TURFGRASS RESEARCH CONFERENCE AND FIELD DAY

September 14, 1993

AND

LANDSCAPE MANAGEMENT RESEARCH CONFERENCE AND FIELD DAY

September 15, 1993

University of California
Riverside

TURFGRASS RESEARCH CONFERENCE AND FIELD DAY
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LANDSCAPE MANAGEMENT RESEARCH
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THE DEVELOPMENT OF THE UC RIVERSIDE TURF PLOTS IS LARGELY DUE TO THE GENEROSITY OF THE FIRMS AND ORGANIZATIONS SHOWN HERE.

TRI CAL INC

A-G Sod Farms Inc.

United States Golf Association 1894

BASF

TORO

roots inc.

pbi / gordon corporation

Sports Turf Manager's Association

GERMAIN'S SEEDS

Monsanto

STERN'S Miracle-Gro PLANT FOOD

Scotts ProTurf

Northern California Golf Association

WEST COAST TURF

EMC EXCEL-MINERAL COMPANY, INC.

GOLF KEEPS AMERICA BEAUTIFUL USGA GREEN SECTION

STOVER SEED COMPANY

DU PONT

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

MEDALIST AMERICA TURFGRASS SEED

CIBA-GEIGY

Southern California Golf Association

Southern California Turfgrass Council

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

RAIN BIRD PREFERRED BY PROFESSIONALS WORLDWIDE ®

CEDAR CHEMICAL CORPORATION

OMC Lincoln CUSHMAN-RYAN

PURSELL INDUSTRIES

LESCO

PLANT GROWTH REGULATORS FOR CLIPPING YIELD REDUCTIONS AND WATER CONSERVATION

Robert L. Green, Research Agronomist, Department of Botany and Plant Sciences, UC Riverside

Current goals for maintaining turfgrasses are to 1) produce acceptable turfgrass quality and function, 2) develop turfgrasses and cultural systems that require lower inputs of labor, water, fertilizers, and pesticides, and 3) be in compliance with environmental issues. Alleged negative aspects of turfgrass management on the environment include: excessive use of water; polluting ground and surface waters with turfgrass chemicals, fertilizers, and soil particulates; impacting nontarget animals and plants with turfgrass pesticides; and using limited landfill space for the disposal of clippings and other landscape wastes. Applications of plant growth regulators (PGR's) may offer the possibility of producing acceptable turfgrasses, while producing less clippings, and requiring fewer mowings, utilizing less N and water, and thereby helping to protect the environment.

Research has shown several agronomic benefits due to PGR applications on warm- and cool-season turfgrasses. They include: clipping reduction; seedhead suppression; reduced scalping and easier management of difficult-to-mow areas; lower water-use rates; and improved stand density, leaf color, and rooting. Other research has shown several negative characteristics due to PGR applications on warm- and cool-season turfgrasses. They include: leaf injury and discoloration; decreased stand density and quality; decreased recovery ability; decreased rooting; and decreased tolerance to pests.

Therefore, it is safe to conclude that research in the area of PGR applications on turfgrasses has been both positive and negative. Several points may help to clarify this situation: 1) there is a need to select the right PGR for the right turfgrass species; 2) successful utilization of PGR's on turfgrasses is facilitated when all of the management program (mowing, watering, fertilizing, etc.) follows recommended practices; and 3) seasonal and environmental characteristics should be considered when applying PGR's.

A positive benefit of the application of PGR's on turfgrasses that is not debated involves the reduction of clippings. It is not uncommon to observe a 50% clipping yield reduction over a four- to six-week period following a single application. This could be significant on sites where clippings are removed. Since there is reduced growth, fewer clippings, and less leaf area, a second benefit may be less water used since there is less leaf evaporative surface area.

Research on bermudagrass and St. Augustinegrass has shown both benefits to be true. However, the clipping-reduction benefit and associated mowing-management benifit probably will be the "claim-to-fame" for PGR's applied on warm-season turfgrasses. Research at UCR involving the cool-season turfgrasses (tall fescue, Kentucky bluegrass; perennial ryegrass) is in progress.

COMPARISON OF RECLAIMED AND POTABLE WATER FOR TURFGRASS IRRIGATION

David A. Shaw, Farm Advisor, U.C. Cooperative Extension, San Diego County

Experimental test plots were established at three sites in the greater San Diego area in 1992 to compare the use of reclaimed water with potable water for turfgrass irrigation purposes. The experiments are located at the Torrey Pines Golf Course in La Jolla, the Eastlake Development in Chula Vista, and the Whispering Palms Water Pollution Control Facility at Fairbanks Ranch.

Each site contains two independent experiments designed for both cool season and warm season turfgrass types due to differences in the water requirements and cultural practices of the two turf types. In the cool season turfgrass experiments, response of tall fescue is compared to that of a bluegrass/ryegrass blend and in the warm season experiments, response of bermudagrass is compared to that of kikuyugrass.

Water treatments consist of potable and reclaimed water and are located side by side in each replicated experiment to minimize the influence of spacial variability commonly found in soils.

Two soils, Diablo clay topsoil and exposed heavy sandy loam subsoil, are being compared at the Eastlake site. The effect of irrigation frequency is being studied at the Torrey Pines site. These treatments are frequent irrigation (six days per week) and infrequent irrigation (two to three days per week) with equal amounts being applied in each regime.

The turfgrass research test plots have been receiving irrigation treatments for approximately one year at the Torrey Pines and Eastlake sites and for approximately eight months at the Whispering Palms site. The latter part of 1992 represented the turfgrass establishment period. During this time water applications exceeded the calculated evapotranspiration (ET) requirements of the turfgrass species. For the 1993 irrigation season, irrigation applications corresponded to calculated ET at the three sites. Since treatments began, approximately 25 to 50 percent more salts have been applied to reclaimed water treatments due to the higher salinity of these waters.

As of July 1993, there are few statistically significant differences due to water or irrigation frequency treatments seen at any site with regard to soil analyses and turfgrass performance. Significant differences have been observed between tall fescue and blue/rye turfgrasses and between bermuda and kikuyu turfgrasses at all sites. Differences seen, although statistically significant, are not relevant in magnitude and are not consistent through sampling and evaluation dates. However, consistent differences are seen in soil constituents and turfgrass performance between the different soil types at the Eastlake site.

Turfgrass at all sites is acceptable in quality and would be suitable for park, golf fairway, or residential yard applications. After less than one year of irrigation treatments, significant differences due to water type (reclaimed versus potable) are not expected and have not been observed. Evaluations of soil analyses and turfgrass performance towards the end on 1993 and during 1994 may reveal differences between water treatments in the long term.

INVASIVE CHARACTERISTICS OF KIKUYUGRASS

Cheryl A. Wilen, Jodie S. Holt, and David W. Cudney, Dept. of Botany and Plant Sciences, University of California, Riverside

Kikuyugrass (Pennisetum clandestinum) is a perennial grass that was introduced into California from western Africa. As an aggressive weed in turf, it interferes with growth of desired turf by spreading rapidly via thick stolons and rhizomes. Kikuyugrass may also spread by seed. Another undesirable characteristic of kikuyugrass is its production of heavy thatch. Currently there are no cultural or single chemical methods to control kikuyugrass with the exception of total renovation using either glyphosate or methyl bromide.

In order to understand how to control kikuyugrass in California, we examined physiological and growth characteristics of this grass. We found that, despite kikuyugrass being a warm-season grass, it had photosynthetic rates similar to those of the cool-season grass tall fescue when subjected to low leaf temperatures. At higher leaf temperatures, kikuyugrass had greater photosynthetic rates than both tall fescue and the warm-season species; it has the potential to produce biomass even during cool periods. Growth rate experiments showed that kikuyugrass produced biomass similar to that of tall fescue when grown under cool temperatures, and its biomass greatly exceeded that of both St. Augustinegrass and fescue when grown in warm temperature.

To examine whether kikuyugrass is spread by seeds, we collected plants from golf courses in Palo Alto, Nipomo, and Riverside and studied their genetic makeup. We found that there were few genotypes overall, which indicted that spread by seeds was not as common as spread by vegetative means. The exception was in Palo Alto, where we found several different genotypes. We hypothesize that this was due to the patchiness of the course, which allowed seeds to germinate and spread without competition from established plants. Thus, spread by seeds could be a problem where the turf is not thick.

Herbicide suppression of kikuyugrass was accomplished using sequential applications of MSMA + tryclopyr (88% control), after which the desired grass species filled the areas vacated by kikuyugrass. Sequential applications of quinclorac* + MSMA or tryclopyr reduced from 80% to less than 1% of the sward.

*not a registered chemical in California

TRAFFIC EFFECTS ON TURFGRASSES UNDER RESTRICTED LIGHT (PAR)

S.T. Cockerham, V.A. Gibeault, and M.Borgonovo
University of California, Riverside

Photosynthetically active radiation (PAR) is measured as micromols per second per square meter (mMol $s^{-1}m^2$).

The Light Intensity Turf Evaluation (LITE) facility has been designed to submit turf to four PAR regimes--full sun, with light restricting canopies (shade) of 33%, 54%, and 78%--under simulated sports traffic, with remote data acquisition sensors collecting data on PAR, air temperature, and relative humidity. Bonsai tall fescue (*Festuca arundinaceae*), Manhattan II perennial ryegrass (*Lolium perenne*), Manhattan II mixed with Jasper creeping red fescue (*Festuca rubra L.*), and El Toro zoysiagrass (*Zoysia Japonica L.*) were evaluated. Traffic treatments were applied with a Brinkman Traffic Simulator.

El Toro zoysiagrass showed good traffic tolerance under full sun and severe light restrictions, but did not recover readily when light was restricted. Perennial ryegrass did perform with PAR restrictions of 54%. Indications are that perennial ryegrass could provide a sports turf cover with about 8 hours of 500 to 600 mMols $s^{-1}m^2$ PAR.

SCREENING FOR ROOTING CHARACTERISTICS OF ZOYSIA SPP. GENOTYPES

J.S. Hartin*, R.L. Green** and V.A. Gibeault**
*UCCE, San Bernardino County
**UCR, Dept.of Botany & Plant Science

Planting low water-use turfgrass is an important aspect of water conservation. Warm-season turfgrasses require significantly less water than cool-season turfgrasses and offer good to superior drought resistance.

In addition to a low water-use rate, zoysiagrasses offer a viable alternative to other turfgrasses for certain uses due to a low nitrogen requirement and superior ability to withstand traffic. Research programs at University of California, Riverside (UCR) and other universities have identified and released superior performing zoysiagrass genotypes over the last few years. Examples from the UCR program include "El Toro" and two new turfgrasses currently being patented.

An important form of drought resistance is the ability of a plant to produce a deep root system capable of acquiring groundwater. It is well documented that rooting characteristics vary among turfgrass genotypes. The objective of this research was to develop a reliable glasshouse screening procedure for predicting rooting depth and mass of Zoysia genotypes in the field.

