TURFGRASS RESEARCH CONFERENCE AND FIELD DAY

September 13, 1994

AND

LANDSCAPE MANAGEMENT RESEARCH CONFERENCE AND FIELD DAY

September 14, 1994

University of California
Riverside

LANDSCAPE MANAGEMENT RESEARCH CONFERENCE AND FIELD DAY
Wednesday, September 14, 1994

Tables of Contents and Conference Schedule

TURFGRASS RESEARCH CONFERENCE AND FIELD DAY
Tuesday, September 13, 1994

Tables of Contents and Conference Schedule

THE DEVELOPMENT OF THE UC RIVERSIDE TURF PLOTS IS LARGELY DUE TO THE GENEROSITY OF THE FIRMS AND ORGANIZATIONS SHOWN HERE.

WorldCup USA94 Making Soccer History

TRI CAL INC

United States Golf Association 1894

BASF

SOUTHLAND SOD FARMS

TORO

BEST.

pbi / gordon corporation

Sports Turf Managers Association

GERMAIN'S SEEDS

Monsanto

fm FARMERS MARKETING CORPORATION

NOR-AM

Scotts ProTurf

MWD METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

NORTHERN CALIFORNIA GOLF ASSOCIATION

GOLF KEEPS AMERICA BEAUTIFUL USGA GREEN SECTION

WEST COAST TURF

STOVER SEED COMPANY

ADVANCE SEED CO. A Subsidiary of Ferry-Morse Seed Company

JOHN DEERE

DUPONT

MEDALIST AMERICA TURFGRASS SEED

VIGORO INDUSTRIES Inc.

SOUTHERN CALIFORNIA GOLF ASSOCIATION

WESTERN TURF & COMMERCIAL JACOBSEN TEXTRON Jacobsen Division of Textron Inc.

SOUTHERN CALIFORNIA TURFGRASS COUNCIL

CIBA

RAIN BIRD PREFERRED BY PROFESSIONALS WORLDWIDE

CEDAR CHEMICAL CORPORATION

OMC Lincoln CUSHMAN-RYAN

PURSELL INDUSTRIES

LESCO

THE FATE OF PESTICIDES AND FERTILIZER IN A TURFGRASS ENVIRONMENT

Marylynn V. Yates
Dept. of Soil and Environmental Sciences, University of California, Riverside, CA 92521

The purpose of this research project is to study the fate of pesticides and fertilizers applied to turfgrass in an environment which closely resembles golf course conditions. The goal is to obtain information on management practices that will result in healthy, high quality turfgrass while minimizing detrimental environmental impacts. The proposed integrated research project has been designed so that all combinations of all treatments can be statistically analyzed. By simultaneously looking at interactions between soils, turfgrasses, irrigation amounts, pesticides, and fertilizers, questions about "best management practices" for turfgrass growth and maintenance will be able to be answered.

The specific objectives of the project are: 1) compare the leaching characteristics of pesticides and fertilizers applied to two turfgrass treatments; 2) study the effects of the soil type and irrigation regime on the leaching of pesticides, nitrates, and phosphorus; 3) compare the leaching and volatilization characteristics of nitrates from different fertilizers; 4) measure the volatilization rate of pesticides from turfgrasses into the atmosphere as a function of time since application; and 5) monitor the effects of different irrigation regimes, fertilizers, and soil types on the quality of the turfgrass.

The site consists of 36 plots, each measuring 12' x 12'. The fairway area consists of 24 plots, 12 each of two different soil types that were located randomly in the fairway area. A lysimeter assembly, consisting of 5 metal cylinders, was placed in the center of each of the 36 plots. The lysimeter assembly and drain system was fabricated using only metal so that there is no potential for pesticide adsorption. All turfgrass-soil type combinations were subjected to two irrigation regimes: 100% crop evapotranspiration (ET_c) and 130% ET_c. Two different fertilizers were used on the plots. One-half of the plots were fertilized with a urea, the other half were fertilized with sulfur-coated urea. The green and fairway plots received 1 and 0.5 lb N per 1000 ft^2 per month.

Weekly samples were collected from the drains and from soil-water samplers in each of the 36 plots and analyzed to determine the concentrations of nitrate-N, phosphate-P, 2,4-D, and carbaryl. The volume of water draining from each plot was measured to enable a calculation of the mass of pesticides and nutrients leached. The volatilization of two pestcides, carbaryl, and 2,4-D from the turfgrass surface into the air was also determined using volatilization flux chambers.

The results of this study indicate that little leaching of nitrate-nitrogen (generally less than 1% of the amount applied) was measured. Leaching of 2,4-D was very low in soils that contained some clay to adsorb the pesticide; however, up to 7.5% leaching was measured in sand. Less than 0.1% of the carbaryl leached, regardless of soil type. Irrigation amount did not significantly affect the amount of leaching of any of the chemicals. Little volatilization of 2,4-D was measured ($\leq$ 1%) from any of the plots, although the difference in the amount volatilized was significantly different between the two turfgrass species used. Little volatilization of carbaryl was measured ($\leq$ 0.05%) from any of the plots; no significant differences between the treatments occurred. Neither fertilizer type nor irrigation amount caused any significant differences in the quality of the turfgrass as determined by bi-weekly turfgrass ratings.

KIKUYUGRASS MANAGEMENT IN COOL AND WARM-SEASON TURF

David W. Cudney[1], James A. Downer[2], J. Michael Henry[3], and Victor A. Gibeault[1]
[1]Dept. of Botany and Plant Sciences, University of California, Riverside, CA 92521
[2]Ventura Co. Coop. Ext., Univ. of Calif., 702 County Square Dr., Ventura, CA 93003
[3]Riverside and Orange Co. Coop. Ext., Univ. of Calif., 21150 Box Springs Rd., Moreno Valley, CA 92557-8708

Kikuyugrass is an invasive, perennial weed of turf in the coastal and inter coastal valleys of southern and central California. No single herbicide treatment will control kikuyugrass. Complete renovation of infested turf with fumigants or glyphosate (Roundup) followed by replanting has been the only means of control. Renovation is expensive and results in loss of the turf for extended periods of time. In addition, reinvasion of kikuyugrass occurs and often within two to three years the kikuyugrass reinvades. A method was needed to slowly reduce the competitive ability of kikuyugrass while allowing the regrowth of desirable turf species. Previous work by Dr. Victor Youngner in the 1960's had shown that MSMA applied in a series of sequential applications was partially effective in reducing kikuyugrass.

Treatments of MSMA, triclopyr (Turflon), fenoxaprop (Acclaim), and quinclorac (Drive) were tested in southern California over a five-year period at Riverside, Ventura, Huntington Beach, and Costa Mesa. These treatments did not control kikuyugrass as single applications, but when applied every five to six weeks over a five-month period, kikuyugrass was reduced from as high as 80% to less than 5% of the sward. Sequential applications of two-way combinations of these herbicides resulted in reductions of kikuyugrass to less than 1% of the sward. This method of control has the advantage of reestablishing the desirable species slowly, without loss of use of the site during the process. The competitive edge is shifted from the weedy kikuyugrass to the desirable species allowing it to reestablish. If the desirable species is not present at a sufficient density, some reseeding may be necessary in the process.

Cool-season turf swards were best reclaimed from kikuyugrass invasion by sequential treatment with quinclorac, triclopyr, or triclopyr plus MSMA. Quinclorac has yet to be registered for use in turf, however, the manufacturer has expressed interest in gaining registration. Triclopyr or triclopyr plus MSMA is labeled for kikuyugrass control in cool-season turf.

Warm-season turf swards were best reclaimed by sequential applications of quinclorac or the triclopyr plus MSMA combination. As with the cool-season species, quinclorac has yet to be registered. Triclopyr ordinarily injures both hybrid and common bermudagrass, however, MSMA has had the effect of reducing the phytotoxic effects of triclopyr on the bermudagrasses in our trials. Triclopyr plus MSMA has yet to be labeled for use in warm-season turf; bermudagrass injury with this combination, although reduced, is still significant, therefore, this combination is not yet recommended. Repeat treatments of MSMA alone are currently the only method of reducing kikuyugrass vigor in warm-season turf swards.

STING NEMATODE IN CALIFORNIA

J. Ole Becker
Dept. of Nematology, University of California, Riverside, CA 92521

For several years patches of poor growth of bermudagrass (*Cynodon* spp.) were observed on several golf courses in the Coachella Valley. The first indications of disease problems normally appeared in April. Plant growth was stunted and exhibited symptoms usually associated with drought stress and nutritional deficiency. However, the bermudagrass did not respond to an increase of watering and fertilization. At this stage, it was easy to pull the grass off the ground while healthy bermudagrass is very difficult to remove. In the following weeks, larger areas of grass turned brown and died. Certain weeds such as spotted spurge (*Euphorbia maculata*) took advantage of the reduced competition by the declining bermudagrass. This pattern of succession was particularly obvious on those golf courses where herbicides were either not or rarely used.

In 1992, sod samples were taken from areas of declining bermudagrass and processed for nematode extraction by members of the Nematology Department at UC Riverside. A rather large-bodied plant parasitic nematode was detected and identified as *Belonolaimus longicaudatus*, the sting nematode. This ell-like roundworm is an important pest in turf as well as on most agricultural and horticultural crops. Its main geographical distribution is in the southeastern part of the U.S. Like all plant parasitic nematodes, *B. longicaudatus* feeds by puncturing plant cells with a mouth sylet and withdrawing cell contents. It does not enter the roots but attach from the outside, mainly near the root tip. These wounds are often points of entry for bacteria and fungi which otherwise would not be able to enter plant tissues. These secondary infections increase the stress on the plants and can accelerate cell and root death. Sting nematode problems are limited to soils of more than 80% sand content, soil temperatures between 70° and 90°F and constant moisture levels.

The detection of an A-rated pest such as the sting nematode in a sample legally requires the lab and its client to inform the California Department of Food and Agriculture (CDFA) as well as the local County Agricultural Agency. Subsequent surveys by the CDFA revealed the presence of this nematode in at least eight golf courses in the Coachella Valley. In addition, we have found *B. longicaudatus* in several home lawns adjacent to one of the golf courses.

In order to limited the spread of this pest into other turfgrass and agriculturally utilized areas, the movement of sting nematode-infested plants and soil has to be restricted. Humans are by far the most important vectors by spreading them with soil, plants or plant products, soiled tools, or vehicle tires. Golf courses where sting nematodes were detected have been subjected to quarantine conditions. However, realistically we have to expect that through ignorance and negligence the sting nematode will eventually be spread to non-infested areas. Fenamiphos and ethoprop are currently labeled for nematode control on turfgrass in California. Although effective in suppressing sting nematode populations, the relief is only temporary and may be utilized best at the beginning of the growing season to support the establishment of new grass roots.

INFLUENCE OF NITROGEN ON WINTER COLOR OF TWO NEW ZOYSIAGRASSES

Victor Gibeault[1], Robert Green[1], Stephen Cockerham[2], and Richard Autio[1]
[1]Dept. of Botany and Plant Sciences, University of California, Riverside, CA 92521
[2]Agricultural Operations, University of California, Riverside, CA 92521

It was the objective of a long-term turfgrass breeding program at the University of California, Riverside to improve zoysiagrass for turfgrass use in temperate and warm-season turfgrass climate zones. Improvement was characterized as increased turfgrass quality and extended green color retention into, or throughout, the winter season of Southern California where most warm-season turfgrasses go dormant. Two new zoysiagrasses have been developed from this ten-year program. DeAnza and Victoria zoysiagrasses are finer textured than El Toro, a previously released cultivar, and have been shown to hold green color into the cool temperature times of the year.

Improving the winter color retention through plant breeding is one method to have a warm-season turfgrass stay green year round, and manipulating cultural practices is a second method. Specifically, it has been shown experimentally and demonstrated in practice that fall fertilization with nitrogen can enhance winter color in warm-season turfgrasses. Also, studies demonstrated that iron may be useful to lessen color loss with bermudagrass in the fall. Therefore, it was the objective of a study conducted in the fall/winter of 1993-94 to evaluate the influence of nitrogen sources, rates, and application timing and iron fertilization on the green color retention of DeAnza and Victoria zoysiagrass, with the study being conducted at the Turfgrass Research Facility at the University of California, Riverside.

The same nitrogen and iron treatments were applied to mature stands of DeAnza and Victoria zoysiagrass on November 4, 1993. Ammonium sulfate and calcium nitrate at 0.5 lbs. per 1,000 sq. ft. of nitrogen every two weeks and the same materials at 1.0 lb. per 1,000 sq. ft. of nitrogen every four weeks were applied as granular materials with and without ferrous sulfate at the rate of 1 oz. per 1,000 sq. ft. every two weeks and 2 oz. per 1,000 sq. ft. every month. Isobutylidene diurea, IBDU, was applied at 2 lbs. of nitrogen per 1,000 sq. ft. every eight weeks, also with and without iron. Control treatments received no nitrogen with iron and no nitrogen without iron. The treatments were rated approximately weekly from mid-November through the end of January and in February, March, and April 1994. A visual rating system was used to determine color and the results were analyzed by recording date.

It was found that both grasses held some green color throughout the winter season without any fertilizer treatments, however, the color retention was weak. DeAnza responded very strongly to nitrogen fertilization, especially with ammonium sulfate and calcium nitrate, by giving consistently very acceptable winter color ratings, that equalled the commonly used cool-season species. There was little difference noted between the rate/timing with these rapid release products. Both gave better winter color than the slow release IBDU. It was also noted that iron, irrespective of rate, did not significantly influence the color of DeAnza.

In contrast, nitrogen alone had much less influence on the winter color retention of Victoria zoysiagrass. Ammonium sulfate, calcium nitrate, and IBDU treated plots were only slightly better in color during the lowest temperature times than the untreated control. Significant color improvement was noted with all iron treatments alone and especially in combination with the soluble nitrogen fertilizers.

In conclusion, this preliminary study has indicated that desirable winter color of a warm-season turfgrass can be achieved by the use of cultivars that have been selected for, or are characterized by, color retention at low temperatures, when fertilized with soluble nitrogen sources (DeAnza) or soluble nitrogen and iron (Victoria).

UCR FIELD PERFORMANCE INDICATOR: HOP, ROLL, AND DEFLECTION EVALUATION OF SOCCER PLAYING SURFACE

S. T. Cockerham[1], J. R. Watson[2], and J. C. Keisling[1]
[1]Agricultural Operations, University of California, Riverside, CA 92521
[2]The Toro Co., 8111 Lyndale Ave. So., Minneapolis, MN 55420-1196

Equipment:

A. FIFA-Approved soccer ball

B. Velocity Acceleration Ramp (VAR)--Ramp 3 meters (10 ft.) long elevated 2.1 meters (7 ft.)

C. Ball Hop Indicator (BHI)--Stationary frame with free-swinging arm at 2 centimeter intervals

D. Ball air pressure gauge

E. Miscellaneous--two 30-meter tapes; stakes for tapes, carrying case

Procedure:

For all evaluations, a soccer ball inflated to 0.6 kg.sq.cm. (8.5 psi) is released from the top of the VAR with V_r, valve pointing down the ramp, and rolls along the acceleration gradient increasing veolicity, leaving the ramp at its maximum velocity, V_m. Ball strikes BHI at V_a at the apex of the first hop after leaving the VAR.

Roll and deflection are measured by allowing the ball to roll free down a straight line marked with a measuring tape until velocity is expended V_s and it stops. Distance from foot of VAR and deflection from the line are measured and recorded. Evaluations are repeated a minimum of ten times (ten ball hop and ten roll/deflection). High reading and low teadings are thrown out, the remaining eight averaged. Measurements are taken in a minimum of three sites on the playing field.

Test Sites:

A. UCR Turfgrass Research Facility--Common Bermudagrass; Tifway II; Santa Ana; DeAnza zoysiagrass; kikuyugrass; perennial ryegrass; Kentucky bluegrass; tall fescue; bare ground.

B. UCR Intramural Playing Field--two or more good turf areas and two or more worn areas.

C. Rose Bowl--hybrid bermudagrass

D. Cultural practices evaluated--mowing height, rolling, water management

World Cup Venues:

Citrus Bowl	Giants Stadium	Silverdome
Cotton Bowl	RFK Stadium	Soldier Field
Foxboro Stadium	Rose Bowl	Stanford Stadium

INCREASED POTASSIUM FERTILIZATIONS FOR ENHANCED TRAFFIC AND DROUGHT RESISTANCE OF PERENNIAL RYEGRASS GROWN ON A SAND ROOT ZONE SPORTS FIELD

R. L. Green[1], F. J. Merino[1], G. H. Pool[2], S. T. Cockerham[2], and V. A. Gibeault[1]
[1]Dept. of Botany and Plant Sciences, University of California, Riverside, CA 92521
[2]Agricultural Operations, University of California, Riverside, CA 92521

Fertilization of turfgrasses with relatively large amounts of potassium (K) has been associated with resistance to many stress conditions including those imposed by diseases, drought, traffic, and high and low temperatures. Potassium may enhance stress resistance by directly or indirectly causing increased rooting, thickened cell walls with an associated higher cellulose content, and decreased tissue hydration resulting in hardy tissue.

Data from several university studies has supported the above benefits, while data from other studies has shown no benefit. Some of this paradox can be explained by recognizing several factors that may influence the outcome of these studies: soil type (sand, clay, loam, etc.) and starting K soil levels; turfgrass species, including their respective K requirements and uptake capabilities; irrigation amount and potential K leaching, especially in sandy soils, clipping removal and thus the removal of K; N fertility rate, an example being at low N rates, K uptake may be low though there is sufficient soil-available K; and soil chemical and physical properties that influence K uptake, an example being high sodium levels in the water or soil hinder K uptake.

There is little debate about the need for K fertilization of turfgrasses grown on a sand root zone, especially if clippings are removed and the area is irrigated to promote optimum turfgrass quality and function. Potassium fertilization in relatively large amounts on many of the native California soils is debatable. However, many agronomists do stress the need for a balanced nutritional program; one that involves N, P, and K.

Potassium is one of the 16 essential elements required for plant growth, excluding carbon, hydrogen, and oxygen. The K requirement for turfgrasses ranks second only to N. Potassium is not a constituent of plant tissues nor organic compounds, such as carbohydrates, proteins, and lipids. However, K is an essential cofactor involved in carbohydrate synthesis and translocation, protein and amino acid synthesis, and enzyme activity. It is also involved in the control of transpiration, respiration, and uptake of certain nutrients such as N and magnesium. Generally, the requirement for K increases with higher N fertilizer rates, heavy irrigations, and clipping removal.

Soils having sufficient amounts of clay minerals may supply appreciable amounts of plant-available K. However, sandy soils contain much less K than clays and have considerably less ability to retain K against leaching. Potassium is very mobile and can be easily leached from plant tissue and from sandy soils. This situation is further exaggerated when clippings are removed and the site is irrigated heavily. This is a typical situation for athletic fields receiving medium to high levels of management. Sand is a popular root zone medium because it resists soil compaction from heavy traffic and because it facilitates drainage so that rainfall has the least impact on sporting events.

The objective of this study was to determine if increasing the K component of the N/K ratio would increase traffic and drought resistance of perennial ryegrass grown on a sand root zone.

MATERIALS AND METHODS

Cultivar

Manhattan II perennial ryegrass.

Experimental Site

A mature, sand-filled basin model sports field established at the UCR Turfgrass Research Field Laboratory in 1984. The root zone is a well-drained, 16-inch deep, medium textured sand with a subsurface drainage system. The perennial ryegrass was established in spring 1992 by sod.

Experimental Design

Strip-plot design with three replications. K treatments formed main plots (12 x 4.5 feet), while traffic treatments were stripped across main plots forming subplots (6 x 4.5 feet).

Mowing

One time per week with a walk-behind rotary mower; mower setting/actual height - 1 7/8 inches and 1 5/8 inches, respectively; clippings removed.

Irrigation

Irrigated to promote maximum turfgrass quality for the entire plot area; 2.62 inches per week during summer months.

K Treatments

Initiated May 13, 1993. Treatments were applied once every 2 weeks; exception was Multicote which was applied once every 4 months at a rate of 2 lb N/1,000 ft^2. Note that these treatments were continuous until the drought treatment, which was July 1994.

Potassium treatments.

Fertilizer Source ($N-P_2O_5-K_2O$)	N/K	Pounds/1,000 ft^2 per month	
		N	K_2O
Urea 45 - 0 - 0	1/0	0.5	0
K-Power 13.75 - 0 - 44.5	1/3	0.5	1.6
Multicote 12 - 0 - 43	1/3	0.5	1.8
K-Power + Urea 19 - 0 - 38	1/2	0.5	1.0
K-Power + Urea 26.4 - 0 - 26.4	1/1	0.5	0.5

Traffic Treatments

Applied with a Brinkman Traffic Simulator (BTS) equipped with football cleats. Two passes with the BTS were equivalent to one football game.

