeded Entries: 12-22

TABLE 1B. MEAN TURFGRASS QUALITY RATINGS OF BUFFALOGRASS (SEEDED) CULTIVARS
GROWN AT NINETEEN LOCATIONS IN THE U.S.
1994 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF 1/

NAME	AR1	AZ1	CA1	CA3	IL1	IL2	KS1	KS2	KS3	MO1	MO2	MS1	NE1	OK1	TX1	TX4	UB1	VA6	WA4	MEAN
NTG-4	5.2	6.2	4.8	4.6	4.0	6.8	6.3	7.3	7.0	5.8	6.6	4.7	5.8	6.1	6.2	3.5	6.0	3.3	5.8	5.6
NTG-5	5.3	6.4	4.5	4.3	3.9	6.6	6.0	6.8	7.0	7.1	6.3	3.3	6.2	6.1	6.4	3.3	6.0	3.6	5.9	5.5
NTG-2	6.1	6.3	4.7	4.3	3.8	7.2	5.4	6.8	7.0	6.8	6.0	2.8	6.0	6.4	6.3	2.8	5.8	4.1	5.6	5.5
NTG-3	3.2	6.7	4.4	4.6	4.4	7.3	6.2	6.8	7.2	7.1	7.0	3.7	5.8	6.1	6.4	2.2	6.0	4.6	3.6	5.4
TATANKA (NTG-1)	4.4	6.3	4.7	4.6	3.8	6.3	5.7	7.0	7.4	6.3	5.8	3.3	5.5	5.9	6.3	2.8	5.9	3.5	4.7	5.3
TEXOKA	5.1	6.0	4.9	4.3	3.3	6.1	6.4	7.0	7.7	6.3	5.5	3.6	5.0	5.9	6.3	3.7	5.8	2.3	3.6	5.2
BISON	4.2	6.4	5.1	4.4	3.2	5.2	5.9	7.6	7.6	6.0	5.5	2.8	5.2	5.8	6.4	2.3	5.5	3.1	5.1	5.1
SHARPS IMPROVED	3.8	6.3	4.8	4.5	3.7	6.1	5.9	7.3	7.3	6.6	5.2	3.4	5.3	5.8	6.5	2.2	5.9	2.4	3.6	5.1
TOP GUN (BAM 101)	4.1	6.2	4.9	4.5	3.3	5.3	5.3	7.1	7.2	5.7	6.1	3.6	5.3	6.0	6.2	2.4	5.7	2.1	4.9	5.0
PLAINS (BAM 202)	4.9	6.3	5.1	4.2	3.8	4.9	4.9	7.4	7.8	5.3	5.9	2.9	4.7	5.8	6.4	3.4	5.1	2.2	4.5	5.0
RUTGERS	4.6	5.7	4.9	5.0	1.7	3.3	4.9	6.6	7.1	3.9	6.7	3.7	1.0	6.1	6.5	2.0	4.1	1.3	2.3	4.3
LSD VALUE	1.7	0.5	0.5	0.4	1.0	1.2	1.4	0.8	0.8	0.9	0.8	0.9	0.6	0.6	0.4	1.0	0.6	1.0	1.9	0.2

TABLE 1C. MEAN TURFGRASS QUALITY RATINGS OF BUFFALOGRASS (VEGETATIVE) CULTIVARS
GROWN AT NINETEEN LOCATIONS IN THE U.S.
1994 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF 1/

NAME	AR1	AZ1	CA1	CA3	IL1	IL2	KS1	KS2	KS3	MO1	MO2	MS1	NE1	OK1	TX1	TX4	UB1	VA6	WA4	MEAN
NE 85-378	6.0	6.5	4.5	5.0	3.9	5.8	6.6	6.9	7.3	7.1	7.0	3.7	6.0	7.4	6.2	4.1	6.5	4.2	4.7	5.8
609 (NE 84-609)	5.8	6.8	5.6	5.0	4.4	5.2	6.1	8.1	8.4	5.5	7.7	4.2	4.3	7.2	6.9	4.8	5.7	1.8	3.4	5.6
315 (NE 84-315)	5.8	6.1	4.9	4.8	4.2	6.2	5.6	6.6	6.4	7.2	7.0	2.9	6.4	7.3	6.0	2.3	6.8	3.9	4.1	5.5
NE 84-436	4.7	6.4	3.7	4.7	4.1	7.3	6.7	6.6	7.4	6.9	6.2	3.7	5.8	7.1	6.5	3.0	6.5	2.6	3.3	5.4
AZ 143	4.8	6.0	4.4	4.5	3.5	7.5	6.2	6.0	6.8	6.3	6.6	3.8	6.3	7.1	6.3	3.3	6.4	2.3	3.6	5.4
PRAIRIE	2.6	6.4	5.5	5.1	3.8	6.9	5.3	6.7	7.0	5.3	7.6	2.7	3.0	6.8	6.7	3.6	5.4	1.5	3.5	5.0
BUFFALAWN	5.3	6.2	5.5	5.2	2.1	6.9	6.7	6.8	7.1	3.7	6.8	4.8	1.0	7.1	6.9	2.8	5.3	1.6	1.4	4.9
NE 84-45-3	3.7	5.8	3.6	4.4	2.7	5.7	4.4	6.1	6.3	5.1	6.1	3.5	5.5	5.8	5.5	1.6	5.3	2.1	3.7	4.6
HIGHLIGHT 25	5.0	6.1	5.3	5.1	1.9	5.7	5.6	5.3	5.2	4.7	7.3	4.3	1.0	6.4	6.8	2.4	4.5	1.3	2.4	4.5
HIGHLIGHT 4	4.7	6.1	5.2	5.0	2.0	5.1	3.9	6.2	6.1	3.7	8.0	3.4	1.1	6.8	6.6	2.8	4.8	1.6	1.9	4.5
HIGHLIGHT 15	3.6	6.1	5.5	5.1	1.7	5.1	5.4	6.0	6.4	4.2	6.7	3.3	1.3	6.1	6.4	3.1	3.7	1.4	2.3	4.4
LSD VALUE	1.7	0.5	0.6	0.4	0.9	1.5	1.0	0.9	0.8	1.1	1.0	1.4	0.5	0.3	0.5	1.0	0.4	0.9	1.7	0.2

1/ TO DETERMINE STATISTICAL DIFFERENCES AMONG ENTRIES, SUBTRACT ONE ENTRY'S MEAN FROM ANOTHER ENTRY'S MEAN. STATISTICAL DIFFERENCES OCCUR WHEN THIS VALUE IS LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

BUFFALOGRASS CULTIVAR TRIAL AT THE TORREY PINES GOLF COURSE
- Preliminary Results -

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Introduction

Buffalograss [*Buchloe dactyloides* (Nutt.) Endelm.], a 5 to 7 million year old species, is the oldest grass native to the American great plains. Buffalograss has been used primarily as a forage crop. However, the drought tolerance, low nutritional requirements, and short growth stature of this grass species have created interest in the applicability of buffalograss as a low maintenance turfgrass. Since the early 1980s, breeding programs throughout the United States have produced near "turf-type" cultivars of buffalograss with improved color and texture and less dormancy than the wild or native grass. In southern California, water conservation awareness (as well as increased water costs) and the desire for quality turfgrass has increased interest in buffalograss. An experimental trial was established at the Torrey Pines Golf Course to evaluate the performance of these new buffalograss cultivars under the coastal conditions in San Diego, California.

Materials and Methods

Experimental Design and Planting

The trial was established at the Torrey Pines Golf Course between the fifth and eighth holes of the north course. Treatments consisted of 24 cultivars of buffalograss, planted in 4 x 6 foot plots with 1.5 feet between plots. The experiment was a randomized complete block design with three replicates (blocks) and a total of 72 individual plots. The buffalograss cultivars were obtained as plugs from a National Turfgrass Evaluation Program (NTEP) trial established at U.C. Riverside and from Dr. Lin Wu at U.C. Davis. Buffalograss can be propagated by seed or vegetatively, depending on the cultivar (Table 1). In this trial, twenty plugs of each cultivar were planted in individual plots on June 19, 1992.

Cultural Practices

The plots were fertilized with 15-15-15 at a rate of one pound nitrogen per 1000 ft^2 at planting. During the 1993 growing season, the plots received three pounds nitrogen per 1000 ft^2. No fertilizer was applied during the 1994 and 1995 growing seasons.

The 4000 ft^2 trial area was irrigated with rotor type sprinklers with a precipitation rate of 0.3 inches/hour and distribution uniformity of 75 percent. Irrigation scheduling utilized reference evapotranspiration (ETo) from the CIMIS weather station at Balboa Park in San Diego and a crop coefficient (Kc) of 0.40 to calculate applied water and system run times. Irrigation was applied at weekly intervals during the growing season.

Buffalograss was mowed at 2.0 inches using a rotary mower at two week intervals during the growing season.

Weed control practices consisted of pre-emergent applications of oxadiazon (Ronstar) at planting and in October 1994. In addition, weeds were controlled in the strips between plots and within plots by spot-spraying with glyphosate (Round-Up) and by hand pulling and cultivation. No other pest management practices were necessary.

Cultivar Evaluation

Each individual buffalograss plot was evaluated for percent cover, color, texture, overall performance, and flower presence. Percent cover was rated in October 1992 and April 1993 on a scale of 1 to 100 percent. Color, texture, and overall performance were rated using a 1 to 9 scale (1= worst and 9 = best). Overall performance was evaluated mid-season in 1993 and 1994 and monthly in 1995. Color was evaluated mid-season in 1993 and 1994 and at frequent intervals during the fall of each year to assess dormancy characteristics of the cultivars. Dormancy periods were determined by totaling the number of weeks when average color ratings for each cultivar were less than 3.0. Presence and type (male and/or female) of flowers were evaluated before mowing in March 1995 using the 1-9 rating scale with 1 = no flowers and 9 = 100% cover with flowers. Data were statistically analyzed to determine if differences in cultivar performance were significant and least significant difference (LSD) values at a = 0.05 were calculated.

Table 1. Buffalograss cultivars used in the Torrey Pines trial, common propagation method, and sponsor/origin.

	Cultivar	Propagation	Sponsor
1.	NE 84-609 (609)	Veg	Crenshaw/Douget Turfgrass, Austin, TX
2.	NE 84-315 (315)	Veg	Crenshaw/Douget Turfgrass, Austin, TX
3.	NE 84-378	Veg	T. Riordan, University of Nebraska
4.	NE 84-46-3	Veg	T. Riordan, University of Nebraska
5.	NE 84-436	Veg	T. Riordan, University of Nebraska
6.	Buffalawn	Veg	Quality Turfgrass, Houston, TX
7.	AZ 143	Veg	C. Mancino, University of Arizona
8.	Hilite 4	Veg	L. Wu, U.C. Davis
9.	Hilite 15	Veg	L. Wu, U.C. Davis
10.	Hilite 25	Veg	L. Wu, U.C. Davis
11.	Prairie	Veg	M. Engelke, Texas A&M University
12.	Rutger's	Seed	Rutger's University
13.	Sharp's Improved	Seed	Sharp's Brothers Seed Co.
14.	NTG - 1 (Tatanka)	Seed	Native Turf Group
15.	NTG - 2	Seed	Native Turf Group
16.	NTG - 3	Seed	Native Turf Group
17.	NTG - 4	Seed	Native Turf Group
18.	NTG - 5	Seed	Native Turf Group
19.	Bison	Seed	Native Turf Group
20.	BAM 101 (Top Gun)	Seed	Bamert Seed Co.
21.	BAM 202 (Plains)	Seed	Bamert Seed Co.
22.	Texoka	Seed	Common
23.	Wu 911	Veg	L. Wu, U.C. Davis
24.	Wu 912	Veg	L. Wu, U.C. Davis

Results

The buffalograss cultivars were successfully established at the Torrey Pines site and produced turf of medium quality under the cultural conditions described above. Significant differences were seen in establishment rate (percent cover), overall turf quality, mid-season color, and dormancy. Differences in coverage were apparent in October 1992 and in April 1993 (Table 2). By mid-1993 most plots had achieved full cover. Significant differences were observed in overall turf quality during the period of March 1995 to February 1996 (Table 3). Significant differences were also seen in mid-season color (Table 4) and in dormancy of the cultivars (Table 5). Flowers were prevalent in about half of the cultivars (Table 6) if the turf was not mowed for 3-4 weeks. There were no significant differences seen in cultivar texture.

Differences between cultivars are significant if the difference between means is greater than the least significant difference (LSD) listed at the bottom of each data column.

Table 2. Average percent of plots covered by buffalograss cultivars in October 1992 and April 1993.

October 1992		April 1993	
Cultivar	%Cover	Cultivar	% Cover
Buffalawn	86.3	Rutger's	93.3
Wu 912	85.7	Wu 912	93.3
Wu 911	84.3	Buffalawn	91.7
Rutger's	73.7	Hilite 4	88.3
Hilite 4	65.7	Wu 911	86.7
Prairie	65.0	Hilite 15	81.7
NE 84-378	57.7	NE 84-378	80.0
NE 84-609 (609)	56.3	NE 84-315 (315)	76.7
Hilite 15	53.0	BAM 202 (Plains)	76.7
AZ 143	52.3	Hilite 25	75.0
Hilite 25	52.3	NE 84-46-3	73.3
NE 84-315 (315)	51.7	NE 84-436	73.3
NTG - 3	46.0	Prairie	73.3
NTG - 4	42.3	AZ 143	70.0
BAM 101 (Top Gun)	41.7	NE 84-609 (609)	68.3
NE 84-436	36.7	NTG - 5	68.3
NTG - 5	36.7	BAM 101 (Top Gun)	66.7
NE 84-46-3	34.7	Sharp's Improved	58.3
NTG - 1	34.7	NTG - 3	58.3
NTG - 2	25.7	NTG - 1	56.7
BAM 202 (Plains)	25.7	NTG - 2	56.7
Sharp's Improved	25.0	Texoka	55.0
Bison	23.0	NTG - 4	53.3
Texoka	19.7	Bison	40.0
LSD =	27.3	LSD =	24.6

Table 3. Buffalograss cultivar OVERALL performance averages for the period of March 1995 to February 1996.

Cultivar	Rating
Hilite 25	4.6
NE 84-609 (609)	4.6
Hilite 4	4.4
Buffalawn	4.4
Wu 912	4.3
Prairie	4.3
Wu 911	4.3
Hilite 15	4.2
BAM 202 (Plains)	4.1
Rutger's	3.9
Bison	3.8
NTG - 4	3.7
Sharp's Improved	3.7
NTG - 3	3.6
NTG - 1	3.6
NE 84-436	3.5
NE 84-315 (315)	3.5
NE 84-378	3.4
BAM 101 (Top Gun)	3.3
Texoka	3.3
NTG - 5	3.2
NTG - 2	3.2
AZ 143	3.2
NE 84-46-3	2.9
LSD =	0.5

Table 4. Buffalograss cultivar average mid-season COLOR ratings.

Cultivar	Rating
NE 84-436	7.3
NE 84-315 (315)	7.2
NE 84-378	7.2
NTG - 1	7.0
NTG - 4	7.0
Bison	6.8
BAM 202 (Plains)	6.8
NTG - 2	6.7
Texoka	6.7
NE 84-609 (609)	6.6
AZ 143	6.6
Sharp's Improved	6.5
NTG - 3	6.5
NTG - 5	6.5
BAM 101 (Top Gun)	6.4
Wu 911	6.3
Buffalawn	6.2
Hilite 25	6.2
Wu 912	6.2
Hilite 4	6.1
Prairie	6.0
Hilite 15	5.8
Rutger's	5.8
NE 84-46-3	5.6
LSD =	0.6

Table 5. Dormancy grouping of buffalograss cultivars tested at Torrey Pines.

Shortest Dormancy (4-8 weeks)				
Hilite 25	Wu 911	Hilite 15	Wu 912	
Moderate Dormancy (10 weeks)				
NE 84-609 (609)	Buffalawn	Hilite 4	Prairie	Rutger's
Longest Dormancy (14 Weeks)				
BAM 202 (Plains)	Bison	NE 84-315	NE 84-378	NE 84-436
NTG-1 (Tatanka)	NTG - 2	NTG - 3	NTG - 4	Texoka
Sharp's Improved	Top Gun	NE 84-46-3	AZ 143	NTG - 5

Table 6. Flower coverage and type for buffalograss cultivars at Torrey Pines - March 27, 1995.

Cultivar	Flower Rating	Type
NE 84-46-3	7.3	M
BAM 101 (Top Gun)	7.0	M/F
Bison	5.7	F
Texoka	5.7	M/F
NTG - 4	5.3	F
NTG - 5	5.3	M/F
BAM 202 (Plains)	4.7	M/F
Sharp's Improved	4.3	M/F
NTG - 3	4.3	M/F
NTG - 2	4.0	M/F
NTG - 1	3.0	M/F
NE 84-436	2.7	F
AZ 143	1.7	M
Hilite 15	1.7	M/F
NE 84-609 (609)	1.0	F
NE 84-315 (315)	1.0	F
NE 84-378	1.0	F
Buffalawn	1.0	F
Hilite 4	1.0	F
Hilite 25	1.0	F
Prairie	1.0	F
Rutger's	1.0	M/F
Wu 911	1.0	M/F
Wu 912	1.0	M
LSD =	3.1	

Discussion

The evaluation of these 24 buffalograss cultivars is useful in cultivar selection and use. Significant differences between the cultivars were seen in the rate of coverage (Table 2). Buffalawn, Wu 912, Wu 911, Rutger's, Hilite 4, and Prairie achieved greater than 65% cover during the first growing season. We feel that if the planting date was earlier, many of the cultivars would have had higher coverage ratings before the onset of dormancy in the fall. Faster coverage will minimize weed control needs by providing a more competitive turf stand. In addition, it will allow for more immediate turf use.

There were also significant differences in overall performance of the cultivars (Table 3). Hilite25, NE 84-609, Hilite 4, Buffalawn, Wu 912, Prairie, Wu 911, Hilite 15, and BAM 202 (Plains) had yearly average overall ratings between 4.1 and 4.5. However, differences seen in mid-season color resulted in a much different ranking of the cultivars (Table 4). The cultivars rated highest for mid-season color had dark green color with some almost blue-green. Cultivars with light green color rated lower. The color is probably related to the genetic origin of the cultivar. For example, the Nebraska (NE) cultivars have a dark green color and are from parentage native to the great plains of the United States. The Hilite and Wu cultivars have a lighter green color and are from plant material originating in Mexico. The Hilite and Wu cultivars also have less dormancy (Table 5). The reduced dormancy resulted in the increased overall performance of these cultivars.

Flower production also varied between cultivars (Table 6). A number of cultivars produced few flowers or flowers which were not readily visible, and received a rating of 1.0. These cultivars are predominantly those vegetatively propagated from female plants. The female buffalograss flower is located near the ground, beneath the leaf canopy. Male flowers are brown to copper colored and are readily visible above the canopy. Cultivars NE 84-46-3 and BAM 101 (Top Gun) had predominate male flowers and the highest flower coverage on March 27, 1995. These flowers provide a unique color and texture and may be a desirable trait for some landscape uses. If not desirable, flower presence in cultivars may increase mowing frequency in order to achieve the desired appearance.

New buffalograss cultivars have shown improvements over the native or common selections. Although buffalograss does not match the high quality of other turfgrass species, it shows great promise as a low maintenance turfgrass. Data on establishment, color, dormancy, and flowering provided from this study are useful in the selection of a buffalograss cultivar for turfgrass or landscape applications.

Acknowledgments: We thank Mr. John Walter, Mr. Jessie Creencia, the staff of the Torrey Pines Golf Course, Dr. Victor Gibeault, and Hunter Industries for providing assistance and materials for this study.

MOWING HEIGHT AND VERTICUTTING FREQUENCY OF 'DE ANZA' AND 'VICTORIA' ZOYSIAGRASSES

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Zoysiagrass (*Zoysia japonica*) is a warm season turfgrass and is well adapted to southern and central California. It forms a uniform, dense, low growth, high quality turf with minimum maintenance requirements. It is commercially propagated by sprigging. Zoysiagrass is tolerant to drought, heat and salinity but has a tendency to produce lots of thatch during the growing season.

Field studies were initiated in Spring, 1995 and continued in 1996 to ascertain clipping yields and turf quality differences at various mowing heights and verticutting frequencies of 'De Anza' and 'Victoria' hybrid zoysiagrasses which were developed at UCR.

Treatments for verticut frequencies were none, 1X and 3X (six week intervals) with split plots of mowing heights of 9.5 mm (3/8"), 12.7 mm (1/2"), 19.1 (3/4"), 31.8 mm (1 1/4") and unmowed. Both cultivars received 1.0 lb. N/1000 sq. ft. every six weeks.

Visual quality of each cultivar in all treatments was high and almost indistinguishable, with the exception of unmowed check plots. Clipping yields decreased with verticutting frequency. Clipping yields in the pooled verticut treatments in mid-summer 1995 were highest at 12.7 mm mowing height. Lowest season clipping yields were obtained from 9.5 mm and 31.8 mm mowing heights.

In Spring, 1996 the experiment was continued with clipping yields and monthly color and turf ratings. Results from the April and May combined clipping yields (from both cultivars) indicated that the highest yields came from the 12.7 mm mowing height, with 9.5 mm and 19.1 mm mowing heights slightly lower. Lowest yields were obtained from the 31.8 mm height. Again, clipping yields from non-verticut plots were higher than the verticut plots.