In an initial glasshouse trial, rooted sprigs of ten Zoysia genotypes were grown for 151 days in 4.0 cm diameter, 122.0 cm deep plastic growth assemblies containing sand. Results indicated that DALZ 8512 produced greater plant mass than Meyer, UCR Z88-3, UCR Z88-8, and Belair, but similar mass to Emerald, DALZ 8514, UCR Z88-14, El Toro and DALZ 8507. DALZ 8512 also produced greater root mass than UCR Z88-14, El Toro, DALZ 8507, Meyer, UCR Z88-3, UCR Z88-8, and Belair, but similar root mass to Emerald and DALZ 8514. DALZ 8512 had the greatest number of root intersections at 92 cm.

To determine the effectiveness of the glasshouse study in predicting rooting characteristics of the genotypes in the field, 152.4 cm deep, 5.0 cm diameter cores were taken from established zoysiagrass plots at UC Riverside in July, 1993. Data taken include number of root initiates, root intersections at 30.5 and 61.0 cm, and root mass per 30.5 cm to a depth of 152.4 cm. Relative comparisons between the two studies will be made.

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GRASS CLIPPING MANAGEMENT

Ali Harivandi, Environmental Horticulture Advisor
Alameda, Contra Costa and Santa Clara Counties

Each year Californians generate approximately 44 million tons of municipal solid waste. As our population grows and trash dumps become scarce, the solid waste problem becomes more critical. Although voluntary waste recycling has been in place in many California communities for years, waste reduction became mandatory for California municipalities with the passage of AB 939, California's Integrated Waste Management Act. This statute mandates that each jurisdiction in the state reduce its trash output by 25% by 1995 and 50% by the year 2000, with 1990 as the base year. Concurrent to the passage of AB 939, the newly created California Integrated Waste Management Board (CIWMB), began implementing a comprehensive set of laws addressing California's solid waste disposal dilemma while lessening the demand on diminishing natural resources.

It is estimated that 20% of waste going to landfills is yard waste. Composting is one successful method of dealing with such waste; the Board is also exploring ways to reduce yard waste generation. Since grass clippings comprise a significant portion of this waste, the Board supports the practice of "grasscycling". Consequently, with the assistance of U.C.C.E., information has been developed to promote grasscycling among both homeowners and professional landscape managers.

Grasscycling is a new term for the old practice of leaving clippings on the lawn after mowing. This practice is environmentally sound, and saves time, energy, and our rapidly declining landfill space. A grasscycling research project at the Bay Area Research and Extension Center in Santa Clara generated interesting data: Preliminary results show that using a mulching (recycling) mower on a bluegrass/ryegrass lawn can reduce grass clipping waste by up to 300 lb/1000 ft^2/year. Regular analysis of grass clippings suggest that leaving this quantity of clippings on lawn can add up to 4 lbs. of nitrogen/1000 ft^2/year. No thatch has accumulated where clippings are returned to the lawn. This project will continue for one more year and is expected to generate additional useful data.

NEW BUFFALOGRASS PERFORMANCE CHARACTERISTICS

V.A. Gibeault, S.T. Cockerham, R. Green and R. Autio

Buffalograss, *Buchloe dactyloides* (Nutt.) Engelm., a warm season grass, is native to the U.S. great plains "short grass country" extending from western Minnesota - central Montana in the north to Texas - Arizona in the south. Outside the U.S. borders, buffalograss is found in Canada and Mexico in natural stands. In areas of its adaptation, rainfall is in the 12-35 inch per year range. Buffalograss is usually dioecious (having separate male and female plants) but monecious (male and female flowers on same plant) plants are fairly common.

Interest in buffalograss has increased in the 1980's and 1990's because it is considered to be low maintenance grass. It is low growing, has a relatively low nutritional requirement, has a low water use rate, and is highly drought resistant. Turfgrass quality characteristics are only fair, however, for the native or range cultivars of buffalograss. Therefore, turfgrass breeding activity for the past decade has focused on improving grass color, overall appearance including density and leaf texture, recuperative potential and lengthening the growing season.

Twenty two cultivars and experimental lines of buffalograss were established vegetatively at the UC Riverside Turfgrass Research Project in August, 1991. Following establishment, the grasses were weekly mowed at 2 inches during the growing season, watered based on calculated ET for warm season turfgrasses, and fertilized at 0.5 lb. N per 1000 sq. ft. in Feb., Apr., Jun., Aug., Oct. and Dec. Monthly visual ratings from various characteristics were taken.

This study will continue for two more years but already there have been obvious differences observed among the cultivars and experimental lines. The grasses selected from Mexico or the southern U.S. perform similarly and in contrast to the more northern selected grasses. The southern grasses appear to be faster to establish, have less staminate culms, are more dense and have better overall turfgrass quality. The more northern selected grasses have a deeper green to gray-green color.

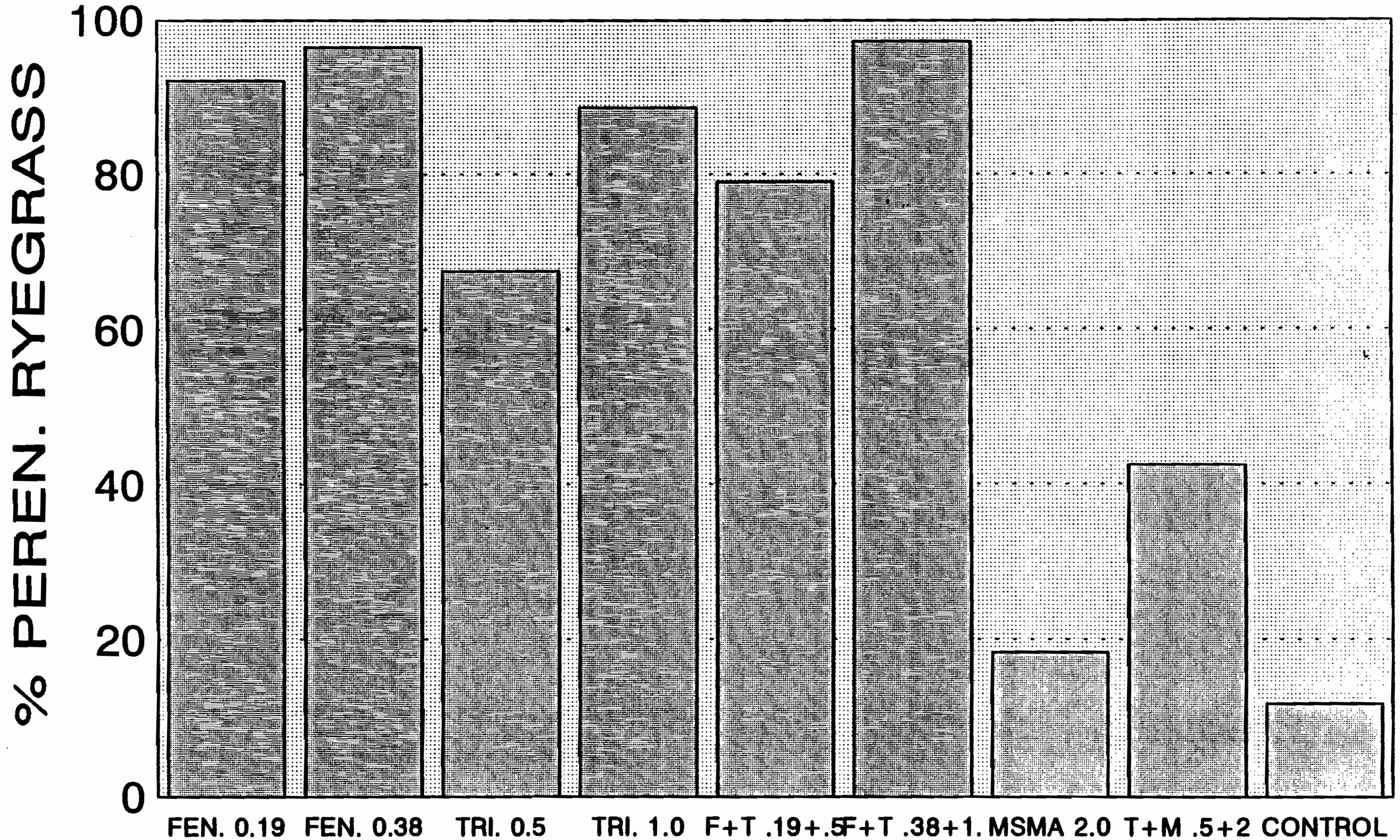
Bermudagrass Renovation To Perennial Ryegrass
Renovation Study UCR Experiment Station

Plot No.	Treatment	Rate al/a	A	B	C	D	E	F	
1	Fenoxaprop	0.19	4	3	5	13	15	7	1
2	Fenoxaprop	0.38	6	4	12	15	6	9	2
3	Triclopyr	0.5	9	10	7	1	17	8	3
4	Triclopyr	1.0	1	12	4	5	2	3	4
5	Fen. + Tri.	0.19+0.5	11	14	13	16	9	12	5
6	fen. + Tri.	0.38+1.0	8	2	10	6	4	5	6
7	MSMA	2.0	14	16	8	9	11	17	7
8	Tri. + MSMA	0.5+2.0	7	13	1	17	3	14	8
9	Fenoxaprop	0.19	5	6	15	2	12	10	9
10	Fenoxaprop	0.38	10	7	11	8	7	15	10
11	Triclopyr	0.5	17	5	17	10	8	1	11
12	Triclopyr	1.0	2	15	3	4	13	11	12
13	Fen. + Tri	0.19+0.5	3	17	9	14	10	16	13
14	Fen. + Tri	0.38+1.0	16	1	6	7	5	2	14
15	MSMA	2.0	13	9	16	12	14	4	15
16	Tri. + MSMA	0.5 + 2.0	15	11	2	11	1	13	16
17	Check		12	8	14	3	16	6	17
			A	B	C	D	E	F	

Note: Variety= Manhattan II Seeded 6-10-92
Applied: Co2 Backpack 30 psi 30 gpn : 7-11-92
Plot Size : 5'X 10'
Mix. For 800ft2 = 2 liters
Treated 4 times in 1992
And at 6 week intervals in 1993, starting 4-23-93

BERMUDAGRASS CONVERSION

TO PERENNIAL RYEGRASS 8/23/93



LSD 0.05 = 16.3

4	9	3	5	8	7	2
10	1	5	10	2	4	6
8	7	9	3	5	1	7
2	6	1	6	8	10	3
			4	6	8	10
			2	9	5	4
			7	3	9	1

Title

Miracle-Gro Fertilizer Project

Objective

To evaluate the efficacy of Miracle-Gro's proprietary fertilizer blends on Common Bermuda grass

Principal Investigators

S.T. Cockerham, R. A. Khan, V. A. Gibeault

Location:

Field 12E, Plot #21.