Traffic treatments.

Date	Number of Passes with BTS	
	High Traffic	Low Traffic
Oct. 4	2	1
Oct. 8	2	1
Oct. 11	2	1
Oct. 15	2	1
Oct. 18	4	2
Oct. 22	2	1
Oct. 25	4	2
Oct. 29	4	2
Nov. 1	4	2
Nov. 5	4	2
Nov. 8	4	2
Nov. 12	4	2
Nov. 15	4	2
Nov. 22	4	2
Nov. 29	4	2
Total Passes	50	25
Game equivalents	25	12.5

Measurements Following Traffic Treatments

1. Visual rating of wear: 1 to 9; 1 = brown, worn turf, 9 = no wear.
2. Traction strength of sod. Taken with a traction torque apparatus equipped with a 42-kg plate with football cleats.
3. N,P,K tissue content of crown.

Drought Treatment

Conducted in July 1994 by withholding irrigation and rating plots visually for drought symptoms (leaf wilting and rolling, and discoloration and eventual firing. Site was rewatered, and recovery from drought was visually rated on a 1 to 9 visual turfgrass quality scale: 1 = brown turf; 9 = best.

Plant Measurements Prior to Drought Treatment

Three plugs (2 $^3/_8$ inches diam. x 6 inches deep) were taken from each K treatment - traffic treatment plot in order to determine verdure mass and root mass in the upper 3 inches and root mass in the 3- to 6-inch depth.

RESULTS

Fertility treatments were applied for almost 5 months prior to traffic treatments. These fertility treatments did not significantly affect wear tolerance of perennial ryegrass (Table 1). The K-treatment x traffic-treatment interaction was not significant. This means that K treatments responded relatively the same regardless of traffic treatment level. Therefore, as presented in Table 1, K treatments are the average of both high-and low-traffic treatments. It should be noted that traffic treatments did significantly affect the amount of wear (data not shown). That is, plots receiving the high-traffic treatment were significantly more worn than plots receiving the low-traffic treatment. <u>In summary, higher amounts of K did not significantly increase the wear tolerance of perennial ryegrass. However, upon close inspection of the data in Table 1, there does appear to be a trend for higher traffic tolerance associated with higher amounts of K</u>.

Fertility treatments did not significantly affect sod strength (Table 2). It is also interesting to note that traffic treatments did not significantly affect sod strength (data not shown). One might expect a more worn turf (high-traffic treatment) to have a lower sod strength than a less worn turf (low-traffic treatment).

Note that at the time of this writing, not all data was available. However, a full summary will be presented at the field day.

Table 1. The effect of N/K ratios and simulated traffic on visual wear measurements of perennial ryegrass grown on a sand root zone.

		Visual Wear Estimate[z]	
Fertility Treatment	N/K	Nov. 23	Nov. 30
Urea	1/0	4.6[y]	4.9
K-Power + Urea	1/1	3.8	4.2
K-Power + Urea	1/2	5.3	5.6
K-Power	1/3	5.3	5.5
Multicote	1/3	4.9	5.0
LSD P = 0.05		1.3	1.4
Pr > F		0.12	0.25

[z] Wear rated from 1 to 9: 1 = brown, worn turf; 9 = no wear.

[y] Means are the average of high- and low-traffic treatments.

Table 2. The effect of N/K ratios and simulated traffic on the traction strength of perennial ryegrass grown on a sand root zone.

Fertility Treatment	N/K	Traction Torque[z] (meter kilograms)
Urea	1/0	4.85[y]
K-Power + Urea	1/1	4.57
K-Power + Urea	1/2	4.67
K-Power	1/3	4.94
Multicote	1/3	4.71
LSD P = 0.05		NS

[z] Traction torque measured with a 42-kg plate with football-type cleats.

[y] Means are the average of high- and low-traffic treatments.

THE INFLUENCE OF TRAFFIC ON TURFGRASS SOILS

J. Michael Henry
Riverside and Orange Counties Coop. Ext., University of California,
21150 Box Springs Road, Moreno Valley, CA 92557-8708

While traffic is something everyone living in Southern California is thoroughly familiar with, it has a different meaning when it comes to the turfgrass environment. There are two components of traffic on turf:

1) Wear--the effects of traffic on the above-ground grass plant and its various parts. It usually involves tearing, abrasion, crushing, or breaking of leaves and/or stems and runners (stolons).

2) Soil Compaction--the result of the weight of a person or vehicle compressing the soil underneath the turfgrass stand. This results in the reduction of pore space between the soil particles and even the flattening of soil clumps or "aggregates" at or near the surface. This reduction in soil pore size hinders entry of water and oxygen into the soil. Less oxygen in the soil impedes root functions such as water and mineral uptake, gas exchange, and root cell division. Less pore space means a denser soil that offers more physical resistance to root growth as well.

Professor John Madison, a former instructor of mine, felt that soil compaction was the single greatest detriment to grass growth in highly trafficked turf situations.

What types of traffic are we talking about?

- Player or foot traffic
- Turf equipment and vehicles (golf carts, mowers, rollers)

These would be the normal, regular sources of traffic encountered daily on sports and recreational turf facilities. Other types of traffic can cause problems on turf such as heavy construction equipment during development of a sports complex or other unusual traffic such as automobile traffic or parking. We won't assume that these types of traffic are part of the regular compaction causes in this discussion.

Other types of traffic damage include divoting and soil displacement, but since these are readily apparent and are correctable by simple replacement, there is little difficulty in dealing with them.

During 1993 while on a sabbatical leave, I spent four months at the Sports Turf Research Institute, Bingley, England, where I conducted turf traffic trials to evaluate grass species and cultivar wear resistance. After returning to California, I participated in traffic studies at the UCR Turf Research Center, but concentrated more on the soils aspects, rather than the grass effects of traffic.

To evaluate the effect of traffic on soil, specific evaluations of soil cores can determine the changes in soil structure brought on by actual or simulated traffic treatments. Soil structure encompasses two aspects: (1) the pore space between the mineral soil particles; and (2) the physical clumping of soil particles into larger aggregates (soil structure). The size and shape of these larger soil particles account for the amount of large pore space in the upper soil horizon and for the ability of water and air to enter the soil environment. Both aspects determine the density of the soil, especially if the soil is a loam or clay type or a sand with significant clay and/or silt fractions.

Let's look at the influences of traffic on soils under sports turf or other high use turf areas.

Pore Space: Soil compaction results in the squeezing of the soil in the upper inch or two so there is less large pore space, making the soil more dense. Clay soils are the most affected by compaction, resulting in the flattening of the "plastic" aggregates when they are wet. This seals off the top of the soil making water penetration and air movement into the soil much more difficult. Without free air and water movement into and through the soil, the pore atmosphere will become saturated with carbon dioxide and other toxic gases from root and microbial respiration. This can result in the death of the root system. Soil that remains saturated with water for long periods due to compaction are even more likely to cause root death since oxygen moves much more slowly through water than through open pores.

Moisture Relations: Soil moisture not only becomes more difficult to manage in a compacted soil but the amount retained in the soil increases. This increased water retention maintains the moist state where further compaction can take place. Dry soils are resistance to compaction, so managing irrigation to avoid wet soil surfaces when heavy traffic is expected will help reduce damage.

Infiltration and Percolation: Water movement into and through soil slows due to reduced pore size.

Soil Temperature: Denser soils hold more water and as a result retain heat longer, resulting in higher summer soil temperatures.

Soil Strength: As particles are pressed together, their cohesiveness increases. In turf this correlates to physical impedance to root growth in soils. An instrument called a Penetrometer is used to measure soil hardness (penetration resistance or soil strength). This instrument provides a quick determination of relative soil compaction on sports turf.

Soil Aeration: Pore space in soils is far more important than the mineral component of soils. Oxygen travels through air 1,000,000 times faster than through water! Water-logged soils (as found in compacted soils) is far less likely to contain adequate oxygen than non-compacted soils. A simple equation for determining soil porosity follows where the soil's particle density is estimated to be 2.65 megagrams (Mg) per cubic meter.

Total soil porosity = 1 - dry bulk density/particle density (2.65 Mg/m^3)

Bulk Density: This term is used to quantify the density of soils. It is a measure of the dried soil weight divided by the volume of that dry soil sample. Bulk density increases as compaction increases as does water runoff (see Table 1).

Bulk density (g/cm^3) = weight (g)/volume cm^3)

Table 1. Effect of Foot Traffic on Soil[a]

Compaction	Infiltration Rate (in./hr.)	Runoff from Rain	Non Capillary Porosity of Top Inch (Vol. %)
None	1.5	0	33.1
Moderate	0.67	52	19.2
Heavy	0.35	76	6.1

[a]Alderfer. 1951. USGA Green Sect. 4(2): 25-28.

Table 2. Recommended Soil Porosity for Trafficked Turfgrass

Turf Use	% Total Pore Space	% Non-Capillary Pore Space
Golf Green Mix[1]	40-55	12-18
Sports Turf Soils[2]	-	10-12

[1]USGA at -0.04 bars
[2]J. H. Madison - at field capacity after compaction

References

Blake, G. R. and K. H. Harge. 1986. Bulk density, p. 363-367. American Society of Agronomy, Methods of Soil Analysis. Part I. Physical and Mineral Methods.

Carrow, R. N. 1980. Influence of soil compaction on three turfgrass species. Agron. J. 72: 1038-1042.

Danielson, R. E. and P. L. Sutherland. 1986. Porosity, p. 443-445. American Society of Agronomy, Methods of Soil Analysis. Part I. Physical and Mineral Methods.

Madison, J. H. 1971. Principles of turfgrass culture. Van Nostrand Reinhold Co., NY.

TURFGRASS RESEARCH AND THE UCR TURFGRASS FACILITY

Robert L. Green
Department of Botany and Plant Sciences, University of California, Riverside, CA 92521

The turfgrass research program at the University of California, Riverside, involves numerous and varied research projects along with numerous scientists from a number of different disciplines and departments. The purpose of this report is to briefly discuss the UCR Turfgrass Facility, probably the most recognized aspect of the turfgrass research program by industry groups and other individuals. However, it should be noted that considerable turfgrass research is conducted at other locations and is involved in such areas as the growth and physiology of kikiyugrass, turfgrass weed control studies, turfgrass nematode control studies, turfgrass insect control studies, and the biological control of turfgrass diseases.

The turfgrass plots and support facilities and equipment are vital for turfgrass field research. This situation has grown and evolved considerably over the past 10 years. A considerable amount of this growth is from the generous support of many industry groups and several granting agencies, such as the U.S. Golf Association and the Metropolitan Water District of Southern California. Numerous individuals in the Agricultural Operations Department and the Botany and Plant Sciences Department have been responsible for the development of these facilities.

Currently, the UCR Turfgrass Facility has 4.5 acres of irrigated turfgrass plots. The field research support facilities incude: one building that houses offices and a plant morphology laboratory; a second building that houses a wet chemistry/physiology laboratory and a turfgrass library and conference room; a turfgrass equipment storage area; an outdoor plant preparation area; a general storage area; warm-season and a cool-season turfgrass glasshouse; and three cold-storage units. The field research support facilities, which are probably more complete than most other turfgrass programs in the U.S., will be discussed during the tour.

PREVENTION AND CONTROL OF TURFGRASS DISEASES

Rudolph A. Khan
Agricultural Operations, University of California, Riverside, CA 92521

The demand for high quality lawns, golf courses, sports fields, and commercial landscapes has increased tremendously in the last half-century. Unfortunately, such facilities can be a haven for growth and survival of pathogens when conditions are ideal for disease outbreak.

Diseases of turfgrasses, as in other plants, develop from a complex interaction between a susceptible host, a disease-producing organism (such as fungus) and an environment favorable for the disease-causing agent. The evidence of such interaction can be observed in such symptoms as leaf blights, crown and root rots, and finally death of the plant. However, no other factor influences turf diseases more than the microenvironment--that environment between the tip of the leaf blade and crown.

Disease prevention centers on integration of good management practices, including proper maintenance: fertilization, irrigation, mowing at the recommended height, aerifying and overseeding when necessary. The turf manager should also take into account the stage of development of the turf, degree of plant vigor, soil types, and water-holding capacity of the soil.

A good fertilization program will stimulate a deep and extensive root system, control shoot growth and provide recuperative potential of the plant. Many turfgrass diseases become more severe where the ratio of N-P-K is out of balance, particularly when the nitrogen is excessively high or deficient.

Excessive nitrogen produces vegetative growth and encourages the development of *Rhizoctonia* brown patch, *Bipolaris* and *Drechslera* leaf spots, summer patch and *Pythium* blight. Stem and crown rust, dollar spot, and anthracnose are often associated with nitrogen deficiency.

Turf diseases most influenced by wear injury and compaction stress are dollar spot, rusts, and summer patch. Heat and drought stress promote summer patch; cool wet weather is deal for rusts, leaf spots, and melting out.

Leaf spots and melting out appear as small, dark spots on the leaf blade. Infected blades turn yellow, thereby giving the turf a mottled appearance.

Dollar spot is diagnosed by the presence of tan lesions with reddish brown margins on leaf blades. The fungus thrives under prolonged high humidity in the turfgrass canopy. Moderate to high nitrogen application is recommended during the period of dollar spot activity. Water thoroughly (deeply) and as infrequently as possible without causing stress between watering periods.

Necrotic ringspot or summer patch is characterized by 6-18 inch circular or semi-circular patches of dead grass with a tuft of healthy grass in the center of individual patches. The roots of such infected plants are dark brown and become partially rotted.

Summer patch can devastate a poorly managed turf. The causal organism attacks roots during periods of heat and drought stress. Plants with shallow root systems due to compaction, excessive nitrogen application are easily killed when infected. Fall fertilization supplemented with light summer fertilization using slow release nitrogen is recommended. This disease is frequently more severe when turfgrass is maintained under conditions of low mowing height and frequent, light irrigation.

Field symptoms of *Rhizoctonia* brown patch include rings of dead or dying grass. On cool-season grass that are close-cut or are very wet, circular irregular patches of blighted areas developed rapidly. The blighted area is purplish green initially and quickly fades to a light brown. During periods of warm humid weather, a "smoke ring" area may appear at the margins of the patches. On grasses that are cut higher, light brown circular patches may appear without the "smoke ring."

Rusts are recognized by the presence of orange pustules on infected blades and occur on all turfgrass species. Grasses growing under stressful environmental conditions are mostly easily parasitized by rust fungi. Typical stresses include drought, nutrient deficiency, low mowing height, shade, and other pathogens. Control of this disease is usually achieved by fertilizing as needed and mowing at the recommended height for the grass species.

Diseases caused by *Pythium* spp. are often referred to as *Pythium* blight, grease spot, cottony blight, crown and root rot. All turfgrasses are susceptible to attack by *Pythium* spp.; however, cool season species are most commonly damaged. The most obvious and severe damage to foliage is caused during hot, humid weather. The foliar disease is most severe with lush, dense grass growing under high nitrogen fertilization. WATER MANAGEMENT IS ESSENTIAL IN REDUCING DISEASE POTENTIAL.

The key to successful disease control is early diagnosis. The final component in turf disease management involves the integration of overall good management practices as well as a practical fungicide program.

THE FATE OF NITROGEN IN A TURFGRASS ENVIRONMENT

Kelly Parkins
Robinson Fertilizer Co., 1460 North Red Gum, Anaheim, CA 92806

The puprose of this research project is to account for the nitrogen applied to turfgrass which is being maintained in a similar manner to a golf course fairway. The tracking of nitrogen through the turfgrass environment is being accomplished by the collection of both clipping yields and irrigation water which leaches through the soil profile. These materials are then analyzed for both ammoniacal and nitrate nitrogen content. The design of the research project also includes several parameters which will help to gain an understanding of what role soil texture, irrigation quantity, and fertilizer rate and type have on the amount of nitrogen found in both the turfgrass clippings and ground water leachate. This study is a follow-up to one funded by the U.S. Golf Association in 1990, which found that less than one percent of the applied nitrogen leached through the soil profile into the drain water.

Site Description

The fairway consits of 24 plots, each measuring 12' x 12'. Each plot contains five lysimeters (22" diameter x 38" depth) fitted with separate drain lines which enable us to collect all of the leachate from a 13.2 ft.^{2} area of each plot. Two soil textures were used in the construction of the plots. Twelve plots were constructed using the native soil at the site, a fine sandy loam, while the other 12 were constructed using a loamy sand that was imported to the site. These two soils represent very different leaching potentials. The plots were sodded with Tifway II hybrid bermudagrass.

Treatments

Eight different combinations of fertilizer source, irrigation amount, and soil type were replicated three times, as it is shown in the table below:

Treatment	Soil Type	Irrigation	Nitrogen Program
1	Sandy Loam	Normal	A
2	Sandy Loam	Normal	B
3	Sandy Loam	Above-normal	A
4	Sandy Loam	Above-normal	B
5	Loamy Sand	Normal	A
6	Loamy Sand	Normal	B
7	Loamy Sand	Above-normal	A
8	Loamy Sand	Above-normal	B

Two irrigation treatments are being used to simulate "normal" and "above-normal" watering conditions on a fairway. The "normal" irrigation schedule is set for 100% ET, with the "above- normal" schedule at 130% ET. The two schedules represent the average and high end of a typical management program and can be used to determine how much of an effect the quantity of water has on the leaching potential of nitrogen, as well as turfgrass quality.

The two nitrogen programs represent the frequency, rate, and formulation of fertilizers used on golf course fairways in a semi-arid climate. These programs, as outlined below, were developed utilizing surveys from golf course superintendents and consultation with a USGA agronomist.

	Program A		Program B	
Month	N Source	lb N/1000 ft^2	N Source	lb N/1000 ft^2
January	$CaNO_3$	1.0	$CaNO_3$	1.0
February	SCU 22-0-6	1.0	$CaNO_3$	1.0
March	SCU 22-0-6	1.0	15-5-7	1.0
April	21-0-0	1.0	15-5-7	1.0
May	16-6-8	1.0	SCU 39-0-0	2.0
June	16-6-8	1.0	--	--
July	--	--	SCU 39-0-0	2.0
August	--	--	--	--
September	--	--	--	--
October	6-20-20	1.0	15-15-15	1.0
November	15-15-15	1.0	22-3-9	1.0
December	$CaNO_3$	1.0	$CaNO_3$	1.0

Factors influencing the fertility practices in each program include temperature, renovation schedule, type of turfgrass, amount of use, and the maintenance budget. All plots will be overseeded with ryegrass from October to April.

We wish to thank the Coachella Valley Water District and the Hi-Lo Desert Golf Course Superintendents Association for funding this project.

PROGRESS REPORT: KIKUYUGRASS MANAGEMENT STUDIES

Stephen T. Cockerham and Rudolph A. Khan
Agricultural Operations, University of California, Riverside, CA 92521

Kikuyugrass (*Pennisetum clandestinum* Hochst ex Chiov.) stolons were planted November 18, 1992, to establish a stand of turfgrass for use in studies of turfgrass cultural practices. To encourage turf growth and cover over the winter, the plot was covered with a vented tarp to increase soil temperatures. The stand was adequate to support studies by early summer 1993.

EXPERIMENT 1 -- KIKUYUGRASS RESPONSE TO MELFLUIDIDE PLANT GROWTH REGULATOR

A field study was conducted in 1993 to evaluate the efficacy of mefluidide (Embark) on growth regulation, flower suppression, and phytotoxicity on kikuyugrass. Two mefluidide formulations were used in the experiment--Embark 2S (2 lbs. mefluidide/gal.) and Embark Lite (0.2 lbs. mefluidide/gal.). Treatments were Embark 2S at 0.4, 0.75, 1.5, and 3.0 fl. oz. per 1,000 sq. ft. (0.25, 0.5, 1.0, and 2 lb. a.i./ac) and embark Lite at 4.0, 7.5, and 15.0 fl. oz. (0.25, 0.5, and 1.0 lb. a.i./ac) with four replications.

Growth Reduction. Kikuyugrass growth was not significantly reduced by treatments of either formulation. Kikuyugrass was found to be tolerant of relatively high rates of mefluidide.

Flower Suppression. Kikuyugrass is a prolific producer of flowers. The visible flowers are actually the white filaments and anthers of the stamens, and they are quite objectionable in turf. At 14 days after treatment, significant flower suppression was observed in the two high Embark Lite treatments and the highest Embark 2S treatment (Table 1). This suggests the Embark Lite formulation to be more effective than the Embark 2S formulation as the two highest Embark Lite applications were at 1.0 and 0.5 lb. a.i.acre, respectively, and the only Embark 2S formulation that was significant at the same level was at 2.0 lbs. a.i./acre.

TABLE 1. Kikuyugrass flower suppression in response to formulations of mefluidide plant growth regulator.