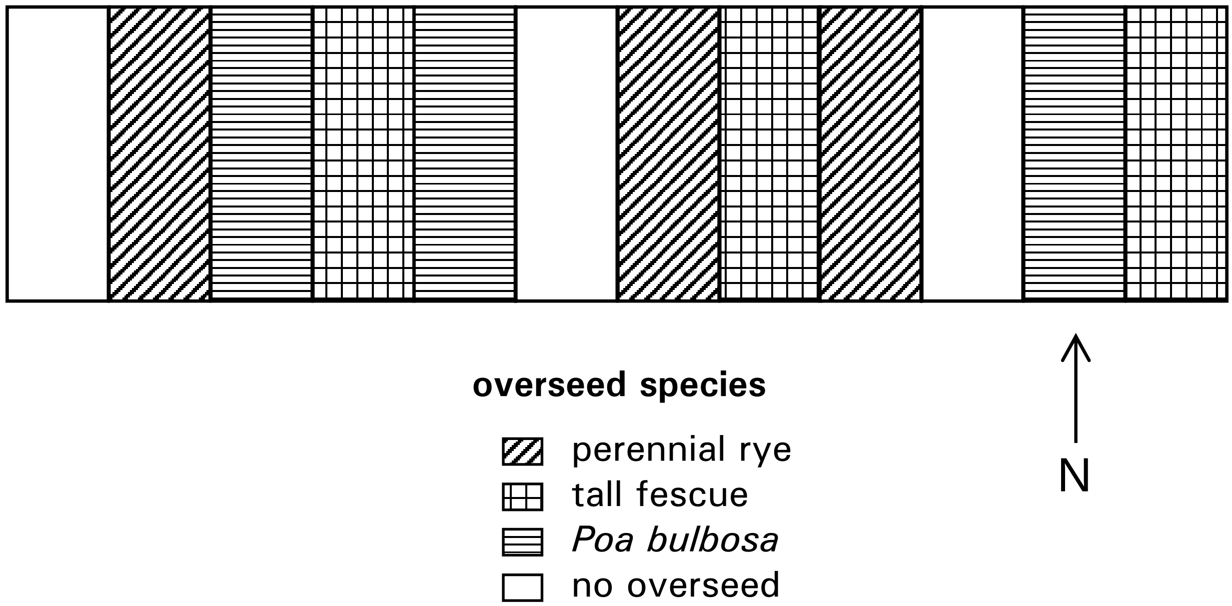
Both cultivars continue to show the acceptable green foliar color at all mowing heights. Check plots (unmowed in 1995) were mowed at 3" (76 mm) height in early Spring, 1996 which masked the scalped appearance observed earlier.

This experiment will be continued up to Fall, 1996 for more data in significant color and clipping yield differences with shorter day length and low soil temperatures.

Summary: Increased clipping yields at 12.7 mm (1/2") mowing height with no verticutting; less clipping yields with multiple verticutting 31.8 mm (1 1/4") or 9.5 mm (3/8") mowing heights; small differences in turf quality at the various mowing heights.

However, the optimum, range of mowing heights for acceptable turf quality during the 1995 growing season was 12.7 mm (1/2") - 19.1 mm (3/4").

'De Anza' zoysiagrass overseed study plot map



FERTILITY AND AERIFICATION ON TRAFFICKED SPORTS TURF

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Managers of turf areas used for sports in schools, parks and specialty venues need a better understanding of how much labor and money input is required to maintain fields at various levels of sports use. This study attempts to quantify the effect on Tifway II hybrid bermudagrass of three levels of fertility and three frequencies of hollow-tine aerification under three levels of simulated sports traffic. Two rootzone media were included: a fine sandy loam (native) and a pure sand prepared on-site.

Nitrogen only (21-0-0) fertilizer is being applied at 2, 3, and 6 lbs per 1000 ft^2 per year. Hollow tine aerification to 4 inches is applied 2, 3, and 5 X from February to September. Simulated cleated sports traffic was simulated using the Brinkman traffic simulator at 18, 12 and 6 professional level football game equivalents (ge) per week. Changes in turf quality, sod strength, and surface hardness is measured.

High Sand Field

Preliminary data from the 6-year-old pure sand field suggest that addition of Nitrogen produces better turf quality under any traffic amount, but aerification has a nominal effect. Traffic at 18 ge per week produced bare spots that recovered after 3 or 4 days. Turf quality was good at 6 ge per week traffic through mid-July. The strength of the field measured with a traction device showed slight differences with treatments. The hardness of the field as measured by a Clegg impact meter revealed slight differences with aerified treatments, but apparently none between fertility levels

Soil Field

Data through early July suggests that N produces better turf quality and resistance to wear when under traffic. Aerification gives a slight improvement in quality. Traction is improved slightly with nitrogen but no noticeable differences with or without aerification. Surface hardness was changed little with aerification or nitrogen, but was dependent on amount of traffic received.

The following suggestions are drawn from preliminary data and should be considered general:

1. Apply fertilizer to improve turf quality and increase sod traction. The effects may last for several weeks after application under any traffic level, although shorter-lasting on pure sand.

2. Aerify with hollow-tine equipment to produce a slight decrease in surface hardness.

AN OVERVIEW OF CULTIVAR PERFORMANCE

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Turfgrass cultivar evaluations are an important component of the University of California Turfgrass Research Facility activities. We cooperate with the National Turfgrass Evaluation Program (NTEP), which is designed to develop and coordinate uniform evaluation trials of turfgrass cultivars and selections in the United states and Canada. 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 collect and disseminate performance information; and to enhance the transfer and use of information and technology relating to turfgrass improvement and evaluation. Test results are used by seed companies and plant breeders to determine the adaptation of a grass. Also, local turf facilities can benefit from cultivar performance characteristics that are obtained in a local climate and local soil.

During 1995 we had 96 tall fescues, 28 zoysiagrasses, 27 bermudagrasses, and 22 buffalograsses under maintenance at UCR. The grasses were mowed weekly during the growing season for the species, fertilized on a regular and moderate program and irrigated to replace water used as calculated from an automated weather station. There were no secondary management practices used during the study. Turfgrass quality was rated on a monthly schedule and at the end of 1995 the results were analyzed and reported by NTEP.

Following are the cultivar and selection information about source of material, plot plans for those studies that are presently available, and the performance results as presented on a national level. In each report, the UCR location is referred to as CA3.

1992 NATIONAL BERMUDAGRASS TEST

Entries and Sponsors

Seeded Entries

Entry #	Name	Sponsor
1	J-27	Jacklin Seed Company
2	Jackpot (J-912)	Jacklin Seed Company
3	Sonesta	O.M. Scott & Son
4	Cheyenne	Pennington Seed Company
5	Primavera (FMC 1-90)	Seed Research of OR/Seeds West, Inc.
6	FMC 2-90	Seeds West, Inc.
7	FMC 3-91	Seeds West, Inc.
8	FMC 5-91	Seeds West, Inc.
9	FMC-6 (FMC 6-91)	Seeds West, Inc.
10	Sundevil	Medalist America
11	Arizona Common	Standard Entry
12	Mirage (90173)	International Seeds, Inc./ Arizona Grain, Inc.-Valley Seed Co.
13	OKS 91-1	Oklahoma State University
14	OKS 91-11	Oklahoma State University
15	Numex-Sahara	Seeds West, Inc. (Standard Entry)
16	Guymon	Oklahoma State University (Standard Entry)

Vegetative Entries

Entry #	Name	Sponsor
17	Floradwarf (FHB-135)	Univ. of Florida-Gainesville
18	Arizona Common	Standard Entry
19	Midiron	Standard Entry
20	Tifgreen	Standard Entry
21	Tifway	Standard Entry
22	Texturf 10	Standard Entry
23	STF-1	Sunnyvale Turf Farm
24	Midlawn	KSU Research Foundation & Oklahoma State University
25	Midfield	Kansas State University & Oklahoma State University
26	Baby (TDS-BM1)	Bladerunner Farms

Bermudagrass NTEP Variety Trial

Block							
	7	10	13	1	5	9	4
I	2	8	11	3	6	14	16
	15	12	22	19	26	20	18
		21	25	23	17	24	27
	5	9	15	6	2	16	13
II	10	1	12	11	3	4	7
	8	14	26	25	20	21	17
		22	19	24	23	18	27
	16	1	13	11	12	15	7
III	9	8	14	3	5	4	6
	10	2	23	20	24	22	25
		21	19	17	26	18	27

N

Varieties:

1. J-27
2. J-912
3. Sonesta
4. Cheyenne
5. FMC 1-90
6. FMC 2-90
7. FMC 3-91
8. FMC 5-91
9. FMC 6-91
10. Sundevil
11. Arizona Common
12. 90173
13. OKS 91-1
14. OKS 91-11
15. Sahara
16. Guymon
17. FHB-135
18. Arizona Common
19. Midiron
20. Tifgreen
21. Tifway
22. Texturf 10
23. STF-1
24. Midlawn
25. Midfield
26. TDS-BMI
27. CT 2

1-16: Seeded varieties
17-27: Vegetative vars.

Established: June 1992 **Mowing:** 5/8 inch **Fertility:** 4 lbs N / 1000 ft^2 / year

TABLE 1B.

MEAN TURFGRASS QUALITY RATINGS OF BERMUDAGRASS (SEEDED) CULTIVARS
GROWN AT TWENTY-ONE LOCATIONS IN THE U.S.
1995 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF 1/

NAME	AL1	AR1	AZ1	CA2	CA3	FL1	GA1	GA2	IL2	KS2	KY1	LA2	MD1	MO2	MS1	OK1	OK2	TX1	UB1	VA1	VA4	MEAN
MIRAGE (90173)	5.1	6.1	6.4	5.0	5.3	5.4	4.8	3.7	6.5	7.3	7.9	5.6	6.0	5.7	5.0	5.9	5.2	5.4	7.3	4.8	6.3	5.8
OKS 91-11	5.1	6.7	6.3	4.8	5.4	5.3	4.3	3.7	5.7	7.6	7.6	4.7	6.3	4.7	4.9	6.0	5.5	6.0	7.2	3.9	5.8	5.6
J-27	5.2	6.0	6.4	4.8	5.2	4.7	4.4	3.8	5.1	7.4	7.3	4.9	6.0	4.9	5.0	5.5	5.0	5.7	7.1	4.4	5.9	5.5
JACKPOT (J-912)	5.1	5.8	5.8	4.6	5.0	5.3	4.9	3.0	6.3	6.6	7.4	5.2	4.2	4.3	5.0	5.8	5.5	5.6	7.1	4.8	6.3	5.4
SUNDEVIL	5.1	5.9	5.6	4.4	5.3	4.7	4.4	3.3	5.5	6.7	7.4	5.0	4.9	5.1	5.0	5.6	5.2	5.0	6.9	3.4	5.8	5.3
GUYMON	5.0	5.7	5.8	4.7	5.3	4.7	4.7	3.3	4.1	7.2	7.5	4.9	6.1	4.8	5.0	5.3	4.9	5.1	6.4	4.2	5.0	5.2
FMC-6 (FMC 6-91)	5.1	6.4	5.8	4.5	4.9	5.1	4.7	3.7	5.3	6.5	6.7	5.1	3.5	2.2	5.0	6.3	5.8	5.6	6.3	1.7	6.3	5.1
FMC 5-91	5.2	5.9	5.2	4.5	5.2	5.4	4.4	3.5	5.9	6.3	6.0	4.5	4.0	3.1	5.0	5.9	5.7	5.1	6.4	2.3	6.1	5.0
FMC 2-90	5.1	6.0	5.1	4.6	4.8	4.9	4.8	3.9	5.0	6.4	6.2	4.8	2.2	1.7	4.9	5.7	5.3	5.2	5.9	2.1	5.7	4.8
FMC 3-91	5.1	5.8	5.9	4.5	5.2	5.2	4.8	3.7	4.9	5.9	4.9	5.5	2.2	1.4	5.0	6.0	5.7	5.2	4.6	1.2	6.4	4.7
SAHARA	5.1	5.7	5.3	4.4	4.9	5.0	4.3	3.3	5.7	5.4	5.6	5.0	3.3	1.6	4.9	5.5	4.9	5.2	6.4	1.5	6.0	4.7
OKS 91-1	5.0	5.5	4.5	4.2	4.6	4.6	4.5	3.1	5.1	6.1	6.8	4.7	3.5	4.0	4.9	5.4	5.0	5.2	4.2	2.3	5.7	4.7
CHEYENNE	5.0	5.5	4.6	4.1	5.1	4.8	4.6	3.4	5.3	6.1	5.1	4.2	1.6	2.5	4.7	5.2	4.9	5.4	7.2	1.3	5.3	4.6
PRIMAVERA (FMC 1-90)	5.0	5.3	4.1	4.3	4.8	4.5	4.5	3.6	5.3	6.0	5.5	4.7	2.2	1.8	4.8	5.1	4.7	5.3	5.9	1.3	5.1	4.5
SONESTA	5.1	5.2	4.7	4.4	4.7	4.6	4.2	2.9	5.0	5.9	5.2	5.1	2.5	1.6	4.6	5.3	4.7	5.1	5.8	1.0	5.9	4.4
ARIZONA COMMON-SEED	5.1	5.5	4.5	4.4	4.8	4.7	4.4	3.5	5.2	6.2	4.3	5.0	2.4	1.3	4.5	4.7	4.2	5.3	5.6	1.7	5.1	4.4
LSD VALUE	0.3	0.5	1.0	0.3	0.3	0.7	1.3	0.7	1.0	0.6	1.3	0.5	1.8	1.8	0.2	0.7	0.7	0.7	1.7	1.7	0.5	0.2

TABLE 1C.

MEAN TURFGRASS QUALITY RATINGS OF BERMUDAGRASS (VEGETATIVE) CULTIVARS
GROWN AT TWENTY-ONE LOCATIONS IN THE U.S.
1995 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF 1/

NAME	AL1	AR1	AZ1	CA2	CA3	FL1	GA1	GA2	IL2	KS2	KY1	LA2	MD1	MO2	MS1	OK1	OK2	TX1	UB1	VA1	VA4	MEAN
TIFWAY	5.1	8.3	7.1	5.7	6.1	7.6	5.8	3.9	7.0	8.8	8.2	6.8	3.1	3.5	7.2	7.9	7.9	6.8	7.5	3.1	7.4	6.4
BABY (TDS-BM1)	5.1	8.5	7.3	5.6	6.0	6.0	4.3	4.0	7.8	7.3	8.4	7.1	2.5	6.5	6.6	8.0	8.2	6.3	5.4	5.5	7.8	6.4
MIDIRON	5.3	8.1	5.9	5.2	5.6	5.4	3.9	3.3	7.1	7.9	7.6	6.0	7.2	5.9	5.9	6.9	6.9	7.0	6.9	5.7	6.9	6.2
MIDLAWN	5.1	8.1	5.8	5.1	5.4	6.1	4.1	2.7	7.1	8.5	8.1	6.1	6.7	5.3	5.5	7.1	6.9	7.0	6.5	6.2	6.3	6.2
TIFGREEN	5.2	8.6	6.8	5.4	5.6	5.9	4.3	3.6	8.0	7.4	7.7	7.0	2.1	6.2	6.3	8.1	8.1	6.1	5.1	3.2	7.8	6.1
MIDFIELD	5.1	6.8	6.4	5.2	5.9	4.3	3.6	3.1	6.9	8.1	7.8	6.3	7.2	6.3	5.4	6.5	6.5	7.1	6.4	5.9	6.1	6.0
STF-1	5.2	7.2	5.2	5.1	5.3	4.9	3.9	3.1	5.9	8.1	6.4	5.4	3.4	6.6	5.7	6.6	6.7	5.9	6.7	3.6	6.4	5.6
TEXTURF 10	5.2	7.4	5.5	4.8	5.7	6.4	3.9	2.5	6.0	6.9	7.0	5.6	1.5	6.3	5.4	6.4	6.2	6.0	6.6	4.0	6.8	5.5
FLORADWARF (FHB-135)	5.0	7.3	6.5	4.5	5.1	5.9	3.0	3.1	7.0	5.9	3.5	5.5	1.7	1.1	4.4	4.7	6.3	4.1	1.0	1.6	6.2	4.5
ARIZONA COMMON-VEG.	5.2	4.6	3.0	3.9	4.5	3.1	3.1	2.5	5.0	5.5	4.0	4.1	2.7	1.3	4.3	5.7	5.3	5.3	5.7	1.1	4.7	4.0
LSD VALUE	0.2	0.9	0.9	0.3	0.5	1.1	1.0	0.6	0.8	0.7	0.9	0.6	2.6	1.4	0.6	0.7	1.2	0.7	2.7	2.2	0.5	0.3

1/ TO DETERMINE STATISTICAL DIFFERENCES AMONG ENTRIES, SUBTRACT ONE ENTRY'S MEAN FROM ANOTHER ENTRY'S MEAN. STATISTICAL DIFFERENCES OCCUR WHEN THIS VALUE IS LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

TABLE 2B. MEAN TURFGRASS QUALITY RATINGS OF BERMUDAGRASS (SEEDED) CULTIVARS FOR EACH MONTH GROWN AT TWENTY-ONE LOCATIONS IN THE U.S.
1995 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF: MONTHS 1/

NAME	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
MIRAGE (90173)	3.8	4.4	4.8	5.2	5.8	5.9	6.0	6.1	6.2	5.5	4.9	3.7	5.8
OKS 91-11	3.8	4.6	4.7	4.9	5.5	5.8	5.9	5.9	5.9	5.3	4.9	3.6	5.6
J-27	3.9	4.4	4.6	4.8	5.3	5.8	5.9	5.7	5.7	5.3	4.6	3.7	5.5
JACKPOT (J-912)	3.8	4.5	4.5	4.7	5.1	5.6	5.7	5.8	5.7	5.5	4.9	3.4	5.4
SUNDEVIL	3.8	4.2	4.2	4.5	5.2	5.5	5.6	5.6	5.5	5.1	4.6	3.7	5.3
GUYMON	3.7	4.3	4.2	4.6	5.2	5.7	5.6	5.4	5.4	5.0	4.2	3.6	5.2
FMC-6 (FMC 6-91)	4.1	4.5	4.2	4.6	4.8	5.3	5.3	5.5	5.4	5.0	5.0	3.6	5.1
FMC 5-91	3.7	4.3	4.3	4.6	4.6	5.1	5.3	5.5	5.5	5.0	4.8	3.6	5.0
FMC 2-90	4.0	4.5	4.2	4.6	4.5	4.9	5.1	5.2	5.0	4.9	4.4	3.6	4.8
FMC 3-91	3.9	4.4	4.3	4.8	4.5	4.8	5.0	5.1	5.0	4.9	4.8	3.6	4.7
SAHARA	3.6	4.2	4.2	4.5	4.5	4.8	5.0	5.2	5.0	4.9	4.6	3.6	4.7
OKS 91-1	3.8	4.2	4.1	4.2	4.5	4.8	5.0	5.0	5.0	4.7	4.4	3.7	4.7
CHEYENNE	3.8	4.1	4.0	4.3	4.3	4.5	4.8	5.0	4.9	5.0	4.8	3.5	4.6
PRIMAVERA (FMC 1-90)	3.8	4.2	3.9	4.2	4.2	4.5	4.7	4.9	4.9	4.7	4.3	3.6	4.5
SONESTA	3.8	4.3	4.0	4.2	4.3	4.5	4.7	4.9	4.7	4.5	4.6	3.7	4.4
ARIZONA COMMON-SEED	3.8	4.2	4.0	4.4	3.9	4.4	4.7	4.8	4.9	4.8	4.5	3.6	4.4
LSD VALUE	1.0	1.0	0.9	0.6	0.5	0.6	0.5	0.5	0.5	0.6	0.7	0.7	0.4

TABLE 2C. MEAN TURFGRASS QUALITY RATINGS OF BERMUDAGRASS (VEGETATIVE) CULTIVARS FOR EACH MONTH GROWN AT TWENTY-ONE LOCATIONS IN THE U.S.
1995 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF: MONTHS 1/

NAME	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
TIFWAY	4.5	5.3	5.4	6.4	6.6	6.6	6.7	6.6	6.7	6.3	5.7	3.7	6.4
BABY (TDS-BM1)	4.2	5.2	5.3	6.1	6.4	6.6	6.3	6.7	6.8	6.2	5.5	3.8	6.4
MIDIRON	4.3	5.1	5.0	5.3	6.6	6.5	6.3	6.5	6.8	5.4	4.7	3.6	6.2
MIDLAWN	4.1	4.8	4.9	5.4	6.2	6.5	6.3	6.4	6.5	5.8	5.3	3.4	6.2
TIFGREEN	4.4	5.1	5.2	6.1	6.1	6.3	6.2	6.4	6.5	5.6	4.9	3.4	6.1
MIDFIELD	4.1	4.9	4.6	5.2	6.1	6.4	6.3	6.2	6.4	5.6	5.0	3.6	6.0
STF-1	4.1	4.6	4.6	4.8	5.4	5.7	5.9	6.0	6.0	5.2	4.8	3.6	5.6
TEXTURF 10	3.8	4.8	4.5	4.7	5.2	5.6	6.0	6.1	6.0	5.5	5.0	3.7	5.5
FLORADWARF (FHB-135)	3.7	4.8	4.5	5.0	4.6	4.7	4.6	4.7	4.4	3.8	4.8	3.6	4.5
ARIZONA COMMON-VEG.	3.6	3.9	3.1	3.6	3.7	4.0	4.2	4.5	4.4	4.4	4.4	3.7	4.0
LSD VALUE	1.2	1.4	1.1	0.9	0.7	0.6	0.6	0.6	0.6	0.7	1.0	0.8	0.6

1/ TO DETERMINE STATISTICAL DIFFERENCES AMONG ENTRIES, SUBTRACT ONE ENTRY'S MEAN FROM ANOTHER ENTRY'S MEAN. STATISTICAL DIFFERENCES OCCUR WHEN THIS VALUE IS LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

BUFFALOGRASS CULTIVAR OVERVIEW

The results that follow are from a NTEP study that was established in 1991 and concluded with the 1995 calendar year data collection. A new buffalograss study will be established in 1996 at the UCR Turfgrass Research Facility.