Design

1. Ramdomized complete block.
2. 10 treatments.
3. 4 replicates/treatment.
4. Each replicate (plot) = 5 x 8 = 40 sq. ft.
5. Total number of plots = 40

Treatments	Rate (lbs. N/100 sq. ft)	grams/plot
1. Check	0.0	0.0
2. Miracle-Gro 26-3-6	2.25	158.7
3. Scott's Turfbuilder 27-3-4	1.25	84.0
4. Miracle-Gro 26-3-6	2.25	158.7
5. All American Garden and Fertilizer 16-16-16	2.4	272.0
6. Miracle-Gro 26-3-6	1.875	130.8
7. K-Gro Premium Lawn Fertilizer 29-3-4	1.04	65.3
8. Miracle-Gro 26-3-6	1.875	130.8
9. Best Turf Supreme 16-6-8	0.8	90.7
10. Miracle- Gro 32-4-8	2.24	127.0

Procedures

1. All fertilizers will be applied by sprinkling preweighed amounts evenly over each plot.
2. Watering by sprinkler irrigation will follow immediately after treatment.

Evaluations

1. Color Ratings weekly for 16 weeks.
2. Clipping samples taken every 2 weeks for 16 weeks; samples will be collected from each plot, oven-dried and weighed. Data to be recorded accordingly.

Date of Appln: 4-20-93

↑ N

Effect of Coated, Slow Release Fertilizers on Santa Ana Bermuda Turfgrass

Block I	2D	1C	3A	2B	4C	1D	2E	4B	4D	3D
	4A	4E	1E	3C	1B	2C	3B	1A	3E	2A
Block II	1C	4B	3D	4A	3B	1B	2A	3E	4D	4C
	2E	2D	1D	1E	2C	4E	3C	2B	1A	3A
Block III	1B	4D	2E	1A	2D	1C	1E	4B	3D	2C
	4E	2B	3C	3B	4C	2A	3A	1D	4A	3E
Block IV	2C	1E	4C	2D	4B	4D	1B	3C	4E	3D
	1A	3A	2B	3E	2A	4A	1D	2E	1C	3B

Frequency/week	No. of Applic.	[illegible]
8 (1.0 N/M)	2	4-16-93 6-11-93
4 (1.0 & 0.5 N/M)	4	4-16-93 5-7-93 6-11-93 7-9-93
2 (0.5 lb N/M)	8	4-16-93 4-30-93 5-14-93 5-28-93 6-11-93 6-25-93 7-09-93 7-23-93

POTASSIUM APPLICATIONS FOR ENHANCED TRAFFIC AND DROUGHT RESISTANCE ON A SAND ROOT ZONE SPORTS FIELD

R.L. Green, F.J. Merino, G.H. Pool, S.T. Cockerham, and V.A. Gibeault
University of California, Riverside

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 maybe 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 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 also is 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.

Following is an outline of a study involving a sand root zone sports field, K fertilization, traffic, and drought. This study is in progress and began in May 1993 and will end in Summer 1994.

Study outline for K applications for enhanced traffic and drought resistance on a sand root zone sports field.

Objective To determine if increasing the K component of the N/K ratio will increase traffic and drought resistance of turfgrasses grown on a sand root zone.

Cultivars Manhattan II perennial ryegrass
Santa Ana bermudagrass

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 bermudagrass portion of the site was established in 1984 while the perennial ryegrass portion was established in spring 1992.

Experimental Design Strip-plot design with 3 replications. K treatments form main plots (12 x 4.5 feet) while traffic treatments are stripped across main plots forming subplots (6 x 4.5 feet).

Mowing Bermudagrass = 2 times/week with a walk-behind reel mower; bench setting/actual height = 1.0 inch and 7/8 inches; respectively; clippings removed. Perennial ryegrass = 1 time/week with a walk-behind rotary mower; mower setting/actual height = 1 7/8 inches and 1 5/8 inches, respectively; clippings removed. Note that the mowing height of perennial ryegrass will be lowered to approximately 1 inch in the 1994 studies.

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

K Treatments

Fertilizer Source ($N-P_2O_5-K_2O$)	N/K	Pounds/1000 feet^2 per month N	Pounds/1000 feet^2 per month 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

K Treatments Continued

K treatments initiated May 13, 1993. Treatments established by one fertilizer application every 2 weeks. Exception is Multicote which is applied once every 4 months. Perennial ryegrass fertilized 12 months/year while bermudagrass fertilized during the summer growing season.

Traffic Treatments Treatments are traffic or no traffic. A Brinkman Traffic Simulator will be used to apply 2 to 3 football game equivalents per week during late September thru mid November 1993. A second test of traffic treatments will be conducted spring/summer 1994.

Drought Treatment Following the second test of traffic treatments (August 1994) irrigation will be reduced over the entire site to impose turfgrass drought stress.

Measurements During and after traffic treatments: visual quantification of turfgrass injury and recovery; above-and below-ground plant morphological characteristics; traction and field hardness; soil compaction; plant and soil K levels. During and after drought treatment: visual quantification of turfgrass injury and recovery.

STOP #4: FIELD ASSESSMENT OF TURFGRASS ROOTING

J.S. Hartin*, R.L. Green, and V.A. Gibeault****
***UCCE, San Bernardino County**
****UCR, Dept. of Botany and Plant Science**

Objectives:

1. To determine rooting characteristics of *Zoysia* spp. genotypes.

2. To determine if glasshouse screening procedure accurately predicts rooting characteristics of *Zoysia* spp. genotypes.

PLOT PLAN

N↑							III	
	8	13	14	3	11	5	9	1
I	10	5	15	2	4	7	6	12
	1	9	6	12	7	8	3	13
	5	1	11	14	12	10	14	15
II	15	9	8	10	7	11	2	4
	2	13	3	4	6			

KEY:
1. El Toro
2. Emerald
3. Belair
4. Meyer
5. DALZ 8501
6. DALZ 8502
7. DALZ 8507
8. DALZ 8512
9. DALZ 8514
10. DALZ 8701
11. UCR Z88-1
12. UCR Z88-5
13. UCR Z88-8
14. UCR Z88-9
15. UCR Z88-14

Note: UCR Z88-3 was included in the glasshouse trials, but was not included in the variety trial.

RESULTS FROM A 1993 BLACK TURFGRASS ATAENIUS GREENHOUSE TRIAL

Richard S. Cowles, University of California, Riverside

Black turfgrass ataenius (BTA) is a high threshold turf pest, requiring populations greater than 40 per square foot to cause visual injury symptoms. In California, damage is most often seen on heat-stressed bentgrass greens, compacted aprons, and tee boxes. Annual bluegrass and bentgrass/perennial rye mixtures are also commonly affected. Because the larvae are small and feed in the soil, they are not normally detected until most larvae have developed to the third (and last) instar. Insecticides that kill this stage are consequently important emergency suppression tools for BTA management.

A greenhouse bioassay for screening chemical and biological control efficacy was developed because high populations of BTA grubs are not generally present in large enough areas to conduct these trials in the field. The treatments used in trial represent the materials available now and those that may soon be registered in California. Arenas (15) were constructed from 20 cm x 10 cm I.D. PVC pipes, with flat end-caps drilled with six 3 mm holes for drainage. Arenas were partially filled with either Coachella Valley blow sand (a common greens construction material) or a standard USGA greens mix. The remainder of the arenas were filled by cutting 10 cm dia. x 8 cm. cores from a practice putting green in Cathedral City, CA, which has had historically high populations of BTA grubs. Throughout the duration of the experiment, turf arenas were maintained in a greenhouse with 21-30°C, and 3 cm twice-daily irrigation provided by microsprinklers. Turf was clipped to 1 cm height prior to infestation with grubs and spraying.

BTA grubs were obtained from a practice tee area on a golf course in Rancho Santa Fe, CA, on July 11. A sod cutter was used to remove approximately 2.5 m^2 of sod, to a depth of 6 cm. The sod and developing grubs were brought back to U.C. Riverside. Grubs (-90% third, -10% second instar) were then removed and immediately placed on the surface of the turf, ten per arena. Only early- and mid-third instar grubs were chosen, as late third instar grubs (prepupae) were expected not to feed. The late third instars were identified by having extensive fat body development, and empty gut, and an inability to burrow.

The only conventional, registered insecticide that gave a degree of kill significantly different from the check was Turcam 2.5G (Table 1, next page). This observation supports the prevailing opinion of golf course superintendents that bendiocarb has been the most effective material for controlling last-instar ataenius grubs. Once existing supplies of this product in California are used up, bendiocarb formulations can no longer be used.

The two chemicals with currently unregistered active ingredients provided good control of larvae when compared to Turcam. However, the greatest surprise was nematode efficacy. Both Steinernema carpocapsae (the commercial name for the product is Exhibit) and S. Glaseri provided better control than any of the chemical insecticides. Since these nematodes can reproduce in infected grubs, further infection cycles can be expected 2-3 weeks following an application, without having had to reapply nematodes. Nematodes are very safe to handle and can be applied with the same equipment as conventional sprays, however, attention to their natural temperature limits its important because they are living organisms.

Effective strategies for BTA control are: (1) promoting healthy root systems so that the turf can tolerate feeding, (2) a preventative insecticide approach, in which even the materials showing poor or moderate activity against third instar grubs can be used to kill adults and young larvae, and (3) a remedial treatment, using insect pathogenic nematodes directed against larvae and pupae.

Table 1. Mean live grubs and percent control of third instar black turfgrass ataenius grubs 12 to 13 days following insecticide application in a greenhouse assay, using ten grubs per arena. Treatments were applied July 16, 1993.

Material	Application Rate (AI/acre)	Mean Live Grubs (±SE)	Percent Control Relative to Check[1]
Check	-	7.4 (0.5)	- a
Registered chemicals			
Carbaryl 80WSP*	1 lb.	4.4 (0.9)	41 abcde
Carbaryl 3.5G*	1 lb.	5.1 (0.7)	30 abcd
Dursban 4EC	4 lb.	5.5 (0.6)	25 abc
Dursban 50W	4 lb.	5.4 (0.3)	27 abc
Dylox 80SP	8 lb.	4.9 (0.7)	34 abcd
Dylox 6.2G	8 lb.	5.5 (0.6)	25 abc
Orthene 75S	3.75 lb.	5.9 (0.7)	20 abc
Tempo 20W	2.15 oz.	6.3 (0.6)	15 ab
Turcam 2.5G	2 lb.	3.8 (0.4)	49 bcde
Unregistered chemicals			
Merit 75WP	0.3 lb.	4.1 (0.8)	44 bcde
Merit 75WP	0.5 lb.	5.4 (0.9)	27 abc
RH0345 2F	0.5 lb.	4.4 (0.8)	41 abcde
RH0345 2F	1 lb.	3.0 (0.5)	59 cdef
RH0345 2F	2 lb.	3.1 (0.7)	58 bcdef
Biological control nematodes			
S. carpocapsae	2×10^9	2.3 (0.4)	69 def
S. glaseri	1×10^9	1.8 (0.9)	76 ef
S. glaseri	2×10^9	0.9 (0.3)	88 f

Percent control differs significantly when not followed by the same letter, based on SNK separation of mean live grubs, α=0.05.

* The normal application rate is 8 lb. AI/acre.