Treatment	Rate*	14 DAT	Rating** 28 DAT	42 DAT
Embark Lite	15.0	6.3 A	6.1 A	3.7 AB
Embark Lite	7.5	6.0 A	5.0 A	2.8 B
Embark 2S	3.0	5.8 A	5.7 A	4.5 A
Embark 2S	1.5	3.5 A	3.3 A	2.5 B
Embark Lite	4.0	3.0 B	3.2 B	2.8 B
Embark 2S	0.75	1.8 C	2.8 C	2.8 B
Embark 2S	0.4	1.8 C	2.3 C	2.5 B
Untreated Ck		2.0 C	2.1 C	2.3 B
LSD		0.989	1.231	1.428

*Product formulation fl. oz./1,000 sq. ft.
**1 = 90-100% of plot with male flowers
9 = no flowers observed
DAT = Days After Treatment
Data in columns followed by same letter do not vary significantly at P = 0.01 according to Duncan's Multiple Range Test

Phytotoxicity. At 14 days after treatment, the kikuyugrass began to show phytotoxicity from the mefluidide applications (Table 2). Highest injury was with Embark Lite 15.0 and 7.5 fl. oz./1,000 sq. ft. (1.0 and 0.5 lb. a.i./acre); Embark 2S 3.0 and 1.5 fl.oz./1,000 sq. ft. (2.0 and 1.0 lbs. a.i./acre). The Embark 2S at .75 fl. oz./1,000 sq. ft. (0.5 lb. a.i./acre) was significantly less phytotoxic.

TABLE 2. Kikuyugrass phytotoxicity to formulations of mefluidide plant growth regulator.

Treatment	Rate*	14 DAT	28 DAT	Rating** 42 DAT
Embark Lite	15.0	5.8 A	6.3 B	6.3 A
Embark 2S	1.5	5.7 A	4.5 A	3.3 B
Embark 2S	3.0	5.0 A	6.0 A	5.5 A
Embark Lite	7.5	4.8 A	5.5 A	6.5 A
Embark Lite	4.0	3.0 B	3.3 C	3.3 B
Embark 2S	0.75	3.0 B	2.5 CD	3.0 B
Embark 2S	0.4	2.0 BC	2.5 CD	1.8 C
Untreated Ck		1.3 C	2.0 D	2.0 C
LSD		1.339	0.947	0.808

*Product formulation fl. oz./1,000 sq. ft.
**1 = no phytotoxicity
9 = 100% of plot chlorotic or light green
DAT = Days After Treatment
Data in columns followed by same letter do not vary significantly at P = 0.01 according to Duncan's Multiple Range Test

EXPERIMENT 2 -- KIKUYUGRASS RESPONSE TO FERTILIZER

Fertilizer was applied June 30, 1993 to kikuyugrass turf as 16-16-16 at the rates of 0.25, 0.5, 1.0, and 2.0 lbs. N/1,000 sq. ft. The 0.5 N/1,000 sq. ft. rate was the lowest initial reponse significantly greater than the untreated check. Treatment response lasted for 30 days in all but the lowest treatment rate. The conlcusion is that applicaiton of less than 0.5 N/1,000 sq. ft. is not adequate.

TABLE 3. Kikuyugrass response to fertilizer application

Treatment	7/12	Turf Score* 7/19	7/26	8/3	8/10
2.0 lbs. N/M	8.0 A	7.7 A	7.0 A	7.0 A	7.0 A
1.0	7.7 AB	7.3 AB	6.3 AB	6.3 A	6.8 A
0.50	6.7 AB	6.3 BC	5.3 BC	6.3 A	6.8 A
0.25	6.3 BC	6.0 C	5.0 C	5.0 B	5.3 B
Untreated	5.3 C	6.0 C	5.0 C	5.0 B	5.0 B

*Turf Score: 9 = Excellent turf
1 = Very poor turf
Data in columns followed by same letter do not vary significantly at P = 0.01 according to Duncan's Multiple Range Test

EXPERIMENT 3 -- VERTICAL MOWING OF KIKUYUGRASS

Kikuyugrass turf is being mowed weekly at 5/8 inch and fertilized at 1 lb. N/1,000 sq. ft. in April, June, August, and October. Traffic will be applied with the Brinkman Traffic Simulator. The treatments are vertical mowing in (A.) May, (B.) September, (C.) May and September, (D.) May, July, and September, (E.) May, June, July, August, and September, and (F.) no vertical mowing with weekly traffic and no traffic. Evaluation will be turf score visual rating, traction plate torque, and Clegg impact tester.

EXPERIMENT 4 -- KIKUYUGRASS RESPONSE TO NITROGEN APPLICATION TIMING

Kikuyugrass turf is mowed weekly at 5/8 inch and vertical mowed in May and September. Treatments started October 1993 as 21-0-0 (ammonium sulfate). Traffic is being applied with a Brinkman Traffic Simulator. Treatments are (A.) 1.0 lb. N/1,000 sq. ft. October, April, and October, (B.) 2.0 lbs. N/1,000 sq. ft. October, April, and October, (C.) 1.0 lb. N/1,000 sq. ft. October, April, June, August, and October, (D.) 0.5 lb. N/1,000 sq. ft. October, April, May, June, July, August, September, and October with traffic and no traffic. Evaluation are visual turf score, traction plate torque, Clegg impact tester, and clipping yields.

TALL FESCUE QUALITY AS AFFECTED BY IRRIGATION FREQUENCY, VARIETY, AND MOWING HEIGHT

Robert Green, Victor Gibeault, William Richie, and Richard Autio
Department of Botany and Plant Sciences, University of California, Riverside, CA 92521

Increasing concern for water conservation has heightened research interest in cultural practices which conserve water. Water consciousness has curbed waste to a great extent, however, some questions remain unanswered. Previous research has revealed that turf quality can be maintained at a deficit irrigation level. The present experiment is designed to basically answer the quesiton of what frequency a deficit level of irrigation can be applied to maintain acceptable turf visual quality.

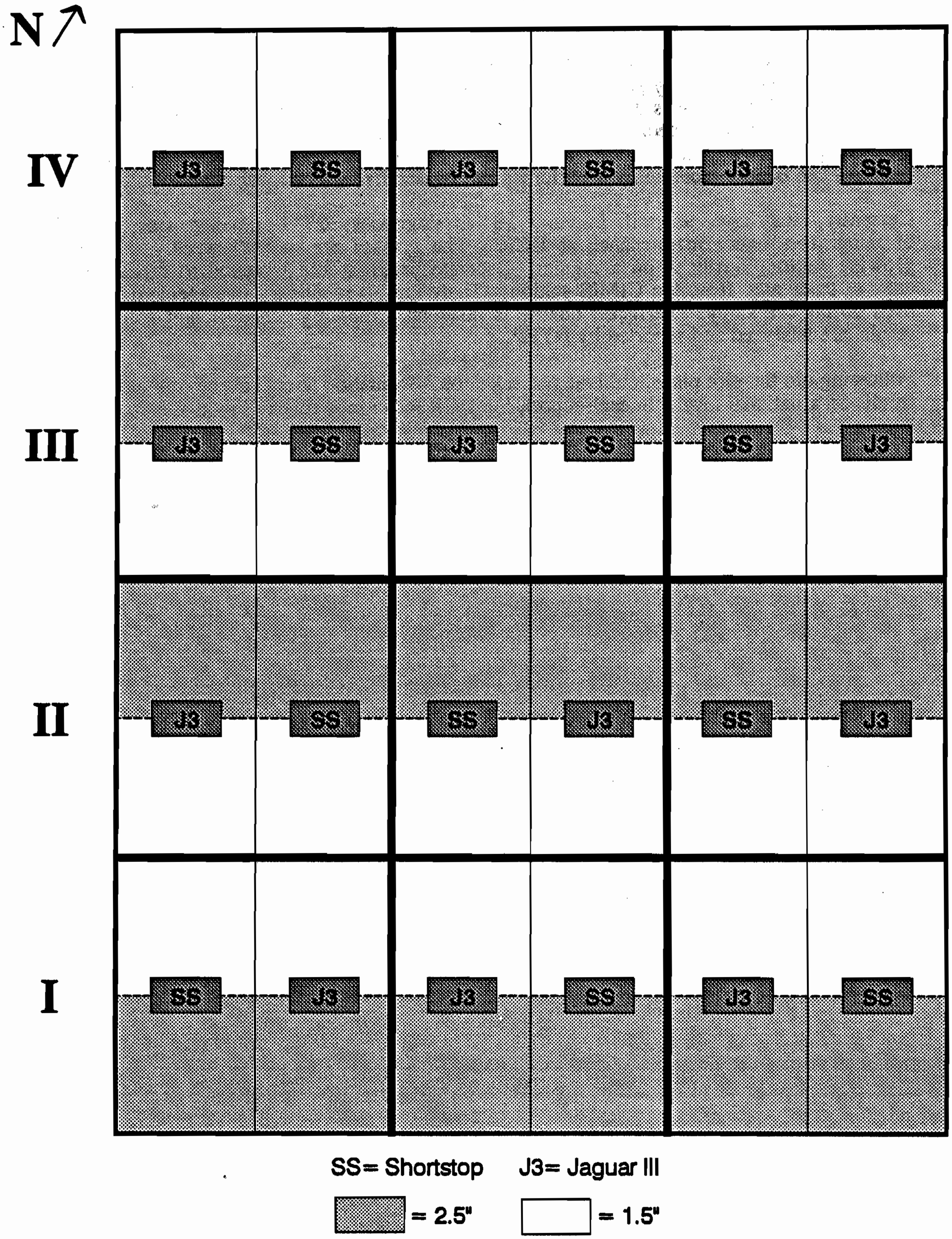
The cultivars of tall fescue, a cool-season grass, are being used. One variety, 'Jaguar III,' is a turf-type variety while the other, 'Shortstop,' is a newer dwarf variety. Two mowing regimes, a 1.5" cutting height and a 2.5" height, are employed in the study. All plots receive a deficit level of irrigation which is determined weekly from the adjacent CIMIS station. Irrigation treatments consist of irrigation 4 times per week, 3 times per week, and twice per week. The three variables: variety, mowing height, and irrigation frequency, are factored together into a split-strip plot experiment design, replicated four times, to determine which combination produces the best turf quality.

Visual turf quality is rated weekly on a 1 to 9 scale where 1 is worst and 9 is optimal. Clipping yields are collected bi-weekly. Other whole-plant measurements include leaf morphology, shoot and leaf densities, and leaf vertical extension rates. Physiological data, to include leaf water content, photosynthetic rates, and chlorophyll content, is also being collected.

Soil moisture is quantified daily at 6" and 12" depths using Watermark granular matrix sensors. Neutron probe readings are also taken weekly at 9", 12", 18", 24", 36", and 48" depths. This reveals any moisture movement through the soil profile and out of the root zone. Both measures of soil moisture also provide a picture of total soil moisture and how it varies between treatments, and over the course of the experiment. The intent is twofold: 1) to determine at what depth roots are extracting moisture, and 2) to determine at what soil moisture levels turf quality remains acceptable.

Rooting has been shown to be a major factor in the drought tolerance of turfgrasses. Upon completion of this experiment, roots will be examined from each irrigation treatment, mowing height, and variety. Root mass and length will be measured from core samples. All data will be statistically analyzed to determine differences between varieties and treatments. Conclusions will be drawn about the effects of irrigation, mowing, and variety on rooting mass and depth. Furthermore, we would like to correlate root parameters with visual scores and physiological parameters to determine if rooting differences contributed to the grasses' ability to tolerate deficit irrigation.

MWD Irrigation Frequency Study



AN OVERVIEW OF CULTIVAR PERFORMANCE

Victor Gibeault and Richard Autio
Department of Botany and Plant Sciences, University of California, Riverside, CA 92521

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. 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 in a local climate and soil.

Currently, we have 96 tall fescues, 28 zoysiagrasses, 27 bermudagrasses, and 22 buffalograsses under maintenance at UCR. The grasses are mowed weekly during the growing season, fertilized on a regular, moderate program and irrigated to replace water used as calculated from the CIMIS station. There are no secondary management practices used during the study. Turfgrass quality is rated on a monthly schedule and annually the results are analyzed and reported by NTEP.

Following are the plot plans, cultivar and selection information about source of material, and results on a national level. In each report, the UCR location is referred to as CA 3.

1992 NATIONAL TALL FESCUE TEST
Entries and Sponsors

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

TABLE 1.

MEAN TURFGRASS QUALITY RATINGS OF TALL FESCUE CULTIVARS
GROWN AT THIRTY-NINE LOCATIONS IN THE U.S. AND CANADA
1993 DATA

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

NAME	AL1	AR1	AR2	AZ1	BC1	CA1	CA3	CO1	DC1	GA1	GA2	IL1	IL2	KS1	KS2	KY1	LA2	MA1	MD1	MO1	MO2
* GEN-91	6.0	6.9	6.1	6.6	5.3	6.7	6.6	6.9	2.7	4.6	2.0	6.6	6.8	6.8	7.5	7.0	3.7	7.1	5.9	7.2	7.0
* JAGUAR 3 (ZPS-J3)	6.7	6.8	6.1	7.0	5.3	7.3	6.6	6.5	3.7	4.9	2.7	6.8	6.6	6.4	8.0	6.6	3.7	6.4	5.8	7.2	7.1
* PIXIE	6.5	6.9	5.4	7.3	5.5	7.1	6.4	6.4	3.3	4.7	3.0	5.9	6.4	6.2	8.2	6.9	3.7	6.9	5.8	8.8	7.3
ISI-AFA	6.9	7.1	6.1	6.8	5.2	7.0	6.5	6.1	2.4	5.0	3.3	5.9	5.8	6.5	8.0	7.0	3.9	6.5	5.8	7.5	7.1
* MB-25-92	6.3	6.8	5.7	6.8	5.3	7.3	6.5	6.3	2.6	4.9	3.3	6.4	6.7	6.5	7.8	7.1	3.3	6.9	6.2	7.2	7.1
* FINELAWN PETITE	6.2	7.1	6.4	7.0	5.0	6.6	6.6	6.6	2.8	4.9	3.0	5.8	6.3	6.3	7.5	6.8	3.6	6.6	5.8	7.0	7.0
* FALCON II (MB-21-92)	6.0	6.5	5.5	7.1	5.0	7.1	6.6	6.6	2.7	4.7	2.7	5.8	5.9	6.6	7.8	7.2	3.3	6.6	6.0	7.3	7.0
* REBEL,JR.	6.5	7.0	5.8	6.8	5.0	6.8	6.5	6.7	2.9	4.7	3.3	6.9	6.6	6.3	8.0	6.5	3.2	5.9	6.0	7.2	7.0
PICK 90-12	6.8	6.8	5.7	6.8	5.2	7.0	6.3	6.1	2.6	5.1	3.0	6.1	6.7	6.4	7.8	6.9	3.8	6.9	5.9	7.5	7.1
* HOUNDOG V (ISI-AFE)	6.8	7.1	5.5	7.0	5.0	6.5	6.4	6.7	3.0	4.6	2.3	6.3	6.1	6.3	7.8	6.8	3.7	6.3	6.1	5.2	7.2
* COYOTE (ZPS-ML)	5.8	7.6	5.0	7.1	5.5	7.1	6.4	6.6	3.1	4.7	2.3	5.1	7.2	5.8	8.0	6.9	3.4	7.3	5.8	7.3	6.9
* LANCER	6.3	7.1	4.9	7.0	5.2	7.3	6.3	6.7	2.8	4.4	3.0	6.5	6.0	6.2	7.8	6.9	3.7	6.6	6.3	7.0	6.9
PST-5DX W/ENDOPHYTE	6.0	6.6	5.7	6.9	5.3	6.9	6.6	6.1	3.0	4.7	3.5	6.1	5.9	5.8	7.5	6.5	3.9	6.4	5.9	7.2	6.8
* TOMAHAWK	6.2	6.7	6.1	6.9	5.0	6.7	6.5	6.5	2.7	4.5	2.3	6.0	6.4	6.3	8.0	6.8	3.1	6.8	5.9	7.0	6.9
* LEXUS	6.0	7.4	6.1	7.1	5.2	6.9	6.6	6.1	2.8	4.4	2.0	5.9	5.9	6.8	8.0	7.0	2.8	7.0	6.0	7.7	7.0
* MB-23-92	6.4	6.8	6.1	7.0	5.0	6.8	6.5	6.0	1.9	4.2	1.7	5.7	6.1	5.9	8.2	6.9	3.4	6.3	6.4	7.2	6.9
* REBEL-3D	6.2	6.9	5.7	6.7	5.5	6.7	6.5	6.7	2.4	4.8	2.7	6.0	6.3	6.2	7.8	6.9	3.6	6.4	5.6	7.3	6.9
* SR 8200	6.8	6.5	5.5	7.0	5.0	6.8	6.4	6.4	2.9	4.9	4.0	6.0	6.8	6.1	7.7	6.4	3.5	5.8	5.8	7.5	6.6
SIU-1	6.1	6.7	5.1	7.0	5.0	7.2	6.4	6.3	3.8	4.3	3.0	6.1	6.8	6.4	7.3	6.7	3.6	5.1	5.9	7.2	6.9
* CORONADO (PST-RDG)	6.7	6.8	5.3	7.1	4.7	7.0	6.5	6.3	2.2	4.9	4.0	5.5	6.6	6.3	7.7	6.8	3.7	7.1	5.6	7.0	6.8
MB-22-92	6.4	6.8	6.0	7.1	5.2	7.2	6.5	5.7	3.1	5.1	2.3	5.7	5.4	6.3	7.8	6.6	3.7	6.3	6.0	7.2	6.9
FA-19	5.6	7.1	5.1	6.8	5.5	7.2	6.5	6.3	2.8	4.6	3.0	6.1	6.2	6.2	7.5	6.3	3.7	6.1	5.7	7.2	6.9
* GUARDIAN	6.4	5.8	5.1	7.1	5.2	6.7	6.5	6.1	3.8	4.2	3.3	6.4	5.9	6.2	7.7	6.3	3.5	5.8	6.0	7.7	7.1
PST-5LX	6.6	6.7	5.4	7.0	5.7	6.6	6.5	6.2	2.2	4.5	2.7	5.8	6.2	6.4	8.0	6.8	3.2	6.4	6.0	7.5	6.6
* DUSTER (ITR-90-2)	5.9	7.1	6.0	7.1	5.5	7.2	6.5	6.4	2.4	3.8	3.0	5.5	5.9	6.0	7.2	6.6	3.3	6.9	5.8	6.5	6.9
* SR 8400	6.5	6.8	5.6	6.9	5.3	6.1	6.4	6.0	3.3	4.1	4.0	6.3	6.5	6.3	7.5	6.3	3.7	5.5	5.9	7.3	6.7
* MICRO DD	6.0	6.8	4.9	6.9	5.2	7.4	6.4	6.3	2.9	4.4	2.7	5.7	6.3	6.5	7.5	6.4	3.6	6.7	5.9	7.0	6.8
PICK 90-10	6.5	7.5	5.2	6.6	5.2	7.1	6.4	6.4	2.8	4.1	3.3	5.9	5.6	6.1	7.5	6.9	3.6	6.8	6.0	6.7	7.0
ISI-ATK	6.7	6.8	5.1	6.9	5.0	7.2	6.3	6.2	3.3	4.4	2.3	6.1	6.0	6.0	7.3	6.4	4.0	6.0	5.7	7.2	6.9
* EMPEROR II (ZPS-E2)	6.0	6.6	5.6	7.1	5.5	7.2	6.4	6.2	2.2	4.7	3.0	5.6	6.5	6.4	8.2	6.8	3.9	6.5	5.7	7.0	6.9
SR 8210	6.5	6.3	5.8	6.9	5.0	6.7	6.4	6.2	2.9	4.5	2.0	5.9	5.2	6.3	7.3	6.5	3.0	5.9	5.8	7.3	6.7
OFI-TF-601	6.7	6.8	5.6	6.9	5.7	6.6	6.5	6.4	3.0	3.9	2.7	5.9	5.9	6.0	7.5	6.4	3.7	5.9	5.9	7.3	6.8
ISI-CRC	6.6	6.4	6.1	6.9	5.5	6.9	6.5	5.8	3.7	4.4	3.0	6.1	6.1	6.2	7.0	6.3	3.8	5.3	5.9	7.3	6.7
PICK CII	6.2	6.1	5.9	6.7	5.0	6.6	6.5	6.0	3.4	4.1	2.7	6.4	6.0	6.0	7.2	6.4	3.4	6.6	6.0	7.2	6.8
ATF-007	5.3	6.6	6.0	6.8	5.0	6.9	6.5	6.0	2.6	4.7	2.7	5.0	5.6	6.4	7.8	6.5	3.6	6.4	5.7	7.0	6.9
* MONTAUK	6.4	6.3	5.3	6.7	5.3	6.4	6.6	6.4	3.0	3.9	3.0	6.0	5.9	6.2	7.3	6.3	3.7	6.1	5.9	7.0	6.7
ATF-006	6.4	7.5	5.0	6.6	5.0	7.1	6.4	6.3	2.4	4.0	3.3	5.4	6.3	6.0	8.0	6.6	3.7	6.3	5.8	7.3	6.6
* SAFARI	6.9	6.0	5.7	6.9	5.5	6.7	6.3	6.5	3.2	4.7	2.3	5.5	6.4	6.1	7.2	6.3	3.4	5.7	6.0	7.2	6.8
* ELDORADO	6.3	6.5	4.9	7.0	5.0	6.9	6.5	6.5	3.1	4.5	3.0	6.1	6.5	6.4	7.2	6.6	3.5	5.8	5.8	7.2	6.6
* DUKE	6.5	6.1	5.4	7.0	5.3	6.6	6.6	6.0	3.2	4.8	3.0	5.9	5.8	6.0	8.0	6.5	3.6	5.7	5.8	7.3	6.7
ZPS-VL	6.4	7.0	5.6	6.3	5.5	7.3	6.4	6.0	2.8	4.3	1.5	5.1	6.4	6.1	7.7	6.8	3.2	7.2	5.4	7.2	6.7
MB-24-92	6.5	7.0	5.1	6.9	5.0	7.1	6.4	6.2	2.7	4.5	3.0	5.5	5.6	6.1	7.5	6.5	3.7	6.2	5.9	7.0	6.9
* COCHISE	5.9	6.4	5.8	6.5	5.7	6.9	6.7	6.2	3.0	4.4	3.7	5.6	6.9	6.5	7.5	6.5	3.2	5.8	5.9	7.0	6.9
PRO-9178	6.2	6.6	5.4	6.9	5.2	7.0	6.5	6.4	3.6	4.3	2.7	6.0	6.5	6.0	7.3	6.3	3.6	6.0	5.8	7.0	6.8
* SILVERADO	6.5	6.5	5.8	6.5	4.8	6.4	6.2	6.0	2.5	4.8	3.0	6.0	5.8	6.4	7.8	6.4	3.7	5.8	5.7	7.2	6.9
* APACHE II (PST-59D)	6.3	7.0	5.5	6.9	5.2	6.9	6.3	6.1	2.3	4.8	2.7	5.2	5.8	5.8	7.8	6.7	3.6	6.6	5.7	7.0	6.7
PICK 90-06	6.3	7.3	6.1	6.4	5.5	7.1	6.4	6.3	2.4	4.3	3.0	5.1	6.4	6.4	7.5	6.3	3.2	6.5	5.6	7.5	6.7
* TITAN 2 (SR 8010)	6.1	6.3	5.3	6.8	5.5	6.7	6.2	6.1	3.2	4.3	2.7	6.1	6.3	6.0	7.2	6.0	4.1	5.3	6.0	7.0	6.8
PST-5VC	6.5	7.5	6.0	6.7	5.2	6.8	6.4	6.0	2.3	5.3	2.0	5.9	5.1	6.1	7.2	6.5	3.7	6.1	5.8	7.5	6.8