1991 NATIONAL BUFFALOGRASS TEST

Entries and Sponsors

Entry No.	Name	Sponsor
1	609 (NE 84-609)	Crenshaw/Douget Turfgrass Austin, Texas
2	315 (NE 84-315)	Crenshaw/Doguet Turfgrass
3	378 (NE 85-378)	T. Riordan, University of Nebraska
4	NE 84-45-3	University of Nebraska
5	NE 84-436	University of Nebraska
6	Buffalawn	Quality Turfgrass Houston, Texas
7	AZ 143	University of Arizona
8	Highlight 4	River City Turf Farm Sacramento, CA
9	Highlight 15	The Grass Farm Morgan Hill, CA
10	Highlight 25	L. Wu, University of California
11	Prairie	M. Engelke, Texas A&M University
12	Rutger's	D. Huff, Rutger's University
13	Sharp's Improved	Sharp's Brothers Seed Co.
14	Tatanka (NTG-1)	Native Turf Group
15	NTG-2	Native Turf Group
16	NTG-3	Native Turf Group
17	NTG-4	Native Turf Group
18	NTG-5	Native Turf Group
19	Bison	Native Turf Group
20	Top Gun (BAM 101)	Bamert Seed Co.
21	Plains (BAM 202)	Bamert Seed Co.
22	Texoka	Standard Entry

Seeded Entries: 12-22

TABLE 1B. MEAN TURFGRASS QUALITY RATINGS OF BUFFALOGRASS (SEEDED) CULTIVARS GROWN AT TWELVE LOCATIONS IN THE U.S.
1995 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF 1/

NAME	AR1	AZ1	CA3	IL1	IL2	KS2	MO1	OK1	TX1	UB1	VA6	WA4	MEAN
NTG-3	5.3	5.5	4.8	4.4	7.1	7.3	5.9	5.9	6.2	5.9	3.9	4.4	5.5
NTG-5	5.8	5.4	4.4	4.3	6.8	7.3	5.5	5.7	5.7	5.9	3.0	5.0	5.4
TATANKA (NTG-1)	5.4	5.5	4.8	3.9	6.7	7.5	5.4	5.6	6.0	5.7	3.2	4.3	5.3
NTG-4	5.5	5.4	5.0	4.2	6.6	7.6	4.2	5.9	5.5	5.8	3.2	5.1	5.3
NTG-2	6.0	5.6	4.5	3.8	6.4	7.3	4.9	6.1	5.6	5.3	3.6	4.5	5.3
SHARPS IMPROVED	4.1	5.4	4.6	3.5	6.8	7.8	5.1	5.9	6.4	5.8	2.7	4.2	5.2
BISON	4.5	5.5	4.5	3.4	6.3	7.8	4.1	5.3	5.9	5.4	2.8	4.3	5.0
TOP GUN (BAM 101)	4.8	5.1	4.5	3.2	6.5	7.2	3.8	5.9	6.3	5.3	2.3	3.9	4.9
TEXOKA	5.5	5.3	4.3	3.3	5.7	7.9	4.9	5.7	5.5	4.9	1.9	3.7	4.9
PLAINS (BAM 202)	5.4	5.5	4.3	3.7	5.9	6.5	3.6	5.0	5.8	4.3	2.3	4.1	4.7
RUTGERS	5.0	5.0	5.1	2.1	4.9	6.5	3.4	6.0	6.5	2.6	1.6	3.6	4.4
LSD VALUE	1.2	0.3	0.6	1.0	0.9	1.3	0.9	0.5	0.6	0.9	0.7	0.9	0.2

TABLE 1C. MEAN TURFGRASS QUALITY RATINGS OF BUFFALOGRASS (VEGETATIVE) CULTIVARS GROWN AT TWELVE LOCATIONS IN THE U.S.
1995 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF 1/

NAME	AR1	AZ1	CA3	IL1	IL2	KS2	MO1	OK1	TX1	UB1	VA6	WA4	MEAN
378 (NE 85-378)	6.5	5.5	4.7	3.8	7.1	7.6	4.9	7.2	5.0	6.0	3.1	4.1	5.4
315 (NE 84-315)	6.1	5.4	4.6	4.3	6.9	6.4	4.9	7.1	4.7	7.0	3.1	4.6	5.4
609 (NE 84-609)	5.9	6.3	5.1	3.8	6.7	8.8	3.3	7.1	7.3	4.5	1.9	4.3	5.4
NE 84-436	5.7	5.3	4.1	3.7	7.5	7.2	5.7	6.7	5.8	6.3	2.3	4.3	5.4
PRAIRIE	3.9	5.8	5.3	3.9	6.9	7.4	5.0	6.5	6.7	4.3	1.3	4.1	5.1
AZ 143	5.1	5.2	4.6	3.5	7.1	6.0	4.7	6.2	6.1	5.8	2.4	3.7	5.0
BUFFALAWN	5.8	5.3	5.4	2.3	7.4	6.7	3.8	6.9	6.7	4.8	1.8	2.5	5.0
HIGHLIGHT 25	5.7	5.4	5.4	2.3	5.2	5.3	5.3	6.9	6.8	3.8	1.6	3.5	4.8
NE 84-45-3	4.7	4.7	4.7	3.2	6.7	6.9	3.1	5.8	4.7	4.3	1.9	3.4	4.5
HIGHLIGHT 15	4.9	5.5	5.5	2.1	5.7	5.8	4.5	6.5	6.4	2.7	1.6	2.5	4.5
HIGHLIGHT 4	5.4	5.6	5.1	2.4	5.6	6.0	3.5	6.4	6.5	3.4	1.7	1.9	4.5
LSD VALUE	1.3	0.2	0.4	0.8	1.3	1.0	1.4	0.7	0.9	0.5	0.7	1.7	0.3

1/ TO DETERMINE STATISTICAL DIFFERENCES AMONG ENTRIES, SUBTRACT ONE ENTRY'S MEAN FROM ANOTHER ENTRY'S MEAN. STATISTICAL DIFFERENCES OCCUR WHEN THIS VALUE IS LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

TABLE 2B. MEAN TURFGRASS QUALITY RATINGS OF BUFFALOGRASS (SEEDED) CULTIVARS FOR EACH MONTH GROWN AT TWELVE LOCATIONS IN THE U.S.
1995 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF: MONTHS 1/

NAME	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
NTG-3	5.0	5.3	5.7	6.0	5.7	6.2	5.9	5.5	5.5	4.8	3.6	2.5	5.5
NTG-5	4.2	4.8	5.4	5.6	5.4	6.2	5.7	5.6	5.5	4.7	3.6	2.3	5.4
TATANKA (NTG-1)	5.0	5.0	5.4	6.0	5.5	6.2	5.5	5.4	5.4	4.8	4.0	2.5	5.3
NTG-4	4.8	4.8	5.7	5.8	5.4	6.3	5.6	5.3	5.3	4.7	3.8	2.5	5.3
NTG-2	4.5	4.8	5.3	5.9	5.2	6.0	5.5	5.3	5.4	4.7	4.1	2.8	5.3
SHARPS IMPROVED	4.8	5.3	5.3	6.2	5.4	5.8	5.4	5.3	5.2	4.9	3.9	2.3	5.2
BISON	4.3	5.0	5.4	6.2	4.9	5.5	5.4	5.2	4.9	4.8	3.7	2.5	5.0
TOP GUN (BAM 101)	4.5	5.0	5.3	5.8	4.9	5.7	5.1	5.0	5.0	4.8	4.1	2.7	4.9
TEXOKA	4.2	4.8	5.3	5.3	4.7	5.6	5.2	5.0	5.1	4.5	3.6	2.3	4.9
PLAINS (BAM 202)	4.5	5.0	5.3	5.6	4.8	5.6	5.2	4.7	4.5	4.7	3.9	2.7	4.7
RUTGERS	5.8	5.2	5.3	5.3	3.8	5.0	4.6	4.7	5.1	5.0	4.8	3.0	4.4
LSD VALUE	1.4	1.3	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	1.1	1.7	0.6

TABLE 2C. MEAN TURFGRASS QUALITY RATINGS OF BUFFALOGRASS (VEGETATIVE) CULTIVARS FOR EACH MONTH GROWN AT TWELVE LOCATIONS IN THE U.S.
1995 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF: MONTHS 1/

NAME	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
378 (NE 85-378)	4.3	4.8	5.4	6.2	5.7	6.5	5.6	5.6	4.9	4.3	3.4	2.5	5.4
315 (NE 84-315)	4.5	4.7	5.4	6.2	6.1	6.2	5.7	5.5	4.9	4.0	3.0	2.3	5.4
609 (NE 84-609)	5.3	5.2	6.0	6.6	4.9	5.8	5.9	5.9	5.8	5.6	5.8	3.8	5.4
NE 84-436	5.0	5.0	5.6	5.8	5.5	6.2	5.6	5.6	5.3	4.3	3.6	2.2	5.4
PRAIRIE	5.2	5.2	6.0	6.2	4.9	5.6	5.3	5.5	5.5	5.4	5.0	3.7	5.1
AZ 143	4.8	5.5	5.9	5.7	5.2	5.8	5.2	5.2	5.2	4.4	3.4	2.5	5.0
BUFFALAWN	5.8	5.3	5.6	5.8	4.7	6.1	5.3	5.1	5.2	4.7	5.1	3.3	5.0
HIGHLIGHT 25	6.0	5.7	5.8	5.8	4.5	5.7	5.0	4.9	5.1	5.2	5.4	3.7	4.8
NE 84-45-3	4.2	5.2	5.1	5.3	4.4	5.4	5.1	4.6	4.4	3.7	2.8	2.5	4.5
HIGHLIGHT 15	5.5	5.5	5.4	5.8	4.2	5.4	4.9	4.3	4.9	4.8	5.2	4.2	4.5
HIGHLIGHT 4	5.5	5.2	5.4	5.3	4.1	5.2	4.9	4.6	5.0	4.5	5.1	3.3	4.5
LSD VALUE	1.3	1.3	0.7	0.7	0.9	0.9	0.9	0.9	1.0	1.1	1.1	1.5	0.8

1/ TO DETERMINE STATISTICAL DIFFERENCES AMONG ENTRIES, SUBTRACT ONE ENTRY'S MEAN FROM ANOTHER ENTRY'S MEAN. STATISTICAL DIFFERENCES OCCUR WHEN THIS VALUE IS LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

NTEP Buffalograss Trial: UC Riverside

(established July 29, 1996)

I	1 5	2 3	3 2	4 1	5 4	6 10	7 9
	8 13	9 6	10 11	11 14	12 8	13 7	14 12
II	15 1	16 2	17 3	18 5	19 4	20 13	21 10
	22 14	23 11	24 8	25 7	26 12	27 9	28 6
III	29 4	30 1	31 5	32 2	33 3	34 11	35 8
	36 10	37 9	38 12	39 6	40 13	41 7	42 14

Varieties:

Seeded	Vegetative	
1. Cody	6. 91-118	11. Stampede
2. Tatanka	7. 86-120	12. UCR-95
3. BAM-100	8. 86-61	13. 609
4. Bison	9. Bonnie Brae	14. 378
5. Texoka	10. Midget	

ZOYSIAGRASS CULTIVAR EVALUATION

The results that follow are from a NTEP study that was established in 1991 and concluded with the 1995 calendar year data collection. A new zoysiagrass study will be established in 1996 at the UCR Turfgrass Research Facility.

1991 NATIONAL ZOYSIAGRASS TEST

Entries and Sponsors

Entry No.	Name	Sponsor
1	Marquis (TC 2033)	Turf Center Spencerville, MD
2	QT 2047	Quality Turfgrass Houston, TX
3	Omni (CD 2013)	Bladerunner Farms Austin, TX
4	TC 5018	Turfgrass Germplasm Services
5	QT 2004	Quality Turfgrass
6	CD 259-13	Bladerunner Farms
7	Korean Common	-
8	JZ-1	Jacklin Seed Company
9	Meyer	-
10	Emerald	-
11	Belair	-
12	Sunburst	Grasslyn, Inc.
13	El Toro	University of California
14	Palisades (DALZ 8514)	Texas A&M University
15	Crowne (DALZ 8512)	Texas A&M University
16	DALZ 8516	Texas A&M University
17	Cavalier (DALZ 8507)	Texas A&M University
18	DALZ 8508	Texas A&M University
19	Royal (DALZ 9006)	Texas A&M University
20	Diamond (DALZ 8502)	Texas A&M University
21	DALZ 8701	Texas A&M University
22	TGS-B10	Turfgrass Germplasm Services
23	TGS-W10	Turfgrass Germplasm Services
24	DALZ 8501	Texas A&M University

Seeded Entries: 7, 8, 22, 23

TABLE 1B. MEAN TURFGRASS QUALITY RATINGS OF ZOYSIAGRASS (VEGETATIVE) CULTIVARS
GROWN AT TWENTY LOCATIONS IN THE U.S.
1995 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF 1/

NAME	AL1	AR1	AZ1	CA2	CA3	GA1	GA2	ID2	IL1	IL2	KS2	MD1	MO1	MS1	OK1	TX1	TX2	UB1	UB2	VA1	MEAN
CAVALIER (DALZ 8507)	4.9	6.9	6.8	4.4	5.6	7.3	4.4	1.7	3.9	7.1	7.4	7.8	5.3	7.1	7.3	7.1	5.4	7.8	6.1	5.4	6.0
MARQUIS (TC 2033)	4.9	6.8	6.5	4.9	6.0	7.3	4.3	1.0	3.7	7.6	8.3	7.7	5.3	7.1	8.0	7.3	5.6	6.2	5.6	4.9	6.0
SUNBURST	4.7	6.0	6.3	5.0	5.6	6.9	4.6	8.0	4.1	5.6	7.3	6.9	5.5	5.9	5.7	6.9	3.5	7.0	5.8	6.2	5.9
EMERALD	4.8	7.5	6.1	3.9	6.0	7.1	4.8	1.0	3.6	5.3	7.9	7.8	4.9	7.2	7.5	6.2	4.6	6.8	5.7	5.7	5.7
TC 5018	4.9	5.8	6.1	4.9	5.4	6.4	4.4	5.3	4.9	5.3	8.0	6.6	5.4	6.0	6.3	6.3	4.0	6.0	5.4	6.4	5.7
OMNI (CD 2013)	4.8	6.7	6.3	5.0	5.7	7.4	3.4	1.3	4.6	7.1	7.6	6.9	5.7	6.0	7.5	6.2	3.8	6.3	5.8	5.7	5.7
DALZ 8508	4.9	6.7	5.9	4.3	5.8	6.9	3.7	1.3	3.5	6.7	7.8	7.5	5.1	7.3	7.6	6.5	4.8	6.6	5.4	3.9	5.6
QT 2004	4.9	6.4	6.2	4.7	5.7	7.3	3.9	1.0	4.2	6.9	7.5	6.9	5.2	5.0	7.5	6.7	2.5	6.7	6.2	5.9	5.6
ROYAL (DALZ 9006)	4.7	6.7	5.9	4.4	5.6	6.9	3.7	1.3	2.9	6.7	7.8	7.1	4.9	6.5	7.6	7.3	5.0	6.7	5.8	3.4	5.5
CD 259-13	4.8	5.9	5.3	5.0	5.4	6.5	4.0	6.0	4.2	5.5	7.7	6.2	5.6	5.8	5.5	6.1	2.0	6.2	5.3	6.8	5.5
MEYER	4.7	6.3	6.2	4.7	5.8	6.7	3.1	1.7	3.9	6.7	8.0	6.9	5.9	6.3	7.5	6.3	1.9	5.4	6.2	5.1	5.5
CROWNE (DALZ 8512)	4.8	5.7	6.6	5.3	5.8	6.6	4.8	1.0	4.6	4.9	7.1	6.6	4.9	6.1	5.4	6.7	4.4	6.6	4.3	6.9	5.5
PALISADES (DALZ 8514)	4.8	5.3	6.9	4.8	5.9	6.5	4.7	1.3	3.9	5.7	7.9	7.0	5.1	6.0	6.0	6.5	4.1	5.7	4.3	6.3	5.4
EL TORO	4.8	5.5	6.5	5.3	6.0	6.3	4.4	1.0	3.9	5.0	7.8	7.0	5.1	6.1	5.3	6.4	4.2	6.4	4.2	7.1	5.4
QT 2047	4.9	6.0	4.9	4.5	4.7	6.2	3.1	7.0	4.4	5.0	6.8	5.5	5.0	6.0	5.5	6.3	2.2	5.3	4.5	5.4	5.2
DALZ 8516	4.9	6.7	6.6	4.3	6.1	7.0	4.2	1.7	2.9	2.1	7.3	6.2	5.4	5.4	7.2	6.0	5.7	4.7	5.6	1.0	5.1
BELAIR	4.8	6.7	5.4	3.4	5.2	6.7	3.7	2.3	4.5	3.7	7.2	5.9	6.0	4.7	6.2	6.5	2.9	4.8	5.4	4.3	5.0
DIAMOND (DALZ 8502)	4.7	6.5	5.9	3.9	5.8	6.0	3.7	1.3	2.7	4.5	7.1	1.0	2.5	5.6	6.9	6.6	5.7	3.6	2.3	1.0	4.4
DALZ 8501	4.8	5.7	5.3	3.8	4.7	6.3	2.8	1.3	3.7	4.7	6.8	1.0	1.3	4.8	5.9	7.2	3.6	3.6	2.8	1.0	4.1
DALZ 8701	4.7	5.8	5.7	4.4	5.2	6.5	3.6	1.0	2.9	1.0	5.1	1.2	1.7	5.0	5.5	5.4	3.7	1.2	1.0	1.0	3.6
LSD VALUE	0.3	0.7	0.4	0.5	0.6	0.6	1.0	1.1	0.9	2.4	1.2	0.6	0.8	1.0	0.8	0.7	1.5	0.8	1.0	2.0	0.2

TABLE 1C. MEAN TURFGRASS QUALITY RATINGS OF ZOYSIAGRASS (SEEDED) CULTIVARS
GROWN AT TWENTY LOCATIONS IN THE U.S.
1995 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF 1/

NAME	AL1	AR1	AZ1	CA2	CA3	GA1	GA2	ID2	IL1	IL2	KS2	MD1	MO1	MS1	OK1	TX1	TX2	UB1	UB2	VA1	MEAN
TGS-W10	4.7	5.9	5.9	4.3	5.3	6.4	3.8	3.0	4.3	3.3	6.0	6.1	5.7	5.0	6.1	6.1	3.3	5.0	5.5	5.5	5.1
TGS-B10	4.8	5.3	5.6	5.0	5.4	6.2	3.5	2.7	4.5	3.7	7.3	6.0	5.5	4.5	5.5	5.7	2.9	5.3	4.7	5.7	5.0
JZ-1	4.9	5.0	5.1	4.7	4.9	6.5	4.2	3.3	4.1	3.9	5.6	5.5	5.1	4.6	5.0	6.0	2.1	5.4	3.9	5.3	4.8
KOREAN COMMON	4.8	4.7	5.1	4.4	4.8	6.2	3.5	3.3	4.0	2.4	5.8	5.3	5.1	4.8	4.8	6.2	2.3	5.3	4.0	5.2	4.6
LSD VALUE	0.3	0.6	0.5	0.9	0.2	0.2	1.2	2.0	1.0	1.2	1.3	0.3	0.5	1.1	1.4	0.5	0.8	0.5	0.6	0.5	0.2

1/ TO DETERMINE STATISTICAL DIFFERENCES AMONG ENTRIES, SUBTRACT ONE ENTRY'S MEAN FROM ANOTHER ENTRY'S MEAN. STATISTICAL DIFFERENCES OCCUR WHEN THIS VALUE IS LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

TABLE 2B. MEAN TURFGRASS QUALITY RATINGS OF ZOYSIAGRASS (VEGETATIVE) CULTIVARS FOR EACH MONTH GROWN AT TWENTY LOCATIONS IN THE U.S.
1995 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF: MONTHS 1/