THE FATE OF CHEMICALS AND FERTILIZERS IN A TURFGRASS ENVIRONMENT

Marylynn. V. Yates, Principal Investigator
University of California, Riverside

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 specific objectives of the project are as follows:

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 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.
5) Monitor the effects of different irrigation regimes, fertilizers, and soil types on the quality of the turfgrass.

The site consists of two sub-areas. The first area represents a sand green, the second a fairway. The sod (Penncross bentgrass on the green plots and Tifway II hybrid bermudagrass on the fairway plots) was installed in early February 1992. Porous metal or ceramic suction cups have been installed in all plots to enable the collection of soil water samples. Drainage water samples are also collected on a weekly basis to monitor the concentrations of nitrate, phosphate, and pesticides that are leaching through the soil profiles.

Two irrigation treatments are being used in the project. One half of the plots are irrigated using an optimum water level (100% ET_c); the other half of the plots are being irrigated at 30% more than the optimum level (130% ET_c). The water requirements of the two turfgrasses are determined daily using a weather station located at the site. Irrigation frequency is based on a 50% moisture depletion.

Fertilizer applications were initiated on April 17, 1992. The fertilizer rates are 1 lb N/1000 ft^2/month and 0.5 lb N/1000 ft^2/month, for the green and fairway plots, respectively. Two fertilizer treatments have been established, resulting in one half of the plots being fertilized with urea and the other half with sulfur-coated urea. Plots are individually fertilized to ensure even application two times per month. To date, no significant differences in the mass of nitrate leached from any of the treatments has been observed.

Two different pesticides have been applied to the plots: Super Trimec and Carbaryl. Both drainage water and air samples have been collected to allow a determination of the amount of pesticides leaching below the rootzone and volatilizing into the air. Leachate samples to date have shown that very low concentrations (< 20 parts per billion) of 2,4-D leach below the rootzone. Air samples are still being analyzed to determine the extent of volatilization.

1992 NATIONAL TALL FESCUE TEST
Entries and Sponsors

Entry	Name	Sponsor
1	Avanti	Davenport Seed Co.
2	Lexus	Barenbrug/USA
3	Vegas	Barenbrug/USA
4	Austin	Barenbrug/USA
5	BAR Fa 214	Barenbrug/Holding
6	BAR Fa 2AB	Barenbrug/Holding
7	BAR Fa 0855	Barenbrug/Holding
8	GEN-91	Genesis Group
9	ATF-006	Advanta Seeds West
10	ATF-007	Advanta Seeds West
11	FA-19	Advanta Seeds West
12	FA-22	Advanta Seeds West
13	Rebel-3D	Lofts Seed Co.
14	Rebel, Jr.	Lofts Seed Co.
15	Bonsai	Turf Merchants (Standard Entry
16	Bonsai Plus	Turf Merchants
17	Twilight	Turf Merchants
18	KWS-DSL	Turf Merchants
19	Micro DD	Turf Merchants
20	Finelawn 88	Finelawn Research Corp
21	Finelawn Petite	Finelawn Research Corp.
22	Kittyhawk	Smith Seed Service
23	Aztec	O.M. Scott & Sons
24	Bonanza II	Proprietary Seed
25	SFL	O.M. Scott & Sons Co.
26	ZPS-E2	Zajac Performance Seeds
27	Pick 90-12	Pickseed West
28	Pick 90-6	Pickseed West
29	Eldorado	Turf-seed, Inc.
30	PST-5LX	Pure-Seed Testing, Inc.
31	PST-5STB	Pure-Seed Testing, Inc.
32	PST-5PM	Pure-Seed Testing, Inc.
33	Safari	Turf-Seed, Inc.
34	Olympic II	Turf-Seed, Inc.
35	PST-RDG	Pure-Seed Testing, Inc.
36	PST-5VC	Pure-Seed Testing, Inc.
37	Silverado	Turf-Seed, Inc.
38	PST-5DX w/endo.	Turf-Seed, Inc.
39	Tomahawk	Turf-Seed, Inc.
40	Monarch	Turf-Seed, Inc.
41	Cochise	Ampac Seed Co.
42	M-2	Mid-Valley Ag Products
43	403	Mid-Valley Ag Products
44	Anthem	Green Seed Co.
45	Astro 2000	Green Seed Co.
46	PST-59D	Pure-Seed Testing, Inc.
47	ZPS-J3	Zajac Performance Seeds
48	ZPS-ML	Zajac Performance Seed
49	ZPS-VL	Zajac Performance Seed
50	ITR-90-2	Pennington Seed Co.
51	Virtue	Pennington Seed Co.
52	OFI-TF-601	Olsen-Fennel Seed Co.
53	Pick CII	Pickseed West
54	Pick 90-10	Pickseed West
55	Phoenix	Barenbrug/Normarc Group
56	Cafa101	Cala Farms, Inc.
57	Ky-31 no endo.	Standard entry
58	Ky-31 w/endo.	Standard entry
59	ISI-AFE	International Seeds
60.	ISI-AFA	International Seeds
61	ISI-CRC	International Seeds
62	ISI-ATK	International Seeds
63	Duke	Cascade International
64	Montank	Cascade International
65	Pixie	Jacklin Seed Co.
66	J-1048	Jacklin Seed Co.
67	Lancer	LESCO, Inc.
68	Trailblazer II	LESCO, Inc.
69	SR8200	Seed Research, Inc.
70	SR8300	Seed Research, Inc.
71	SR8400	Seed Research, Inc.
72	SR8010	Seed Research, Inc.
73	SR8210	Seed Research, Inc.
74	Arid	Jacklin Seed Co.
75	PSTF-LF	Pro-Seeds Marketing
76	PSTF-200	Pro-Seeds Marketing (Standard entry)
77	PSTF-401	Pro-Seeds Marketing
78	Guardian	Roberts Seed Co.
79	Leprechaun	Roberts Seed Company
78	Guardian	Roberts Seed Company
79	Leprechaun	Roberts Seed Company
80	Falcon	E.F.Burlingham Standard entry
81	MB-21-92	E.F. Burlingham
82	MB-22-92	E.F. Burlingham
83	MB-23-92	E.F. Burlingham
84	MB-24-92	E.F. Burlingham
85	MB-25-92	E.F. Burlingham
86	PRO-9178	Seed Research, Inc.
87	CAS-LA20	Cascade Int'l Seed Co.
88	CAS-MA21	Cascade Int'l Seed Co.
89	WXI-208-2	Willamette Seed Co.
90	Shenandoah	Willamette Seed Co.
91	Bonanza	Standard entry
92	SIU-1	Sou. Illinois University
at UCR:		
93	MED 2-11-24	Medalist
94	MED 2-18-18	Medalist
95	MED 2-12-10	Medalist
96	MED 10-8-5	Medalist

NTEP TALL FESCUE VARIETY TRIAL

est. Oct. 1992 U.C.R.

N ↑

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

UCR - TURFGRASS RESEARCH CENTER - PROJECT SUMMARY

Starting Date October 1992
Completion Date ______
Project No. ______
Plot No. 11

Title: NTEP Tall Fescue Variety Trial

Objective: To evaluate tall fescue variety performance in southern California

Investigator(s):
Name V.A. Gibeault Dept. B/PS Phone x. 3575
Name R. Autio Dept. B/PS Phone x. 3898

Species/Cultivars: 96 tall fescue varieties

Management: Mowing Frequency 1 x/Wk. Height 2 in.
Fertilizer-Material ______ Rate ½ n/M/mo. in 8 applications
Irrigation - /X/ as needed ______ % ET_o / /Other (Specify Below)
Special ______

Experimental Design: /X/ CRD / / RCB / / SPLT / / Other ______
No. of Reps 3 Size of Rep. 30 x 60 Total Plot 60 x 90
Treatments: ______

Data Collection: 1) Variable turfscores Frequency monthly
2) Variable ______ Frequency ______
3) Variable ______ Frequency ______

Special Instructions/Comments: collect other data as appropriate.

NTEP BERMUDAGRASS TRIAL, U.C.R.

est. June 1992

I

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

II

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

III

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

1. J-27
2. J-912
3. SONESTA
4. CHEYENNE
5. FMC 1-90
6. FMC 2-90
7. FMC 3-91
8. FMC 5-91
9. FMC 6-91
10. SUNDEVIL
11. ARIZ. COMM.
12. 90173
13. OKS 91-1
14. OKS 91-11
15. SAHARA
16. GUYMON
17. FHB-135
18. ARIZ. COMM.
19. MIDIRON
20. TIFGREEN
21. TIFWAY
22. TEXTURF 10
23. STF-1
24. MIDLAWN
25. MIDFIELD
26. TDS-BM1
27. CT 2

entries 1-16 are seeded
entries 17-27 are vegetative

UCR - TURFGRASS RESEARCH CENTER - PROJECT SUMMARY

Starting Date: June 1992
Completion Date:
Project No.: 12 & 16
Plot No.:

Title: NTEP Bermudagrass Trial

Objective: To evaluate bermudagrass performance in southern California.

Investigator(s):

Name: V.A. Gibeault — Dept.: B/PS — Phone: x. 3575
Name: R. Autio — Dept.: B/PS — Phone: x. 4430

Species/Cultivars: 27 bermudagrass cultivars

Management: Mowing Frequency 1-2 x/Wk. Height 3/4 in.
Fertilizer-Material ______ Rate ½ /M/every other month
Irrigation - /X/ as needed ______ % ET_o / /Other (Specify Below)
Special

Experimental Design: / / CRD /X/ RCB / / SPLT / / Other
No. of Reps 3 Size of Rep. 27 x ______ Total Plot 6 x 7
Treatments:

Data Collection: 1) Variable turf quality Frequency monthly
2) Variable ______ Frequency ______
3) Variable ______ Frequency ______

Special Instructions/Comments:

ZOYSIA NATIONAL VARIETY TRIAL

↑ N

Rep							
I	19	18	4	1	26	7	16
I	8	28	2	25	11	20	14
I	21	13	3	15	10	23	9
I	22	12	17	5	24	6	27
II	6	23	27	28	5	12	3
II	7	19	11	22	10	17	25
II	24	1	26	14	4	13	21
II	15	18	16	9	2	8	20
III	28	4	10	11	2	24	9
III	19	18	5	6	13	22	25
III	20	15	27	12	23	3	16
III	17	21	7	1	8	14	26

VARIETIES

1. TC2033
2. GT2047
3. CD2013
4. TC5018
5. GT2004
6. CD259-13
7. * Korean Common
8. * JZ-1
9. Meyer
10. Emerald
11. * Belair
12. Sunburst
13. El Toro
14. DALZ8514
15. DALZ8512
16. DALZ8516
17. DALZ8507
18. DALZ8508
19. DALZ9006
20. DALZ8502
21. DALZ8701
22. * TGS-B10
23. * TGS-W10
24. DALZ8501
25. Z88-8
26. Z88-11
27. Z88-14
28. Z88-3

* Seeded variety.