TABLE 1. (CONTINUED)

MEAN TURFGRASS QUALITY RATINGS OF TALL FESCUE CULTIVARS
GROWN AT THIRTY-NINE LOCATIONS IN THE U.S. AND CANADA
1993 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF

NAME	AL1	AR1	AR2	AZ1	BC1	CA1	CA3	CO1	DC1	GA1	GA2	IL1	IL2	KS1	KS2	KY1	LA2	MA1	MD1	MO1	MO2
* LEPRECHAUN	6.5	6.6	5.5	6.7	5.0	6.7	6.6	6.2	2.9	4.1	3.0	5.7	6.2	6.5	7.3	6.6	3.4	5.9	5.9	7.0	6.9
* MIRAGE (KWS-DSL)	6.3	7.0	5.2	6.9	6.0	7.1	6.5	6.3	3.1	4.7	3.5	5.5	6.2	6.3	7.7	6.1	2.8	5.8	5.8	7.0	7.0
* AVANTI	6.1	6.5	5.3	7.3	5.2	6.8	6.4	6.3	3.0	4.8	2.5	5.5	6.3	6.2	7.5	6.3	3.4	5.4	5.9	7.3	6.9
M-2	6.2	6.1	5.6	7.0	5.8	7.0	6.5	6.0	3.5	4.6	2.5	6.0	6.4	6.2	6.8	6.1	3.6	5.8	5.9	7.0	6.7
BAR FA 0855	5.9	6.5	5.4	6.9	5.3	6.9	6.4	6.1	2.4	4.1	2.3	5.9	6.1	6.0	7.2	6.1	3.6	6.0	5.7	7.2	6.7
WXI-208-2	6.7	6.3	5.4	6.8	5.7	7.4	6.4	5.9	3.1	4.7	3.0	4.6	5.7	5.6	7.5	6.5	3.7	5.9	5.9	7.2	7.1
* VIRTUE	5.7	6.5	5.4	7.0	5.5	6.7	6.5	6.1	3.2	3.8	1.0	6.1	5.9	6.4	7.3	6.6	3.5	6.5	5.8	7.0	7.1
403	6.0	6.4	5.5	7.0	6.0	6.6	6.4	5.3	3.5	3.8	2.7	6.3	6.8	6.2	7.7	6.3	3.8	6.3	6.0	7.2	6.8
* TRAILBLAZER II	6.5	6.5	5.9	6.8	5.5	6.4	6.3	6.2	2.9	4.7	3.0	5.8	5.7	6.1	7.5	6.5	3.6	5.5	5.6	6.8	6.8
* VEGAS	5.8	6.8	5.3	7.0	4.7	7.0	6.3	5.4	3.0	4.3	2.0	6.5	6.1	6.1	7.5	6.4	3.7	6.4	5.8	7.2	6.6
* SR 8300	6.8	6.3	5.9	7.0	5.7	6.3	6.6	5.9	3.4	4.4	2.7	6.2	6.4	6.0	7.0	6.3	3.8	5.0	5.9	6.0	6.3
* SHENANDOAH	6.6	6.0	5.0	7.0	5.5	6.3	6.3	6.0	3.0	4.1	3.3	5.4	6.5	6.2	7.2	6.3	3.8	5.3	5.9	7.0	6.6
* ADOBE (SFL)	7.0	6.4	5.0	6.6	5.0	7.3	6.5	6.3	2.3	4.9	3.0	6.0	5.4	5.9	7.5	6.3	3.9	6.3	5.7	7.0	6.8
* BONSAI PLUS	6.0	6.0	5.3	6.5	5.0	7.0	6.5	6.2	2.7	4.4	3.7	5.9	5.3	5.9	8.0	6.2	3.5	6.3	5.8	7.7	6.6
PSTF-401	6.7	6.1	5.4	6.8	5.0	6.9	6.5	5.8	3.4	4.5	3.3	6.7	5.8	6.2	7.2	6.3	3.2	5.1	6.0	7.2	6.7
PST-5PM	5.4	7.0	5.4	7.0	5.0	6.6	6.5	6.1	2.5	4.4	2.7	5.9	5.6	6.0	7.5	6.6	3.5	6.4	5.7	7.0	6.6
PSTF-LF	7.0	5.9	5.5	7.1	5.3	6.5	6.5	6.1	4.0	4.7	3.0	6.2	6.0	5.8	7.2	6.2	3.7	5.5	5.8	7.3	6.6
* BONANZA II	6.3	6.5	5.7	6.9	5.3	6.6	6.4	6.1	3.0	4.4	3.0	6.0	5.8	6.2	7.2	6.1	3.8	5.4	5.9	7.0	6.8
BAR FA 2AB	5.8	6.7	5.9	6.9	5.7	6.8	6.5	6.2	2.4	4.1	2.7	5.8	5.9	6.4	7.7	6.7	3.7	5.9	5.7	7.0	6.8
CAFA101	6.2	6.0	5.5	7.0	5.0	6.7	6.4	5.6	3.4	4.2	2.7	5.9	6.4	5.8	6.8	6.2	3.1	5.4	6.0	5.7	6.4
FA-22	6.7	6.7	5.1	6.8	5.0	7.2	6.4	6.0	2.7	4.4	2.0	5.5	6.4	5.6	6.8	5.9	3.7	5.3	6.0	7.2	6.9
* ALAMO (J-1048)	6.4	6.3	4.2	7.2	5.3	6.4	6.7	6.0	3.0	4.4	2.3	5.7	5.9	6.1	7.3	6.1	3.7	6.0	5.9	7.0	6.6
* KITTYHAWK	6.5	6.4	4.9	7.0	5.0	7.0	6.0	6.0	3.0	4.1	2.3	5.5	5.9	5.9	6.7	6.0	3.4	5.7	5.7	7.3	6.5
* AUSTIN	6.0	5.9	5.1	7.1	5.0	6.6	6.3	5.8	3.2	4.3	4.0	6.2	6.1	6.0	6.3	6.1	3.8	5.7	6.0	7.2	6.8
PSTF-200	5.9	5.9	5.5	7.1	4.7	6.6	6.3	5.7	4.0	4.7	3.0	6.3	5.8	6.1	6.2	6.3	4.1	5.7	5.8	7.2	6.3
* FINELAWN 88	6.3	6.1	5.0	6.9	5.2	6.8	6.4	5.8	3.0	4.3	3.3	5.9	6.1	6.0	7.3	6.2	3.6	5.8	5.8	7.0	6.4
* AZTEC	6.2	6.7	5.6	7.0	5.5	6.6	6.5	6.4	3.0	4.3	2.3	6.1	2.5	6.0	7.0	6.4	3.1	4.6	5.8	7.2	6.7
* OLYMPIC II	6.3	5.7	5.4	7.1	4.7	7.2	6.3	5.8	3.2	4.4	3.0	5.9	5.8	5.8	6.5	5.8	3.6	5.0	5.9	7.2	6.4
* MONARCH	5.6	6.3	5.3	7.0	5.3	6.6	6.4	6.0	3.2	4.0	2.3	5.2	5.5	5.9	7.0	6.1	3.1	5.7	5.7	7.0	6.6
PST-5STB	5.8	6.8	4.8	7.0	5.5	6.8	6.7	6.1	2.4	4.1	2.3	5.1	5.7	6.2	7.0	6.0	3.5	6.3	5.6	7.2	6.5
BAR FA 214	5.8	6.6	5.8	6.8	4.7	7.1	6.5	5.8	2.6	4.4	2.0	6.3	5.4	5.8	6.7	5.9	3.6	5.5	5.9	7.3	6.3
* BONANZA	6.1	5.6	5.0	6.9	5.3	6.6	6.4	6.0	3.1	4.3	2.7	5.7	6.1	5.6	7.2	6.0	3.4	5.3	5.8	5.5	6.3
* PHOENIX	6.8	5.8	5.2	6.9	5.3	5.9	6.3	6.0	3.2	4.5	3.3	5.7	5.7	5.6	6.7	5.8	3.8	5.1	5.8	5.8	6.3
CAS-MA21	6.1	6.2	4.9	7.0	5.2	6.7	6.5	5.5	3.3	4.3	2.3	5.8	5.7	5.8	6.8	6.3	3.2	5.8	5.8	7.2	6.7
* BONSAI	5.7	7.0	4.9	6.8	5.2	7.4	6.5	6.0	2.2	4.6	2.7	5.1	4.6	5.6	7.5	5.5	3.6	6.8	5.6	7.0	6.5
* ASTRO 2000	6.4	5.8	5.1	7.0	4.8	6.7	6.3	6.0	3.7	4.1	2.7	5.8	5.7	5.7	6.5	6.2	3.7	4.9	6.0	6.7	6.3
CAS-LA20	5.5	6.2	5.5	6.7	4.8	6.6	6.4	5.4	2.5	4.2	2.7	5.5	5.8	5.8	6.5	6.3	3.7	6.1	5.6	7.3	6.7
* ARID	6.6	5.6	4.9	7.0	5.3	6.1	6.2	5.5	4.6	4.3	3.0	5.7	5.3	5.6	6.3	5.5	3.8	4.4	5.7	7.0	5.4
* TWILIGHT	5.8	6.0	4.7	6.9	4.7	6.2	6.5	5.7	2.2	4.7	3.5	4.4	5.4	5.4	7.7	5.7	3.1	7.1	5.8	7.2	6.1
* FALCON	6.9	5.3	4.7	6.9	5.5	6.3	6.0	5.4	3.8	4.3	3.5	5.4	5.4	5.7	6.2	5.3	3.0	5.0	5.8	7.3	5.3
* ANTHEM	6.4	5.0	5.3	7.0	5.0	5.9	6.0	4.9	3.8	4.0	4.0	6.1	4.4	5.3	5.3	5.0	3.9	4.6	5.6	7.2	5.5
* KY-31 W/ENDO.	6.6	3.9	4.3	6.7	4.7	4.8	5.0	4.5	3.2	4.0	4.0	4.7	4.4	4.7	4.3	4.2	3.9	3.8	5.2	5.2	4.9
* KY-31 NO ENDO.	6.1	4.1	4.4	6.7	4.7	4.6	5.4	4.7	3.3	4.1	2.3	5.0	4.3	4.9	4.5	4.5	3.5	3.9	5.3	5.3	5.1
LSD VALUE	0.9	0.6	0.9	0.5	0.8	0.5	0.3	0.5	1.0	0.6	1.7	1.0	1.3	0.7	0.8	0.4	0.6	0.7	0.4	0.6	0.4

* COMMERCIALLY AVAILABLE IN THE USA IN 1994

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

TABLE 1. (CONTINUED)

MEAN TURFGRASS QUALITY RATINGS OF TALL FESCUE CULTIVARS
GROWN AT THIRTY-NINE LOCATIONS IN THE U.S. AND CANADA
1993 DATA

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

NAME	MO3	MO4	MS1	NE1	NE2	NE3	NJ1	NJ2	PA1	PA2	RI1	SD1	UB1	UB2	VA1	VA4	VA8	WA1	MEAN
GEN-91	5.7	5.5	5.8	6.6	6.4	5.4	6.5	5.9	6.9	3.8	5.9	6.4	7.7	7.0	5.8	5.8	4.3	6.5	6.0
JAGUAR 3 (ZPS-J3)	5.1	6.3	5.8	5.8	6.3	4.7	6.0	6.7	7.4	3.4	6.0	6.2	7.1	6.7	5.4	5.7	4.3	6.3	6.0
PIXIE	5.0	5.8	6.0	6.3	6.0	4.2	6.4	6.2	6.4	3.5	5.7	6.0	7.5	6.5	5.5	5.8	3.9	6.5	5.9
ISI-AFA	5.9	4.9	5.7	6.6	6.2	3.9	7.0	6.4	7.3	3.5	5.8	5.8	7.3	6.5	6.2	5.9	4.0	5.9	5.9
MB-25-92	5.1	5.4	5.7	5.9	6.0	4.8	6.6	6.3	6.9	3.4	6.0	5.6	7.3	6.7	5.2	6.0	3.8	6.4	5.9
FINELAWN PETITE	5.7	5.9	5.8	6.3	6.4	4.4	6.6	5.9	6.1	3.4	5.7	6.1	7.5	6.9	5.0	6.3	4.7	6.1	5.9
FALCON II (MB-21-92)	5.2	6.5	6.1	6.2	5.4	4.8	6.7	6.8	7.0	3.6	5.3	5.7	7.5	6.5	6.0	5.7	4.3	5.8	5.9
REBEL,JR.	5.3	5.0	5.9	6.4	5.6	5.1	5.7	5.4	7.7	4.1	5.7	5.6	7.1	6.6	5.3	5.5	4.5	6.1	5.9
PICK 90-12	5.5	6.3	6.2	5.8	5.5	4.4	7.2	6.3	7.1	3.0	5.1	5.5	7.3	5.4	5.4	5.6	3.8	5.8	5.8
HOUNDOG V (ISI-AFE)	5.4	6.0	6.0	6.4	6.0	4.8	6.6	6.7	7.2	3.8	5.7	5.4	7.5	6.2	5.2	5.7	4.7	5.8	5.8
COYOTE (ZPS-ML)	5.4	5.5	5.5	6.4	5.4	4.3	6.7	6.3	6.3	2.9	5.6	6.0	7.6	6.1	5.6	6.0	3.8	6.9	5.8
LANCER	5.5	5.5	5.9	6.4	6.0	5.0	5.9	5.7	4.8	3.2	5.7	6.5	7.4	7.0	5.4	5.8	3.8	6.2	5.8
PST-5DX W/ENDOPHYTE	4.8	5.3	5.9	6.4	5.8	4.6	6.5	6.0	7.6	3.4	5.8	6.0	6.9	6.3	5.4	5.9	3.9	5.5	5.8
TOMAHAWK	4.7	5.4	5.7	6.3	5.8	4.5	6.3	5.7	7.0	3.5	5.6	5.7	6.9	6.5	5.3	6.1	4.0	6.0	5.8
LEXUS	5.7	4.5	5.7	6.6	5.7	5.0	6.1	6.2	5.7	2.9	5.7	5.2	7.7	6.9	5.0	6.0	3.5	5.7	5.8
MB-23-92	5.5	6.1	5.9	6.3	5.9	4.8	6.1	5.5	7.5	3.5	5.5	5.6	7.3	6.5	5.4	5.7	3.5	6.0	5.7
REBEL-3D	5.4	5.6	5.8	5.9	5.6	4.7	6.4	5.4	6.2	3.4	5.8	6.0	7.3	6.4	5.2	5.6	3.5	6.0	5.7
SR 8200	4.7	6.1	6.0	5.8	5.9	4.4	5.8	5.5	6.4	4.0	5.8	5.6	6.7	5.7	5.4	5.7	4.3	5.9	5.7
SIU-1	4.6	5.7	6.0	6.1	5.6	4.7	5.4	5.4	6.8	3.5	6.1	6.2	6.8	6.6	5.4	5.9	4.3	6.0	5.7
CORONADO (PST-RDG)	5.2	5.6	5.5	5.7	5.7	5.1	6.6	6.0	6.8	3.1	5.4	5.4	7.0	5.6	4.8	5.7	3.6	6.1	5.7
MB-22-92	5.2	5.0	6.1	6.2	5.8	5.0	5.8	5.4	7.1	2.9	5.6	6.1	6.9	6.0	5.6	5.7	3.7	6.0	5.7
FA-19	4.8	5.4	5.8	5.8	5.6	5.1	6.0	5.6	7.7	3.7	5.4	6.0	7.0	6.1	5.1	5.6	4.2	5.8	5.7
GUARDIAN	4.8	5.6	6.2	6.1	6.0	5.2	5.4	5.9	6.1	3.7	5.5	5.9	6.8	6.3	5.2	5.3	4.2	6.1	5.7
PST-5LX	5.0	5.2	5.3	5.5	5.6	4.8	6.4	5.5	7.5	3.2	5.5	5.6	7.0	6.7	5.7	5.8	3.9	5.9	5.7
DUSTER (ITR-90-2)	5.3	5.8	5.7	6.3	5.7	3.9	6.1	6.0	6.7	3.4	5.7	5.4	7.5	6.1	6.0	5.4	4.2	6.0	5.7
SR 8400	4.5	5.7	5.9	5.9	5.9	3.9	6.1	5.2	7.2	3.8	5.8	5.6	6.5	5.7	5.5	5.5	4.4	6.0	5.7
MICRO DD	5.3	5.5	5.8	6.1	5.8	4.4	6.1	5.7	6.0	3.8	5.9	5.9	7.0	6.1	5.0	5.4	4.0	6.1	5.7
PICK 90-10	5.1	5.2	5.8	6.2	5.8	4.6	6.2	5.2	6.8	3.3	5.6	5.3	7.4	6.1	4.9	5.9	3.7	6.0	5.7
ISI-ATK	4.9	5.7	6.1	6.1	6.0	4.5	5.2	5.0	6.9	4.2	5.9	6.0	6.8	5.9	5.3	5.5	4.2	5.7	5.7
EMPEROR II (ZPS-E2)	5.0	4.9	5.7	5.8	5.4	4.7	6.0	5.8	6.8	3.2	5.3	5.7	6.9	5.6	5.5	5.7	3.5	6.4	5.7
SR 8210	5.3	6.3	5.8	6.4	6.0	4.9	6.0	5.4	6.9	3.8	5.7	5.9	6.6	6.1	5.3	5.8	3.8	6.5	5.7
OFI-TF-601	5.5	5.0	6.0	5.8	5.9	4.4	5.6	5.3	5.9	3.9	5.7	6.0	6.9	6.4	5.4	5.6	4.1	6.1	5.7
ISI-CRC	5.0	5.3	5.9	6.2	5.8	4.4	5.2	4.7	6.9	4.2	5.8	5.7	6.4	6.6	5.1	5.5	4.8	5.4	5.7
PICK CII	4.7	5.7	5.8	5.8	5.6	4.7	5.3	5.2	6.4	4.1	6.0	6.0	7.1	6.9	5.4	5.5	4.0	6.0	5.7
ATF-007	5.3	5.7	5.8	6.3	6.0	4.8	6.2	5.8	6.1	3.0	5.6	5.5	7.5	6.1	5.7	5.7	3.7	6.6	5.7
MONTAUK	4.8	5.6	5.9	5.9	5.9	4.7	5.4	5.6	7.6	3.5	5.3	5.9	6.7	6.3	5.4	5.4	4.1	6.1	5.7
ATF-006	5.3	5.1	5.3	5.8	6.0	4.9	5.6	5.3	6.3	3.4	5.6	6.0	7.3	6.8	4.7	5.6	3.5	6.3	5.7
SAFARI	4.5	5.2	6.1	6.1	5.5	4.6	6.0	5.6	6.4	4.5	6.0	6.1	6.5	6.2	5.3	5.6	4.0	5.5	5.7
ELDORADO	4.6	5.6	5.7	5.7	5.8	3.8	5.9	5.9	6.7	3.8	5.3	6.2	7.0	6.6	4.9	5.5	4.1	5.7	5.7
DUKE	4.5	5.2	6.1	5.8	5.5	4.3	5.7	5.7	7.7	3.4	5.7	5.5	6.8	6.1	5.5	5.4	4.0	6.0	5.7
ZPS-VL	5.5	5.8	5.4	6.4	5.8	4.8	6.0	6.0	6.3	3.1	5.4	5.5	7.0	4.9	5.3	6.0	3.6	6.4	5.7
MB-24-92	5.6	5.1	5.3	6.0	6.2	4.9	6.4	4.9	6.8	3.1	5.6	5.3	7.0	6.5	5.4	5.6	3.4	5.9	5.6
COCHISE	5.3	5.4	5.8	5.6	5.4	4.3	5.9	5.1	6.9	3.6	5.7	5.6	6.8	6.4	4.7	5.5	3.7	5.6	5.6
PRO-9178	4.8	5.1	5.8	6.1	5.9	4.4	5.2	5.6	6.1	3.3	5.5	6.3	6.7	6.7	5.0	5.5	4.1	6.0	5.6
SILVERADO	4.9	5.3	5.7	6.0	5.9	4.9	6.0	5.7	6.1	3.2	5.5	6.0	6.9	6.4	5.5	5.4	4.1	5.9	5.6
APACHE II (PST-59D)	5.9	4.4	5.6	5.5	5.8	4.6	6.0	5.5	7.4	3.3	5.4	5.9	7.1	5.9	5.3	5.6	4.0	5.8	5.6
PICK 90-06	5.3	5.7	5.4	5.9	5.9	4.5	6.6	5.4	6.8	2.6	5.1	5.2	7.0	5.3	5.0	5.9	3.5	6.2	5.6
TITAN 2 (SR 8010)	4.3	5.5	6.0	5.9	5.8	4.6	5.1	5.5	7.1	4.9	5.8	6.5	6.3	6.1	5.1	5.1	4.3	5.6	5.6
PST-5VC	4.3	5.0	5.6	5.3	5.3	5.1	5.8	5.7	7.1	3.0	5.3	6.0	7.5	6.2	5.8	6.4	3.3	5.7	5.6