NAME	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
CAVALIER (DALZ 8507)	4.5	5.0	5.7	6.0	5.8	6.7	6.2	6.4	6.4	6.3	5.1	4.4	6.0
MARQUIS (TC 2033)	4.5	5.3	5.6	6.3	5.9	6.6	6.1	6.3	6.4	6.3	5.5	4.3	6.0
SUNBURST	3.8	5.0	5.4	6.1	5.9	6.1	6.0	5.7	5.8	5.7	4.9	3.6	5.9
EMERALD	3.9	4.9	5.5	5.8	5.6	6.5	6.0	6.1	6.1	6.0	4.5	3.7	5.7
TC 5018	3.7	5.0	5.5	5.8	5.6	6.0	5.9	5.9	5.9	5.4	4.2	3.3	5.7
OMNI (CD 2013)	4.0	4.9	5.1	5.8	5.6	6.2	6.0	5.8	6.0	5.8	5.1	4.3	5.7
DALZ 8508	3.7	5.0	5.3	5.9	5.2	6.3	6.0	6.0	6.1	5.8	4.9	3.9	5.6
QT 2004	3.8	4.9	5.1	5.5	5.5	6.2	5.8	5.9	5.9	5.6	4.7	4.1	5.6
ROYAL (DALZ 9006)	3.7	4.5	5.2	5.7	5.2	6.3	6.0	6.0	6.1	5.8	4.9	4.1	5.5
CD 259-13	3.1	4.5	4.8	5.3	5.3	5.9	5.7	5.5	5.6	5.3	4.0	3.2	5.5
MEYER	3.4	4.5	4.9	5.3	5.6	6.4	6.0	5.6	5.5	5.1	4.3	3.3	5.5
CROWNE (DALZ 8512)	4.5	5.1	5.7	5.8	5.4	5.9	5.6	5.9	5.9	5.8	5.2	4.2	5.5
PALISADES (DALZ 8514)	4.2	5.0	5.6	5.8	5.3	5.9	5.5	5.7	5.8	5.7	5.3	4.6	5.4
EL TORO	4.3	4.8	5.6	5.7	5.2	5.9	5.5	5.8	6.0	5.8	5.1	4.6	5.4
QT 2047	3.5	4.2	4.8	5.4	4.8	5.5	5.4	5.1	5.2	4.8	3.8	2.9	5.2
DALZ 8516	3.9	4.5	4.9	5.6	4.7	5.4	5.3	5.5	5.6	5.6	5.5	5.2	5.1
BELAIR	3.6	4.6	4.6	4.9	4.8	5.4	5.3	5.6	5.7	5.1	4.2	2.9	5.0
DIAMOND (DALZ 8502)	4.3	5.0	5.1	4.9	3.9	4.8	4.7	4.8	5.0	5.0	5.0	4.3	4.4
DALZ 8501	4.1	4.6	4.8	4.0	3.6	4.5	4.4	4.4	4.6	4.8	4.7	3.8	4.1
DALZ 8701	3.6	4.9	4.9	4.0	3.4	3.8	3.8	3.9	4.2	4.3	5.0	3.9	3.6
LSD VALUE	1.2	1.4	1.1	0.7	0.7	0.6	0.7	0.6	0.7	0.8	0.9	1.0	0.6

TABLE 2C. MEAN TURFGRASS QUALITY RATINGS OF ZOYSIAGRASS (SEEDED) CULTIVARS FOR EACH MONTH GROWN AT TWENTY LOCATIONS IN THE U.S.
1995 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF: MONTHS 1/

NAME	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
TGS-W10	3.5	4.8	4.6	5.2	5.0	5.3	5.2	5.5	5.6	5.3	4.4	3.0	5.1
TGS-B10	3.3	4.5	4.9	5.0	4.8	5.3	5.3	5.4	5.6	5.1	4.0	3.1	5.0
JZ-1	3.4	4.1	4.6	4.9	4.8	5.0	4.8	5.2	5.1	4.9	4.1	3.2	4.8
KOREAN COMMON	3.4	4.3	4.5	5.0	4.8	4.8	4.6	4.9	4.8	4.8	4.1	3.0	4.6
LSD VALUE	1.1	1.5	1.1	0.7	0.6	0.4	0.5	0.4	0.5	0.6	0.6	0.8	0.4

1/ TO DETERMINE STATISTICAL DIFFERENCES AMONG ENTRIES, SUBTRACT ONE ENTRY'S MEAN FROM ANOTHER ENTRY'S MEAN. STATISTICAL DIFFERENCES OCCUR WHEN THIS VALUE IS LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

NTEP Zoysiagrass Trial: UC Riverside

(established July 29, 1996)

	1 9	2 12	3 14	4 15	5 11	6 10	7 13	8 16
I	9 1	10 6	11 5	12 8	13 3	14 18	15 19	16 17
	17 4	18 7	19 2	20 13	21 14	22 18	23 12	24 16
	25 3	26 8	27 15	28 10	29 17	30 11	31 19	32 9
II	33 4	34 1	35 6	36 2	37 7	38 5	39 A	40 B
	41 8	42 3	43 4	44 5	45 1	46 2	47 6	48 7
III	49 18	50 14	51 16	52 10	53 17	54 9	55 12	56 19
						57 13	58 11	59 5

Varieties:

Seeded	Vegetative	
1. ZEN 500	9. DALZ 9601	17. Zeon
2. ZEN 400	10. J 14	18. Meyer
3. Zenith	11. Miyako	19. Emerald
4. J 36	12. HT 210	A. YZ 3
5. J 37	13. De Anza	B. YZ 7
6. Chinese Common	14. Victoria	
7. Z 18	15. El Toro	
8. Korean Common	16. Jamur	

1992 NATIONAL TALL FESCUE TEST
Entries and Sponsors

Entry	Name	Sponsor
1	Avanti	Davenport Seed Co.
2	Lexus	Barenbrug/USA
3	Vegas	Barenbrug/USA
4	Austin	Barenbrug/USA
5	BAR Fa 214	Barenbrug/Holding
6	BAR Fa 2AB	Barenbrug/Holding
7	BAR Fa 0855	Barenbrug/Holding
8	Genesis (GEN-91)	Genesis Group
9	Ninja (ATF 006)	Ampac Seed Co.
10	ATF-007	Advanta Seeds West
11	FA-19	Advanta Seeds West
12	FA-22	Advanta Seeds West
13	Rebel-3D	Lofts Seed Co.
14	Rebel, Jr.	Lofts Seed Co.
15	Bonsai	Turf Merchants, Inc. (Standard Entry)
16	Bonsai Plus	Turf Merchants, Inc.
17	Twilight	Turf Merchants, Inc.
18	Mirage (KWS-DSL)	Turf Merchants, Inc.
19	Micro DD	Turf Merchants, Inc.
20	Finelawn 88	Finelawn Research Corp.
21	Finelawn Petite	Finelawn Research Corp.
22	Kittyhawk	Smith Seed Service
23	Aztec	O.M. Scott & Sons Co.
24	Bonanza II	Proprietary Seed
25	Adobe (SFL)	O.M. Scott & Sons Co.
26	Empress (ZPS-E2)	Zajac Performance Seeds
27	Crossfile II (Pick 90-12)	Pickseed West
28	Shortstop II (Pick 90-6)	Pickseed West
29	Eldorado	Turf-Seed, Inc.
30	PST-5LX	Pure-Seed Testing, Inc.
31	PST-5STB	Pure-Seed Testing, Inc.
32	PST-5PM	Pure-Seed Testing, Inc.
33	Safari	Turf-Seed, Inc.
34	Olympic II	Turf-Seed, Inc.
35	Coronado (PST-RDG)	Pure Seed Testing, Inc.
36	PST-5VC	Pure Seed Testing, Inc.
37	Silverado	Turf-Seed, Inc.
38	PST-5DX w/endophyte	Turf-Seed, Inc.
39	Tomahawk	Turf-Seed, Inc.
40	Monarch	Turf-Seed, Inc.
41	Cochise	Ampac Seed Co.
42	M-2	Mid-Valley Ag Products
43	403	Mid-Valley Ag Products
44	Anthem	Green Seed Co.
45	Astro 2000	Green Seed Co.
46	Apache II (PST-59D)	Pure-Seed Test., Inc.
47	Jaguar 3 (ZPS-J3)	Zajac Performance Seeds
48	Coyote (ZPS-ML)	Zajac Performance Seeds
49	Gazelle (ZPS-VL)	Zajac Performance Seeds
50	Duster (ITR-90-2)	Pennington Seed Co.
51	Virtue	Pennington Seed Co.
52	Palisades (OFI-TF-601)	Olsen-Fennel Seeds
53	Chieftain II (Pick CII)	Roberts Seed Co.
54	Sun Pro (Pick 90-10)	Pickseed West
55	Phoenix	Barenbrug/Normarc Group
56	Generic (Cafa101)	Cala Farms, Inc.
57	Ky-31 no endo.	Standard entry
58	Ky-31 w/endo.	Standard entry
59	Houndog V (ISI-AFE)	International Seeds, Inc.
60	ISI-AFA	International Seeds, Inc.
61	ISI-CRC	International Seeds, Inc.
62	Avalon (ISI-ATK)	Olsen-Fennel Seed Co.
63	Duke	Cascade International
64	Montauk	Cascade International
65	Pixie	Jacklin Seed Co.
66	Alamo (J-1048)	Medalist America
67	Lancer	LESCO, Inc.
68	Trailblazer II	LESCO, Inc.
69	SR 8200	Seed Research, Inc.
70	SR 8300	Seed Research, Inc.
71	Grande (SR 8400)	Royal Seeds of Salem
72	Titan 2 (SR 8010)	Smith Seed Services
73	SR 8210	Seed Research, Inc.
74	Arid	Jacklin Seed Company (Standard entry)
75	PSTF-LF	Pro-Seeds Marketing
76	Wildcat (PSTF-200)	Pro-Seeds Marketing
77	Heritage (PSTF-401)	Pro-Seeds Marketing
78	Guardian	Roberts Seed Company
79	Leprechaun	Roberts Seed Company
80	Falcon	E.F. Burlingham (Standard entry)
81	Falcon II (MB-21-92)	E.F. Burlingham
82	Renegade (MB-22-92)	E.F. Burlingham
83	Marksman (MB-23-92)	E.F. Burlingham
84	Starlet (MB-24-92)	E.F. Burlingham
85	Southern Choice (MB-25-92)	E.F. Burlingham
86	PRO-9178	Seed Research, Inc.
87	CAS-LA20	Cascade Int'l Seed Co.
88	CAS-MA21	Cascade Int'l Seed Co.
89	Debutante (WXI-208-2)	Willamette Seed Co.
90	Shenandoah	Willamette Seed Co.
91	Bonanza	Standard entry
92	Pyramid (SIU-1)	Olsen-Fennel Seed Co.

Tall Fescue NTEP Variety Trial

	74	85	22	31	13	4	17	40	20	7	71	44	75	72	29	1
	69	24	11	52	42	89	78	3	87	14	46	83	61	21	50	54
I	81	2	59	86	55	90	82	35	26	70	15	45	30	27	33	84
	10	18	73	64	9	41	53	6	60	8	68	12	91	36	25	51
	66	76	39	62	63	28	43	32	92	34	80	19	65	5	79	48
	38	47	88	23	77	56	49	58	37	16	57	67	95	96	94	93
	63	5	73	8	17	40	10	1	80	39	51	82	71	76	38	91
	70	26	42	20	41	83	22	84	61	18	9	29	56	75	45	33
II	31	57	79	88	2	58	60	3	54	65	77	21	23	64	32	35
	74	43	66	50	6	4	81	16	90	59	92	49	36	55	12	87
	52	37	47	34	89	68	85	14	24	28	62	78	27	44	46	13
	25	53	11	30	15	69	72	19	7	67	86	48	93	95	96	94
	65	41	80	79	31	66	81	8	87	6	74	75	84	7	44	11
	85	18	58	56	39	27	72	62	71	46	45	50	88	9	55	21
III	12	77	76	1	43	30	68	5	23	25	2	60	82	40	61	14
	28	53	17	38	34	64	69	24	91	78	37	84	70	67	22	57
	83	73	35	29	13	4	33	3	26	89	16	51	20	52	59	49
	10	42	19	48	15	90	92	36	63	47	32	86	95	94	93	96

KEY:

1 = Avanti	21 = Finelawn Petite	41 = Cochise	61 = ISI-CRC	81 = MB-21-92
2 = Lexus	22 = Kittyhawk	42 = M-2	62 = ISI-ATK	82 = MB-22-92
3 = Vegas	23 = Aztec	43 = 403	63 = Duke	83 = MB-23-92
4 = Austin	24 = Bonanza II	44 = Anthem	64 = Montank	84 = MB-24-92
5 = BAR Fa 214	25 = SFL	45 = Astro 2000	65 = Pixie	85 = MB-25-92
6 = BAR Fa 2AB	26 = ZPS-E2	46 = PST-59D	66 = J-1048	86 = PRO-9178
7 = BAR Fa 0855	27 = Pick 90-12	47 = ZPS-J3	67 = Lancer	87 = CAS-LA20
8 = GEN-91	28 = Pick 90-6	48 = ZPS-ML	68 = Trailblazer II	88 = CAS-MA21
9 = ATF-006	29 = Eldorado	49 = ZPS-VL	69 = SR 8200	89 = WXI-208-2
10 = ATF-007	30 = PST-5LX	50 = ITR-90-2	70 = SR 8300	90 = Shenandoah
11 = FA-19	31 = PST-5STB	51 = Virtue	71 = SR 8400	91 = Bonanza
12 = FA-22	32 = PST-5PM	52 = OFI-TF-601	72 = SR 8010	92 = SIU-1
13 = Rebel-3D	33 = Safari	53 = Pick CII	73 = SR 8210	93 = MED 2-11-24
14 = Rebel, Jr.	34 = Olympic II	54 = Pick 90-10	74 = Arid	94 = MED 2-18-18
15 = Bonsai	35 = PST-RDG	55 = Phoenix	75 = PSTF-LF	95 = MED 2-12-10
16 = Bonsai Plus	36 = PST-5VC	56 = Cafa101	76 = PSTF-200	96 = MED 10-8-5
17 = Twilight	37 = Silverado	57 = Ky-31	77 = PSTF-401	
18 = KWS-DSL	38 = PST5DX/endophyte	58 = Ky-31/endophyte	78 = Guardian	
19 = Micro DD	39 = Tomahawk	59 = ISI-AFE	79 = Leprechaun	
20 = Finelawn 88	40 = Monarch	60 = ISA-AFA	80 = Falcon	

Established: October 1992 **Mowing:** 2 inches **Fertility:** 4 lbs N / 1000 ft^2 / year

TABLE 1. MEAN TURFGRASS QUALITY RATINGS OF TALL FESCUE CULTIVARS
GROWN AT FORTY LOCATIONS IN THE U.S. AND CANADA
1995 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF 1/

NAME	AL1	AR1	AR2	AZ1	BC1	CA1	CA3	GA1	GA2	IL1	IL2	IN1	KS1	KS2	KY1	MA1	MD1	MI1	MO1	MO2	MO3
* JAGUAR 3 (ZPS-J3)	5.4	7.2	6.9	6.9	5.7	7.6	6.0	5.0	2.2	6.4	6.4	5.9	7.1	7.9	7.8	5.5	6.4	6.5	6.0	6.1	6.4
* HOUNDOG V (ISI-AFE)	5.4	7.5	6.2	7.0	6.0	7.6	6.0	4.8	2.3	6.6	7.3	5.1	7.0	7.8	8.0	5.5	6.2	5.7	5.6	6.5	6.7
* FALCON II (MB-21-92)	5.3	6.5	7.1	6.8	5.4	7.5	5.8	5.2	2.6	5.6	7.1	5.9	7.1	7.8	7.8	5.5	6.0	6.1	6.0	6.1	6.9
ISI-AFA	5.3	6.5	6.8	6.9	5.7	7.6	6.1	5.3	3.1	5.6	7.1	5.9	7.2	7.9	7.8	6.2	6.0	6.2	5.6	6.0	6.3
PST-5DX W/ENDOPHYTE	5.3	7.1	6.6	6.9	5.7	7.6	6.1	5.4	2.5	6.6	6.5	6.0	7.0	7.4	7.9	5.3	5.8	6.1	5.0	5.9	6.1
* CROSSFIRE II (PICK 90-12)	5.4	7.5	7.2	6.9	6.1	7.7	5.9	4.9	2.8	6.7	7.2	5.5	7.1	7.5	8.1	5.6	5.8	6.5	5.6	5.9	6.9
* CORONADO (PST-RDG)	5.1	7.3	7.0	6.9	5.9	7.6	6.1	5.4	3.3	6.0	7.3	5.5	7.3	7.7	7.8	5.2	5.8	5.7	5.7	5.9	6.8
* SOUTHERN CHOICE (MB-25-92)	5.4	7.2	6.7	6.9	5.3	7.7	6.0	5.3	2.9	5.6	6.4	6.0	7.3	7.6	8.1	5.2	6.4	6.3	5.4	6.1	6.5
ATF-007	5.4	7.5	6.6	6.9	5.6	7.6	6.1	5.1	2.7	5.8	6.3	5.6	7.5	7.8	7.9	5.0	5.9	6.2	5.5	6.3	7.1
* COYOTE (ZPS-ML)	5.4	7.7	6.9	7.0	5.9	7.7	5.9	5.0	2.5	5.9	7.0	5.7	7.3	7.8	8.4	5.5	5.6	5.8	5.6	5.8	5.8
* FINELAWN PETITE	5.4	7.1	6.5	6.8	5.7	7.6	6.0	5.2	3.1	6.1	6.3	5.5	7.3	7.5	7.3	5.7	5.8	6.3	6.0	6.4	6.6
* GENESIS (GEN-91)	5.4	7.1	7.0	7.0	6.1	7.6	5.9	4.8	2.2	6.2	6.4	5.6	7.3	7.9	7.8	5.4	6.1	6.3	5.7	6.5	7.0
PST-5PM	5.1	6.9	6.3	6.9	6.3	7.6	6.0	5.1	2.5	6.4	6.1	6.0	6.6	7.6	7.6	5.2	5.9	6.4	5.6	6.0	6.8
* REBEL,JR.	5.4	6.9	6.6	7.0	6.3	7.5	5.9	5.1	2.6	6.5	6.3	5.9	7.0	7.2	7.4	5.6	5.7	6.3	6.0	6.2	5.9
* LEXUS	5.4	7.5	6.8	6.9	5.7	7.4	6.1	4.8	1.6	6.4	6.4	4.8	7.8	7.9	7.6	4.8	5.8	6.1	5.8	5.8	6.9
* LANCER	5.4	7.9	6.0	7.1	5.9	7.6	5.8	5.1	2.7	5.9	6.4	5.8	7.0	7.7	7.8	4.8	6.0	6.4	5.6	5.8	6.9
* PIXIE	5.4	7.4	6.3	6.8	5.7	7.6	6.0	5.3	2.8	5.0	6.6	5.2	7.1	7.6	7.9	5.3	6.0	6.5	5.6	5.8	6.4
* GRANDE (SR 8400)	5.3	6.8	6.5	6.9	6.1	7.6	6.1	4.8	3.4	6.5	6.5	5.6	6.5	7.4	7.7	5.5	6.0	6.1	5.7	5.9	5.9
* APACHE II (PST-59D)	5.2	7.4	6.2	6.9	5.8	7.7	5.8	5.0	2.6	6.4	6.5	5.6	7.0	7.9	7.9	5.5	5.7	6.3	5.8	6.0	6.7
* EMPRESS (ZPS-E2)	5.4	6.8	6.3	7.0	5.6	7.7	6.0	5.1	2.3	6.1	6.9	5.4	7.0	7.7	8.2	5.0	6.0	6.3	5.7	5.9	6.3
* DUSTER (ITR-90-2)	5.3	7.3	6.8	6.7	6.1	7.7	5.9	4.6	1.8	5.2	6.8	5.6	6.9	7.3	7.7	5.2	5.9	6.3	6.1	5.8	6.5
* RENEGADE (MB-22-92)	5.5	6.8	6.4	6.6	5.9	7.6	5.9	5.6	2.4	5.9	6.0	5.3	6.9	7.3	7.5	4.6	6.2	6.1	5.9	5.9	6.7
* MARKSMAN (MB-23-92)	5.4	7.3	6.3	6.9	5.4	7.7	6.0	5.1	1.8	5.3	6.5	5.7	6.7	7.6	7.5	5.6	6.1	6.2	5.6	6.2	6.7
* PYRAMID (SIU-1)	5.3	6.8	6.4	7.1	5.7	7.7	6.0	4.7	2.0	5.6	6.5	6.2	7.4	7.2	7.3	5.6	5.7	6.1	5.8	6.1	5.9
* DEBUTANTE (WXI-208-2)	5.4	6.7	6.0	6.5	5.8	7.6	6.0	5.2	3.0	5.5	6.2	5.8	6.8	7.2	7.8	5.3	5.6	5.9	5.7	5.8	6.3
* MICRO DD	5.5	7.0	5.8	7.1	5.7	7.6	5.9	5.2	2.2	5.6	6.1	5.8	7.2	7.5	7.6	5.2	6.1	6.3	5.2	5.9	6.8
* STARLET (MB-24-92)	5.4	7.3	6.3	6.9	5.6	7.6	5.9	5.2	2.8	6.0	6.0	5.3	6.7	7.7	7.6	4.7	6.3	5.8	5.6	6.3	6.6
FA-19	5.3	7.0	6.5	6.9	5.7	7.6	5.9	4.9	2.5	6.2	6.5	6.1	7.1	7.3	7.7	5.3	5.5	6.1	5.3	6.0	6.3
* TOMAHAWK	5.4	6.5	6.6	7.1	5.8	7.6	6.0	5.0	2.4	5.6	6.2	5.5	7.0	7.3	6.8	4.6	6.0	5.9	5.9	5.9	5.9
* GAZELLE (ZPS-VL)	5.3	7.3	6.3	6.6	5.3	7.6	6.0	4.7	1.2	4.9	6.8	5.2	7.0	7.5	7.5	5.2	5.8	5.9	6.1	5.8	7.0
* SR 8210	5.4	7.3	6.4	6.9	5.9	7.5	5.9	5.1	1.9	5.8	5.3	5.6	6.8	7.2	7.5	4.9	5.8	6.3	6.2	5.9	6.4
* SHORTSTOP II (PICK 90-06)	5.4	7.3	6.5	6.9	6.2	7.6	6.0	4.9	2.8	5.5	7.0	5.0	7.4	7.6	7.7	5.4	5.5	5.9	5.2	5.9	5.9
* SUN PRO (PICK 90-10)	5.3	7.8	6.1	6.9	5.7	7.7	6.1	4.6	2.8	5.5	6.2	5.2	7.4	7.8	7.3	5.7	5.9	6.0	5.3	5.8	6.2
PST-5VC	5.4	6.9	6.4	6.9	6.3	7.4	5.9	5.0	2.0	5.6	5.7	6.2	7.1	7.3	7.5	5.2	5.9	5.7	5.1	6.3	5.9
* ADOBE (SFL)	5.4	7.5	6.0	6.7	5.1	7.7	5.9	5.5	2.8	6.0	6.1	6.0	6.9	7.4	7.5	5.1	5.8	5.9	5.8	5.9	5.8
* LEPRECHAUN	5.3	7.6	6.2	6.6	5.7	7.6	5.9	4.8	2.5	5.6	6.5	5.4	6.9	7.4	7.3	5.0	5.7	5.9	5.7	5.9	6.0
* ALAMO (J-1048)	5.3	6.8	6.0	6.9	5.4	7.4	6.0	5.1	2.3	6.4	6.1	5.4	6.6	7.3	7.3	5.1	5.8	6.4	6.0	5.9	6.3
* SAFARI	5.3	6.3	6.0	6.9	6.0	7.6	6.0	5.2	2.4	5.2	6.1	5.5	6.8	7.1	7.3	5.0	6.2	6.1	5.5	6.1	5.9
PST-5LX	5.3	7.0	6.4	6.8	5.4	7.5	5.9	5.3	2.0	5.6	6.1	5.0	7.0	7.6	7.8	5.0	6.2	6.1	5.4	5.7	6.6
* SR 8200	5.4	6.5	5.7	6.9	5.5	7.5	5.9	5.4	3.2	6.3	6.3	5.5	6.6	7.0	7.7	5.3	5.9	6.1	5.5	6.0	6.4
* NINJA (ATF-006)	5.4	7.6	6.6	7.1	5.9	7.6	6.0	5.0	2.8	5.0	6.4	5.8	7.0	7.7	7.5	4.1	5.7	5.8	5.1	5.8	6.7
* PALISADES (OFI-TF-601)	5.3	6.8	6.0	7.0	6.1	7.3	6.0	4.6	2.2	5.3	6.1	5.4	6.8	7.4	7.3	5.1	5.9	6.5	5.8	6.0	5.8
* DUKE	5.4	6.8	6.0	7.0	5.6	7.5	6.1	5.0	2.4	5.6	5.5	5.6	7.0	7.5	7.4	4.9	5.6	6.4	6.0	6.1	5.9
* SILVERADO	5.2	7.0	6.3	6.8	6.1	7.6	6.0	4.9	2.9	5.6	6.3	5.7	6.9	7.4	7.8	5.0	5.8	6.0	5.4	6.0	6.1
* BONSAI PLUS	5.3	6.3	6.5	6.8	5.9	7.6	5.8	5.0	3.2	6.4	6.7	5.0	6.4	7.4	7.1	4.6	5.8	6.4	5.3	5.9	6.1
BAR FA 2AB	5.2	6.6	6.5	6.8	6.5	7.3	5.8	4.5	2.5	5.7	5.9	5.2	7.0	7.5	7.1	4.7	5.6	5.8	5.7	5.8	5.8
* GUARDIAN	5.3	6.1	6.0	6.6	5.5	7.5	5.9	5.0	2.8	6.0	6.4	5.4	6.4	7.2	7.5	5.1	5.9	6.4	5.5	6.3	5.8
FA-22	5.3	7.6	6.0	6.5	6.0	7.5	5.8	4.9	2.0	5.9	6.7	5.8	6.7	7.0	7.3	5.8	6.0	6.2	5.5	6.0	5.9
* VIRTUE	5.3	6.8	6.3	6.8	6.1	7.5	5.9	4.4	1.0	5.7	5.9	5.1	7.0	7.3	7.1	5.2	5.6	6.0	6.0	5.6	6.2
* VEGAS	5.3	7.0	6.1	6.9	5.4	7.6	5.8	4.9	1.8	6.6	6.2	5.3	7.3	7.3	7.5	4.8	5.8	5.6	5.8	6.0	6.3