6/91

UCR - TURFGRASS RESEARCH CENTER - PROJECT SUMMARY

Starting Date June 1991 Project No. ______

Completion Date ______ Plot No. 18

Title: NTEP Zoysia Trial

Objective: To evaluate zoysia varieties in southern California

Investigator(s):

Name V.A. Gibeault Dept. Bot & Pl Sci Phone X3575

Name R. Autio Dept. Bot & Pl Sci Phone X4430

Species/Cultivars: 28 zoysia cultivars

Management: Mowing Frequency 2 x/Wk. Height ~~3/4~~ 1 in.

Fertilizer-Material ______ Rate ~~1# N/M/6 wk.~~ ½# N/m/alt. month.

Irrigation - /X/ as needed ______ % ET_o / /Other (Specify Below)

Special ______

Experimental Design: / / CRD /X/ RCB / / SPLT / / Other ______

No. of Reps 3 Size of Rep. 60 x 30 Total Plot 60 x 90

Treatments: ______

Data Collection: 1) Variable Turfscores Frequency Monthly

2) Variable ______ Frequency ______

3) Variable ______ Frequency ______

Special Instructions/Comments: ______

NTEP BUFFALOGRASS TRIAL
(Plot #8)

↑ N

	19	18	4	1	7	16	8
I	2	11	20	14	21	13	3
	15	10	9	22	12	17	5
	6	5	12	3	7	19	6
	11	22	10	17	1	14	4
II	13	21	15	18	16	9	2
	8	20	4	10	11	3	16
	17	21	7	1	8	14	2
III	9	19	18	5	6	13	22
	OPEN				12	15	20

VARIETIES

1. NE 84-609
2. NE 84-315
3. NE 85-378
4. NE 84-45-3
5. NE 84-436
6. Buffalawn
7. AZ143
8. Highlight 4
9. Highlight 15
10. Highlight 25
11. Prairie
12. Rutgers
13. Sharp's Improved
14. NTDG-1
15. NTDG-2
16. NTDG-3
17. NTDG-4
18. NTDG-5
19. Bison
20. BAM 101
21. BAM 202
22. Texoka

8/91

UCR - TURFGRASS RESEARCH CENTER - PROJECT SUMMARY

Starting Date August 1991 Project No. 8
Completion Date ______ Plot No. ______

Title: NTEP Buffalograss Trial

Objective: To evaluate buffalograss varieties in southern California

Investigator(s):
Name V.A. Gibeault Dept. B/PS Phone x. 3575
Name R. Autio Dept. B/PS Phone x. 4430

Species/Cultivars: 22 buffalograss cultivars

Management: Mowing Frequency 1 x/Wk. Height 2 in.
Fertilizer-Material ______ Rate ½ n/M/alternate months
Irrigation - /_/ as needed ______ % ET_o /_/Other (Specify Below)
Special ______

Experimental Design: /_/ CRD /x/ RCB /_/ SPLT /_/ Other ______
No. of Reps 3 Size of Rep. ______ x ______ Total Plot 6 x 7
Treatments: ______

Data Collection: 1) Variable turfscore Frequency monthly
2) Variable ______ Frequency ______
3) Variable ______ Frequency ______

Special Instructions/Comments: ______

The following four abstracts were prepared and presented by the authors at a U.C. continuing conference for Environmental Horticulture personnel on June 22-24, 1993, at U.C. Riverside. They are included here for your information.

BUFFALOGRASS [BUCHLOE DACTYLOIDES (NUTT.) EMGELM.] CULTIVAR IDENTIFICATION USING RAPD MARKERS

Lin Wu, and Houng Lin
Department of Environmental Horticulture, University of California, Davis CA 95616

The polymerase chain reaction (PCR) and random primer amplified DNA fragments (RAPD) are potentially useful methods for turfgrass cultivar identification. RAPD markers were studied in twenty-five vegetatively propagated buffalograss lines using oligonucleotide random primers and agarose-gel-electrophoresis to determine their potential for cultivar identification. The variation of RAPD markers was extensive. The RAPD markers produced by one random primer were sufficient to separate the 25 buffalograss lines. Cluster analysis based on the RAPD markers produced by two random primers revealed that the 25 buffalograss lines generally fell into two groups, diploid and hexaploid. This result reflects the genetic diversity between the diploid and hexaploid buffalograss races.

Three DNA extraction methods including sarcosyl lysis-chloroform extraction-isopropanol precipitation, SDS lysine-isopropanol precipitation, and boiling in the presence of chelex-100 resin, and fresh or oven-dried tissues were tested for reproducibility of RAPD marker. The three DNA extraction methods, using dry or fresh plant tissues, produced highly comparable RAPD marker profiles. Over 80% of the RAPD markers were consistently detected in six replicate analysis. The above studies demonstrate that small quantities (5 mg) oven-dried leaf tissue, and different DNA extraction methods can be used for buffalograss fingerprint studies.

Two specific primers (19mer) were constructed according to a DNA sequence isolated from the buffalograss genome. A more powerful RAPD procedure will be used for buffalograss cultivar identification.

WEED CONTROL WITH TURFGRASS CULTIVARS

Clyde Elmore
Agricultural Botany Department, University of California, Davis

Crabgrass is one of the major weed species in much of the turfgrass in the United States. Crabgrass (hairy or large crabgrass and smooth crabgrass) is found in either new or established turf. Often it invades turfgrass when there is an open gap for weeds to establish. Once it has seeded there is additional opportunity for spread in the turf. Preemergence herbicides have been the principal defense against crabgrass. Several herbicides (Betasan, DCPA, Balan, trifluralin, pendimethalin, Ronstar) have given control of crabgrass and are often used once per year to control crabgrass.

A project was started in 1989 to evaluate cultivars of ryegrass, fescue and bluegrass for suppression of the invasion of large crabgrass. Bluegrass was less effective than ryegrass which was also less effective than fescue to suppress large crabgrass. The cultivars Fawn, Olympic, Rebal and Bonsai have been further evaluated and found to be very effective for large crabgrass control. No cultivar has been totally effective for crabgrass control when planted together in the spring. Fall planting of these species appears to be effective for spring control. Addition data will be presented on competition trials.

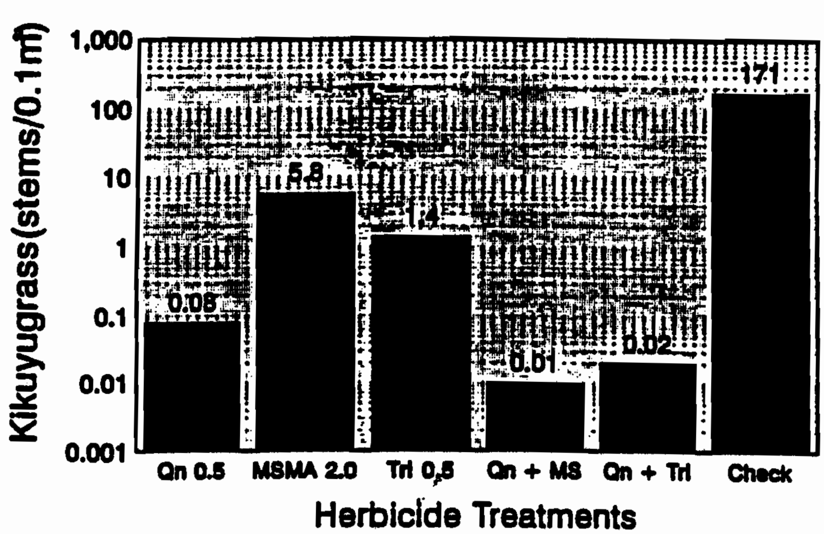
INTEGRATED KIKUYUGRASS MANAGEMENT IN COOL SEASON TURF

David W. Cudney, Jim A. Downer, Mike Henry, and Vic Gibeault
Department of Botany and Plant Sciences, U.C., Riverside

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 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 is back. A method was needed to slowly reduce the competitive ability of kikuyugrass while allowing the regrowth of desirable turf species. Previous work by Vic Younger 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, and quinclorac were tested in southern California over a four year period. These treatments did not control kikuyugrass as single applications, but when applied every five weeks over a five month period, kikuyugrass was reduced from 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. The following graph illustrates the control which was obtained utilizing sequential applications. This method of control has the advantage of removing the objectionable turf species slowly by shifting the competitive edge from the weedy species to the desirable species. This is done without loss of use of the turf area. Trials are underway in 1993 to find ways to reduce kikuyugrass in warm season turf (hybrid and common bermudagrass). Additional trials are being conducted as a joint project with Clyde Elmore at U.C., Davis to test sequential applications as a means of removing bermudagrass from cool season turf.

Kikuyugrass/Perennial Ryegrass
Huntington Beach 1992



LSD 0.05 = 34

THE EFFECTS OF PRIMO AND THREE NITROGEN FERTILIZER LEVELS ON THE ABOVE- AND BELOW-GROUND GROWTH CHARACTERISTICS OF TIFWAY BERMUDAGRASS

Robert L. Green
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Current goals for maintaining turfgrasses are to produce acceptable turfgrass quality and function; develop turfgrasses and cultural systems that require lower inputs of labor, water, fertilizers, and pesticides; and be compatible with current environmental issues. Applications of plant growth regulators may offer the possibility of producing acceptable turfgrass quality and function, while producing less clippings and requiring fewer mowings and utilizing less N and water, thus helping to protect the environment. One objective of this study was to begin to determine the effect of Primo applications on the above- and below-ground morphological characteristics of Tifway bermudagrass. A second objective was to begin to determine if Primo applications can result in lower N fertilizer inputs, while maintaining acceptable turfgrass visual quality.

Plugs of Tifway bermudagrass were grown for a total of 5.5 months in 4-inch diameter and 36-inch deep PVC cylinders that were cut and rejoined in 12-inch sections. The cylinders were uniformly filled with a medium-textured sand. Turfs were fertilized at 3 different N rates for 7 weeks prior to Primo applications. Primo was applied at 400 g a.i./ha; a check was also included. Data of visual turfgrass quality and clipping yields were collected for 6 weeks following Primo applications. Other above-ground morphological characteristics were measured. At harvest, the root systems were analyzed for mass, length, and branching.

Data from this study indicated that Primo is a well-suited plant growth regulator for Tifway bermudagrass that is fertilized at commonly-applied N rates. These data indicated that the potential benefits of Primo applications may include the production of: a turfgrass with a thicker, darker-green canopy, yet this canopy produced less clippings (about 50% reduction over 6 weeks); a turfgrass that required lower N inputs to produce acceptable visual quality (at least during the last 4 weeks of a 6-week period following Primo applications); and a turfgrass with a higher root mass and deeper rooting, which may translate into a turfgrass with a higher degree of stress tolerance.