TABLE 1. (CONTINUED)

MEAN TURFGRASS QUALITY RATINGS OF TALL FESCUE CULTIVARS
GROWN AT THIRTY-NINE LOCATIONS IN THE U.S. AND CANADA
1993 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF

NAME	MO3	MO4	MS1	NE1	NE2	NE3	NJ1	NJ2	PA1	PA2	RI1	SD1	UB1	UB2	VA1	VA4	VA8	WA1	MEAN
LEPRECHAUN	5.0	4.8	5.8	6.2	5.8	4.4	5.8	5.5	6.8	3.2	5.6	5.9	6.9	6.3	5.1	5.5	3.8	5.6	5.6
MIRAGE (KWS-DSL)	4.6	5.2	5.7	5.8	5.3	4.5	5.9	5.5	6.3	3.7	5.5	6.1	6.7	5.5	4.8	5.5	4.2	5.9	5.6
AVANTI	4.7	5.2	5.9	6.0	5.9	4.8	5.8	5.0	6.1	3.9	5.8	5.6	6.6	6.4	5.1	5.1	4.1	5.7	5.6
M-2	5.1	5.2	5.9	6.2	5.6	4.3	4.9	5.2	5.4	4.0	5.6	6.4	6.3	5.9	5.0	5.4	4.3	6.2	5.6
BAR FA 0855	5.2	6.0	6.0	6.1	6.1	5.0	5.2	5.2	6.9	4.0	5.4	5.7	6.5	6.1	5.1	5.4	4.1	5.6	5.6
WXI-208-2	5.3	5.6	5.6	5.5	5.8	4.8	5.5	5.4	6.0	3.1	5.4	5.8	6.6	5.7	5.5	5.4	4.2	5.7	5.6
VIRTUE	5.0	5.9	5.7	5.8	5.9	4.6	6.2	5.4	5.6	3.5	5.3	5.8	6.8	6.1	5.3	5.4	4.3	5.7	5.6
403	4.8	5.0	6.0	6.1	5.8	4.5	5.7	4.9	4.9	3.8	5.6	5.8	6.5	6.0	4.7	5.4	4.3	5.6	5.6
TRAILBLAZER II	4.5	5.4	5.8	5.8	6.0	4.7	5.9	5.6	4.9	3.6	5.5	5.8	7.1	5.9	4.8	5.5	4.3	6.0	5.6
VEGAS	5.2	6.1	5.7	6.3	6.0	4.6	5.8	5.3	5.7	3.2	5.6	5.2	6.7	5.8	5.3	5.5	3.6	6.1	5.6
SR 8300	4.5	5.4	5.9	6.0	6.0	5.0	4.7	4.7	7.1	3.7	5.4	5.9	6.7	6.3	5.4	5.5	4.1	5.6	5.6
SHENANDOAH	4.6	5.7	5.8	5.6	5.8	5.1	5.0	4.6	6.8	4.0	5.5	5.7	6.6	6.3	5.6	5.5	4.0	6.0	5.6
ADOBE (SFL)	4.6	5.4	5.8	5.8	5.6	4.6	5.1	5.2	6.3	3.3	5.5	5.6	6.5	6.3	4.7	5.5	4.6	5.6	5.6
BONSAI PLUS	5.3	5.3	5.6	5.8	5.8	4.4	5.6	5.1	5.3	3.2	5.8	5.7	6.6	6.2	4.8	5.3	4.5	6.0	5.6
PSTF-401	4.3	5.9	5.8	5.8	5.9	4.7	5.1	4.7	5.5	4.4	5.5	5.7	6.4	6.5	4.9	5.2	4.0	5.6	5.6
PST-5PM	4.9	5.1	5.7	5.3	5.8	4.0	6.1	5.9	6.4	3.4	5.5	5.6	6.8	6.1	5.1	5.8	4.2	5.5	5.6
PSTF-LF	4.6	5.7	5.9	5.3	5.6	4.7	5.0	4.8	5.9	3.9	5.4	5.9	6.4	5.3	5.0	4.9	4.0	5.5	5.5
BONANZA II	4.6	5.3	5.9	5.9	5.5	4.7	5.0	4.9	5.2	3.3	5.6	6.1	6.6	6.3	5.3	5.4	3.8	5.7	5.5
BAR FA 2AB	4.8	5.1	5.6	5.5	5.8	5.3	6.1	5.1	4.9	3.4	5.3	4.6	6.9	6.2	5.0	5.2	3.2	5.9	5.5
CAFA101	4.1	6.0	6.0	6.0	5.8	4.4	5.0	5.1	6.6	4.7	5.7	6.1	6.4	5.7	5.3	5.2	4.4	5.8	5.5
FA-22	4.3	5.6	5.9	5.5	5.3	4.4	5.4	5.2	7.0	3.6	5.8	5.9	6.8	6.1	5.0	5.5	3.5	5.8	5.5
ALAMO (J-1048)	5.1	4.9	5.7	5.8	5.8	4.2	5.4	5.0	6.4	2.8	5.6	6.2	6.5	6.3	5.5	5.4	4.1	5.7	5.5
KITTYHAWK	4.8	5.4	6.0	5.8	5.6	4.1	4.6	5.1	6.7	4.0	5.9	6.2	6.3	6.5	4.9	5.4	3.9	6.0	5.5
AUSTIN	4.9	5.0	5.9	5.8	5.7	4.2	5.2	4.9	6.1	3.8	5.4	5.5	6.4	5.9	5.0	5.3	4.0	5.6	5.5
PSTF-200	4.1	5.9	6.1	5.2	5.5	4.7	5.3	4.6	5.8	4.1	5.9	5.7	6.3	5.9	4.9	5.1	3.9	5.4	5.5
FINELAWN 88	4.7	5.1	5.8	5.9	5.5	4.4	4.3	4.5	6.7	3.8	6.0	5.4	6.3	5.8	4.7	5.1	4.0	5.4	5.5
AZTEC	4.5	5.2	5.6	5.8	5.7	4.3	5.5	4.9	6.4	3.6	6.1	6.2	6.8	6.6	5.2	5.7	3.6	5.5	5.5
OLYMPIC II	4.1	6.0	5.9	5.8	5.8	4.4	4.3	4.7	6.3	4.6	6.0	6.0	6.1	5.2	5.1	5.5	4.3	5.8	5.5
MONARCH	4.5	5.1	6.1	5.4	5.3	4.1	5.0	5.1	6.8	3.4	5.2	5.9	6.3	6.0	5.2	5.1	3.9	5.7	5.4
PST-5STB	4.4	5.0	5.6	6.0	5.9	4.9	6.5	4.3	5.8	3.3	5.0	5.2	6.5	5.6	4.5	5.3	3.7	5.5	5.4
BAR FA 214	4.1	5.0	5.6	5.6	5.6	4.5	4.9	4.7	5.9	3.5	5.3	5.3	6.6	6.7	5.3	5.5	3.6	5.6	5.4
BONANZA	4.5	5.8	5.7	5.2	5.6	4.6	4.4	5.0	7.3	3.1	5.4	5.2	6.5	6.3	5.3	5.4	3.8	5.7	5.4
PHOENIX	4.5	5.8	5.9	5.8	5.8	4.0	4.7	4.0	6.3	4.6	5.7	5.6	5.9	5.5	4.9	5.2	3.9	5.6	5.4
CAS-MA21	4.2	4.9	5.6	5.8	5.7	4.4	4.6	4.8	6.7	3.0	5.1	5.3	6.3	6.1	4.9	5.1	4.3	5.8	5.4
BONSAI	4.9	5.3	5.3	5.9	5.6	4.6	5.9	4.5	4.9	2.7	5.2	5.7	6.9	6.0	4.2	5.6	2.8	6.3	5.4
ASTRO 2000	3.8	5.3	5.8	5.7	5.9	4.6	4.5	4.1	5.8	4.3	5.9	5.8	5.9	5.7	4.9	5.0	3.8	5.5	5.3
CAS-LA20	4.3	5.0	5.8	5.8	5.5	4.5	4.8	4.3	6.8	2.9	5.3	5.0	6.2	6.0	4.8	5.5	3.4	5.5	5.3
ARID	3.7	5.3	5.9	5.7	5.7	4.5	3.9	3.7	6.4	4.6	5.7	5.9	5.7	5.5	5.0	5.3	3.9	5.3	5.3
TWILIGHT	5.1	5.1	5.4	6.3	5.8	3.6	4.8	3.9	3.7	3.4	5.2	4.8	6.4	5.8	3.8	4.6	3.8	5.1	5.2
FALCON	3.9	5.5	6.0	5.4	5.7	3.8	3.7	3.5	6.3	4.0	5.6	5.0	5.2	5.6	4.3	4.5	4.3	5.4	5.1
ANTHEM	3.6	5.5	6.0	4.8	5.4	4.1	3.3	3.1	5.3	4.5	5.6	5.7	5.1	5.1	4.2	4.5	3.8	5.3	5.0
KY-31 W/ENDO.	2.5	5.4	5.7	4.6	5.4	3.8	2.6	2.0	5.0	4.9	5.6	5.8	4.1	4.4	3.8	3.7	3.5	4.5	4.5
KY-31 NO ENDO.	3.0	5.1	5.7	4.8	5.5	3.4	2.7	2.1	5.1	4.8	5.5	5.5	4.1	4.2	3.9	3.9	3.7	4.3	4.5
LSD VALUE	0.7	1.1	0.4	0.7	0.7	1.1	0.8	0.7	1.0	0.7	0.6	0.9	0.4	1.1	0.6	0.5	0.8	0.7	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 EQUAL TO OR LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

1991 NATIONAL ZOYSIAGRASS TEST

Entries and Sponsors

Entry No.	Name	Sponsor
1	TC 2033	Turfgrass Germplasm Services Bradenton, FL
2	QT 2047	Quality Turfgrass Houston, TX
3	CD 2013	Crenshaw/Douget Turfgrass Austin, TX
4	TC 5018	Turfgrass Germplasm Services
5	QT 2004	Quality Turfgrass
6	CD 259-13	Crenshaw/Douget Turfgrass
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	DALZ 8514	Texas A&M University
15	DALZ 8512	Texas A&M University
16	DALZ 8516	Texas A&M University
17	DALZ 8507	Texas A&M University
18	DALZ 8508	Texas A&M University
19	DALZ 9006	Texas A&M University
20	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 1A.

MEAN TURFGRASS QUALITY RATINGS OF ZOYSIAGRASS CULTIVARS
GROWN AT TWENTY-TWO LOCATIONS IN THE U.S.
1993 DATA

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

NAME	AL1	AR1	AZ1	CA1	CA2	CA3	GA1	GA2	IL1	IL2	KS2	KY1	MD1	MO1	MS1	NE1	OK1	TX1	TX2	UB1	UB2	VA1	MEAN
DALZ 8507	7.2	8.1	6.2	7.0	6.5	6.4	7.2	4.1	4.5	8.9	8.0	5.7	7.3	6.1	7.3	3.0	6.4	5.4	4.5	6.2	5.8	5.3	6.2
* EMERALD	7.0	7.6	6.1	7.0	6.3	5.9	6.7	3.6	4.3	8.7	8.3	5.0	6.2	6.5	7.4	4.8	6.0	6.2	5.9	6.4	7.0	3.7	6.2
CD 2013	6.9	7.5	5.9	6.3	5.3	5.9	6.9	3.8	5.1	8.8	8.0	4.0	7.0	6.8	6.7	5.6	6.8	5.0	4.9	6.7	5.9	5.0	6.1
TC 2033	6.9	7.0	5.4	6.6	5.9	6.1	6.3	3.8	4.4	8.5	8.3	5.4	7.5	6.3	7.1	4.8	7.1	5.9	5.3	5.6	5.7	4.2	6.1
DALZ 8508	7.0	8.3	5.6	6.8	6.1	6.2	7.1	3.3	3.9	9.0	8.0	4.1	7.0	6.0	7.5	3.5	6.1	5.0	5.5	6.4	6.5	4.8	6.1
DALZ 9006	6.9	7.6	5.9	6.5	6.2	6.3	6.9	3.4	4.2	9.0	7.0	5.7	7.5	5.9	7.4	2.9	5.6	6.0	5.3	6.3	6.1	4.7	6.1
QT 2004	6.8	7.5	6.0	6.1	5.2	5.8	6.8	4.3	4.9	8.8	7.7	3.5	7.0	6.7	6.0	6.3	6.0	5.1	4.6	6.9	6.3	3.9	6.0
SUNBURST	7.0	6.2	6.0	5.2	5.8	5.5	6.8	4.3	5.3	6.4	6.3	5.9	6.7	6.3	5.9	6.4	6.1	4.9	4.9	7.0	6.5	4.8	5.9
DALZ 8514	7.0	5.8	6.0	5.1	6.1	5.8	6.2	5.0	4.8	5.8	8.0	4.9	6.5	5.6	5.9	3.9	6.9	5.5	5.9	5.3	5.3	6.9	5.8
TC 5018	7.0	5.5	5.6	5.1	5.5	5.4	6.0	3.9	5.5	5.5	7.3	6.3	6.7	6.3	5.8	6.2	6.1	5.8	5.1	6.0	6.2	5.1	5.8
DALZ 8512	7.2	5.7	6.1	5.2	6.3	5.9	6.4	4.8	5.7	4.6	7.3	4.8	7.0	5.2	6.1	3.7	6.4	5.4	5.5	5.6	4.9	6.8	5.8
* MEYER	4.8	7.0	5.9	5.9	4.8	5.5	6.5	3.0	4.9	8.2	7.7	4.5	6.8	6.8	5.9	6.7	5.8	4.9	4.8	5.2	6.3	3.5	5.7
* EL TORO	6.9	5.6	6.0	5.3	6.2	5.9	6.1	3.9	5.7	5.5	7.3	4.1	7.0	5.8	5.8	3.2	6.0	5.7	5.2	5.0	5.0	6.6	5.6
* BELAIR	4.5	6.5	5.7	5.2	5.5	5.2	6.3	3.8	5.2	5.4	8.0	5.7	6.2	7.0	5.0	7.4	6.0	3.7	5.2	5.5	6.3	3.5	5.6
CD 259-13	5.9	5.7	5.6	5.4	5.8	5.4	6.6	3.2	5.7	5.3	6.3	5.5	6.3	5.9	5.3	6.1	5.6	4.4	3.9	6.3	6.5	5.2	5.5
DALZ 8516	6.2	6.7	5.6	6.1	4.8	6.0	6.0	4.0	2.6	8.8	8.7	2.6	5.8	5.7	7.0	2.3	6.0	4.4	5.8	5.6	5.1	3.3	5.4
QT 2047	6.7	5.3	5.4	5.0	5.1	4.2	5.8	3.4	5.1	6.5	6.7	5.7	6.2	6.5	5.7	6.5	5.2	5.0	4.3	4.7	5.6	4.1	5.4
TGS-W10	5.8	5.5	6.1	4.3	5.0	5.4	6.1	3.7	5.3	3.7	6.7	6.0	6.0	6.4	5.1	6.7	5.8	4.0	5.3	5.6	6.1	3.7	5.4
TGS-B10	5.9	5.5	5.8	4.4	5.4	5.3	6.0	2.8	5.9	3.0	6.3	5.9	5.8	6.2	4.8	5.8	5.8	4.7	4.6	5.7	5.7	4.3	5.2
DALZ 8502	6.8	5.1	5.5	6.0	6.9	6.1	5.5	3.3	1.4	7.7	7.7	2.0	3.5	3.2	6.8	.	4.9	6.3	6.3	5.1	3.7	1.8	5.0
JZ-1	5.3	5.5	5.6	4.4	5.1	4.8	5.8	3.3	5.3	2.8	5.7	4.9	5.8	5.9	4.4	5.3	5.4	4.6	4.3	4.7	4.5	4.0	4.9
* KOREAN COMMON	5.3	5.0	5.5	4.3	5.0	4.8	5.7	3.7	5.3	2.2	5.3	4.9	5.7	6.1	4.2	4.8	5.9	4.0	4.8	4.9	4.9	3.9	4.8
DALZ 8501	5.8	4.4	4.8	5.7	5.9	4.9	5.7	2.3	1.4	8.5	5.7	1.3	2.7	2.2	6.4	.	5.2	3.9	5.5	3.8	3.1	1.3	4.3
DALZ 8701	6.2	3.9	5.0	4.1	6.6	6.0	5.5	2.7	1.3	8.2	5.7	1.5	1.0	1.0	5.5	.	5.2	5.1	5.7	3.1	1.8	1.0	4.1
LSD VALUE	0.9	1.1	0.5	0.6	0.6	0.5	0.7	1.8	0.7	0.5	1.6	2.0	0.8	0.8	0.6	1.2	0.9	1.6	0.8	0.6	0.9	1.5	0.2

* COMMERCIALLY AVAILABLE IN THE USA IN 1994

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

TABLE 4A.