TABLE 1. (CONT'D)

MEAN TURFGRASS QUALITY RATINGS OF TALL FESCUE CULTIVARS
GROWN AT FORTY LOCATIONS IN THE U.S. AND CANADA
1995 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF

NAME	AL1	AR1	AR2	AZ1	BC1	CA1	CA3	GA1	GA2	IL1	IL2	IN1	KS1	KS2	KY1	MA1	MD1	MI1	MO1	MO2	MO3
* MONTAUK	5.5	7.0	6.5	6.9	4.9	7.6	6.0	4.6	2.9	5.7	5.2	5.9	6.9	7.2	7.2	4.6	6.0	6.5	5.3	5.8	6.4
* TITAN 2 (SR 8010)	5.3	6.5	6.1	6.7	5.7	7.5	5.4	5.1	2.6	5.8	5.8	5.6	6.3	6.9	7.5	5.2	6.1	6.4	5.4	6.0	6.0
* SR 8300	5.3	6.5	6.1	6.8	5.7	7.4	5.9	5.1	2.5	5.5	5.8	5.6	6.4	6.9	7.5	4.9	6.1	6.3	5.5	5.9	5.9
* COCHISE	5.3	6.6	6.0	6.6	5.9	7.6	5.9	5.0	3.2	5.2	5.8	5.7	6.5	7.5	7.4	5.1	5.9	6.3	5.9	5.9	6.2
BAR FA 0855	5.3	6.8	5.8	6.9	6.2	7.3	5.9	4.8	2.3	5.6	5.8	5.8	6.5	7.1	6.8	5.0	6.0	6.2	5.8	5.8	6.0
HERITAGE (PSTF-401)	5.3	6.5	5.7	7.0	5.7	7.4	5.8	4.6	3.2	6.5	5.4	6.0	6.7	6.6	7.5	5.1	5.9	6.6	5.5	5.9	5.6
* TRAILBLAZER II	5.3	6.3	6.1	6.9	5.4	7.6	5.8	5.1	2.1	5.3	6.0	5.4	7.0	7.3	7.7	4.1	6.0	6.3	5.1	6.0	6.3
AVALON (ISI-ATK)	5.4	7.0	5.5	6.6	5.7	7.3	5.4	4.8	2.3	6.2	5.5	5.3	6.6	7.3	7.1	5.6	5.6	6.1	5.9	6.0	5.9
* REBEL 3D	5.3	6.5	5.9	7.0	6.0	7.4	6.0	5.3	2.3	5.8	6.2	5.8	7.0	7.5	7.2	4.2	5.8	6.3	5.8	5.9	6.2
PRO-9178	5.4	6.7	5.8	6.8	6.4	7.6	5.9	4.9	2.1	5.8	6.5	5.5	6.7	7.1	7.4	4.9	5.6	6.3	5.2	6.0	6.1
M-2	5.3	6.5	6.1	6.8	5.6	7.6	6.1	5.2	2.2	5.5	6.2	6.0	6.5	7.2	7.3	4.9	5.8	6.2	5.6	6.0	5.9
403	5.4	6.5	5.7	6.8	5.9	7.6	5.6	4.9	2.7	6.0	6.5	5.5	6.6	6.9	7.3	5.3	6.0	6.5	5.0	5.8	6.1
* ELDORADO	5.3	6.8	6.3	6.9	5.3	7.4	6.0	5.0	2.9	5.5	6.3	4.8	6.9	7.2	7.8	4.8	5.5	6.3	5.8	5.6	6.1
ISI-CRC	5.4	6.5	6.0	6.7	5.4	7.5	5.8	5.1	2.3	5.7	5.5	5.0	7.0	7.1	7.4	5.0	6.0	6.2	5.4	6.3	6.0
* AVANTI	5.2	6.7	6.3	7.0	5.9	7.4	5.9	4.9	1.8	5.2	5.7	5.4	7.0	7.0	6.8	5.1	5.8	6.4	5.4	5.8	5.9
* CHIEFTAIN II (PICK CII)	5.2	6.7	5.9	6.9	5.4	7.4	5.8	4.3	2.4	6.0	5.4	5.2	6.9	7.3	7.4	4.9	6.0	6.3	5.6	5.7	6.2
* BONSAI	5.2	7.6	5.9	7.0	5.5	7.6	5.9	3.8	2.3	5.8	6.8	6.1	6.4	7.4	6.8	4.5	5.6	5.5	5.4	5.8	6.1
* MIRAGE (KWS-DSL)	5.3	7.0	6.1	6.0	5.9	7.6	5.9	5.2	2.4	5.3	5.6	5.6	6.7	7.4	7.0	4.9	5.7	6.3	5.8	5.8	6.4
* SHENANDOAH	5.3	5.9	5.8	7.0	5.6	7.3	5.9	5.0	3.2	5.0	6.2	5.4	6.2	6.5	6.8	5.2	5.9	6.5	5.7	5.9	6.0
WILDCAT (PSTF-200)	5.4	5.6	5.5	6.8	5.0	7.3	5.8	5.4	2.6	6.5	6.0	5.1	6.2	6.7	7.5	5.2	5.9	5.9	5.3	6.1	5.9
* BONANZA II	5.4	6.2	6.1	6.8	5.5	7.3	6.0	5.1	2.8	5.8	6.2	5.8	6.4	6.9	7.3	4.6	5.7	6.5	5.5	5.9	5.9
* GENERIC (CAFA 101)	5.3	6.0	5.4	6.8	5.9	7.5	5.8	4.7	2.8	6.0	6.4	5.4	6.3	6.7	7.2	5.2	6.2	6.3	5.7	6.0	6.0
PSTF-LF	5.4	6.3	5.8	6.8	5.2	7.6	5.8	5.2	3.1	6.0	5.2	5.1	6.4	7.0	7.2	4.9	5.8	6.1	5.8	6.0	6.1
BAR FA 214	5.4	7.3	5.9	6.9	5.8	7.8	5.9	4.6	1.8	6.4	5.8	6.0	6.8	6.7	7.0	4.5	5.8	6.1	5.4	5.7	5.7
* KITTYHAWK	5.3	6.8	5.8	6.9	5.9	7.5	5.8	4.9	2.2	6.1	6.3	5.1	7.0	7.1	6.9	5.0	5.9	5.9	5.5	6.0	6.1
* MONARCH	5.2	6.6	6.3	6.9	5.5	7.6	5.9	4.8	2.1	5.7	5.9	5.7	6.3	7.0	7.4	5.1	5.9	5.9	5.1	5.8	5.8
PST-5STB	5.3	7.5	5.9	6.5	5.8	7.8	6.1	4.9	2.0	5.0	5.3	5.0	6.5	6.8	6.7	4.6	5.7	5.9	5.1	5.9	5.8
* AZTEC	5.4	6.7	6.5	6.9	5.3	7.5	6.0	5.0	2.4	6.0	2.9	5.5	6.9	7.0	7.2	5.0	6.1	6.4	5.1	5.8	6.0
* FINELAWN 88	5.3	6.2	5.9	6.8	5.3	7.4	5.9	5.1	3.1	5.9	5.6	5.2	6.2	7.0	7.0	4.3	5.8	6.3	5.3	5.8	5.9
* AUSTIN	5.3	6.3	6.1	6.9	5.3	7.4	5.6	4.9	2.4	6.1	5.8	5.2	6.9	6.7	6.8	5.4	5.8	6.4	5.4	5.8	5.9
CAS-LA20	5.3	6.8	6.1	6.9	5.4	7.6	5.9	4.6	2.4	5.9	5.9	4.5	6.6	7.0	7.0	4.3	5.4	5.9	5.4	5.5	6.2
CAS-MA21	5.3	6.2	6.1	6.9	5.1	7.4	5.9	4.9	2.3	5.8	6.0	5.4	6.6	7.0	7.2	4.2	5.8	6.3	5.8	5.6	6.3
* PHOENIX	5.4	6.2	6.0	6.7	5.1	6.8	5.3	4.7	2.9	6.2	5.8	5.6	6.2	6.6	7.1	4.8	6.0	6.7	5.6	6.2	5.8
* OLYMPIC II	5.3	5.6	5.7	6.9	5.6	7.4	5.6	4.9	2.7	4.9	5.5	5.8	6.1	6.3	6.8	4.7	5.7	6.4	5.6	5.9	6.0
* ASTRO 2000	5.3	6.3	5.8	7.0	5.6	7.5	5.6	4.8	2.8	5.1	5.0	5.2	6.2	6.5	7.3	4.8	5.9	6.3	6.1	6.2	5.3
* BONANZA	5.3	5.8	5.7	6.8	5.4	6.6	6.0	4.9	2.4	4.9	5.6	5.5	6.1	6.8	6.9	5.0	5.7	6.0	5.9	5.8	5.8
* TWILIGHT	5.3	6.5	5.3	6.3	5.4	7.6	5.8	5.1	2.4	4.7	5.1	4.3	6.4	7.7	5.6	4.0	5.6	5.7	5.2	5.2	6.3
* ARID	5.4	5.3	5.1	6.7	5.2	5.9	5.3	4.7	2.6	4.8	4.0	5.3	5.8	5.9	6.8	4.9	5.6	6.1	5.5	5.7	4.9
* FALCON	5.2	5.0	5.1	6.6	5.6	6.4	5.0	4.7	2.6	5.0	5.0	4.8	5.5	5.4	6.5	4.5	5.8	6.2	5.5	5.5	5.2
* ANTHEM	5.3	4.9	4.7	6.7	5.7	5.8	4.9	4.4	2.5	5.7	4.0	5.6	5.2	5.4	6.3	3.9	5.6	5.9	5.1	5.5	4.4
* KY-31 W/ENDO.	5.3	4.0	3.8	6.3	4.7	4.3	4.0	4.0	2.6	4.4	4.0	4.0	4.2	4.3	5.3	3.8	4.7	5.1	4.9	5.4	3.8
* KY-31 NO ENDO.	5.3	4.4	4.0	6.3	4.6	4.8	4.0	4.2	1.9	4.3	4.1	3.8	4.5	4.5	5.3	3.8	4.9	5.8	5.0	5.0	3.6
LSD VALUE	0.2	0.8	0.8	0.4	1.0	0.3	0.4	0.6	1.4	1.1	1.0	0.8	0.6	0.5	0.5	1.2	0.6	0.5	0.8	0.5	0.8

* COMMERCIALLY AVAILABLE IN THE USA IN 1996.

1/ TO DETERMINE STATISTICAL DIFFERENCES AMONG ENTRIES, SUBTRACT ONE ENTRY'S MEAN FROM ANOTHER ENTRY'S MEAN. STATISTICAL DIFFERENCES OCCUR WHEN THIS VALUE IS LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

TABLE 1. (CONT'D)

MEAN TURFGRASS QUALITY RATINGS OF TALL FESCUE CULTIVARS
GROWN AT FORTY LOCATIONS IN THE U.S. AND CANADA
1995 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF 1/

NAME	MS1	NE1	NE2	NE3	NJ1	NJ2	NV1	PA1	PA2	RI1	SD1	TX1	UB1	UB2	VA1	VA4	VA6	VA8	WA1	MEAN
JAGUAR 3 (ZPS-J3)	5.9	6.7	6.6	5.0	5.7	6.8	5.8	6.6	3.6	5.9	6.0	6.9	7.5	6.0	6.0	5.7	4.1	6.0	6.4	6.1
HOUNDOG V (ISI-AFE)	6.2	6.5	7.0	5.3	6.1	6.1	6.3	7.1	3.7	5.9	4.8	7.0	7.7	6.1	5.8	5.7	4.1	5.6	6.6	6.1
FALCON II (MB-21-92)	5.7	7.2	6.5	5.0	5.9	6.1	6.5	6.5	3.6	6.0	5.4	6.8	7.8	6.0	6.0	5.4	4.4	6.0	6.6	6.1
ISI-AFA	6.1	7.2	6.8	4.0	5.9	6.2	6.1	6.9	3.5	5.6	5.6	6.7	7.5	6.1	6.1	5.7	4.0	6.1	6.1	6.1
PST-5DX W/ENDOPHYTE	6.2	7.0	7.5	4.6	5.4	6.4	6.0	6.7	3.5	5.6	6.1	7.2	7.6	6.2	5.6	5.9	4.7	5.2	6.5	6.1
CROSSFIRE II (PICK 90-12)	5.8	6.5	5.8	4.6	6.0	6.0	6.5	6.9	3.4	5.5	5.9	6.7	7.6	5.9	5.5	5.6	3.5	5.2	6.0	6.0
CORONADO (PST-RDG)	6.2	7.1	5.5	5.1	5.7	6.1	6.3	5.9	3.9	6.0	5.7	6.6	7.5	5.7	5.7	5.8	3.6	5.4	6.5	6.0
SOUTHERN CHOICE (MB-25-92)	5.9	5.9	6.7	5.3	5.8	6.1	5.8	6.3	3.5	6.1	5.9	6.7	7.6	6.0	5.5	5.6	3.8	5.6	6.4	6.0
ATF-007	5.9	6.7	6.5	4.6	5.1	6.1	6.1	6.6	3.5	5.9	6.0	6.9	7.5	5.6	6.1	5.6	3.8	5.2	6.7	6.0
COYOTE (ZPS-ML)	5.9	6.1	6.3	5.0	5.7	6.2	5.5	6.8	3.5	6.1	5.5	6.9	7.6	6.4	5.8	5.4	3.4	5.5	6.4	6.0
FINELAWN PETITE	6.0	6.5	7.2	4.9	5.1	5.2	5.6	5.9	3.6	5.7	5.1	7.0	7.7	6.7	5.3	5.4	3.9	6.3	6.2	6.0
GENESIS (GEN-91)	5.7	6.5	5.5	4.8	5.6	6.2	5.7	6.3	3.7	5.4	4.9	6.7	7.4	6.1	5.7	5.1	3.9	5.7	6.5	6.0
PST-5PM	6.1	6.1	5.2	4.8	5.4	6.0	6.0	6.9	3.7	5.5	5.5	7.2	7.6	6.3	5.8	5.9	3.6	5.9	6.2	6.0
REBEL,JR.	6.1	5.9	5.5	5.9	5.1	5.3	6.0	6.4	3.7	5.6	5.8	6.7	7.3	6.0	5.7	5.4	4.3	6.0	6.1	6.0
LEXUS	5.8	5.8	5.7	5.6	5.5	6.3	6.3	6.6	3.3	6.8	5.6	6.9	7.4	6.1	5.6	5.7	3.2	5.3	6.4	6.0
LANCER	6.0	6.7	6.7	5.1	5.6	6.0	6.4	6.4	3.5	5.9	5.0	6.7	7.3	6.0	5.0	5.6	3.7	4.8	6.2	6.0
PIXIE	6.0	6.0	6.1	4.8	5.6	5.6	6.0	6.6	3.5	5.9	5.1	7.0	7.7	5.8	6.0	5.8	3.6	5.4	6.7	5.9
GRANDE (SR 8400)	6.0	7.3	6.7	4.6	4.8	5.1	6.0	6.4	3.7	5.5	5.5	6.8	7.1	5.8	5.6	5.4	3.9	6.2	6.1	5.9
APACHE II (PST-59D)	6.0	6.5	6.1	4.5	4.9	5.4	6.1	6.3	3.5	5.6	4.9	6.9	7.5	5.9	5.8	5.1	4.1	5.8	6.2	5.9
EMPRESS (ZPS-E2)	6.0	7.2	6.1	5.4	5.2	5.6	6.0	6.6	3.3	5.7	5.0	6.9	7.2	5.4	5.4	5.7	3.8	5.1	6.5	5.9
DUSTER (ITR-90-2)	5.8	6.3	6.3	4.8	4.7	5.5	5.7	6.8	3.6	5.8	5.7	6.8	7.6	6.2	6.0	5.3	3.7	5.2	6.5	5.9
RENEGADE (MB-22-92)	6.1	7.2	5.7	5.3	4.7	5.1	6.0	6.6	3.7	5.6	5.3	6.6	7.3	5.5	5.6	5.6	4.1	6.1	6.6	5.9
MARKSMAN (MB-23-92)	5.9	6.4	6.8	4.6	5.3	5.4	5.5	6.4	3.5	5.7	5.2	7.0	7.5	6.1	5.5	5.3	4.1	5.0	6.6	5.9
PYRAMID (SIU-1)	6.0	7.3	6.2	5.0	4.5	4.8	6.0	6.3	3.5	5.8	6.1	6.9	7.3	5.7	5.5	5.3	4.1	5.9	6.2	5.9
DEBUTANTE (WXI-208-2)	6.0	6.8	5.9	5.0	5.2	5.1	6.3	6.6	3.7	5.6	5.7	6.7	7.1	6.0	5.8	5.2	4.0	5.6	6.6	5.9
MICRO DD	5.8	5.9	6.1	5.0	5.2	5.3	5.9	6.5	3.5	6.4	5.8	6.9	7.1	5.9	5.3	5.5	3.7	5.3	6.2	5.9
STARLET (MB-24-92)	6.0	6.1	6.7	5.0	4.7	4.5	5.8	6.3	3.3	6.1	5.3	6.8	7.3	6.0	5.1	5.1	4.6	5.3	6.5	5.9
FA-19	5.8	6.8	5.8	5.0	4.8	5.5	6.0	6.6	3.6	5.3	5.2	6.8	7.0	6.1	5.5	5.0	3.7	5.1	6.5	5.9
TOMAHAWK	5.8	6.7	6.1	4.6	4.9	5.4	6.0	6.3	3.7	5.7	5.9	6.7	7.5	6.2	5.6	5.1	4.8	5.8	6.5	5.9
GAZELLE (ZPS-VL)	5.9	6.3	6.0	6.0	4.8	5.1	5.3	6.6	3.5	6.0	6.0	6.7	7.3	5.8	5.6	5.3	4.2	5.8	6.4	5.8
SR 8210	6.0	6.3	6.5	4.7	4.6	5.1	6.2	6.8	3.6	5.4	5.4	7.1	7.4	5.9	5.5	5.6	3.3	5.3	6.7	5.8
SHORTSTOP II (PICK 90-06)	5.8	5.8	6.7	5.0	5.0	5.9	6.1	6.7	3.4	5.9	4.9	7.0	7.3	5.6	5.3	4.9	3.2	4.9	6.2	5.8
SUN PRO (PICK 90-10)	6.0	6.4	5.9	4.6	4.9	5.6	5.3	6.4	3.5	5.8	5.5	6.5	7.7	5.9	5.4	5.4	3.3	5.2	6.4	5.8
PST-5VC	5.9	6.7	5.1	4.9	4.8	5.5	5.8	6.9	3.4	5.8	5.5	6.7	7.2	5.9	6.0	5.1	4.3	5.0	6.7	5.8
ADOBE (SFL)	6.1	6.4	6.3	4.3	5.1	5.6	5.4	6.5	3.3	5.6	5.2	6.8	7.1	5.9	5.4	5.4	3.8	5.4	6.0	5.8
LEPRECHAUN	5.6	6.2	6.8	5.7	5.0	5.7	6.0	6.8	3.6	5.3	5.7	6.4	7.3	5.8	5.1	5.2	3.3	4.8	6.0	5.8
ALAMO (J-1048)	6.1	6.9	6.0	4.5	4.2	5.5	6.4	6.1	3.3	5.7	5.3	6.4	7.0	5.6	5.7	5.3	3.8	5.3	6.4	5.8
SAFARI	5.9	5.5	6.0	5.3	4.9	5.9	6.3	6.1	3.7	5.2	5.9	6.7	6.9	5.8	5.6	5.4	3.7	6.1	6.2	5.8
PST-5LX	5.5	6.5	6.3	4.7	5.1	5.2	5.9	6.5	3.6	5.8	5.4	6.4	7.1	6.0	5.7	5.0	3.9	5.1	6.0	5.8
SR 8200	6.1	6.2	5.9	4.1	4.6	5.4	5.5	6.3	3.7	5.4	5.3	6.8	7.0	5.7	5.6	5.6	3.4	6.0	6.1	5.8
NINJA (ATF-006)	5.0	6.4	6.1	4.0	4.6	5.5	5.8	6.3	3.5	6.4	5.7	6.5	7.4	5.6	5.6	4.8	3.7	5.0	6.7	5.8
PALISADES (OFI-TF-601)	6.0	6.0	5.9	4.3	4.5	5.2	6.2	6.4	3.6	5.5	5.6	6.7	7.2	6.0	5.9	5.3	3.6	5.5	6.4	5.8
DUKE	6.0	5.8	6.3	4.3	4.7	5.8	5.8	6.3	3.4	5.2	5.2	6.6	7.2	5.4	5.9	5.1	4.2	5.8	6.5	5.8
SILVERADO	5.3	6.5	5.9	4.9	4.8	5.1	5.7	6.2	3.6	5.5	5.7	6.7	7.0	5.6	5.9	4.8	3.2	5.2	6.2	5.8
BONSAI PLUS	5.9	6.5	6.7	4.8	4.3	5.1	5.9	5.8	3.4	5.6	5.2	6.9	6.9	5.5	5.1	5.1	3.8	5.8	6.4	5.8
BAR FA 2AB	5.8	5.7	6.8	4.9	4.6	5.5	5.8	6.7	3.3	6.1	5.6	7.0	7.3	5.8	5.5	4.9	3.9	5.2	6.2	5.8
GUARDIAN	5.9	6.7	5.7	4.8	4.5	5.7	5.6	6.5	3.6	5.6	5.5	6.4	6.8	5.5	5.7	5.3	3.9	5.8	6.1	5.8
FA-22	5.6	5.9	6.1	5.0	4.1	5.0	5.9	6.6	3.5	5.6	4.9	7.2	6.8	5.8	5.5	5.0	4.1	5.3	6.2	5.8
VIRTUE	5.8	6.1	5.9	5.5	5.1	5.7	6.0	6.3	3.6	5.7	5.8	7.0	7.1	6.0	5.3	4.8	4.1	5.5	6.1	5.8
VEGAS	5.7	5.5	6.3	4.9	5.0	5.4	5.8	6.7	3.4	5.8	5.4	6.9	6.9	5.5	5.4	5.0	3.6	5.1	6.1	5.7