LANDSCAPE MANAGEMENT RESEARCH CONFERENCE

AND FIELD DAY

SEPTEMBER 15, 1993

TERMITES MAY BE WEAKENING OUR URBAN TREES

Thomas Atkinson, Extension Entomology Specialist, Department of Entomology, UC Riverside

NOTES:

MANAGING NUISANCE STREET TREE INSECT PESTS 1992-1993 RESEARCH RESULTS

Richard Cowles, Extension Entomology Specialist, Department of Entomology
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Numerous insect pests affecting street trees in California are principally a concern because of nuisance honeydew or falling frass, along with unsightly blackened or chewed leaves. Some of these pests can also considerably decrease tree vigor and cause decline if left untreated for multiple years. Some of the especially common pests that are mainly a concern because of dripping honeydew are tulip tree aphid, woolly ash aphid, and elm leaf aphid. Elm leaf beetle can defoliate elm species and *Zelkova*. Concern in managing this species arises from the nuisance of falling frass, loss of tree vigor, invasion of structures by overwintering adults, and outbreaks of other pests due to broad-spectrum insecticides used for its control. Spider mites, sycamore scale, and sycamore lace bugs are primarily a concern because of browning of foliage and premature leaf drop.

Three treatment options fit in well with management of these pests in urban settings.

1) Ultra-refined horticultural oils (SunSpray 6E and SAF-T-SIDE) are products that are not phytotoxic to growing plants unless used on drought-stressed plants or at high temperatures. Oils are effective miticides, killing all developmental stages in one application. Pavel Svihra (Marin Co. Coop. Ext.) has investigated control of sycamore scale, which causes unsightly spotting and distortion of leaves and season-long leaf drop. One application of 1% oil or 1% M-Pede soap timed at bud break gave excellent season-long control of this pest, much better control than the previously recommended dormant oil timing.

2) *Bacillus thuringiensis* products, selective microbial pesticides, have been around for a long time. A new idea in landscapes is the combination of Bt with horticultural oils (studied by Steve Dreistadt, U.C. Davis). This combination kills more developmental stages than a single spray of either material. Elm leaf beetle can thus be controlled with one M-Trak + oil spray, because all life stages (except pupae) are affected. Including horticultural oil may also improve the stability of Bt products, yet is compatible with biological control.

3) Systemic insecticides can be tremendously valuable for managing both sucking and chewing insects. Current problems involved with use of systemics involves loss of registration (dicrotophos), requirement of closed systems for handling Metasystox-R, and damage to trees from trunk injections. Experiments (my work) conducted with a new experimental insecticide, NTN33893, from Miles Inc., involved elms, ash, and tulip trees. This material has an unusual combination of characteristics, including low mammalian toxicity, high water solubility, and high stability in the soil. The results

below suggest that this material will be extraordinarily useful for control of aphids when applied either through trunk or soil injection, or subsurface placement of granules. Further studies (and registration, hopefully in 1994) are required before this material can be recommended for control of other pests, such as elm leaf beetle and non-aphid sucking insects.

<u>1992: Aphids/leaf, trunk injections</u>

	Woolly ash aphid	Elm leaf aphid
Check	21.4	9.58
NTN33893	2.57	0.0
Bidrin	0.0	0.91
Orthene	25.9	0.0
MSR	2.57	0.0

<u>1993: Aphids/leaf and honeydew ratings*</u>

	Tulip tree aphid	Honeydew
Check	95.2	92.8
NTN33893 75W	0.0	4.4
NTN33893 2.5G	1.6	10.6

* soil applications

DISEASE MANAGEMENT FOR GAZANIAS

Donald M. Ferrin, Plant Pathologist, Department of Plant Pathology
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Gazanias represent a relatively new ornamental crop in southern California. It's drought tolerance and ability to thrive under a variety of conditions make it well suited for a variety of landscapes uses in southern California. Another attribute that makes gazanias desirable for use in the landscape is that they are relatively disease-free. However, as with many plants, once they are grown on a large scale, they are found to be hosts of some of the more common diseases affecting nursery and landscape plants, in particular Pythium root rot and Rhizoctonia root and crown rots.

Until recently, one of the most commonly used fungicides for the control of Rhizoctonia diseases was benomyl. However, this product is no longer available for use on ornamentals. Other fungicides, as well as a biological control agent, are currently being evaluated for control of these diseases.

Dr. Robert Gilbertson at U.C. Davis has also recently found that gazanias are hosts for at least four viruses, including cucumber mosaic, lettuce mosaic and turnip mosaic viruses. All of these viruses can be transmitted by a variety of aphids in a nonpersistent manner. Symptoms on gazanias include chlorotic flecking and distortion of the leaves. However, symptoms appear to less severe on plants in the summer months, presumably because of a decrease in virus multiplication within the plants. The effects of virus infection on host growth and flowering, and the ability of the host to withstand drought are not currently known.

Because of the wide host ranges of these viruses, particularly cucumber mosaic virus, virus-infected plants introduced into the landscape potentially serve as sources of inoculum for spread of the viruses to other susceptible ornamental and vegetable hosts. The only sure means of control of these virus diseases is through the use of virus-free plants. To date, the development and implementation of virus elimination and certification programs have not been addressed.

UPDATE ON LANDSCAPE WEED MANAGEMENT

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NOTES:

USES OF ANTITRANSPIRANTS IN THE NURSERY AND LANDSCAPE

Ursula K. Schuch
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Antitranspirants are applied to a variety of tree crops or nursery plants to reduce water loss. Antitranspirants are marketed for protection against drying winds, chilling, freezing, and transplant shock. Metabolic antitranspirants reduce transpiration by affecting the mechanism of guard cells, while waxes and film-forming antitranspirants form a physical barrier on the surface of leaves and stems which decreases water loss by partially covering or blocking stomata. Waxes are traditionally used on bareroot roses for protection from water loss during storage and shipping. Most film-forming antitranspirants are acrylic or terpenic polymers, waxes or latex emulsions. Even the most promising film-forming antitranspirants are more permeable to water than to carbon dioxide by a factor of four, and in addition to reduced transpiration a concurrent reduction in photosynthesis has often been found.

Duration and effectiveness of antitranspirants vary with environmental and plant conditions. Uneven coverage of the antitranspirant film can result in inconsistent effectiveness and can be due to species differences in leaf texture or anatomy of stomata, application technique (dip or spray), dilution of the compound, or number of applications. The water potential at the time of antitranspirant application and the degree of stress that plants are exposed to will determine possible benefits. Antitranspirants are generally not beneficial when plants are exposed to extreme desiccation or very little stress. In studies with antitranspirants the evaluation period has not always been long enough to determine when the effectiveness of the compounds was lost. Finally, the evaluation criteria such as survival after transplanting, degree of wilting, chilling or frost injury, leaf water potential, transpiration, photosynthesis or stomatal conductance are important in judging effectiveness of an antitranspirant. When using an antitranspirant, beneficial short-term effects on reduced transpiration and higher water potentials have to be evaluated against possible negative long-term effects such as phytotoxicity, leaf drop or reduced reproductive ability.

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MOWING TO RENOVATE GROUNDCOVERS

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Dennis R. Pittenger, Extension Environmental Horticulturist, University of California Cooperative Extension, Riverside, CA 92521

Groundcovers are widely used in the landscape as transition plantings, borders, and slope covers. In California, they have special merit since their irrigation and maintenance requirements are often less demanding than those of turfgrasses. However, once established, many species of groundcovers either lose vigor and thin out, or grow vigorously and develop an irregular, overgrown appearance with a thick and uneven thatch of stemmy growth. In both cases their appearance is unsightly and the groundcovers can collect trash, pose a fire hazard, harbor rodents, and interfere with irrigation. Regular pruning or renovation of groundcovers is sometimes recommended to keep plantings vigorous, neat, healthy, and attractive and reduce thatch. Unfortunately, there are no research-based guidelines for mechanical management of groundcovers that specify proper timing and height of mowing, or expected recovery rates for individual species. In our study, eight species of groundcovers commonly used in California were subjected to renovation by mowing for a two-year period: red apple, prostrate coyote bush, pink iceplant, trailing lantana, prostrate myoporum, trailing African daisy, dwarf rosemary, and garden verbena. Plant response was evaluated monthly for height, density, thatch, overall appearance. Six species responded favorably to a four-inch mowing; thatch and height were significantly reduced for up to several months with only a brief loss of aesthetic quality. Prostrate coyote bush, trailing lantana, prostrate myoporum, and garden verbena responded well to March mowings while pink iceplant and trailing African daisy responded well to June mowings. In the two species that did not respond favorably to mowing, red apple and dwarf rosemary, mowing significantly reduced thatch and height but their aesthetic quality and density were unacceptable for several months. These findings provide landscape managers, architects and designers with the specific information needed to conduct effective, minimal input maintenance programs where a low-growing, non-turf plant material is desired.

USES AND EFFECTS OF EUCALYPTUS MULCHES

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Much of the greenwaste produced in California is from trees. Eucalyptus are a prominent part of Southern California landscapes, we have historic and protected windrows, and numerous species commonly planted to landscapes. According to recent surveys, it is a common belief among horticulturists that Eucalyptus mulches and composts are toxic to ornamental plants). Fresh Eucalyptus is perceived to be more toxic than composted material but it is surprising that so many believe composted Eucalyptus to be toxic. These beliefs may have come from observation that few plants grow under large Eucalyptus. Although a toxic origin for this lack of plant growth is a natural assumption, these observations don't consider tree water use and the copious mulch produced by most Eucalyptus species. Belief that Eucalyptus mulch products are toxic may have originated with early research reports. It has long been recognized that Eucalyptus foliage contains essential oils of economic importance (Penfold and Willis, 1961.), however it has also been shown that these chemicals can be transferred to soil.

Bare zones associated with naturalized stands of *E. camalduensis* were found to contain the terpenes cineole and alpha-pinene (DelMoral and Muller, 1970). They also found that fog drip was the mechanism of toxin transport from the foliage of *E. globulus* to the bare zone soil surface. Concentration of terpenes in soils by absorption is necessary for their activity. The degree of inhibition may be estimated as a direct relationship to the amount of colloidal material in the soil. Sandy soils rarely develop such toxicities. Phenolic acids also collect in leaf litter; they concentrate as mulch accumulates through the year. Winter rains then leach high concentrations of acids into the root zone and may directly inhibit germination of herbaceous plants. While the early work of DelMoral and Muller supported the notion that Eucalyptus are toxic, later work by Bowman and Kirkpatrick, 1986 found that soil moisture depletion was the major effect exerted by mature Eucalyptus in suppression of seedlings. A recent paper studied toxin leachates with methods which more accurately reflect "natural" leaching rates of rainfall (May and Ash 1990). This work supported the role for allelochemical inhibition of understory vegetation. It was further stated that detritus from Eucalyptus contained inhibitory chemicals 5 months after detachment from the tree. May and Ash also recognized that dry climates will concentrate toxins and enhance the allelopathic effects on surrounding plants. Most studies of Eucalyptus are technical and or ecological and do not concern the horticultural properties of Eucalyptus derived products. In a recent text on soils, Handrek and Black note toxicities have been observed with E. globulus, but do not reference any research paper. In an effort to evaluate horticultural aspects of Eucalyptus wastes Skimina conducted several tests at Monrovia Nursery and found some inhibition of seedlings, but also observed growth enhancements of ornamental plants with Eucalyptus derived leachates. In our studies, landscape trees benefited from Eucalyptus mulches, fresh or composted. Eucalyptus derived container media were satisfactory but did not hold enough water, and were of a high pH which promoted chlorosis in some plants. Seedling assays of various species of fresh or composted Eucalyptus mulch showed that Eucalyptus compost stimulated seedling germination, but fresh mulches retarded germination. We believe that Eucalyptus derived mulches have many uses in landscapes and most fears of using them are not justified. The benefits of using mulches are increased weed control, conservation of moisture and improved soil qualities.