GENETIC COLOR RATINGS OF ZOYSIAGRASS CULTIVARS
1993 DATA

GENETIC COLOR RATINGS 1-9; 9=DARK GREEN 1/

NAME	AR1	AZ1	CA1	CA2	ID2	IL1	KY1	MO1	NE1	OK1	TX1	TX2	MEAN
DALZ 8516	8.3	7.7	7.0	8.0	7.0	6.3	5.7	5.3	7.0	8.3	8.3	5.7	7.1
BELAIR	9.0	8.0	6.0	8.0	5.3	7.0	6.7	5.3	6.7	9.0	7.0	5.7	7.0
EMERALD	7.0	7.0	7.3	7.0	6.0	6.7	6.3	5.0	7.0	9.0	8.0	6.3	6.9
TC 2033	7.3	6.3	6.7	7.0	7.0	7.0	6.0	5.0	7.3	9.0	7.7	5.3	6.8
DALZ 8508	7.3	7.0	7.3	7.3	5.7	6.7	6.7	5.0	6.5	8.3	7.7	5.3	6.7
MEYER	7.7	7.0	6.3	7.3	6.7	6.7	6.3	5.0	6.7	8.7	7.3	4.7	6.7
DALZ 9006	7.3	6.3	7.3	7.7	6.7	6.3	6.3	4.3	7.0	7.7	8.0	5.0	6.7
DALZ 8514	5.3	7.0	6.3	7.0	7.3	6.3	4.3	5.0	7.0	8.3	6.0	6.0	6.3
DALZ 8502	7.0	7.0	7.0	7.3	6.0	3.0	4.0	5.7	.	8.7	8.0	6.0	6.3
DALZ 8512	5.7	7.0	6.0	7.0	6.7	6.3	3.7	5.7	7.0	8.7	5.7	5.7	6.3
EL TORO	6.0	7.0	5.7	7.7	6.0	6.3	4.7	5.7	7.0	7.7	6.0	5.3	6.3
TGS-W10	8.0	7.3	5.0	7.0	5.3	6.0	4.7	4.7	6.0	7.7	7.3	5.0	6.2
DALZ 8507	7.3	7.0	6.7	7.0	6.0	5.0	5.0	5.3	6.0	8.3	5.7	3.3	6.1
QT 2004	6.7	6.7	6.3	6.7	5.7	6.0	4.0	5.7	6.0	7.7	6.7	4.7	6.1
TC 5018	7.0	6.3	5.7	7.3	6.0	5.7	4.7	3.7	6.3	8.0	6.7	5.0	6.0
TGS-B10	7.3	7.0	4.7	7.0	6.0	6.3	4.3	3.3	6.0	8.3	6.7	4.7	6.0
CD 259-13	7.0	6.3	6.0	7.3	5.3	6.0	3.0	3.7	5.7	7.7	7.0	4.7	5.8
SUNBURST	6.7	6.7	5.7	6.3	5.7	6.0	3.3	5.0	5.3	8.0	5.7	5.0	5.8
CD 2013	7.0	6.7	7.0	5.3	5.0	6.0	4.0	4.7	6.0	7.0	6.3	4.0	5.8
DALZ 8701	8.3	7.0	6.0	7.0	5.7	2.0	5.0	1.0	.	9.0	6.0	5.7	5.7
DALZ 8501	7.3	6.3	6.3	6.7	4.3	3.0	3.5	5.7	.	8.3	5.3	5.3	5.7
JZ-1	6.3	6.3	5.0	6.0	5.7	6.3	3.7	4.0	6.0	7.3	6.7	4.3	5.6
KOREAN COMMON	6.0	6.0	5.7	6.0	5.3	5.7	3.0	4.0	5.3	7.3	6.0	4.7	5.4
QT 2047	6.3	6.0	5.0	7.0	4.7	5.7	3.3	3.0	5.7	7.3	6.7	4.0	5.4
LSD VALUE	1.4	0.6	1.3	1.2	1.5	1.4	1.4	0.8	1.0	0.8	1.4	1.0	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 EQUAL TO OR LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

TABLE 6A. LEAF TEXTURE RATINGS OF ZOYSIAGRASS CULTIVARS
1993 DATA

LEAF TEXTURE RATINGS 1-9; 9=VERY FINE 1/

NAME	AR1	CA1	KY1	OK1	MEAN
DALZ 8508	8.7	9.0	8.3	9.0	8.8
DALZ 9006	8.3	9.0	8.0	9.0	8.6
DALZ 8507	9.0	9.0	7.0	9.0	8.5
EMERALD	8.0	9.0	7.3	9.0	8.3
DALZ 8501	6.7	9.0	8.5	9.0	8.3
QT 2004	7.3	8.3	7.5	8.7	8.0
TC 2033	7.3	8.0	7.0	8.0	7.6
CD 2013	6.7	7.3	7.0	8.3	7.3
DALZ 8502	7.0	9.0	4.0	9.0	7.3
DALZ 8516	7.3	6.0	7.3	7.7	7.1
MEYER	6.3	5.7	7.0	8.0	6.8
DALZ 8701	5.0	7.7	3.0	9.0	6.2
QT 2047	5.0	6.0	4.3	6.7	5.5
CD 259-13	5.0	6.0	4.3	6.0	5.3
SUNBURST	5.3	5.3	4.3	6.3	5.3
BELAIR	5.3	5.3	4.0	6.3	5.3
DALZ 8514	4.7	5.7	4.0	6.3	5.2
TC 5018	5.3	5.3	4.0	6.0	5.2
DALZ 8512	4.0	5.3	4.0	6.0	4.8
TGS-W10	4.0	4.3	4.0	7.0	4.8
EL TORO	3.7	5.3	4.0	6.0	4.8
TGS-B10	4.3	4.3	3.7	6.0	4.6
KOREAN COMMON	4.3	4.0	2.3	6.0	4.2
JZ-1	3.3	4.0	3.0	6.0	4.1
LSD VALUE	1.2	0.8	0.7	0.8	0.5

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

TABLE 24A. SCALPING (APRIL) RATINGS OF ZOYSIAGRASS CULTIVARS
1993 DATA

SCALPING RATINGS 1-9; 9=NONE 1/

NAME	CA3
BELAIR	9.0
CD 2013	9.0
CD 259-13	9.0
DALZ 8507	9.0
DALZ 8508	9.0
DALZ 8512	9.0
DALZ 8514	9.0
DALZ 8516	9.0
EL TORO	9.0
EMERALD	9.0
JZ-1	9.0
KOREAN COMMON	9.0
MEYER	9.0
QT 2004	9.0
SUNBURST	9.0
TC 2033	9.0
TC 5018	9.0
TGS-B10	9.0
TGS-W10	9.0
DALZ 8502	8.7
DALZ 8701	8.7
DALZ 9006	8.7
DALZ 8501	4.3
QT 2047	4.0
LSD VALUE	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 EQUAL TO OR LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

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/Farmers Mkt. Corp.
6	FMC 2-90	Farmers Marketing Corp.
7	FMC 3-91	Farmers Marketing Corp.
8	FMC 5-91	Farmers Marketing Corp.
9	Sultan (FMC 6-91)	Farmers Marketing Corp.
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	Farmers Marketing Corp. (Standard Entry)
16	Guymon	Oklahoma State University (Standard Entry)

Vegetative Entries

Entry #	Name	Sponsor
17	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	TDS-BM1	Turfgrass Development Systems

TABLE 1B.

MEAN TURFGRASS QUALITY RATINGS OF BERMUDAGRASS (SEEDED) CULTIVARS
GROWN AT TWENTY-ONE LOCATIONS IN THE U.S.
1993 DATA

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

NAME	AL1	AR1	AZ1	CA2	CA3	FL1	GA1	GA2	IL2	KS2	KY1	LA2	MO2	MS1	NE1	OK1	TX1	TX2	UB1	VA1	VA4	MEAN
OKS 91-11	6.3	7.3	6.8	5.4	6.0	5.5	5.3	5.0	5.5	7.2	5.7	4.8	3.8	4.6	6.5	6.0	5.7	4.2	6.2	4.9	5.1	5.6
JACKPOT (J-912)	6.6	7.3	5.4	5.4	5.4	5.5	5.6	4.8	5.2	7.0	5.0	5.4	3.2	5.0	4.8	7.0	5.8	5.1	6.5	5.8	5.4	5.6
SULTAN (FMC 6-91)	6.3	7.4	5.7	5.2	5.4	6.0	5.8	5.6	5.7	7.1	4.9	5.2	2.2	5.1	5.5	5.7	5.8	4.7	6.2	5.0	5.6	5.5
J-27	5.8	6.5	6.4	5.3	5.6	5.1	5.2	4.8	4.0	7.8	6.3	5.2	4.4	4.7	5.5	5.3	5.8	5.4	5.5	5.4	5.0	5.5
MIRAGE (90173)	6.2	5.8	6.0	5.2	5.4	5.9	5.8	5.2	3.8	7.3	5.9	5.5	4.3	5.0	5.0	6.0	5.6	5.1	6.0	4.8	5.1	5.5
FMC 5-91	5.9	6.8	5.3	5.3	5.5	5.4	5.8	5.1	5.5	7.1	4.9	4.8	2.8	4.9	5.0	7.0	5.8	4.8	4.8	4.8	5.0	5.4
FMC 2-90	6.0	6.8	4.9	5.1	5.3	5.8	6.0	5.2	4.7	6.8	5.0	5.0	2.3	4.8	5.0	6.3	4.9	4.7	6.0	4.5	4.8	5.2
GUYMON	5.8	6.0	6.1	5.3	5.4	4.9	5.9	4.8	2.4	7.3	5.5	5.2	4.6	4.6	4.7	6.3	5.8	4.7	4.7	5.0	4.8	5.2
OKS 91-1	6.1	6.3	5.2	4.8	5.1	5.7	5.8	5.2	4.8	6.6	4.7	4.7	3.1	4.9	.	6.0	5.0	4.9	5.5	4.6	4.7	5.2
FMC 3-91	5.7	5.7	5.8	4.9	5.4	5.5	5.6	5.0	4.6	6.3	4.7	5.3	2.1	4.6	5.0	6.0	5.5	4.9	5.7	4.3	5.1	5.1
NUMEX-SAHARA	6.2	6.1	5.8	4.9	5.3	5.6	5.6	5.1	5.0	6.2	4.8	5.2	1.9	4.6	4.8	6.0	5.2	4.3	5.5	4.0	4.8	5.1
SUNDEVIL	6.0	5.8	5.4	5.1	5.3	5.6	5.7	5.3	4.4	6.6	4.9	4.6	2.9	4.8	4.5	6.3	5.1	4.5	5.5	4.1	4.8	5.1
SONESTA	5.7	5.8	5.7	5.0	5.2	5.9	5.4	4.3	5.2	6.3	4.3	5.0	2.0	4.8	5.3	6.3	5.2	4.7	5.2	4.2	4.5	5.0
PRIMAVERA (FMC 1-90)	5.4	5.8	4.8	4.9	5.3	5.1	5.5	5.1	4.5	6.1	4.5	4.6	1.9	4.6	5.3	6.3	4.9	4.9	5.2	4.2	4.7	4.9
CHEYENNE	5.2	5.8	5.2	4.9	5.2	5.4	5.7	4.5	4.3	5.4	3.9	4.3	2.6	4.8	.	6.0	4.8	4.5	6.0	3.5	4.3	4.8
ARIZONA COMMON-SEED	5.5	5.3	5.1	4.7	5.1	5.5	5.6	5.3	4.1	6.2	3.8	4.4	2.8	4.7	4.5	6.0	4.7	4.1	5.5	3.2	4.3	4.8
LSD VALUE	0.6	0.8	1.0	0.2	0.3	0.5	0.9	0.8	1.1	0.8	0.5	0.5	1.5	0.4	1.3	0.9	0.5	0.6	0.5	1.0	0.5	0.2

TABLE 1C.

MEAN TURFGRASS QUALITY RATINGS OF BERMUDAGRASS (VEGETATIVE) CULTIVARS
GROWN AT TWENTY-ONE LOCATIONS IN THE U.S.
1993 DATA

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

NAME	AL1	AR1	AZ1	CA2	CA3	FL1	GA1	GA2	IL2	KS2	KY1	LA2	MO2	MS1	NE1	OK1	TX1	TX2	UB1	VA1	VA4	MEAN
TDS-BM1	7.5	8.7	6.4	6.1	6.6	7.0	6.7	6.2	8.2	7.8	6.3	7.2	5.2	7.0	8.0	7.7	6.3	5.9	7.7	6.8	6.7	7.0
TIFGREEN	7.4	8.6	6.6	6.2	6.0	6.4	6.4	6.4	7.8	7.6	6.2	7.3	5.3	6.9	7.8	7.0	6.5	5.2	7.8	6.9	6.8	6.8
TIFWAY	7.0	7.5	7.0	6.3	6.6	6.6	6.7	5.7	7.7	8.6	6.1	7.1	3.0	7.3	5.0	6.7	6.2	6.0	6.7	7.0	6.8	6.5
MIDIRON	7.0	7.4	6.0	5.4	6.1	6.6	6.2	5.4	7.1	7.9	5.6	7.1	4.8	5.9	6.7	6.0	6.4	5.8	6.3	6.0	6.3	6.3
MIDLAWN	6.8	7.6	6.3	5.6	5.9	5.0	5.6	5.5	7.4	7.4	5.0	6.4	4.8	6.0	7.2	7.0	6.6	5.3	6.3	6.5	5.7	6.2
MIDFIELD	6.3	6.5	6.5	5.8	5.9	6.0	5.6	5.5	7.4	8.0	5.9	6.8	5.5	5.9	6.0	6.7	6.5	5.1	5.5	5.8	5.1	6.1
STF-1	6.6	7.3	5.8	5.9	5.5	5.7	6.1	4.9	5.9	7.8	5.5	6.4	5.0	5.8	6.5	6.7	6.6	5.7	6.5	5.6	5.4	6.1
TEXTURF 10	6.7	7.5	5.2	6.3	6.0	6.0	6.2	5.4	6.0	7.4	5.8	6.1	4.5	5.6	6.0	6.7	6.4	5.4	6.2	5.6	5.5	6.0
FHB-135	6.3	4.3	6.0	5.1	5.4	6.9	6.3	5.1	8.3	6.4	5.8	6.3	2.5	6.7	5.0	5.0	5.2	5.2	6.2	5.0	6.7	5.7
ARIZONA COMMON-VEG.	5.1	5.5	3.8	4.8	4.4	5.0	4.8	4.9	3.8	5.6	4.2	5.0	3.1	4.9	.	6.3	5.0	4.2	5.2	3.9	3.8	4.7
LSD VALUE	0.7	1.2	0.8	0.4	0.5	0.8	0.8	0.5	0.5	0.6	0.5	0.4	1.0	0.4	0.9	1.3	0.5	0.9	0.4	0.6	0.7	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 EQUAL TO OR LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

TABLE 4A.

GENETIC COLOR RATINGS OF BERMUDAGRASS CULTIVARS
1993 DATA

GENETIC COLOR RATINGS 1-9; 9=DARK GREEN 1/

NAME	AL1	AR1	AZ1	CA2	CA3	GA1	GA2	KY1	MO2	NE1	TX1	TX2	VA1	MEAN
TIFWAY	6.7	8.7	7.7	8.3	8.0	6.3	6.0	6.7	6.0	6.5	8.0	5.7	8.3	7.1
FHB-135	7.0	9.0	9.0	8.0	8.3	7.0	4.0	6.0	3.7	6.0	7.3	5.3	9.0	6.9
TEXTURF 10	6.7	8.3	7.3	8.3	7.7	6.0	5.3	6.3	4.7	7.0	7.7	5.7	7.7	6.8
TDS-BM1	7.0	8.7	7.3	8.0	8.0	7.0	6.7	4.0	5.3	5.7	8.7	5.7	5.7	6.7
OKS 91-11	6.0	8.0	8.7	8.0	7.0	6.7	4.7	5.0	4.3	6.7	8.0	6.0	7.7	6.7
MIDIRON	6.7	8.3	7.0	7.0	7.3	5.7	5.3	5.7	5.0	6.0	8.3	6.0	7.0	6.6
TIFGREEN	7.0	8.3	6.7	7.0	8.0	5.3	6.7	4.0	5.0	6.0	8.3	6.3	5.7	6.5
STF-1	6.0	6.3	6.0	7.0	7.0	6.3	5.0	6.7	5.0	5.0	8.3	6.0	6.3	6.2
J-27	5.3	6.3	7.3	7.0	7.0	6.3	4.3	5.3	5.3	5.5	7.7	5.7	6.3	6.1
MIDLAWN	5.3	7.0	6.0	6.7	7.3	6.0	5.7	6.0	4.0	6.0	7.7	5.7	6.0	6.1
JACKPOT (J-912)	6.0	7.0	7.0	7.0	7.0	6.3	4.3	3.7	4.3	6.0	7.3	5.7	7.0	6.1
GUYMON	6.7	6.0	7.7	6.7	7.0	6.0	5.0	4.0	4.7	5.7	7.3	6.0	5.7	6.0
NUMEX-SAHARA	6.0	7.0	6.3	7.0	7.0	6.3	5.0	4.0	5.0	6.5	6.7	5.3	5.7	6.0
MIRAGE (90173)	6.0	6.3	7.3	7.0	6.7	6.0	5.3	4.3	5.3	4.7	7.0	6.0	5.7	6.0
FMC 5-91	5.7	7.3	6.3	6.7	6.7	6.3	4.7	4.0	4.7	5.5	7.0	5.7	6.7	5.9
MIDFIELD	5.3	5.7	6.3	6.3	7.0	5.3	5.0	5.3	5.3	6.0	8.7	5.7	5.0	5.9
SULTAN (FMC 6-91)	5.7	7.0	6.7	6.7	6.7	6.0	5.3	4.0	3.7	6.0	7.3	6.0	6.0	5.9
SONESTA	5.7	6.7	6.3	7.0	6.3	6.0	4.3	4.0	5.0	5.5	7.0	5.7	6.3	5.8
FMC 2-90	5.7	7.3	6.3	7.3	7.0	5.7	4.7	4.0	3.3	6.0	7.0	6.0	5.3	5.8
SUNDEVIL	6.0	5.3	6.3	7.0	7.0	6.0	5.0	4.7	5.3	4.0	7.0	5.3	5.3	5.7
OKS 91-1	5.3	5.7	5.7	7.0	6.7	6.0	5.3	3.3	5.3	.	6.3	5.7	5.7	5.7
ARIZONA COMMON-SEED	5.7	5.0	6.7	6.7	5.7	6.3	5.0	4.0	5.7	6.0	6.3	5.3	3.7	5.5
FMC 3-91	5.7	5.3	6.0	7.0	7.0	6.0	4.7	4.0	3.3	6.0	7.0	5.0	5.0	5.5
PRIMAVERA (FMC 1-90)	5.3	5.7	5.7	6.7	6.7	6.0	4.7	4.0	4.0	5.0	7.0	5.0	4.3	5.4
CHEYENNE	5.0	6.0	6.0	6.7	6.0	5.0	4.0	3.7	5.3	.	7.3	5.3	3.3	5.3
ARIZONA COMMON-VEG.	5.3	5.0	5.3	7.0	6.0	5.7	4.7	3.0	5.3	.	7.7	5.0	3.0	5.3
LSD VALUE	1.1	1.3	1.1	0.8	0.8	1.3	1.1	1.0	1.8	1.5	0.9	0.9	1.8	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 EQUAL TO OR LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

TABLE 6B. LEAF TEXTURE RATINGS OF BERMUDAGRASS (SEEDED) CULTIVARS
1993 DATA

LEAF TEXTURE RATINGS 1-9; 9=VERY FINE 1/

NAME	AZ1	IL2	KY1	TX1	VA1	MEAN
JACKPOT (J-912)	5.7	6.3	4.7	7.0	6.0	5.9
OKS 91-11	5.7	5.7	5.0	7.0	5.7	5.8
SULTAN (FMC 6-91)	6.0	5.7	5.0	7.0	5.3	5.8
FMC 5-91	5.7	5.7	4.7	7.0	5.3	5.7
SONESTA	6.7	5.0	4.7	7.0	4.0	5.5
OKS 91-1	5.3	5.0	4.7	7.0	4.3	5.3
FMC 3-91	6.3	4.0	4.7	7.0	4.0	5.2
FMC 2-90	5.0	4.0	4.7	7.0	4.7	5.1
PRIMAVERA (FMC 1-90)	5.3	3.3	5.0	7.0	4.0	4.9
CHEYENNE	5.0	4.0	4.7	7.0	3.0	4.7
NUMEX-SAHARA	5.7	4.3	4.3	7.0	2.3	4.7
MIRAGE (90173)	5.0	3.3	3.0	7.0	4.0	4.5
SUNDEVIL	5.3	4.0	4.0	6.0	3.0	4.5
J-27	4.3	3.7	3.3	7.0	3.7	4.4
ARIZONA COMMON-SEED	5.3	3.3	4.3	7.0	1.3	4.3
GUYMON	4.0	4.0	3.0	7.0	2.3	4.1
LSD VALUE	1.3	2.0	0.7	0.7	2.0	0.7

TABLE 6C. LEAF TEXTURE RATINGS OF BERMUDAGRASS (VEGETATIVE) CULTIVARS
1993 DATA

LEAF TEXTURE RATINGS 1-9; 9=VERY FINE 1/

NAME	AZ1	IL2	KY1	TX1	VA1	MEAN
FHB-135	8.0	9.0	9.0	9.0	8.3	8.7
TIFGREEN	8.3	9.0	7.3	9.0	8.7	8.5
TDS-BM1	8.3	9.0	6.3	9.0	9.0	8.3
TIFWAY	8.7	8.0	7.0	8.3	8.3	8.1
MIDLAWN	8.0	8.0	5.7	9.0	7.0	7.5
MIDIRON	6.7	6.7	5.3	7.7	7.3	6.7
MIDFIELD	7.0	6.0	4.3	8.3	5.3	6.2
STF-1	6.3	5.7	5.0	7.7	6.0	6.1
TEXTURF 10	5.3	6.0	4.3	7.7	6.3	5.9
ARIZONA COMMON-VEG.	4.0	3.0	3.3	7.0	3.0	4.1
LSD VALUE	0.7	1.1	0.9	1.3	1.2	0.5

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

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	" " "
5	NE 84-436	" " "
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	NTDG-1	Native Turf Development Group
15	NTDG-2	" " " "
16	NTDG-3	" " " "
17	NTDG-4	" " " "
18	NTDG-5	" " " "
19	Bison	" " " "
20	Top Gun (BAM101)	Bamert Seed Co.
21	Plains (BAM202)	" " "
22	Texoka	-

Seeded Entries: 12-22

TABLE 1B.