TABLE 1. (CONT'D)

MEAN TURFGRASS QUALITY RATINGS OF TALL FESCUE CULTIVARS
GROWN AT FORTY LOCATIONS IN THE U.S. AND CANADA
1995 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF

NAME	MS1	NE1	NE2	NE3	NJ1	NJ2	NV1	PA1	PA2	RI1	SD1	TX1	UB1	UB2	VA1	VA4	VA6	VA8	WA1	MEAN
MONTAUK	5.7	6.4	5.9	5.4	4.5	5.4	6.4	6.4	3.5	5.6	5.0	6.7	7.1	5.6	5.4	4.9	3.6	5.3	6.3	5.7
TITAN 2 (SR 8010)	6.1	6.3	6.4	4.6	4.0	5.0	5.8	6.1	3.9	5.0	6.0	6.8	6.8	5.6	5.7	5.5	4.1	5.5	6.0	5.7
SR 8300	5.8	6.8	6.0	5.0	4.0	5.2	6.2	6.4	3.5	5.2	5.6	7.0	6.7	5.8	5.6	5.2	3.8	5.5	6.2	5.7
COCHISE	5.8	6.6	5.9	4.9	5.0	5.3	5.9	6.1	3.6	5.1	4.8	7.0	7.0	5.6	5.2	5.2	4.2	4.5	6.0	5.7
BAR FA 0855	5.7	5.9	6.5	5.0	4.5	5.1	6.0	6.9	3.7	5.6	5.8	7.0	6.5	5.3	5.1	4.6	3.6	5.8	6.2	5.7
HERITAGE (PSTF-401)	6.1	5.7	5.8	4.7	4.3	5.4	6.5	5.9	3.6	5.4	5.5	6.8	6.7	5.5	5.1	5.3	3.8	5.4	6.1	5.7
TRAILBLAZER II	5.7	6.7	6.0	4.8	4.6	5.8	5.8	6.2	3.5	5.1	5.1	6.7	7.3	5.5	5.3	5.3	4.4	5.1	6.1	5.7
AVALON (ISI-ATK)	6.1	6.0	6.7	4.2	4.4	5.4	5.9	6.4	3.4	5.2	6.1	7.1	6.8	5.4	5.4	5.4	3.9	4.9	6.2	5.7
REBEL 3D	5.6	5.7	5.5	4.7	4.7	5.3	6.3	5.7	3.5	5.7	5.4	6.4	7.0	6.0	5.1	4.8	3.9	5.1	5.9	5.7
PRO-9178	5.9	5.5	6.2	4.3	4.6	5.0	6.1	6.1	3.5	5.1	5.0	6.9	7.0	5.8	5.2	5.2	3.9	4.8	6.6	5.7
M-2	6.1	5.7	5.3	4.4	4.6	5.3	5.6	6.3	3.6	5.7	5.7	6.6	6.7	5.4	5.2	5.4	4.2	5.2	6.3	5.7
403	5.8	5.4	5.3	4.9	5.0	5.6	5.7	5.9	3.5	5.4	5.3	6.7	7.1	5.6	5.3	5.1	4.0	5.0	6.0	5.7
ELDORADO	5.5	5.9	6.0	4.0	5.1	5.6	6.4	5.2	3.6	5.8	4.9	6.7	7.3	5.7	5.3	5.1	4.1	4.9	5.8	5.7
ISI-CRC	6.0	6.9	5.7	4.1	4.2	5.0	5.8	6.6	3.6	5.1	5.5	7.2	6.8	5.3	5.4	5.3	3.7	5.0	6.0	5.7
AVANTI	5.9	5.3	5.9	4.8	4.3	5.1	5.6	6.8	3.8	5.7	5.8	6.4	6.8	5.9	5.5	4.7	4.2	5.3	6.2	5.7
CHIEFTAIN II (PICK CII)	5.8	6.1	5.5	4.7	4.6	4.9	5.5	6.4	3.6	5.6	5.4	6.9	7.0	6.0	5.4	5.0	4.0	5.0	5.8	5.7
BONSAI	5.6	6.6	5.3	4.6	4.7	4.7	5.6	6.0	3.3	5.4	5.8	7.1	7.1	5.8	4.9	5.3	3.6	5.0	6.7	5.7
MIRAGE (KWS-DSL)	5.1	6.3	5.8	5.2	4.5	5.1	6.1	5.8	3.4	6.0	5.5	6.8	6.8	5.2	5.2	4.7	3.4	5.1	6.2	5.6
SHENANDOAH	5.8	6.5	5.5	5.0	4.4	4.7	6.1	5.9	3.6	5.2	5.7	6.8	6.7	5.5	5.3	5.1	4.0	5.6	6.2	5.6
WILDCAT (PSTF-200)	6.0	5.4	5.3	4.7	4.7	5.2	6.3	6.2	3.7	5.7	5.8	7.1	6.7	5.5	5.2	5.4	4.1	5.0	5.9	5.6
BONANZA II	5.8	4.7	5.7	4.6	3.8	5.0	6.4	6.0	3.3	5.6	4.8	7.0	7.0	5.8	5.5	5.4	3.9	5.4	5.9	5.6
GENERIC (CAFA 101)	5.8	5.7	5.7	4.1	4.2	5.0	5.8	6.7	3.7	4.9	5.5	6.7	6.7	5.3	5.5	5.0	4.2	5.3	5.9	5.6
PSTF-LF	6.1	6.0	5.4	5.0	3.8	4.8	6.3	5.2	3.7	5.4	5.4	6.7	6.7	4.7	5.2	5.4	3.6	5.9	6.0	5.6
BAR FA 214	5.7	6.7	5.7	4.5	4.1	5.1	5.8	5.7	3.6	4.9	5.2	7.0	6.7	5.3	5.6	4.9	3.6	4.9	5.9	5.6
KITTYHAWK	6.0	5.3	5.0	3.9	4.1	4.1	6.2	6.0	3.6	5.1	5.1	7.0	6.8	5.5	5.2	5.0	4.2	5.3	6.2	5.6
MONARCH	5.9	5.9	5.5	3.7	4.1	4.5	5.9	5.6	3.6	5.6	5.4	7.0	7.0	5.2	5.4	4.9	3.8	5.4	6.2	5.6
PST-5STB	5.3	6.4	6.1	4.9	4.8	4.7	6.0	6.2	3.5	5.6	5.4	6.9	6.7	5.6	4.7	5.0	3.7	5.1	6.1	5.6
AZTEC	5.5	5.3	5.6	4.0	4.5	5.2	5.8	6.4	3.5	5.4	5.3	6.6	7.2	5.9	5.2	5.0	3.7	5.2	6.0	5.6
FINELAWN 88	5.8	5.8	5.9	4.2	4.0	5.1	6.3	5.9	3.5	5.2	5.6	6.7	6.4	5.6	5.2	4.6	4.2	5.5	5.8	5.6
AUSTIN	5.8	5.3	5.3	3.8	4.5	5.0	6.0	6.0	3.5	5.2	5.9	6.8	6.5	5.2	5.4	4.7	4.2	5.6	5.4	5.6
CAS-LA20	6.0	5.7	5.7	4.5	4.3	4.9	5.5	6.6	3.2	5.5	5.1	6.4	6.5	5.7	5.2	5.0	4.1	5.5	6.3	5.6
CAS-MA21	5.9	5.5	5.6	4.4	3.6	4.7	5.9	6.3	3.3	5.3	5.4	6.8	6.7	5.3	5.4	4.7	4.1	5.5	6.1	5.6
PHOENIX	6.0	6.0	5.0	4.3	3.8	4.6	5.4	5.7	3.7	5.0	5.4	6.8	6.3	4.7	5.4	5.3	4.2	5.5	6.0	5.5
OLYMPIC II	5.9	6.2	5.9	4.9	3.8	4.7	5.7	6.0	3.8	5.1	5.4	6.9	6.3	4.8	5.2	4.8	4.3	5.6	6.2	5.5
ASTRO 2000	5.8	5.9	5.3	4.8	4.0	4.7	5.8	5.9	3.6	4.7	5.0	6.2	6.3	5.0	5.0	4.8	4.1	5.3	6.0	5.5
BONANZA	5.8	5.9	5.1	4.5	3.5	4.4	6.2	6.1	3.4	5.0	5.3	6.7	6.5	5.4	5.0	4.8	4.3	5.3	5.9	5.4
TWILIGHT	5.1	5.9	5.7	3.5	3.2	4.0	6.3	4.1	3.4	6.9	4.4	6.7	5.8	5.0	4.1	4.4	3.6	5.3	5.4	5.2
ARID	5.6	6.1	5.6	4.4	3.3	3.9	5.4	5.3	3.5	5.0	5.6	6.8	6.0	4.8	5.0	4.6	3.8	5.3	6.0	5.2
FALCON	5.7	5.7	5.5	4.0	3.1	3.5	6.1	5.1	3.7	4.6	5.4	6.4	5.9	4.8	4.7	4.2	3.6	5.3	5.6	5.1
ANTHEM	5.3	5.9	5.1	4.8	3.1	3.2	5.4	5.1	3.8	4.1	4.6	6.5	5.7	4.2	4.8	4.6	3.7	4.8	5.4	4.9
KY-31 W/ENDO.	4.9	4.5	5.6	4.4	2.2	2.0	5.3	3.7	3.6	2.9	4.7	6.0	4.8	3.9	4.0	4.0	4.1	4.4	4.3	4.3
KY-31 NO ENDO.	4.6	4.8	5.3	4.0	2.2	2.1	5.3	3.7	3.5	2.7	4.8	5.9	4.6	3.6	4.0	3.4	3.9	4.5	4.8	4.3
LSD VALUE	0.4	1.7	1.3	1.2	0.6	0.7	0.7	0.8	0.3	0.6	0.7	0.5	0.5	0.7	0.5	0.5	1.0	1.0	0.6	0.1

1/ TO DETERMINE STATISTICAL DIFFERENCES AMONG ENTRIES, SUBTRACT ONE ENTRY'S MEAN FROM ANOTHER ENTRY'S MEAN. STATISTICAL DIFFERENCES OCCUR WHEN THIS VALUE IS LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

TABLE 2. MEAN TURFGRASS QUALITY RATINGS OF TALL FESCUE CULTIVARS FOR EACH MONTH GROWN AT FORTY LOCATIONS IN THE U.S. AND CANADA
1995 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF: MONTHS 1/

NAME	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
JAGUAR 3 (ZPS-J3)	5.3	5.4	6.1	6.1	6.3	6.3	6.1	5.8	5.9	6.5	6.3	6.0	6.1
HOUNDOG V (ISI-AFE)	5.4	5.4	5.8	6.0	6.2	6.3	6.1	5.8	6.0	6.6	6.5	5.9	6.1
FALCON II (MB-21-92)	5.2	5.1	6.0	6.0	6.4	6.4	6.0	5.7	6.0	6.5	6.2	5.8	6.1
ISI-AFA	5.2	5.4	5.9	6.0	6.4	6.4	6.0	5.6	5.9	6.6	6.3	6.2	6.1
PST-5DX W/ENDOPHYTE	5.1	5.3	5.7	6.0	6.2	6.4	5.9	5.7	5.9	6.6	6.2	6.3	6.0
CROSSFIRE II (PICK 90-12)	5.1	5.5	6.3	6.0	6.2	6.3	6.1	5.7	5.9	6.5	6.2	5.7	6.0
CORONADO (PST-RDG)	5.1	5.5	5.9	6.0	6.3	6.3	6.0	5.6	5.9	6.6	6.3	6.2	6.0
SOUTHERN CHOICE (MB-25-92)	5.1	5.5	6.0	6.0	6.2	6.3	5.9	5.7	5.8	6.5	6.4	6.0	6.0
ATF-007	4.9	5.3	5.5	5.9	6.3	6.4	6.0	5.6	5.9	6.6	6.4	6.0	6.0
COYOTE (ZPS-ML)	5.2	5.3	5.7	6.0	6.3	6.4	6.0	5.7	5.7	6.4	6.3	6.1	6.0
FINELAWN PETITE	5.2	5.3	5.6	6.1	6.3	6.3	5.9	5.5	5.8	6.5	6.2	6.0	6.0
PST-5PM	5.1	5.6	5.7	5.9	6.2	6.2	5.9	5.5	5.9	6.5	6.3	6.0	6.0
GENESIS (GEN-91)	5.0	5.2	5.8	6.0	6.3	6.3	5.9	5.4	5.8	6.4	6.5	5.8	6.0
REBEL,JR.	5.2	5.4	5.6	6.0	6.2	6.3	5.9	5.6	5.8	6.4	6.2	5.8	6.0
LEXUS	4.9	5.4	5.6	5.9	6.4	6.4	5.9	5.5	5.8	6.4	6.2	5.7	6.0
LANCER	5.0	5.4	6.0	6.0	6.2	6.2	5.9	5.5	5.8	6.4	6.2	6.0	6.0
PIXIE	5.1	5.5	5.6	5.9	6.2	6.3	5.9	5.5	5.8	6.5	6.2	6.1	5.9
GRANDE (SR 8400)	5.0	5.5	5.8	5.8	6.0	6.2	6.0	5.6	5.9	6.5	6.1	5.9	5.9
EMPRESS (ZPS-E2)	5.0	5.5	6.1	6.0	6.1	6.1	5.8	5.5	5.9	6.4	6.0	5.8	5.9
APACHE II (PST-59D)	5.0	5.4	5.7	5.9	6.1	6.2	5.9	5.6	5.7	6.4	6.2	5.7	5.9
DUSTER (ITR-90-2)	4.8	5.3	5.5	5.9	6.2	6.3	5.9	5.5	5.7	6.3	6.0	5.6	5.9
RENEGADE (MB-22-92)	5.1	5.4	5.5	5.8	6.1	6.2	5.9	5.5	5.7	6.3	6.2	5.9	5.9
MARKSMAN (MB-23-92)	4.9	5.4	5.8	5.8	6.2	6.1	5.9	5.5	5.7	6.3	6.1	5.7	5.9
PYRAMID (SIU-1)	5.2	5.3	5.8	5.8	6.0	6.1	5.9	5.5	5.7	6.4	6.2	5.7	5.9
DEBUTANTE (WXI-208-2)	5.0	5.4	5.4	5.8	6.2	6.2	5.8	5.5	5.7	6.3	5.9	5.8	5.9
MICRO DD	5.1	5.4	5.4	5.9	6.2	6.1	5.8	5.4	5.8	6.4	6.2	6.0	5.9
STARLET (MB-24-92)	4.9	5.4	5.5	5.8	6.1	6.2	5.8	5.4	5.6	6.3	6.2	5.7	5.9
FA-19	4.9	5.3	5.8	5.7	6.1	6.1	5.8	5.5	5.7	6.4	6.0	5.9	5.9
GAZELLE (ZPS-VL)	4.8	5.3	5.4	5.9	6.2	6.2	5.8	5.4	5.6	6.3	5.9	5.6	5.8
TOMAHAWK	5.0	5.4	5.9	5.9	6.3	6.2	5.8	5.4	5.6	6.1	6.1	5.9	5.8
SR 8210	5.0	5.3	5.4	5.7	6.0	6.1	5.8	5.5	5.7	6.4	6.1	5.9	5.8
SUN PRO (PICK 90-10)	4.9	5.4	5.5	5.8	6.1	6.2	5.9	5.4	5.7	6.3	6.0	5.7	5.8
PST-5VC	4.8	5.4	5.6	5.9	6.2	6.1	5.7	5.4	5.6	6.4	6.1	5.9	5.8
SHORTSTOP II (PICK 90-06)	4.9	5.3	5.9	5.9	6.1	6.2	5.9	5.4	5.6	6.3	6.0	5.7	5.8
ADOBE (SFL)	4.9	5.5	5.6	5.8	6.0	6.1	5.8	5.3	5.7	6.4	6.1	5.9	5.8
LEPRECHAUN	4.7	5.3	5.9	5.8	6.1	6.1	6.0	5.3	5.6	6.1	5.9	5.6	5.8
SAFARI	5.4	5.4	5.8	5.7	5.8	6.0	5.9	5.5	5.7	6.3	6.0	6.0	5.8
ALAMO (J-1048)	5.0	5.5	5.5	5.8	6.0	6.1	5.8	5.5	5.6	6.3	5.9	5.8	5.8
PST-5LX	4.8	5.2	5.3	5.8	6.2	6.2	5.8	5.3	5.5	6.2	5.9	5.6	5.8
SR 8200	5.2	5.4	5.6	5.7	5.9	6.0	5.7	5.4	5.8	6.4	6.2	6.1	5.8
NINJA (ATF-006)	4.9	5.3	5.6	5.7	6.2	6.1	5.8	5.3	5.4	6.3	6.1	5.7	5.8
PALISADES (OFI-TF-601)	5.0	5.3	5.5	5.7	5.9	6.0	5.7	5.5	5.6	6.3	6.1	5.9	5.8
DUKE	5.1	5.3	5.4	5.7	6.0	6.0	5.8	5.5	5.6	6.2	6.0	5.9	5.8
SILVERADO	4.8	5.4	5.9	5.7	6.0	6.2	5.8	5.3	5.5	6.2	5.9	5.6	5.8
GUARDIAN	4.9	5.5	5.8	5.8	5.9	6.0	5.7	5.3	5.5	6.3	5.9	5.8	5.8
FA-22	4.7	5.2	5.6	5.8	5.9	6.1	5.8	5.4	5.6	6.3	5.9	5.6	5.8
VIRTUE	5.1	5.3	5.6	5.8	6.0	6.1	5.7	5.3	5.5	6.1	5.9	5.4	5.8
BAR FA 2AB	5.0	5.3	5.4	5.8	5.9	6.1	5.8	5.2	5.6	6.3	6.1	5.8	5.7
BONSAI PLUS	5.1	5.5	5.6	5.9	6.1	6.0	5.7	5.3	5.5	6.0	6.0	5.7	5.7
VEGAS	4.8	5.1	5.9	5.9	6.0	6.1	5.8	5.3	5.5	6.1	5.7	5.5	5.7