BUFFALOGRASS EVALUATIONS

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San Diego County, UC Cooperative Extension

NTEP BUFFALOGRASS TRIAL
(Plot #8)

N ↑

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

OPEN

VARIETIES

1. NE 84-609
2. NE 84-315
3. NE 85-378
4. NE 84-45-3
5. NE 84-436
6. Buffalawn
7. AZ143
8. Highlight 4
9. Highlight 15
10. Highlight 25
11. Prairie
12. Rutgers
13. Sharp's Improved
14. NTDG-1
15. NTDG-2
16. NTDG-3
17. NTDG-4
18. NTDG-5
19. Bison
20. BAM 101
21. BAM 202
22. Texoka

8/91

HERBICIDE SYMPTOMS, CLASSIFICATION BY MODE OF ACTION

by

Barry Tickes, Dave Cudney, and Clyde Elmore

Herbicides are applied with the goal of injuring or killing unwanted plants. Many of the herbicides used in California are selective in that they injure weeds and cause minimal disruption of desirable plants. Occasionally, however, desirable plants are injured. This can happen through soil residues of herbicides from applications in previous crops, from spray drift of herbicides moving "off target", or from mistakes in application rates or improper herbicide choice. Crop injury can be caused by many factors and may not be due to herbicides. Nutrient deficiencies, salinity, drought, insect, disease, and nematode injury can all produce crop symptoms that can be mistaken for herbicide damage. It would be helpful to know what types of injury to expect from the herbicides that are most commonly used.

The following project was established in order to capture pictorial evidence of the symptoms produced by the most common herbicides. These herbicides were grouped into ten categories or "families" based on their modes of action. Seven crops were selected and treated with levels of herbicides sufficient to produce symptoms characteristic of their "herbicide family". The seven crops were: bean, tomato, sugarbeet, cotton, corn, wheat, and woody plants. Approximately 25 herbicides were grouped into the ten "families". Both pot studies and field studies were used to produce the herbicide symptoms. The goals of the project are: 1) to produce a slide set which would be useful to weed scientists and others who work with herbicides, 2) to produce a book with descriptions and pictures of herbicide symptoms which would be a useful reference to those trying to discern herbicide injury form other crop injury symptoms.
The ten herbicide "families" grouped by mode of action consisted of:

1. The Growth Regulator Herbicides (2,4-D, MCPP, Banvel, and Turflon). These are mostly foliar applied herbicides which are systemic and translocate in both the xylem and phloem of the plant. They mimic natural plant auxins causing abnormal growth and disruption of the conductive tissues of the plant. The injury from this family of herbicides consists of twisted, mal-formed leaves and stems.

2. The inhibitors of amino acid synthesis (Roundup, Pursuit, Touchdown, Glean, and Oust). Both foliar and soil applied herbicides are in this family. Roundup and Touchdown translocate in the phloem with photosynthate produced in the leaves. Others in this family move readily after root or foliar absorption. These herbicides inhibit certain enzymes critical to the production of amino acids. Amino acids are the building blocks of proteins. Once protein production stops, growth stops. Symptoms are stunting and symptoms associated with lack of critical proteins.

MONKEY FLOWER (*MIMULUS*) HYBRIDIZATION AND SELECTION

University of California Riverside Botanic Gardens
Steve Morgan, Curator

1. Background:

The shrubby, perennial species of *Mimulus* (Scrophulariaceae) have great potential as landscape plants for a wide range of semi-arid climates and landscape situations. They could prove useful as moderate-water bedding plants and landscape perennials, colorful nursery container plants, slope covering and stabilizing plants, and candidates for inclusion in hydroseeding seed mixes. Known commonly as "monkey flowers," they offer showy flowers in a variety of colors, a long bloom season, easy culture, easy propagation from seed and cuttings, and moderate water requirements. David Verity at UCLA made hybrids in past years and supplied the U.C.R. Botanic Gardens with seed of 30 hybrid families to use in our work.

2. Goals:

The goal of the project is to continue hybridizing and selecting the Verity hybrid *mimulus* to develop plants with bushy habit, larger flowers, improved flower color, longer bloom period, improved heat tolerance, improved disease resistance in the landscape and ability to withstand summer watering. We will select types that show resistance to damping-off disease in the seed bed, that propagate readily, that make healthier container stock, and that are longer-lived under moderate summer irrigation programs. Also, by successive selfings of selected cultivars, we hope to produce seed that breeds "true" for the same desirable characters. A grant from the California Association of Nurserymen supports this project.

3. Progress:

We germinated seed of many of David Verity's 30 hybrid families and seedlings were transplanted to a field on the Agricultural Experiment Station in May, 1989. Plants were furrow irrigated once a week for 24 hours, which supplied about 2 in. of water each week until they were established. Cuttings of plants with desirable foliage and flower characters were taken for propagation and then planted out in separate plots to test both for drought tolerance and for ability to withstand summer watering. The selections were also propagated to test in container stock conditions and planted out into several garden situations to test their landscape adaptability. The same selections were selfed to produce seed for planting this fall and re-selection spring of 1994. Propagation and selection of the original selections continues.

SAGE (*SALVIA*) SELECTION AND TESTING

There are over 900 species of *Salvia* (Lamiaceae or Labiatae), native to both the New and Old World. The genus includes the sage of culinary use (*Salvia officinalis*), scarlet sage (*Salvia splendens*) and mealy cup sage (*Salvia farinacea*) used as bedding plants, and numerous sages are important components of our native Chaparral, Coastal Sage Scrub and other Plant Communities. They vary greatly in their habit, foliage scent, flower form and color, uses, climate adaptability and horticultural potential.

In 1984, the Botanic Gardens received a 3-year grant from the Elvenia Slosson Foundation to study various species of *Salvia* for their drought tolerance in garden situations. Since that study, the Gardens has continued collecting and testing *Salvia* species and selections for their adaptability and value in Inland Southern California Gardens. The plants come from many sources, including seed lists of other Botanic Gardens around the world and collecting trips to Mexico by Andy C. Sanders (UCR Herbarium), Steve Morgan (UCR Botanic Gardens) and others. To date, the Botanic Gardens has more than 50 species of *Salvia* planted out in their collection and many more in propagation for testing. The project is ongoing and more species and selections are added each year.

[f:mimulus:pittang – 8/31/93]

ALTERNATIVE LANDSCAPE PLANT MATERIAL OBSERVATIONS

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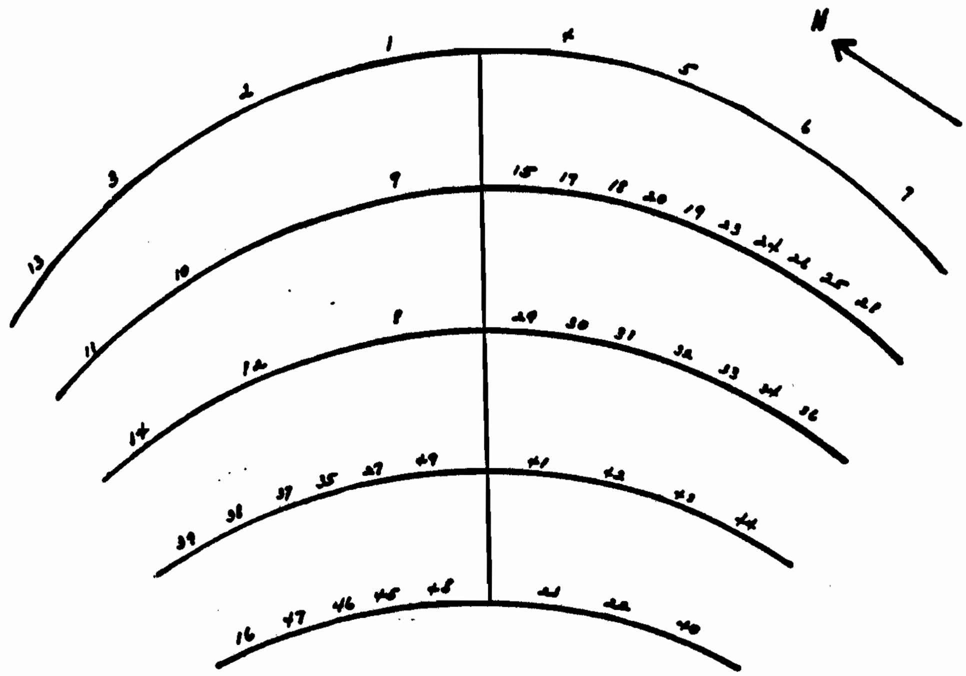

TREES

Species	Common Name	Species	Common Name
1) Acacia abyssinica		8) Cercidium floridum	Blue Palo Verde
2) Acacia aneura	Mulga	9) Prosopis alba	Argentine Mesquite
3) Acacia minuta	Sweet Acacia	10) Prosopis chilensis	Mesquite
4) Acacia pennatula		11) Prosopis glandulosa	Texas or Honey Mesquite
5) Acacia shaffneri	Twisted Acacia	12) Vauquelinia californica	Arizona Rosewood
6) Acacia stenophylla	Shoestring Acacia	13) Yucca angustissima	
7) Acacia willardiana	Palo Blanco	14) Yucca elata	Soap Tree

SHRUBS

Species	Common Name	Species	Common Name
15) Acacia Notabilis		33) Leucophyllum frutescens	'Green Cloud'
16) Acacia redolens		34) Leucophyllum frutescens	Texas Sage or Ranger
17) Ambrosia deltoidea	Triangle leaf bursage	35) Leucophyllum frutescens	'Compacta'
18) Antigonon leptopus	Queen's Wreath	36) Leucophyllum frutescens	'White Cloud'
19) Baccharis	'Centennial'	37) Leucophyllum laevigatum	Chihuahuan Sage
20) Caesalpinia mexicana		38) Muhlenbergia dumosa	Bamboo Muhly
21) Caesalpinia gilliesii	Yellow Bird of Paradise	39) Muhlenbergia rigens	Deer Grass
22) Caesalpinia pulcherrima	Red Bird of Paradise	40) Oenothera berlandieri	Mexican Evening Primrose
23) Calliandra eriophylla	Fairy Duster	41) Oenothera spubbii	Evening Primrose
24) Dalea bicolor	Silver Dalea	42) Pennisetum setaceum	'Cupreum'; Red Fountain Grass
25) Dalea pulchra	Indigo Bush	43) Pennisetum setaceum	Green Fountain Grass
26) Dalea greggii	Trailing Indigo Bush	44)	Red Three Awn
27) Dasylirion atrotriche	Green Desert Spoon	45) Ruellia peninsularis	
28) Dasylirion wheeleri	Desert Spoon	46) Salvia coccinea	
29) Encelia farinosa	Brittle Bush	47) Sophora secundiflora	Texas Mountain Laurel
30) Justicia candicans		48) Verbena goodingii	
31) Justicia spicigera	Firecracker Plant	49) Yucca glauca	Soap Weed
32) Leucophyllum candidum	Violet Silver Leaf		
	'Silver Cloud'		

STOP #5: GROWTH AND DEVELOPMENT OF MAGNOLIA AND OAK TRANSPLANTED FROM THREE CONTAINER SIZES

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*UCCE San Bernardino County
**Dept. of Botany & Plant Science

Objective: To evaluate growth rate and quality of two commonly-planted landscape tree species transplanted from three container sizes.