MEAN TURFGRASS QUALITY RATINGS OF BUFFALOGRASS (SEEDED) CULTIVARS
GROWN AT NINETEEN LOCATIONS IN THE U.S.
1993 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
NTDG-5	5.7	6.4	5.6	4.7	4.9	6.6	6.7	7.2	7.1	6.2	5.3	3.5	5.8	6.7	5.8	4.9	5.8	3.8	5.9	5.7
NTDG-4	5.3	6.5	5.8	4.8	4.7	6.6	6.3	7.5	7.1	4.6	5.8	4.8	5.5	6.9	5.6	4.6	5.7	4.6	5.9	5.7
NTDG-2	6.8	6.7	5.5	4.8	4.5	6.7	6.4	7.3	6.9	5.4	4.4	3.1	6.0	6.8	5.7	4.7	5.5	5.0	5.7	5.7
NTDG-1	3.8	6.2	5.6	4.6	4.5	7.2	6.3	7.5	7.5	4.9	5.4	3.8	5.7	6.6	5.8	4.7	5.6	4.4	5.9	5.6
NTDG-3	1.7	6.3	5.5	4.9	4.9	7.3	6.1	6.9	7.2	5.9	5.7	3.6	5.8	6.7	5.9	4.6	6.0	4.2	5.5	5.5
RUTGERS	6.3	6.3	5.8	5.8	2.4	6.3	5.6	7.5	7.3	4.6	6.0	4.7	2.8	7.3	5.9	5.0	4.5	1.4	6.8	5.4
TOP GUN (BAM 101)	4.0	6.4	5.4	4.8	4.3	4.9	6.1	7.5	7.6	5.2	5.4	4.4	5.4	7.0	5.6	4.9	4.9	3.4	4.8	5.4
TEXOKA	4.5	6.0	5.4	4.5	3.7	7.3	6.1	7.5	7.4	5.7	3.6	3.9	5.3	7.2	5.3	5.4	5.2	1.6	5.6	5.3
SHARPS IMPROVED	3.5	6.5	5.7	4.7	4.4	5.3	5.7	7.6	7.4	5.6	4.3	4.0	5.2	7.2	5.5	4.4	5.5	2.9	5.6	5.3
PLAINS (BAM 202)	4.5	6.2	5.5	4.6	4.3	3.6	5.6	7.7	7.7	4.5	4.3	3.2	5.2	6.6	5.7	4.7	4.9	2.9	5.9	5.1
BISON	3.8	6.4	5.8	4.5	3.8	3.9	5.7	7.8	7.7	5.2	2.8	3.0	5.0	6.9	5.3	4.4	5.0	3.8	5.9	5.1
LSD VALUE	1.8	0.5	0.5	0.4	1.0	1.2	0.5	0.7	0.7	1.1	1.4	1.0	0.7	0.4	0.7	0.5	0.5	1.1	1.0	0.2

TABLE 1C.

MEAN TURFGRASS QUALITY RATINGS OF BUFFALOGRASS (VEGETATIVE) CULTIVARS
GROWN AT NINETEEN LOCATIONS IN THE U.S.
1993 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
609 (NE 84-609)	4.7	7.0	5.9	4.6	4.8	5.0	6.4	8.8	8.7	4.1	7.4	5.1	5.8	7.1	6.7	5.4	4.6	3.3	6.5	5.9
315 (NE 84-315)	5.8	6.5	5.7	5.1	5.2	6.4	5.9	6.8	6.8	5.1	7.4	3.4	6.7	7.0	5.7	4.8	5.8	4.2	5.5	5.8
BUFFALAWN	6.2	6.5	6.5	6.1	2.7	7.3	5.9	7.3	7.5	5.1	5.8	5.6	4.1	7.2	6.2	5.0	5.9	2.1	6.5	5.8
NE 85-378	5.0	6.1	5.6	4.8	4.9	6.5	6.1	6.8	7.1	5.2	6.2	4.1	7.2	6.7	6.0	4.9	6.5	4.2	5.5	5.8
NE 84-436	4.3	6.5	5.4	4.8	4.7	7.0	6.0	6.4	6.6	5.3	5.8	3.9	6.6	7.1	6.3	5.1	7.1	4.9	4.7	5.7
AZ 143	4.8	6.2	5.6	5.1	4.5	6.8	5.3	5.7	5.5	5.2	6.2	4.0	6.7	6.7	6.0	4.6	5.9	5.1	5.5	5.6
PRAIRIE	3.0	6.6	6.2	5.6	4.3	6.4	5.8	7.4	7.6	4.5	7.6	3.1	5.1	6.8	6.5	4.6	5.2	2.9	6.1	5.5
HIGHLIGHT 4	4.2	6.5	5.7	5.7	1.7	6.6	5.0	6.9	7.2	4.6	7.4	4.1	3.4	6.8	6.4	5.4	4.8	2.4	6.2	5.3
HIGHLIGHT 25	4.8	6.2	6.4	5.8	2.1	7.1	5.3	6.5	6.2	4.2	6.6	5.2	3.0	7.2	6.1	5.1	4.8	2.6	5.7	5.3
HIGHLIGHT 15	3.7	6.3	6.0	5.8	2.3	6.9	5.7	7.3	7.2	4.8	5.8	4.4	2.9	7.1	5.8	5.1	4.0	2.8	6.7	5.3
NE 84-45-3	3.5	5.9	5.3	4.5	3.6	5.7	5.6	7.0	7.0	4.1	5.6	4.0	5.8	6.4	5.2	4.2	5.5	2.1	4.5	5.0
LSD VALUE	2.2	0.6	0.6	0.3	1.0	1.6	1.0	0.8	0.5	1.5	1.6	1.7	0.6	0.7	0.5	0.6	0.5	1.1	1.1	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 EQUAL TO OR LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

TABLE 4A. GENETIC COLOR RATINGS OF BUFFALOGRASS CULTIVARS
1993 DATA

GENETIC COLOR RATINGS 1-9; 9=DARK GREEN 1/

NAME	AR1	AZ1	CA1	IL1	IL2	KS1	MO1	MO2	NE1	TX1	TX4	MEAN
609 (NE 84-609)	8.0	8.0	6.3	5.3	8.7	7.7	7.0	8.0	6.3	8.0	4.7	7.1
TEXOKA	7.3	8.0	6.0	4.7	8.3	7.3	8.0	7.3	4.7	8.0	4.0	6.7
PLAINS (BAM 202)	7.3	8.0	6.0	5.0	9.0	7.7	8.0	4.7	5.7	8.0	4.0	6.7
NE 85-378	8.7	8.0	5.7	5.0	9.0	8.3	7.7	3.0	5.3	7.7	4.0	6.6
BISON	7.3	8.0	6.0	4.7	9.0	8.0	7.7	4.0	6.0	7.7	3.7	6.5
315 (NE 84-315)	7.7	8.0	5.7	5.7	8.3	7.0	8.0	4.0	5.0	7.7	4.0	6.5
NTDG-2	7.7	8.0	6.0	5.0	8.3	6.7	7.7	4.3	5.7	8.0	3.7	6.5
NTDG-4	7.3	8.0	6.0	5.0	7.3	7.3	7.7	5.3	5.3	7.7	4.0	6.5
NTDG-1	7.3	8.0	6.0	4.7	8.0	8.0	7.5	3.7	5.3	8.0	3.7	6.4
NE 84-436	7.3	8.0	6.3	4.7	8.0	7.3	7.7	3.7	4.7	8.0	4.0	6.3
NTDG-3	6.7	8.0	5.7	5.0	7.7	7.7	7.3	4.3	5.0	8.0	4.0	6.3
TOP GUN (BAM 101)	6.3	8.0	6.0	5.0	7.3	7.7	7.3	5.0	5.0	7.7	4.0	6.3
NTDG-5	7.3	8.0	6.0	4.3	7.0	8.0	7.3	4.0	5.0	8.0	4.0	6.3
AZ 143	6.0	8.0	6.0	5.0	7.7	7.3	7.7	3.3	5.7	8.0	3.7	6.2
NE 84-45-3	7.0	7.7	5.7	5.0	7.7	7.7	7.5	3.7	5.3	8.0	3.0	6.2
SHARPS IMPROVED	6.3	7.7	6.0	4.7	7.7	7.7	7.0	4.3	5.0	8.0	3.7	6.2
PRAIRIE	5.0	8.0	6.3	4.0	4.7	7.0	7.0	7.7	5.0	7.3	4.0	6.0
BUFFALAWN	6.0	7.0	6.3	4.0	3.0	7.3	5.7	7.3	5.3	6.7	3.7	5.7
HIGHLIGHT 4	5.0	7.7	6.7	1.0	3.0	6.3	6.3	8.0	5.7	6.7	4.0	5.5
RUTGERS	5.3	7.0	5.7	4.0	2.0	6.7	5.7	6.7	5.0	6.7	4.0	5.3
HIGHLIGHT 15	5.3	7.0	6.0	4.0	1.7	6.3	5.7	6.3	5.3	6.0	4.7	5.3
HIGHLIGHT 25	5.0	7.0	5.3	4.3	1.0	6.3	5.3	6.3	5.7	6.3	3.7	5.1
LSD VALUE	1.2	0.3	0.7	0.7	1.2	1.1	0.9	1.7	1.0	0.6	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 EQUAL TO OR LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

TABLE 6B. LEAF TEXTURE RATINGS OF BUFFALOGRASS (SEEDED) CULTIVARS
1993 DATA

LEAF TEXTURE RATINGS 1-9; 9=VERY FINE 1/

NAME	CA1	MO1	OK1	MEAN
RUTGERS	6.7	7.3	9.0	7.7
NTDG-1	7.0	8.0	7.7	7.6
TEXOKA	6.0	8.0	8.0	7.3
NTDG-5	6.0	8.0	7.7	7.2
NTDG-3	6.3	8.0	7.3	7.2
SHARPS IMPROVED	5.7	7.7	8.0	7.1
TOP GUN (BAM 101)	5.7	7.7	8.0	7.1
BISON	6.3	7.3	7.7	7.1
NTDG-2	6.3	7.3	7.7	7.1
NTDG-4	5.7	7.0	8.0	6.9
PLAINS (BAM 202)	5.7	7.3	7.7	6.9
LSD VALUE	1.7	0.7	0.7	0.6

TABLE 6C. LEAF TEXTURE RATINGS OF BUFFALOGRASS (VEGETATIVE) CULTIVARS
1993 DATA

LEAF TEXTURE RATINGS 1-9; 9=VERY FINE 1/

NAME	CA1	MO1	OK1	MEAN
HIGHLIGHT 15	7.3	7.7	9.0	8.0
BUFFALAWN	7.0	7.7	9.0	7.9
HIGHLIGHT 25	7.0	7.7	9.0	7.9
HIGHLIGHT 4	6.7	8.0	9.0	7.9
AZ 143	6.3	8.0	8.0	7.4
NE 85-378	6.3	8.0	8.0	7.4
NE 84-45-3	6.3	7.5	8.3	7.4
315 (NE 84-315)	6.0	8.0	8.0	7.3
NE 84-436	6.0	7.7	8.0	7.2
PRAIRIE	6.7	7.0	8.0	7.2
609 (NE 84-609)	5.7	7.0	8.0	6.9
LSD VALUE	1.5	0.7	0.3	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 EQUAL TO OR LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

TABLE 23A. FALL COLOR (NOVEMBER) RATINGS OF BUFFALOGRASS CULTIVARS
1993 DATA

FALL COLOR RATINGS 1-9; 9=COMPLETE COLOR RETENTION 1/

NAME	CA3	MS1	OK1	UB1	MEAN
609 (NE 84-609)	8.0	6.0	6.7	6.0	6.7
HIGHLIGHT 15	7.3	4.7	6.7	4.3	5.8
HIGHLIGHT 4	7.0	4.7	6.3	4.3	5.6
PRAIRIE	7.0	3.7	5.7	6.0	5.6
HIGHLIGHT 25	7.7	4.0	6.0	4.3	5.5
RUTGERS	6.3	4.7	6.0	4.7	5.4
BUFFALAWN	6.7	4.0	6.0	4.7	5.3
BISON	4.0	3.7	6.0	3.0	4.2
PLAINS (BAM 202)	3.3	3.7	5.0	3.0	3.8
NTDG-4	3.3	4.0	5.0	1.7	3.5
SHARPS IMPROVED	3.3	3.3	4.7	2.7	3.5
TEXOKA	2.7	4.0	5.0	2.0	3.4
TOP GUN (BAM 101)	2.7	3.7	4.0	2.7	3.3
NTDG-1	2.3	3.3	4.3	2.0	3.0
NTDG-3	2.3	3.3	4.3	2.0	3.0
NTDG-2	2.0	3.3	4.0	2.0	2.8
NTDG-5	2.0	3.0	4.0	2.0	2.8
NE 84-436	1.7	3.3	4.0	1.3	2.6
315 (NE 84-315)	1.7	3.0	4.0	1.0	2.4
NE 85-378	1.7	2.7	4.0	1.3	2.4
AZ 143	1.0	3.0	4.0	1.0	2.3
NE 84-45-3	1.0	3.0	4.0	1.0	2.3
LSD VALUE	1.3	1.3	0.7	0.6	0.5

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

TABLE 31A. HERBICIDE INJURY RATINGS OF BUFFALOGRASS CULTIVARS 1/
1993 DATA

HERBICIDE INJURY RATINGS 1-9; 9=NO INJURY 2/

NAME	AR1	MEAN
HIGHLIGHT 25	5.7	5.7
HIGHLIGHT 4	5.7	5.7
NE 84-45-3	5.0	5.0
NE 84-436	4.3	4.3
AZ 143	4.0	4.0
HIGHLIGHT 15	4.0	4.0
RUTGERS	4.0	4.0
609 (NE 84-609)	3.7	3.7
BUFFALAWN	3.7	3.7
NTDG-4	3.7	3.7
315 (NE 84-315)	3.3	3.3
PLAINS (BAM 202)	3.3	3.3
TOP GUN (BAM 101)	3.3	3.3
BISON	3.0	3.0
TEXOKA	3.0	3.0
NE 85-378	2.7	2.7
PRAIRIE	2.7	2.7
SHARPS IMPROVED	2.3	2.3
NTDG-1	2.0	2.0
NTDG-5	2.0	2.0
NTDG-2	1.7	1.7
LSD VALUE	2.3	2.3

1/ HERBICIDE APPLIED WAS A MIXTURE OF 2,4-D, MCPP AND DICAMBA.

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

LANDSCAPE MANAGEMENT RESEARCH CONFERENCE

AND FIELD DAY

SEPTEMBER 14, 1994

This year's field research activity in landscape management at UC Riverside is made possible by generous contributions from the following firms, agencies, and organizations:

- Metropolitan Water District of Southern California, Los Angeles, CA
- U.S. Dept. of Agriculture Forest Service, Pacific Southwest Research Station, Berkeley, CA
- The Toro Company, Riverside, CA
- Sea Tree Nurseries, Inc., East Irvine, CA
- The Council for A Green Environment, Sacramento, CA
- Deep Root Partners, L.P., Burlingame, CA
- Landscape Growers, Inc., Monterey Park, CA
- Boethling Treeland Farms, Inc., Woodland Hills, CA

Africanized Honey Bees

P. Kirk Visscher Asst. Professor, Dept. of Entomology U. C. Riverside

Who are they?

Apis mellifera scutellata •A bee of tropical Africa
- •Hybridized with European races of Apis mellifera (The extent of hybridization is unclear Migrating front may be different than final equilibrium

What do they do?

Defensive behavior
- •A lower threshold for defensive response •Larger scale response
- •Longer lasting agitation

Nestsite preferences •Accept smaller cavities than European bees

Where have they been?

Came from Africa •Range to about 30-32° South Latitude
- •displaced by other races in extreme south, highlands.

Introduced to Brazil •21° South Latitude (corresponds to Guadalajara)
- •A tropical success

Spread limited in South •30-35° South latitude (corresponds to So. California)

Where are they going?

No one really knows •Climatic limits •Competition •Gene flow

What's all the fuss about?

Public perceptions Risk assessment

What are we to do?

Education
- •Minimizing stinging incidents, Beeproofing, Preparedness

Research •Defensive behavior •Control methodology
- •Minimizing envenomization from stings

Preparedness •Beekeepers •Public areas

Control •Registration of surfactants •Develop new controls

Who you gonna call?

California Dept. of Agriculture • Bee identification • Certification

Firefighters and rescue •rescues in stinging situations

Vector control districts •removal of swarms in public areas

Pest control companies •Structural PCO's - structures
- •Landscape PCA's–colonies outside

University of California •research: control, behavior, genetics •extension

County agencies (Ag Commissioners, Task Forces)
- •coordination of response & training •apiary registration

Beekeepers
- •Response limited by regulations, liability, economics.

INFLUENCE OF IRRIGATION SCHEDULING ON GROUNDCOVER PERFORMANCE

Dennis R. Pittenger
Southern Region, University of California Coop. Ext., Riverside, CA 92521, and
Dept. of Botany and Plant Sciences, University of California, Riverside, CA 92521

Previous field research with six species of groundcovers showed that four species, representing a range of plant forms and origins, maintained aesthetically acceptable performance when irrigated at 30% of ET_0, while two species apparently have irrigation requirements greater than 50% of ET_0.

In that study irrigations of 1.5 in. were scheduled when percentages of cumulative ET_0 totaled 1.5 in. Treatments were 50%, 40%, 30%, and 20% x ET_0. Thus, each irrigation applied the same amount of water and the soil was rewetted to the same depth at each irrigation, but seasonal total amounts of water varied because the number of irrigations per treatment varied. The average schedules were 17 days @ 50% ET_0, 23 days @ 40% ET_0, 34 days @ 30% ET_0, and 46 days at 20% ET_0.

These average schedules provided water very infrequently even in the wettest treatment, and tested the drought resistance capabilities of the species involved. The question remains whether or not groundcover performance under a low total amount of irrigation (30% ET_0) can be improved by small amounts of water applied frequently rather than large amounts of water applied infrequently. Frequent irrigations of small amounts of water result in more shallow penetration of water into the soil and thus may rewet only a portion of the root system. However, shallow frequent irrigation may reduce heat and drought stress on plant material.

The primary objective of this study is to determine under deficit irrigation if frequent, shallow irrigations or infrequent, deep irrigation result in differences in groundcover quality when the total water applied is equal.

Methods, Procedures, and Scope of Work

Six species of groundcovers growing in 12 ft x 15 ft plots at the University of Californis South Coast Research and Extension Center in Irvine are being treated with four irrigation schedules 1/wk, 2/wk once every two weeks and once every four weeks. Species are *Baccharis pilularis*, *Drosanthemum hispirdum*, *Vinca major*, *Osteospermum fruticosum*, *Potentilla tabernaemontanii*, and *Hedera helix*. The amount of water applied at each treatment is 30% of CIMIS ET_0 accumulated since the previous irrigation minus any precipitation exceeding 0.1 inches in a single event.

The following data are being collected during the study:

1. Monthly visual evaluation of groundcover performance and density using 1-9 rating scales (by a 3-member panel).
2. Soil moisture content.

Although the study is not completed, trends are emerging that suggest *Vinca* and *Osterospermum* may be more responsive to scheduling than the other species are under deficit irrigation. Also, *Potentilla* did not survive under any of these treatments.

RECLAIMED WATE FOR LANDSCAPE IRRIGATION

David A. Shaw
San Diego Co. Coop. Ext., University of California,
5555 Overland Ave., Building 4, San Diego, CA 92123

Key Point to the Presentation:

Soil chemistry will eventually come to equilibrium with that of the irrigation water. Knowledge of irrigation water quality is imperative! Reclaimed water purveyors should make water analyses available to irrigators.

Acceptable (tolerance) levels of water constituents or quality characteristics relevant to irrigation of plant materials can be found in many references and are summarized in Table 1. Although these are general guidelines for water quality, critical values depend on soil type, drainage capability, plant materials, and irrigation management.