TABLE 2. (CONT'D) MEAN TURFGRASS QUALITY RATINGS OF TALL FESCUE CULTIVARS FOR EACH MONTH GROWN AT FORTY LOCATIONS IN THE U.S. AND CANADA
1995 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF: MONTHS

NAME	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
MONTAUK	5.0	5.3	5.5	5.8	5.9	6.0	5.8	5.4	5.5	6.1	5.9	5.7	5.7
TITAN 2 (SR 8010)	4.8	5.3	5.6	5.6	5.8	5.9	5.6	5.6	5.7	6.3	5.9	5.9	5.7
SR 8300	4.9	5.4	5.5	5.7	6.0	6.0	5.6	5.4	5.5	6.2	5.9	5.7	5.7
COCHISE	4.9	5.4	6.0	5.9	6.1	6.0	5.7	5.2	5.4	6.0	5.9	5.7	5.7
BAR FA 0855	5.1	5.4	5.5	5.6	5.9	6.0	5.7	5.4	5.5	6.2	5.8	5.6	5.7
HERITAGE (PSTF-401)	5.1	5.4	5.5	5.5	5.7	5.9	5.8	5.5	5.7	6.2	6.0	5.9	5.7
TRAILBLAZER II	4.9	5.3	5.7	5.7	5.9	6.0	5.7	5.4	5.4	6.1	5.9	5.7	5.7
AVALON (ISI-ATK)	4.9	5.2	5.5	5.6	5.7	5.9	5.7	5.4	5.7	6.2	6.0	5.8	5.7
REBEL 3D	5.0	5.4	5.5	5.6	6.0	6.1	5.8	5.3	5.4	6.0	5.9	5.8	5.7
PRO-9178	4.9	5.3	5.7	5.7	6.0	6.0	5.6	5.2	5.5	6.2	6.0	5.8	5.7
M-2	5.0	5.3	5.5	5.7	5.9	5.9	5.7	5.3	5.5	6.2	6.0	5.8	5.7
403	4.8	5.4	5.8	5.8	5.9	5.9	5.8	5.3	5.5	6.1	5.8	5.7	5.7
ELDORADO	4.9	5.4	5.7	5.8	5.9	5.9	5.6	5.3	5.5	6.0	6.0	5.8	5.7
ISI-CRC	5.1	5.3	5.6	5.6	5.6	5.9	5.7	5.4	5.6	6.2	5.8	5.8	5.7
AVANTI	4.8	5.3	5.4	5.6	5.7	5.9	5.7	5.3	5.5	6.2	6.1	5.6	5.7
CHIEFTAIN II (PICK CII)	4.8	5.3	5.5	5.7	5.9	6.0	5.7	5.2	5.4	6.0	5.8	5.4	5.7
MIRAGE (KWS-DSL)	4.8	5.2	5.7	5.7	5.9	6.0	5.7	5.2	5.2	6.1	5.9	5.5	5.6
BONSAI	4.7	5.0	5.0	5.8	6.0	6.1	5.7	5.2	5.5	6.1	5.8	5.5	5.6
SHENANDOAH	5.2	5.3	5.7	5.7	5.8	5.9	5.6	5.3	5.5	6.0	5.9	5.8	5.6
WILDCAT (PSTF-200)	5.0	5.3	5.8	5.7	5.6	5.8	5.6	5.4	5.6	6.1	5.9	5.9	5.6
BONANZA II	4.9	5.5	5.8	5.8	5.8	5.9	5.5	5.3	5.5	6.2	5.9	5.8	5.6
GENERIC (CAFA 101)	5.0	5.4	5.5	5.6	5.7	5.9	5.6	5.4	5.4	6.0	5.9	5.7	5.6
BAR FA 214	4.8	5.3	5.6	5.6	5.9	5.8	5.5	5.1	5.4	6.2	5.7	5.6	5.6
KITTYHAWK	4.9	5.4	5.5	5.7	5.8	5.8	5.6	5.3	5.3	6.1	5.9	5.7	5.6
PSTF-LF	5.2	5.4	5.5	5.6	5.5	5.9	5.6	5.4	5.5	6.1	5.8	5.8	5.6
MONARCH	4.8	5.3	5.5	5.6	5.7	5.9	5.7	5.3	5.2	6.0	5.8	5.7	5.6
AZTEC	4.9	5.3	5.2	5.5	5.7	5.7	5.6	5.3	5.3	6.3	6.0	5.7	5.6
FINELAWN 88	4.9	5.5	5.5	5.7	5.7	5.8	5.6	5.2	5.4	5.9	5.9	5.7	5.6
PST-5STB	5.0	5.3	5.7	5.7	5.9	5.9	5.4	5.2	5.2	5.9	5.8	5.5	5.6
AUSTIN	4.9	5.5	5.4	5.6	5.8	5.8	5.5	5.2	5.4	6.0	5.8	5.6	5.6
CAS-LA20	5.0	5.2	5.4	5.7	5.7	5.9	5.5	5.2	5.4	6.0	5.8	5.7	5.6
CAS-MA21	4.9	5.1	5.5	5.6	5.8	5.8	5.5	5.2	5.4	6.0	5.7	5.6	5.6
PHOENIX	5.0	5.2	5.5	5.4	5.5	5.7	5.5	5.3	5.5	6.0	5.7	5.7	5.5
OLYMPIC II	5.2	5.1	5.4	5.5	5.5	5.7	5.5	5.3	5.4	5.8	5.8	5.7	5.5
ASTRO 2000	5.1	5.3	5.4	5.5	5.4	5.6	5.5	5.2	5.4	5.9	5.8	5.7	5.5
BONANZA	4.9	5.3	5.4	5.5	5.5	5.7	5.5	5.1	5.3	5.9	5.7	5.6	5.4
TWILIGHT	4.6	5.1	5.0	5.2	5.4	5.5	5.2	4.9	5.1	5.5	5.7	5.3	5.2
ARID	4.9	5.1	5.3	5.0	5.0	5.4	5.2	5.0	5.2	5.7	5.2	5.4	5.2
FALCON	5.0	5.1	5.3	5.0	5.0	5.3	5.1	4.8	5.0	5.4	5.3	5.3	5.1
ANTHEM	4.9	5.1	5.1	4.8	4.8	5.0	4.8	4.7	5.0	5.3	5.0	5.3	4.9
KY-31 W/ENDO.	4.2	4.4	4.3	4.2	4.1	4.3	4.4	4.3	4.4	4.5	4.3	4.5	4.3
KY-31 NO ENDO.	4.4	4.5	4.4	4.3	4.2	4.4	4.4	4.1	4.2	4.4	4.2	4.4	4.3
LSD VALUE	0.8	0.9	0.8	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.5	0.7	0.3

1/ TO DETERMINE STATISTICAL DIFFERENCES AMONG ENTRIES, SUBTRACT ONE ENTRY'S MEAN FROM ANOTHER ENTRY'S MEAN. STATISTICAL DIFFERENCES OCCUR WHEN THIS VALUE IS LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

LANDSCAPE MANAGEMENT RESEARCH CONFERENCE AND FIELD DAY

WEDNESDAY, SEPTEMBER 18, 1996

LANDSCAPE MANAGEMENT RESEARCH CONFERENCE AND FIELD DAY
WEDNESDAY, SEPTEMBER 18, 1996

TABLE OF CONTENTS AND CONFERENCE SCHEDULE

THE FOLLOWING COMPANIES, AGENCIES, AND ORGANIZATIONS HAVE GENEROUSLY PROVIDED DIRECT OR INDIRECT SUPPORT TO ONE OR MORE OF THE UC LANDSCAPE MANAGEMENT PROJECTS AND PROGRAMS FEATURED IN THIS YEAR'S RESEARCH CONFERENCE AND FIELD DAY. THEIR SUPPORT IS VERY MUCH APPRECIATED.

METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA
Los Angeles, CA

CALSENSE
Carlsbad, CA

UNITED STATES FOREST SERVICE, PACIFIC SW BRANCH
Davis, CA

THE TORO COMPANY - IRRIGATION DIVISION
Riverside, CA

GRIFFIN CORPORATION
Valdosta, GA

LANDSCAPE GROWERS, INC.
Monterey Park, CA

BOETHING TREELAND FARMS, INC.
Woodland Hills, CA

SEATREE NURSERIES, INC.
Irvine, CA

QUAIL BOTANICAL GARDENS
Encinitas, CA

COUNCIL FOR A GREEN ENVIRONMENT
Sacramento, CA

DEEPROOT PARTNERS, L. P.
Burlingame, CA

USE OF GROWTH REGULATORS IN THE LANDSCAPE

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Plant growth can be regulated in various ways. Selecting genetic dwarfs is one way of controlling plant growth and is commonly practiced when landscape architects or consumers choose dwarf annual, perennial, or woody plants. Pruning is another common technique to control growth of woody plants. Water and mineral nutrients are important growth regulators and stimulate shoot growth when provided in ample amounts, or retard shoot elongation when provided in limited quantities. For the purpose of stimulating plant growth in the landscape, proper amounts of fertilizer and water can be easily applied.

Most chemical plant growth regulators (PGR's) are sought for their growth controlling properties, such as retarding shoot elongation, eliminating trunk sprouts, controlling root growth, chemical edging, and preventing flowering and fruit set. PGR's can retard growth by retarding internode elongation, primarily through inhibiting gibberellin production. Growth retarding substances have no effect on terminal buds and include compounds such as uniconazole (Sumagic), paclobutrazol (Bonzi), daminozide (B-Nine) and flurprimidol (Cutless). The application of growth inhibiting substances such as maleic hydrazide (Royal Slo-Gro), dikegulac (Atrimmec), melfluidide (Embark), and naphthalene acetic acid (Tree-Hold) inhibit cell division in terminal buds. These compounds generally increase lateral branching because of the reduction in apical dominance, but frequently result in temporary chlorosis or leaf distortion.

Some benefits of using PGR's in the landscape are the reduction of green waste clippings, saving labor costs by increasing time intervals between pruning or mowing, eliminating nuisance fruit which cannot be controlled otherwise, darker green foliage color, increased resistance to transplant shock and other plant stresses, and lower water use.

Efficacy of PGR's depends to a large extent on the plant species or cultivar treated, method and frequency of application, and timing of application in relation to the growth cycle. The weather during and after application will also influence treatment success. It is also important to understand how the PGR is absorbed and translocated within the plant. Some PGR's need to contact the entire foliage or all flowers of a plant to be effective, while others are effective when applied to the trunk, because they are translocated through the xylem (water conducting) system throughout the plant. PGR's should not be applied to diseased or otherwise stressed plants, as this could result in damage. For best results, users should follow individual PGR label directions as closely as possible.

LANDSCAPE WEED CONTROL UPDATE AND ALTERNATIVES TO HERBICIDES

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Management of landscape weeds is a continual problem due to the variety of species used in landscape plantings and the planting of both annuals and perennials. Landscape weed control can be accomplished using chemical and non-chemical techniques and through innovative application techniques. New herbicides or new formulations of older herbicides have been introduced in California for weed control in landscapes. Where these herbicides will fit in a weed control program will be discussed as well as techniques that the landscaper can use to reduce weeds and consequently, the amount of herbicides will be covered.

A general plan for weed control in the landscape and new chemicals available:

Management

a) Groundcovers - good choice of groundcover which is competitive with weeds by having a closed canopy will reduce the number of annual weeds by shading the germinating seedlings.
b) Sprinklers - placement, type.

Non-chemical controls

a) Mulch - organic (bark, straw, etc.) or inorganic (lava rock, marble chips, etc.), 2-4 inches is best as a deeper mulch may cause root damage due to overwet soil.
b) Landscape cloth (geotextiles) - does a good job in controlling broadleaves, some grasses but this is a long-term method of weed control and does not lend itself to plantings of annuals in the landscape, often used in conjunction with mulches, non-woven and woven materials are available.
c) Flaming - not often used in Southern California.
d) Hand-weeding - expensive and time consuming but is often the only choice where landscape plants may be injured by herbicides.

Chemical controls

a) Manage - nutsedge control, not yet registered in California.
b) Gallery (isoxaben) - recent registration, preemergence especially good for broadleaf weed control, good plant safety in most cases, good tank mix with Surflan (oryzalin).
c) Scythe (pelargonic acid) - new post-emergent non-selective herbicide, not translocated but very fast acting.
d) Roundup Pro (glyphosate) - new formulation of an old favorite with improved rainfastness.

Application technology

a) Wipe on - used for translocated herbicides, eliminates drift.
b) Wet blade - blade cuts weed and herbicide is immediately applied to cut tip.

UPDATE ON OLEANDER LEAF SCORCH - A NEW PROBLEM

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A decline of oleanders was first noticed in the Palm Springs-Indio area of Riverside County in 1993. The incidence of the disorder has increased dramatically east of Palm Springs such that some landscape managers have abandoned any plans to replant oleander. Cal Trans also observed die-back of oleander along highways in the Coachella Valley near Indio. The same oleander problem was also discovered in Irvine in 1995. Oleanders die within about two years from the first appearance of symptoms.

A new strain of the bacteria, *Xylella fastidiosa,* is the most likely candidate to cause the disorder, and we have started experiments to prove this and to test whether it causes disease in oleander. Until this proof, known as Koch's postulates, is completed we cannot be sure that the disease is caused by this organism. UC Berkeley scientists inoculated plants in November 1995, but leaf scorch symptoms had not appeared by June 1996. However, the *Xylella* bacteria have been recovered from these test plants. Additional testing is under way at UC Riverside to determine the causal agent of this disease, but until symptoms appear and the organism is recovered from the test plants, a positive relationship between the bacteria and the disease cannot be established.

In California, *X. fastidiosa* causes Pierce's disease of grapevines, alfalfa dwarf, and almond leaf scorch. In the eastern U.S., various strains of *X. fastidiosa* cause phony peach disease and leaf scorch diseases of sycamore, elm, maple, oaks, mulberry and other trees. These diseases are most severe in states along the Gulf of Mexico and the Atlantic coast as far north as coastal Virginia. Another strain is causing a new disease, citrus variegated chlorosis in Brazil. The disease had spread from a few trees in 1987 to over 30% of the trees in the major citrus regions by 1995.

X. fastidiosa can infect many species of plants without causing disease symptoms. Such plants are reservoirs of the bacteria. In most of these symptomless hosts, the bacteria occurs only in localized areas of the plant's xylem system.

X. fastidiosa is vectored by sucking insects that feed on xylem sap. They can acquire the bacterium by feeding on infected symptomless plants or on diseased plants. In California, certain leafhoppers called sharpshooters are the most important vectors, but spittlebugs are also vectors. In 1990, a leafhopper not seen before in California, but common in the southeastern U.S., was discovered in Orange County. Since then it has been found to be abundant in citrus from Ventura County to western Riverside County. It occurs most commonly on citrus, crape myrtle, peach and several other species of woody ornamentals. The leafhopper was identified by the California Department of Food and Agriculture as *Homalodisca coagulata*, the glassy-winged sharpshooter. This species is considered to be the prime vector of *X. fastidiosa* to peach and grape in George, Florida, and other southern states.

The newly introduced glassy-winged sharpshooter leafhopper seems to be closely associated with the rapid spread of the new oleander leaf scorch disease in Orange County, because it is present in large numbers on oleander and has been shown to be carrying *X. fastidiosa*. Since this insect is such an efficient vector of *X. fastidiosa* to peach and grape in Florida and Georgia, it may become more important in California on these crops as well as oleander.

The glassy-winged sharpshooter appears to readily feed on and occasionally lay eggs on oleander. This trait could allow its dissemination into Northern California along highway plantings of oleander. In addition, many species of plants in commercial nurseries in Southern California could harbor eggs of the glassy-winged sharpshooter that hatch after being shipped to areas where this insect does not yet occur.

Other common species of sharpshooters that could vector *X. fastidiosa* to oleanders include a California species of *Homalodisca*, the smoke tree sharpshooter (*Homalodisca lacerta*), which is a native of the Mojave Desert region in eastern Riverside and San Bernardino Counties, and the blue-green sharpshooter (*Graphocephala atropunctata*) common throughout coastal California. This species is considered the most important vector for Pierce's disease of grapevines in coastal grape-growing areas from San Diego through Mendocino Counties.

Currently, a team of 14 researchers at UC Riverside and UC Berkeley have begun to study the vectors, the bacterial pathogen and the reactions of a variety of crop and ornamental plants to the new strain of *X. fastidiosa*. Two grant proposals have been submitted, and funding, if received, will be available in September 1996. This new pathogen is difficult to work with because it is very slow to show symptoms in woody plants and is more difficult to culture than most plant pathogenic bacteria.

A symposium on the new oleander strain was held in March 1996 at UC Riverside. University, state and county agencies (CDFA, Ag. Commissioner and Cal Trans), and industry representatives learned about current knowledge of the oleander problem and discussed research needs. Since that time, preliminary findings by CDFA plant pathologists have revealed that a nursery grower in Tustin, CA had oleander nursery stock infected with *X. fastidiosa*. More recently, a nursery in northern Los Angeles County also was found to have infected oleanders.

It is hoped that many of the questions about this new strain of *X. fastidiosa* can be answered in the coming year, but it doesn't appear that a "quick fix" is likely.

Questions of Economic and Policy Importance

1. Costs of losses of oleanders? (removal, replacement)
   a) In Southern California
   b) If new strain also becomes serious in Northern California highways, parks, golf courses, home landscapes, etc.

2. Nursery industry consequences?
   a) Loss of oleander as a crop or a need for more to replace losses?
   b) Quarantine restrictions on shipments (to prevent introduction of new sharpshooter or disease to other parts of California)?
   c) Certification standards for nursery crops?

3. Consequences for other crops?
   a) Grape industry -- increased threat of Pierce's Disease? Higher rates of spread? Appearance in areas where now absent or rare?
   b) Peach and stone fruits (prune, cherry, apricot, etc.)
   c) Citrus?
   d) Other trees? (elm, sycamore, mulberry, maple, oaks, or other native species)
   e) Quarantine restrictions by other countries on shipments of fresh fruit/produce?

DO GREEN PLANTS CONTRIBUTE TO AIR POLLUTION?

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Green plants in the landscape are beneficial for several reasons, including aesthetics, mitigating noise, reducing wind velocity, and providing surfaces for deposition of airborne particles. Plants release water vapor, which provides a cooling effect in the urban landscape. Plants also release oxygen (O_2) and consume carbon dioxide.

However, plants also emit a variety of volatile organic compounds (VOCs) which enter into atmospheric reactions. The haze of the Smoky Mountains is one manifestation of plant emissions. It is now known that VOCs are emitted from many plant species, including agricultural crops, urban landscapes and natural plant communities in unirrigated areas. Isoprene, a five-carbon compound, is generally the principal emission from broadleaved plants, such as oaks and eucalyptus. Pines and other conifers have as their largest emission monoterpenes, a family of ten-carbon compounds. Isoprene emission rates tend to be higher than those for monoterpenes, and isoprene is the dominant biogenic emission in California airsheds.

In the South Coast Air Basin (SoCAB), which encompasses the greater Los Angeles area, VOCs and oxides of nitrogen (NO_x) react in the presence of sunlight to form ozone (O_3). Ozone negatively affects human health and crop yields. Vegetative emissions are approximately three times more reactive than the VOC emissions from automobiles, and thus have higher ozone-forming potential. The ozone of the troposphere is a criteria pollutant, and is formed at low altitudes by reactions different than those which form stratospheric ozone.

An accurate estimate of the magnitude of biogenic contributions is critical in formulating strategies to reduce peak ozone concentrations, because the timing, location and magnitude of ozone peaks are dependent upon the relative strengths of NO_x and VOC emissions. In the SoCAB, vegetation contributes approximately 160 metric tons per day of volatile organic compounds, approximately 10% of the total VOC emissions. In a more rural environment, such as the San Joaquin Valley, biogenic emissions may constitute a much larger fraction of the total. The contribution of plant emissions to the atmosphere is substantial in other parts of the United States, especially the Southeast.

Of significance to the landscape industry are differences in biogenic emissions among plant species, especially trees. Among tree species, isoprene emission rates differ by a factor of 10,000. If emission rates are the same, plants with large biomass are greater contributors of biogenic emissions to the atmosphere than are plants with smaller canopy volumes. Contributions of individual plants are small. However, when large-scale tree planting programs are envisioned, the emission rates of the intended species should be considered.

PLANT STRESS PROTEINS AS INDICATORS FOR SCREENING DROUGHT AND COLD TOLERANCES

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The long-range goals of research in my laboratory are to promote the development of environmental stress tolerance in plants and to facilitate safe, resource-efficient agricultural and landscape practices. The strategy is to identify biochemical characteristics of stress adaptation and then use these characteristics: 1) to develop indices that can be used as guidelines for practices such as irrigation water management, and 2) to establish simple genetic markers for the development of plants with enhanced stress tolerance. Currently, this effort revolves around one family of proteins known as dehydrins (1). Dehydrins are produced in plants in response to low non-freezing temperatures or any environmental influence with a dehydrative component, including seed development, drought stress, freezing temperatures, and osmotic stress. A survey of the distribution of dehydrins has revealed that organisms as distant from plants as cyanobacteria can produce related proteins during osmotic stress or dehydration. Dehydrins have been purified from plants and genetically engineered *Escherichia coli* strains, as well as from the cyanobacterium *Anabaena*, for *in vitro* biochemical studies. Immunocytochemical studies have shown that maize dehydrins are present in the nucleus and cytoplasm. The recent discovery that a barley dehydrin locus co-segregates with a freezing tolerance determinant is now under further investigation to test the possibility that dehydrin genes control freezing tolerance in barley and related cereal crop plants. These basic research components of my laboratory have been supported by grants from various sources including USDA/CSREES Plant Response to the Environment Program (95-37100-1595), NSF Integrative Plant Biology Program (IBN-9205269), Pioneer Hi-Bred, and the Southwest Consortium on Plant Genetics and Water Resources (88-34186-3340). We can now attempt to utilize the materials and methods developed during these fundamental studies for practical purposes, including landscape management.