Table 1. Approximate acceptable levels of water constituents or quality characteristics:

Constituent/Quality:	pH	E.C.(dS/m)	SAR	Boron (ppm)	Chloride (meq/l)
Acceptable Level:	6.5 - 8.0	<1.5	<10	<1.0	<10

The pH (activity of the hydrogen ion) is generally not a problem with reclaimed water. However, high pH can result in the tie up of available iron, causing iron chlorosis in plant materials.

TDS (total dissolved solids) of reclaimed water is about 300 ppm higher than the TDS of potable water before municipal use and reclamation. ANY irrigation water will result in increased soil salinity unless there is adequate drainage and leaching of salts. Management options include proper soil preparation, incorporating a leaching fraction into the irrigation regime, blending water, and/or selecting tolerant plant materials.

Tables listing the tolerance or sensitivity of plant materials to salinity, although limited, are available. Research studies to expand these lists are necessary.

Toxic ions such as chloride and boron may affect trees and shrubs. Turfgrasses show more tolerance of toxic ions because leaves are regularly removed by mowing.

Sodium hazard, indicated by a high sodium adsorption ratio or SAR (a ratio of sodium to calcium and magnesium) primarily results in the dispersal of clay particles and loss of soil structure and hence permeability. This can severely affect soils with a high clay content and can be extreme if the irrigation water has low TDS (i.e., what little salt present is sodium). Sodium has also been observed to interfere with potassium uptake in plants resulting in potassium deficiency. Management options include gypsum applications and leaching through slow sprinkling. This replaces sodium with calcium and magnesium on the soil exchange complex and leaches sodium.

Waters high in carbonate or bicarbonate may precipitate soil calcium as calcium carbonate. This increases SAR and permeability problems and reduces calcium available for plants.

In conclusion, reclaimed water may be used successfully for irrigation of plant materials. Irrigation managers may need to implement soil, water, or tissue testing, along with increased system maintenance and precise irrigation scheduling.

References:

Haravandi, M. A. 1982. The use of effluent water for turfgrass irrigation. Calif. Turfgrass Culture 32(3,4): 1-4.

Haravandi, M. A. 1988. Irrigation water quality and turfgrass management. Calif. Turfgrass Culture 38(3,4): 1-4.

Pettygrove, G. W. and T. Asano (eds). 1984. Irrigation with reclaimed wastewater--a manual. Rep. No. 84-1 wr. Calif. State Water Res. Control Board, Sacramento, CA.

PROGRESS REPORT ON HERBICIDES FOR GROUNDCOVER PLANTINGS

John Kabashima
Orange County Coop. Ext., University of California,
South Coast Research and Extension Center, 7601 Irvine Blvd., Irvine, CA 92718

NOTES:

UPDATE ON WASTE MANAGEMENT ISSUES

David Crohn
Dept. of Soil and Environmental Sciences, University of California, Riverside, CA 92521

Landscapers will enjoy increased access to organic amendments as municipalities strive to meet AB 939. AB 939 requires California municipalities to divert 25% of the waste stream from landfilles by 1995 and 50% by the year 2000. Yard trimming comprise approximately 18% of municipal wastes and many of these will be processes into composts. Biosolids (sewage sludge) products will also become increasingly available.

The ultimate price of composts and mulches will depend on the cost of collecting, processing, and distributing the product. Environmental regulations may significantly raise the cost of composting operations, but these regulations are currently still in development by the various boards of the California Environmental Protection Agency. Federal regulations govern the use of biosolids, materials that can serve as both organic amendments and fertilizers. Because transportation constitutes the most expensive waste management activity, cities may find landscape uses more economical than alternatives such as farmland use.

STUDIES ON YARDWASTE USE IN THE LANDSCAPE

James Downer
Ventura Co. Coop. Ext., University of California,
702 County Square Dr., Ventura, CA 93003

Urban yardwastes may be a blend of herbaceous and woody plant mterials or composed of a single species (such as eucalyptus waste). Curbside collections of yardwastes are producing excess stock piles of organic materials which have poorly understood qualities. We have little information on the nutrient content of such recycled organic materials or of the flux of nutrients throughout the year. Viable weed seed populations, plant pathogens, and pesticide residues in yardwastes are also unknown. Answers to these questions will be resolved in time but require long-term studies which are not yet completed.

The majority of my work has been to determine the effect of various products applied as mulches or amendments. A study on bedding plants is highlighted here to provide information about application methods for organic materials and interactions with fertilizer.

Mulches, Amendments, and Fertilizer Effects on Bedding Plant Establishment: This study was designed to test various organic materials effects on petunia transplant estabishment. The main question was whether mulches (surface applied organics) or amendments (incorporated organics) with or without fertilizer would lead to faster petunia establishment (more flowers). Conifer compost, yardwaste, peatmoss, coffee compost, and biosolids compost (sewage sludge) were applied as mulches or incorporated into a loam soil. Three petunia transplants were planted into each plot and each combination of plots received urea (2#N per 1000 sq. ft.) or were unfertilized.

Organic materials promoted early flowering, however, plants in soils with no added organic matter but with added fertilizer had the most flowers. There was no overal difference between mulching or incorporating organic materials, but, the quality of the organic material made a significant difference (Table 1). Coffee compost was clearly toxic and inhibited growth (Table 2). Applied nitrogen did not help coffee treated plots. Such toxicity may be due to the allelopathic (chemical interference) nature of coffee (Putnam 1988). Although peatmoss performed well as an amendment (25 flowers average), it was poor as a mulch (13 flowers average). This may have been due to drying early in the study when peatmoss may act like a wick to remove water from small rootballs. Fertilizer was more effective as a top dress (mulch; 26 flowers) than incorporated (21 flowers). This is unusual since urea volatilization is minimized by incorporation, but the fertilizers were well watered after application, and may have been retained in the upper surface (rootzone) better than incorporated treatments. In unfertilized plots, biosolids (composted sewage sludge and yardwaste) gave the most flowers suggesting that the nitrogen in the biosolids is stimulating growth and flowers. A point must be made that this study was on an excellent loam soil. Our findings reinforce the pont that nitrogen is the only amendment necessary to promote growth (and early flowering) in loam soils. Results may differ greatly in a sandy soil. Although not rated in this study, weed control is a benefit from mulching that is not obtained from incorporated materials.

TABLE 1. Main effects of mulches, fertilizers, and application methods

Organic Material	Average Number of Flowers 40 Days Post Planting	Application		Fertilizer	
None	19	Mulched	17	Fertilized	16
Christmas Tree Compost	19	Amended	18	Not Fertilized	19
Peatmoss	18				
Coffee Compost	12				
Biosolids	20				
Composted Greenwaste	17				
Significance[1]	***		NS		*

[1]Some differences between treatments statistically different at: *$P < .05$, ***$P < .001$ or NS not significantly different.

TABLE 2. Interactions between source of organic material and fertilizer

Organic Material	Average Number of Flowers 40 Days Post Planting: No Fertilizer	Urea 2#N/1000 sq ft
None	14	24
Christmas Tree Compost	17	22
Peatmoss	17	19
Coffee Compost	13	11
Biosolids	21	19
Composted Greenwaste	16	17

Some differences within and between columns are significantly different at $P < .05$.

EFFECTS OF MULCHES ON THE GROWTH OF PLANTS

Donald R. Hodel and Jim Downer
University of California Cooperative Extension
2615 So. Grand Ave., Suite 400, Los Angeles, CA 90007
702 County Square Dr., Ventura, CA 93003

Mulches are used in landscapes to improve plant growth, reduce labor, and save money. Mulches reportedly save water, control weeds, moderate root-zone temperatures, add nutrients, encourage beneficial soil microflora and fauna, and improve such soil properties as porosity, water infiltration, structure, and cation exchange capacity. Unfortunately, information on the effects of mulches on palms is lacking in California since nearly all mulch studies have concerned non-palm plant materials.

In March 1993, we began a study in Ventura, California to determine the effects and suitability of various mulches on palms in the landscape. Specifically, we wanted to know how various mulches affected palm size and leaf production, available soil moisture, and plant water use. The palm species used were *Archontophoenix cunninghamiana* (king palms), *Syagrus romanzoffiana* (queen palms), and *Washingtonia robusta* (Mexican fan palms). Chipped *Eucalyptus sideroxylon* trimmings, tall fescue turfgrass clippings, living tall fescue turfgrass planted around the palm's base, and no mulch (bare earth) were the four treatments.

After a sufficient dry-down period on *Washingtonia* (3" ETo), soil mulched with grass clippings and *Eucalyptus* chips had tensiometer readings 35% and 14% lower respectively at 6-inch depths and 19% and 42% lower respectively at 18-inch depths than unmulched soil. Soil with living turfgrass had a tension 90% higher at an 18-inch depth than unmulched soil. Porometer readings of water lost or transpired from *Washingtonia* leaves after the same dry-down period showed that plants mulched with *Eucalyptus* chips had a transpiration rate 9.7% higher than unmulched palms and 13.6% higher than those with living turfgrass; both porometer readings indicate *Washingtonia* mulched with *Eucalyptus* chips had more water available for plant use after the dry-down period.

King palms mulched with *Eucalyptus* chips and grass clippings had 38% and 25% greater stem calipers respectively and 37% more leaves than unmulched ones. While unmulched king palms had stem calipers 35% greater than those with living turfgrass, leaf production did not differ significantly. Although there were no significant differences between unmulched queen palms and those mulched with *Eucalyptus* chips and grass clippings, those with living turfgrass had significantly smaller stems and fewer leaves. *Washingtonia* showed no significant differences among the treatments although three months earlier those mulched with *Eucalyptus* chips and grass clippings had significantly larger stem calipers and more leaves.

Mulches of non-living organic material improved the growth of king and queen palms while living turfgrass was detrimental to early growth. Mulches improved the early growth of newly planted *Washingtonia* fan palms; however, these palms are such vigorous and prolific growers that mulches or turfgrass around their bases have little or no long-term effect.

ESTABLISHMENT OF LANDSCAPE TREES

Dennis R. Pittenger
Southern Region, University of California Coop. Ext., Riverside, CA 92521, and
Dept. of Botany and Plant Sciences, University of California, Riverside, CA 92521

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 can frequently 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 container surfaces with root-inhibiting compounds may result in better quality root systems, reduced root damage to pavement, and better establishment rates.

To determine whether or not tree establishment and surface root development in the landscape are influenced by the nursery production container shape, size, and/or copper coatings, two tree species with high invasive-root potential were grown in 12 different container treatments and then transplanted to the filed. The tree species selected were Brazilian pepper (*Schinus trebirthifolius*) and Indian laurel fig (*Ficus microcarpa nitida*), and the containers treatments were regular and tall shapes of 1-, 3-, and 5-gallon pots with and without Spinout® (Cu OH) coating (active ingredient = copper hydroxide). After up to one year in the landscape, trees are being excavated to measure root growth beyond the original rootball, root circling, and the amount of rooting in the surface 9 to 12 inches of soil. Tree height and trunk caliper wil also be recorded.

Presently, the first phase of tree excavation is in progress. Trees produced in the 1-gallon container treatments are being harvested for data collection 12 months after they were transplanted.

BIOLOGICAL CONTROL FOR THE EUCALYPTUS LONGHORNED BORER AND OTHER INSECT PESTS OF EUCALYPTUS

L. M. Hanks, J. G. Millar, T. D. Paine, and R. S. Cowles
Dept. of Entomology, University of California, Riverside, CA 92521

Eucalyptus species are one of the most prevalent trees in urban and rural landscapes throughout California. They have a number of desirable characteristics, such as fast growth, tolerance of poor soils, resistance to drought, and, until recently, virtually no insect pests. In the past few years, however, several Australian insect pests have been introduced into California. These include the Eucalyptus longhorned borer (ELB), the bluegum psyllid, and very recently, the Eucalyptus snout beetle (ESB).

Over the past three years, several parasite species have been imported for biological control of ELB, including 4 larval parasites and an egg parasite. In 1993, 54,000 parasites of two species were released. The egg parasite, *Avetianella longoi*, became established at a number of sites in southern and one site in central California last year, and populations have successfully overwintered and are spreading rapidly. Parasitism rates were high: in field surveys last summer, the parasites located 71% of the available ELB egg masses, with 89% parasitism within egg masses.

Efforts to establish ELB larval parasites are continuing in 1994, with 3,000 to 5,000 parasites per week being reared and released. Releases are restricted to 2 sites per species to provide the critical mass of insects required to obtain establishment. Larval parasites have been recovered from trap logs at sites, but they have not yet been recovered from naturally infested wood.

The Eucalyptus snout beetle was detected in California for the first time at a site in Ventura in March of this year. A highly specific and extremely effective egg parasite, *Anaphes nitens*, which has been used worldwide for control of this pest, has been imported to control snout beetle populations. Releases will begin as soon as release permits are obtained.

TREE ROOT DEVELOPMENT IN CONTAINERS

Ursula K. Schuch and Dennis R. Pittenger
Dept. of Botany and Plant Sciences, University of California, Riverside, CA 92521

Trees planted in urban areas contribute to energy conservation and beautification of the environment. Unfortunately, there is a high mortality rate for trees transplanted into urban sites. 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 can frequently be attributed to poor root development in the original container-grown nursery stock. Recent research findings suggest that trees produced in unconventionally shaped containers or treating inner surfaces with root-inhibiting compounds may result in better quality root systems, reduced root damage to pavement, and better establishment rates.

<u>Objectives</u>: This study was designed to determine whether root and shoot development are influenced by container configuration (diameter x height) and volume. We will determine whether trees grown in 1-, 3-, and 5-gal. pots in tall, narrow containers will have more roots and increased shoot growth compared to plants grown in conventional containers of the same volume. The second objective will determine whether plants grown in containers that are coated with a root inhibiting compound, cupric hydroxide, will have better quality roots, less circling roots, and more biomass production than plants grown in untreated containers.

<u>Production results in 1-gal. containers</u>: Fiscus (*Ficus retusa* L. 'nitida') and Brazilian pepper (*Schinus terebinthifolius* Raddi.) liners were grown for 6 months in the greenhouse in 1-gal. containers. Cupric hydroxide coating prevented matting of roots on the side of the root ball in both species and root circling at the bottom of the containers in ficus. Pepper trees grown in regular-shaped containers had a higher biomass production versus trees growing in tall containers.

<u>Production results in 3- and 5-gal. containers</u>: Plants were transplanted from the 1-gal. pots to 3- or 5-gal. containers with tall or regular shape and with or without cupric hydroxide coating on the inner surface of the containers. Plants were transferred from the UC Riverside greenhouse and grown in the 3- and 5-gal. containers outdoors in a nursery in Irvine, California. Pepper trees grew much faster than ficus and were evaluated after 4 months in the nursery, when they started to outgrow their containers. For pepper, cupric hydroxide 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.

Fiscus trees remained for 9 months at the outdoor nursery until they had completely filled the container media with roots. For ficus, the least amount of root matting was found in plants growing in tall, cupric hydroxide-treated containers. Plants in regular-shaped 3-gal. containers had fewer small roots and a lower total root dry weight than plants in tall 3-gal. containers. Small and total root mass in 5-gal. containers was higher in regular versus tall-shaped containers. Ficus trees grew taller in regular 3-gal. versus tall 3-gal. and in tall 5-gal. versus regular 5-gal. containers. Cupric hydroxide alone affected shoot and large root dry weights, with higher weights for plants in coated containers and lower weights for plants in uncoated containers. Total dry weight, including shoot and root mass, and caliper of ficus trees was not affected by any of the treatments at the end of the nursery production phase.

TRACKING THE GIANT PALM BORER

Richard Cowles
Dept. of Entomology, University of California, Riverside, CA 92521

The giant palm borer, as its name suggests, is several times larger than its close relatives, with adults ranging from 1.25 to 2" long. Until the 1950's, this native of the Coachella Valley was considered rare. However, the practice of transplanting palm trees and the increase in availability of palms has led to a population increase, to the point that the giant palm borer can now be considered somewhat of a pest. Transplanting palms has influenced the occurrence of this pest in two ways: infested trees have been moved out of the native range of the beetle, so that beetles have emerged in new locations. The consequences of this movement has varied. In St. George, Utah, and Las Vegas, Nevada, larger numbers of transplanted trees, especially date palms, have had to be removed. In other communities such as Riverside, and within the Coachella Valley, emergence holes are visible from California fan palms transplanted several years ago that now look completely healthy.

The work conducted in 1993 and 1994 at UCR involved six trees that had died in Palm Desert following transplanting. Because it is known that transplanting increases the likelihood of palm borer attack, and feeding sites in the foliage were observed that could be traced to the time of transplanting, these trees offered the first opportunity for researching the minimum time for palm borer development. Palm trees were sectioned to (1) reconstruct the pattern in which eggs are laid, based on occurrence of early-instar larval galleries, and (2) sample fungi associated with palm borer infestation.

Clusters of early instar galleries occur within six feet of the base of the tree, demonstrating that eggs are laid into crevices in the trunk. Larval galleries occur from a height of six feet to the top of the trunk, with the greatest concentration of galleries from the center to the top of the tree. Adults started emerging from the trees approximately June 1, indicating that under ideal conditions (warm temperatures and intact, moist logs) one generation (egg to adult) can be completed in ten months. Feeding by adult in the crown of the tree may contribute to the tree mortality by allowing entry of pathogenic fungi. *Thielaviopsis* fungi may be one of the most important known pathogens found in trees infested by the giant palm borer.

TREE SPECIES EVALUATION PROJECT

Donald Hodel and Dennis Pittenger
Los Angeles Co. Cooperative Extension,
2615 So. Grand Ave., Suite 400, Los Angeles, CA 90007
Dept. of Botany and Plant Sciences, University of California, Riverside, CA 92521

Background and Objectives:

There is a limited palette of medium-sized tree species in use in southern California, and as development has expanded into the inland areas, the palette has become more narrow due to the more harsh climatic conditions (i.e., more extreme temperatures and lower humidity). However, there appears to be a number of species with the potential to perform well in these environments as landscape trees, but they are underutilized or their actual performance is undocumented under these conditions.

The objectives of this study are to:

1. Determine the adaptability, performance, and horticultural qualities of undertutilized, non-native, and/or xerophytic tree species when maintained at 35% of ET_0 versus 80% ET_0 at Riverside.
2. Identify and report tree species that serve well as medium-sized landscape trees in non-native interior valleys of southern California.

Methods and Procedures:

There were 37 tree species selected and transplanted at UCR in July 1994. Selection criteria were:

1. Mature height not likely to exceed 35 ft. in 25 to 30 years in the landscape.
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 U.S.
4. Exceptional functional and/or ornamental value or attributes.
5. Tolerates 20 degrees F.
6. No known serious defects.

Each species is replicated three times by individual trees in each irrigation treatment. Plants were transplanted from 1-, 5-, or 15-gallon containers and spaced at 20 ft. x 19 ft. Irrigation is being provided as needed to keep the rootball moist for the first 6 to 12 months. Irrigation treatments will be initiated in the summer of 1995 and will be scheduled when accumulation of daily $ET_0 \times 0.35 = 1.5$ inches for one treatment, and when $ET_0 \times 0.8 = 1.5$ inches for the other. Additional qualitative and quantitative data will be regularly recorded to assess species' physical and horticultural performance.

Data to be collected:

1. Annual measurements of height, width of crown and trunk caliper at 15 cm from soil.
2. Monthly or seasonal notation of functional and aesthetic characteristics.
3. Overall assessment of performance and acceptability for use in the landscape.

Species selected:

Evergreen

1. Standard = Magnolia grandiflora 'Majestic Beauty'
2. Acacia melanoxylon
3. Agonis flexuosa
4. Arbutus unedo
5. Callistemon viminalis
6. Eriobotrya deflexa 'Coppertone'
7. Eucalyptus torquata
8. Geijera parviflora
9. Hymenosporum flavum
10. Ligustrum lucidum
11. Maytenus boaria
12. Metrisidorus excelsus
13. Pinus thunbergiana
14. Pittosporum rhombifolia
15. Quercus ilex

Deciduous

1. Standard = Liquidamber styraciflua 'Palo Alto'
2. Acer palmatum
3. Acer rubrum 'Red Sunset'
4. Acer saccharum 'Majesty'
5. Brachychiton acerifolius
6. Cornus kousa 'Summer Stars'
7. Crataegus phaenopyrum
8. Ginkgo biloba 'Autumn Gold'
9. Gleditsia triacanthos 'Imperial'
10. Koelreuteria bipinnata
11. Malus floribunda 'Hopa'
12. Nyssa sylvatica
13. Parkinsonia aculeata
14. Prunus prsica 'Helen Borcher'
15. Robinia ambigua 'Idahoensis'
16. Sapium sebiferum
17. Sophora japonica
18. Sorbus aucuparia
19. Tilia cordata 'Greenspire'
20. Tipuana tipu
21. Zelkova serrata 'Village Green'
22. Zizyphus jujuba