Seasonal patterns of protein accumulation have been described in a number of woody plants, with dehydrins typically accumulating during periods of low temperature in each plant species (2). In Non-Pareil almond trees in McFarland, California a dehydrin protein of approximately 65 kDa accumulates during the Fall and persists through the Winter. Dehydrin proteins were also observed during the Winter of 1995/6 in *Liquidambar styraciflua* and *Magnolia grandiflora* trees at the University of California Agricultural Operations plots in Riverside, California. Drought-stress can also evoke the accumulation of dehydrins in woody plants and turfgrasses. For example, low water treatments evoked dehydrin accumulation in terminal buds of avocado and shoot apices of bermudagrass. The possibility that dehydrins can serve as time-integrated indicators of cold-acclimation or drought stress in trees and turfgrasses merits further investigation and is being pursued in part by the development of a rapid immunological assay of dehydrins that may be suitable for use by personnel with minimal technical training.

1. Close T.J, (1996) Dehydrins: emergence of a biochemical role of a family of plant dehydration proteins. Physiologia Plantarum (in press).

2. Wisniewski M., Close T.J., Artlip T., Arora R. (1996) Seasonal patterns of *dehydrins* and 70 kDa heat shock proteins in bark tissues of eight species of woody plants. Physiologia Plantarum 96: 496-505.

WATER RETENTION PROPERTIES OF LANDSCAPE MULCHES

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The use of mulches in landscape plantings is increasing. Mulches have been promoted by water conservation, green waste reduction, and other programs primarily to reduce evaporation from soil. In addition, many of the materials used for mulching provide an improved aesthetic appearance for the landscape. Many different materials are available from rock to composted manure, sludge, greenwaste products, wood chips from pruning operations and bark products from lumber mill operations.

Mulches can benefit landscapes by reducing soil evaporation, cooling the soil, suppressing weed growth, and possibly providing nutrients for plant growth. Unfortunately, there may be some negative effects of mulches. There are some issues regarding the use of mulch products that need further scientific study in order to resolve controversy and allow us to fully understand how these materials affect soils, plants, and landscape management. These issues, phrased as questions, include:

- What are the chemical properties of mulches, such as salinity, pH, and toxic ions, and their short- and long-term effect on soils and plant materials?
- Are there any allelopathic effects from utilizing some green waste mulches?
- Are viable weed seeds introduced into the landscape through mulch applications?
- Are plant pathogens introduced into the landscape through mulch applications?
- If mulch is applied near the root crown of landscape plants, are there plant disease implications?
- Do mulch applications provide shelter and nesting material resulting in increased vertebrate and insect populations?
- How do mulches change plant - soil - water relations? Do mulches absorb water? What are the effects of layering? How do mulches change the transpiration of plant materials?

Presentation of these issues is not intended to discourage overall use of mulches, but to aid in providing best management practices for the wise use of mulch materials. Fortunately, recent studies, some yet unpublished, have provided resolution to the above issues. For example: data are available on the salinity and pH for many materials used for mulch; studies have shown that Eucalyptus mulches do not cause decline of landscape plant materials; composting temperatures of 150°F result in reduction in the viability most weed seeds; and the presence of a mulch layer reduces germination of weed seeds. To answer the remaining questions, there is need for additional studies on the relationships between plant pathogens and mulches and between irrigation management practices and mulches.

In 1995, studies were undertaken at two locations in San Diego County to determine the moisture holding characteristics and evaporation rates of 12 different mulching treatments. The following four studies were designed to test the water retention, water loss, and insulation properties of mulches commonly used in the landscape. Results will help in improving efficiency of irrigation management practices and aid in determining irrigation frequency of landscaped areas which utilize mulch under sprinkler and drip irrigation systems.

I. Determine the water holding capacity of various mulch materials.

II. Determine physical properties of mulch materials for adequate descriptions of the materials. Determine bulk density.

III.
- A. Determine depth of water needed to penetrate the mulch treatments.
- B. Determine water loss from mulches in the field under different ET_0 values to determine a "Kc" and how the Kc changes as the mulch dries between irrigations.
- C. Determine the insulative properties of each treatment by measuring soil moisture in the top six inches over time.

IV. Determine benefits (water conservation and growth of plant materials) of mulch treatments under sprinkler and drip irrigation.

Mulches tested:

	Mulch	**Thickness**
1.	Yardwaste	1"
2.	Yardwaste	3"
3.	Yardwaste	5"
4.	Composted Yardwaste	3"
5.	Kellogg's Xerimulch	3"
6.	A-1 Soils "Organic Ground Cover"	3"
7.	Kellogg's Grow-mulch	3"
8.	Medium Bark	3"
9.	Landscape Fabric	-
10.	Landscape Fabric with A-1 Mulch	3"
11.	1" Rock	3"
12.	Control (No Mulch)	

Data are currently being collected and analyzed for the above experiments. Results of these studies will be available in late 1996.

EFFECTS OF SIZE, SHAPE AND COPPER COATINGS OF NURSERY CONTAINERS ON TREE ROOT DEVELOPMENT IN THE LANDSCAPE

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Trees planted in urban areas provide significant benefits in terms of energy conservation, beautification and creating a human scale for environments. Unfortunately there is a high mortality rate for trees transplanted into urban sites, and surviving trees often bring about a major long-term cost from the damage their roots inflict upon sidewalks and other paved areas. Poor tree establishment and shallow root growth after transplanting may be attributed to poor root development in the original container-grown nursery stock. Recent research findings suggest that trees produced in unconventionally shaped containers and treating inner containers surfaces with copper-based root-inhibiting compounds may result in better quality root systems and better establishment rates.

Objectives of the study were to:

a) Determine whether root and shoot development are influenced by container configuration (diameter x height) and volume.

b) Determine whether establishment in the landscape is influenced by the production container configuration.

c) Determine whether container configuration influences surface root development.

d) Determine whether coating the inside of production container with Spin Out® (a copper hydroxide-based product) will prevent root circling and improve establishment of trees in the landscape.

Two tree species that develop vigorous root systems, ficus (*Ficus retusa* L. *nitida*) and Brazilian pepper (*Schinus terebinthifolius* Raddi.) were selected for the study. For the container production phase of the study, liners were grown for 6 months in the greenhouse in one-gal. containers of different configuration (reg. or tall) and with or without copper coating. The Spin Out® coating prevented matting of roots on the side of the root ball in both species and root circling at the bottom of containers in ficus. Brazilian pepper trees growing in regular-shaped containers had a higher biomass production versus trees growing in tall containers.

Subsequently, trees were transplanted to 3 or 5 gal. containers with shape or coating as described above. For Brazilian pepper, the Spin Out® coating versus no coating reduced circling and matting of roots, trees in regular versus tall containers had increased above ground biomass, and trees in 5-gal. versus 3-gal. containers grew more medium and small-sized roots and produced more total biomass.

At the conclusion of the container-production phase, trees of each species and container treatment were transplanted into the field at UC Riverside. Approximately one year after transplanting, the trees were harvested. Trunks, stems, and shoots were run through a chipper and above-ground dry weights were determined, while root systems were excavated in zones that were 0-12 inches, 12-24 inches, or 24-36 inches from the trunk. Harvested roots were separated into size classes based on their diameter. Most of the differences in root mass were due to distance from the trunk, with the greatest difference occurring in the 0-12 inch zone. Generally, roots of ficus grown in 3- and 5-gal. nursery containers were similarly distributed across root size classes from very small (< 2 mm diam) through large (> 10 mm diam) in the 0-12 inch zone. In contrast, large roots in Brazilian pepper accounted for a much greater proportion of the total root mass in the same zones. The shape of the 3 - or 5-gal. nursery production containers had no effect on the distribution or size of roots that developed after trees were transplanted. For both species, there were interactions of root mass among the Spin Out® container treatment and container shape, size, and/or distance from the trunk.

TREE ROOT BARRIER STUDY

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Millions of dollars are spent annually to repair pavement and other hardscape items broken or lifted by tree roots. The installation of an impervious physical barrier adjacent to the root balls of newly planted trees is a practice that has become widely used in many urban areas during the past 10 to 15 years to prevent surface root growth near paved areas. Commercially-produced, cylindrical barriers are being specified by cities in development guidelines and by landscape architects in their planting specifications. They are constructed of rigid plastics and are designed to restrict the growth of roots from the initial root ball. It is further claimed that they deflect roots downward and that roots then continue to grow horizontally out the bottom of the barrier which is 18 to 24 inches deep. However, neither the efficacy nor the influence of physical barriers on root and shoot system development have been studied widely in replicated field experiments.

The objectives of this study are to:

a) Determine the influence of various types of physical root barriers on surface root development.

b) Determine the effect of root barriers on tree shoot growth.

c) Determine the growth of roots within and at the bottom of root barriers.

Methods and Procedures

The study began in June 1992 at UC Riverside. Two commonly used landscape tree species, *Liquidambar styraciflua* and *Ficus nitida*, were transplanted as 5-gallon sized plants into a field site of 20 ft x 20 ft spacing. The experimental design is a 10 x 10 Latin square of 5 root barrier treatments, 2 tree species and 10 replicates. Planting pits 4 ft long x 3 ft wide x 2.5 ft deep were dug for each tree.

The following root barrier treatments have been included:

1. 'DeepRoot' barrier (DeepRoot Partners, L. P.) 30 in. diameter x 24 in. deep.

2. Standard 15-gallon nursery container with the bottom removed (14 in. top diameter x 12.5 in. bottom diameter x 17 in. height).

3. Black polyethylene (12 mil) sleeve the same dimensions as a 15-gallon container.

Check: Standard transplanting of a 5-gallon tree so that the surface of the root ball is at the field soil level.

The DeepRoot and 15-gallon container barriers were set in the planting pit, partially filled with soil and watered to settle soil in and outside the barrier before transplanting. Trees were transplanted into these barriers and the polyethylene sleeve barriers so that the surface of their root ball was even with the surface of the backfill soil in the barriers. The top edge of all barriers were initially 1 to 3 inches above the grade in and out of the barriers. All trees were watered by hand after transplanting to thoroughly wet the root ball and the surrounding soil. Drip irrigation was used to irrigate the planting in year 1, while mini-sprinklers have been used since. Irrigation has been applied frequently to maintain soil moisture content in the available range to a depth of a 2 feet. Weeds are controlled by a combination of pre-emergent and post-emergent herbicides.

Excavation of root systems is scheduled to begin in the fall of 1996, at which time data on tree top growth and root system growth inside and outside of the barrier treatments will be collected.

SYMPTOMS AND DIAGNOSIS OF OLEANDER LEAF SCORCH DISEASE

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Oleander leaf scorch, a new disorder of oleander, is devastating plantings of oleander in some areas of Southern California. The bacterium that appears to be associated with this disorder, *Xylella fastidiosa*, is probably transmitted by the insect vector "sharpshooter", a type of leafhopper. Strains of *X. fastidiosa* have been associated with diseases that cause tremendous losses in many economically important plants, including grapevine, alfalfa, peach, plum, almond, elm, sycamore, oak, and maple.

Familiarity with identification and diagnosis of oleander leaf scorch is important for landscape professionals working with plantings of oleander in locations such as golf courses, homes, shopping centers, and freeways. For example, if removal of infected plantings followed by replacement with clean plant material is an option, a mistaken diagnosis could be quite costly. Identification of the disorder in the field is based on observation of characteristic symptoms. The major symptoms of diseases caused by *X. fastidiosa* include: leaf marginal necrosis, leaf abscission, dieback, delayed growth in the spring, and decline of vigor leading to death of the plant. On oleander, the first observable symptoms tend to be a yellow or orangeish-brown "scorching" of the leaf tip and margin. Over a period of months, leaves die and fall from the plant, and the plant dies gradually, section by section. Other factors, such as drought stress, may cause symptoms similar to those associated with oleander leaf scorch. Therefore, it is important to identify the cause of the problem before taking action.

Because symptoms can be misleading, other tests must be employed to verify the presence of the pathogen. The most basic indicator of *X. fastidiosa* infection is the detection of *X. fastidiosa* colonies on a specialized culture medium, using a technique only available since 1978, developed by researchers studying Pierce's disease of grapevine, a disease caused by *X. fastidiosa.* A less cumbersome test for the presence of *X. fastidiosa* is the commercially available ELISA (enzyme-linked immunosorbent assay) kit, which employs antibodies that "recognize" *X. fastidiosa* cells, signaling their presence with a color reaction. DNA fingerprinting methods are also available, and provide the greatest level of sensitivity (can detect very low levels of infection).

This demonstration stop will allow conference attendees to observe how various identification and detection techniques are used. Serological (ELISA), culture media, and DNA fingerprinting will be included. Participants can closely examine how these methods work and what kind of information they provide.

DEVELOPMENT OF DWARF LILAC CULTIVARS FOR SOUTHERN CALIFORNIA

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The project of developing dwarf lilac cultivars for Southern California is the outgrowth of selecting and developing a wide range of cultivars for this region. Most lilac cultivars require more winter chilling than occurs at all but the higher elevations. As a result, it is necessary to rely on selections having a low chilling requirement to expand the use of lilacs in the warmer areas.

The cultivar 'Excel,' brought to the Citrus Experiment Station about 1941 for experimental work with olives (same plant family), turned out to be a cultivar with a low-chill requirement. It flowers profusely and consistently, has a strong fragrance, and seems to thrive in this climate even though it was developed in Manitoba, Canada. The flowers of 'Excel' are of a light lilac color and therefore represents only one color in the seven recognized by the International Lilac Society: white, violet, bluish, lilac, pinkish, magenta, and purple.

'Pocahontas,' a purple-flowered cultivar, is another cultivar having a low-chill requirement. It is with cultivars such as 'Excel' and 'Pocahontas' that crosses may yield a range of plant sizes from dwarf to tall. Results are slow in coming because of the slow rate of growth of lilacs. Dr. Giles Waines, Director of the UCR Botanic Gardens has become interested in the development of dwarf lilacs and will be carrying this project forward.

At the recent Annual Conference of the International Lilac Society, it was reported that a dwarf lilac had been produced through irradiation and that through tissue culture propagation small plants will be available for distribution in 1997. Obviously such an advance will greatly accelerate progress in developing low-chill cultivars with a wide range of colors suitable for Southern California.

Literature for lilacs:

Fiala, Fr. John L. 1988. Lilacs, The Genus Syringa. Timber Press.

Lilacs. Quarterly Journal of the International Lilac Society. Published by the International Lilac Society. Owen M. Rogers, Editor, 131 Main Street, Durham, NH 03824.

DETERMINING LANDSCAPE WATER REQUIREMENTS

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The Mixed Landscape Study is a key element of the Metropolitan Water District-funded turf and landscape research projects at UC Riverside. Covering some 40,000 square feet, the research facility was constructed and planted in the summer and fall of 1995 and is among the first of its kind nationally. The facility includes plots with trees (Bradford pear), turf (Marathon III tall fescue), and groundcover (potentilla or spring cinquefoil) alone and in combinations (see plot map). Eight individually controlled irrigation systems allow application of two irrigation treatments (80% and 55% ET_0) replicated four times.

The general objective of the mixed landscape study is to determine what impact different landscape plant combinations have on plant water use and which environmental parameters are responsible for this.

Specific objectives of the study are to:

a) Determine if the water requirements of landscape, composed of a mixture of turfgrass, groundcover, and tree species with similar water requirements, is the same as a planting of equal area composed of a single species.

b) Evaluate the appropriateness of the "landscape coefficient method" of estimating water requirements of a landscape.

c) Characterize in quantitative terms the components and factors that determine the water requirements of a newly established landscape.

Baseline data collection (turfgrass clipping yields, stomatal conductance, tree and groundcover leaf water potential, canopy temperature, and various weather parameters) was begun in the spring of 1996. Irrigation treatments will be initiated sometime in the fall of 1996, depending on establishment of the plots.

MWD Mixed Landscape Study

Plot Assignments

N

II

Tree GC	Tree	GC Turf	Tree GC Turf
Vinca	GC	Turf	Tree Turf
Tree Turf	Tree GC Turf	GC Turf	Tree
GC	Turf	Tree GC	Vinca

IV

Tree GC Turf	GC	Tree Turf	Turf
Vinca	GC Turf	Tree	Tree GC
Tree GC	Vinca	Turf	Tree GC Turf
Tree	GC Turf	Tree Turf	GC

I

Tree	Vinca	Tree Turf	Tree GC Turf
GC Turf	Turf	Tree GC	GC
Turf	GC	Tree GC Turf	Vinca
Tree	GC Turf	Tree GC	Tree Turf

III

Tree GC	Tree Turf	GC Turf	GC
Turf	Tree GC Turf	Vinca	Tree
Turf	Tree Turf	Tree GC Turf	GC Turf
Tree GC	Vinca	Tree	GC

USE OF NEW HERBICIDE PRODUCTS

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Two new products, Gallery (isoxaben) and Scythe (pelargonic acid) available for use in the landscape will be demonstrated. Gallery has been available in most of the U.S. but only recently has been registered in California. Flats with weeds sprayed with Gallery, Gallery + Surflan (oryzalin), and untreated will be shown. Scythe will be sprayed on plants at intervals to demonstrate its activity and injury symptoms.

TREE SPECIES EVALUATION PROJECT

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Introduction

There is a limited palette of medium-sized trees used in the Southern California landscape. As urban development has expanded into inland areas, this palette has become even more limited due to harsher climatic conditions (i.e. greater extremes of temperature and lower humidity). However, there appears to be a number of tree species with the potential to perform adequately in inland areas, but they are underutilized or their actual performance is undocumented under these conditions.

The objectives of this study are to:

a) Determine the adaptability, performance, and horticultural qualities of underutilized, non-native, and/or xerophytic tree species when maintained in Riverside at 35% of ET_0 versus 80% of ET_0.

b) Identify non-native tree species which perform well as medium-sized landscape trees in inland areas valleys of Southern California.

Methods and Procedures

Thirty-five species of trees (see table) were selected and transplanted at UC Riverside in July 1994. Selection criteria were:

1. Mature height in the landscape not likely to exceed 35 ft. in 25-30 years.

2. Species is underutilized and/or its performance is not well documented in non-desert interior valleys of Southern California.

3. Species is in commercial production in the United States.

4. Exceptional functional and/or ornamental value or attributes.

5. Tolerates 20°F.

6. No known serious defects or deficiencies.

Each species is replicated three times by individual trees in each irrigation treatment. Trees were transplanted from 1-, 5-, or 15-gal. containers and spaced at 20 x 19 ft. Irrigation was provided via mini-sprinklers as needed to maintain a sufficiently moist root ball for the first 18 months. Irrigation treatments commenced in the spring of 1996, and are scheduled when accumulation of daily ET_0 x 0.35 = 1 inch for one treatment, and when ET_0 x 0.80 = 1 inch for the other. Additional qualitative and quantitative data are regularly recorded to assess the species' physical and horticultural performances.

Data collected are:

1. Semi-annual measurements of height, width of crown, and trunk caliper at six inches from soil.

2. Monthly rating of functional and esthetic characteristics.

3. Overall assessment of performance and adaptability for use in the landscape.

The following table lists the trees and summarizes the first-year data for each species.

TREE SPECIES EVALUATION PROJECT
Height and Caliper from planting through February 1996

TREE GENUS	CALIPER (mm)	HEIGHT (m)	TREE GENUS	CALIPER (mm)	HEIGHT (m)
Agonis flexuosa	22.4	0.15	Maytenus boaria	12.8	1.05
Callistemon viminalis	23.3	0.75	Acer rubrum ‘Red Sunset’	24.4	0.90
Eriobotrya deflexa ‘Coppertone’	18.0	0.40	Crataegus phaenopyrum	18.7	1.16
Eucalyptus torquata	26.3	0.68	Malus floribunda ‘Hopa’	8.5	0.32
Geijera parviflora	29.3	1.04	Nyssa sylvatica	18.4	0.90
Ligustrum lucidum	37.4	0.95	Robinia ambigua ‘Idahoensis’	27.9	1.80
Pinus thunbergiana	20.2	0.99	Tilia cordata ‘Greenspire’	13.6	0.59
Quercus ilex	12.8	0.75	Zelkova serrata ‘Village Green’	20.8	0.54
Liquidambar styraciflua ‘Burgundy’	20.5	1.48	Sophora japonica	38.7	1.45
Acer palmatum	18.0	0.71	Zizyphus jujuba ‘Lang’	22.8	2.65
Ginkgo biloba ‘Autumn Gold’	12.1	0.60	Magnolia grandiflora ‘Majestic	18.7	0.63
Gleditsia triacanthos ‘Imperial’	21.3	0.43	Acer platanoides ‘Deborah’	5.8	0.20
Koelreuteria bipinnata	39.9	1.03	Crinodendron patagua	6.4	0.25
Parkinsonia aculeata	41.3	1.70	Sorbus hupehensis ‘Coral Fire’	16.1	0.32
Prunus persica ‘Early Red’	44.6	1.39	Brachychiton acerifolius	65.6	1.80
Sapium sebiferum	49.0	1.55	Bauhinia variegata	9.1	0.23
Tipuana tipu	75.4	2.00	Acacia melanoxylon	60.8	1.45
Arbutus unedo	14.2	0.33			