N↑

B1		A3
A2	A1	B2
A3	B3	A1
B1	B2	B3
B3	A2	B1
A1	B2	A2
A1	A3	A2
B3	A3	B1
A3	B2	A2
B2	B3	A1
	B1	

TREE SPECIES:
Magnolia = A
Oak = B

SIZE CLASSIFICATIONS:
24" Boxed specimen = 1
15 Gallon specimen = 2
5 Gallon specimen = 3

NEW TECHNOLOGY FOR ESTIMATING LANDSCAPE TREE WATER USE

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NOTES:

The following six abstracts were prepared and presented by the authors at a U.C. continuing conference for Environmental Horticulture personnel on June 22-24, 1993, at U.C. Riverside. They are included here for your information.

FUTURE OF ORGANIC AMENDMENTS IN CALIFORNIA

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California Assembly Bill 939 requires all state municipalities to divert 25% of their waste from landfills by 1995 and 50% by 2000. Since yard wastes represent a significant component of the waste stream, many areas have opted to collect garbage and yard wastes separately. The yard wastes are then generally processed for land application, either as compost or mulch. These products have many beneficial properties (see Dave Chaney, Laurie Drinkwater, and Stu Pettygrove's timely new CE publication: *Organic Soil Amendments and Fertilizers*), but they also carry some perceived or actual risks associated with salinity, long-term nitrate pollution, and pathogen control. It is not always clear how these materials are best used on the farm. Currently it is difficult to accurately predict, for example, mineralization rates for composted green waste nitrogen. Furthermore, the large-scale composters who are organizing themselves to process these newly available green materials are not always familiar with the needs of agriculture and related industries when producing and marketing their product. I suggest that UC Cooperative Extension investigate ways of indexing or quantifying the properties of green waste, sewage sludge, and animal manure, and other organic products so that (1) farmers can understand how to use them properly and (2) so that producers of these materials have a target on which to focus their quality control efforts.

TRUNK TEMPERATURES OF CALIFORNIA SYCAMORE

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A rapid, easy method of estimating tree stress is desirable for evaluation of shade tree water status. Most equipment for estimates of plant water potential and transpiration are costly, and time consuming to use. Shackel et.al. observed that trunk temperature depression over ambient air temperatures exist in stems of irrigated peach trees in a field setting. They further postulate that unheated stem temperature biases may be a function of the level of transpirational water flux through the stem.

In a study of California Sycamore(*Platanus racemosa*) mulched with Eucalyptus yardwastes, trunk temperatures of mulched trees were lower than unmulched tree stem temperatures during the growing season. All trees had similar temperatures during the dormant season (see table).Unmulched trees which tended to be under greater moisture stress, transpired less; thus were warmer than trees with mulch. Further study is needed to verify the role of stem temperatures as an estimator of tree water status.

Low-Trunk temperatures of *Platanus racemosa* as affected by mulch treatment.

Mulch Treatment

	LTT °F [1]				% SoilWater[2]	SC[3]
	Fall	Winter	Spring	Summer	Fall	
no mulch	78.3	70.4	84.9	90.6	12.7	124.1
mulched	74.9	70.8	79.8	87.7	15.6	185.8
F value[4]	29.8	2.67	31.05	13.8	4.921	8.99
Probability	.000	.121	.000	.001	0.033	0.005

1. LTT = low-trunk temperatures. Winter readings were during dormancy. Trees were well foliated during other seasons.
2. Water content is % vol. by time domain reflectometry.
3. SC is stomatal conductance using a Licor 1600.
4. F values and probabilities from single degree of freedom orthagonal contrasts.

LITERATURE CITED

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CARBOHYDRATE TRANSPORT IN WOODY PLANTS

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Most of our knowledge of carbohydrate biosynthesis and phloem transport comes from studies using herbaceous annual plants. However, unlike herbaceous annuals, in which sucrose is the primary carbohydrate synthesized and transported, many woody ornamental species synthesize and transport unusual carbohydrates, such as raffinose oligosaccharides and sugar alcohols, in the phloem. The minor vein anatomy of these plants is also distinctly different from that of herbaceous annuals, suggesting that the phloem loading pathway in woody plants may not be the same as that currently accepted for herbaceous plants. In our laboratory, we are examining phloem loading and carbohydrate biosynthesis in two woody ornamentals, olive and euonymus. These two species synthesize and export a combination of sucrose, raffinose oligosaccharides and sugar alcohols. Our data indicate that these types of carbohydrates are synthesized in different locations within the source leaf. In addition, it appears that these carbohydrates are delivered to the phloem transport system via a cytoplasmic route from the sites of photosynthetic sugar production to the minor veins of the phloem.

POTENTIAL FOR OFF-SITE HERBICIDE MOVEMENT IN NURSERIES

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There is a general concern about off-site movement of herbicides in the nursery industry. There are some herbicides that have been found in ground water in agricultural sites where herbicides have been used extensively for many years. Often it is apparent that the sites where herbicides are found have been from mishandling of the materials rather than grower use. We have been concerned about the principal herbicides used in the nursery, thus we started research projects to evaluate the leaching capabilities in potting mix and comparing it to soils.

Initially we evaluated oxyfluorfen (Goal) in container soils with different amounts of water applied, different rates of application, and different locations of placement of the material. We found that at use rates oxyfluorfen did not move through nursery soil and did not appear in the leachate. Only at excessive rates or with heavy irrigation rates could the herbicide be found in the leachate.

The herbicide oxadiazon was then evaluated using similar methods by researchers in South Carolina. Similar results as for oxyfluorfen were observed with this herbicides.

With the registration of metolochlor in nursery containers we started similar testing on this compound. Our results indicated excessive movement through container mixes and light (sandy) soils at use rates. In discussions with researchers at North Carolina they had differing results. In this project we shipped our potting mix to N. C. State to be evaluated in their trials. They also found that metolachlor moved through the mix. We have recommended against using this herbicide in our soil mixes. Data from these latter trials will be published in the Journal of Environmental Horticulture.

Oryzalin (Surflan) is currently being researched in South Carolina.

INTEGRATING LOW TOXICITY PESTICIDES AND NATURAL ENEMIES IN THE NURSERY AND LANDSCAPE

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We have been involved in several projects to reduce use of toxic pesticides in the landscape and nursery. In cooperation with Ellen Zagory and staff at the University Arboretum in Davis, we have developed and instituted a program that has reduced insecticide spraying in the nursery by 40%. Much of this reduction can be credited to the use of an IPM intern who monitored plants regularly to determine need for treatment. Treatment guidelines were "seat-of-the-pants" and not research-based. Organophosphate and pyrethroid insecticides were entirely eliminated and insecticidal soap, *Bacillus thuringiensis*, and ant stakes the only insecticides applied. Soap sprays gave good temporary control of most of the soft bodied, exposed insects and mites, including lacebugs (*Corythuca morrilli*), aphids, and oak leaf phylloxera. Insect problems that could not be controlled with soap sprays included stem gall moths (*Periploca ceanothiella*) on ceanothus, katydid chewing on redbud and mealybug infestations on heuchera. Phytotoxicity due to soaps was observed on redbud but not on California lilac, coyote bush, toyon, or valley oak with up to 7 to 12 sprays between April and September. Observations at the annual Arboretum plant sale indicated that customers did not discriminate between plants damaged or undamaged by many pests. Katydid chewing and necrosis on redbud leaves and agromyzid mining on verbena did not reduce marketability. Lacebug damage on *Baccharis* actually improved saleability over undamaged plants. However, valley oaks with leaves heavily spotted from oak leaf phylloxera took four times as long to sell as lightly spotted trees. Further investigation into customer tolerance for damage is warranted.

Recently, we have tried to integrate a biological control component into the arboretum IPM program with the use of green lacewing (*Chrysoperla rufilabrus*) releases on the roses, mealybug destroyers (*Cryptolaemus montrouzieri*) on huechera, and ladybeetles (*Hippodamia convergens*) on a number of plant species. We have also investigated the toxicity of leaf residues of commonly applied insecticides in the landscape (soaps, oils, pyrenone, malathion, carbaryl and a water control) on adult lady beetles (*Hippodamia convergens, Crytolaemus montrouzieri*) at weekly intervals. Whereas toxicity of oils and soaps was insignificant one hour after spraying and pyrenone after a day, malathion and carbaryl continued to cause significant mortality of ladybeetles up to 2 to 4 weeks after application, depending on ladybeetle species and pesticide. Methods were "worst case" with beetles exposed to excised leaves in petri dishes and entailing possible exposure through a combination of ingestion, contact and inhalation.

FINDINGS OF U.S. EPA'S 1990 NATIONAL HOME AND GARDEN PESTICIDE USE SURVEY

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The NHGPUS was a one-time national survey of 2,078 U.S. housing units in the 48 contiguous states and the District of Columbia conducted under the direction of the U.S. EPA for the purpose of supporting regulatory actions and providing national data on pesticide use in and around homes. A 3-stage probability sampling design identified a sample of 2,447 primary residences to be interviewed, of which 85% participated. Data were collected in August and September 1990 and included responses to the following:

1. which pesticides were used;
2. what they were used for;
3. how often they were used;
4. how and where they were applied, including safety precautions used;
5. how unused portions were stored and/or disposed of;
6. how product containers were disposed of;
7. how child-resistant packaging was used;
8. how effective the products were judged to be;
9. which pests were major problems;
10. use of commercial pest control services; and
11. household characteristics and gardening activity.

Quantitative data were not collected.

It was found that 75% of households use pesticides indoors, 22% use them on lawns, 10% use them on food crops and 16% use them on ornamentals. The two types of pests most frequently reported to be major problems were household nuisance pests (ants, cockroaches, mosquitos, fleas, spiders, etc.). Garden pests and household microorganisms were considered major by only about 3% of households. However, 48% of households treated for microorganisms (mildew, mold, virus, bacteria), while 18%-36% treated for the insects considered to be major problems.

The estimated mean number of all pesticide products in storage at residences (disinfectants, fungicides, insecticides, molluscicides, rodenticides, herbicides, repellents) was 3.8%. Over 20% of households had 6 or more products stored, and about 47% of households with children under 5 years of age had at least 1 pesticide stored insecurely. Of households that had disposed of pesticides in the past year, 36% poured leftover diluted products down the sink/toilet.

Fifteen percent of households with lawns hired someone to apply pesticides to them, and 20% of all households had their homes commercially treated for indoor pests.

These findings can provide a great deal of useful information for identifying and planning Cooperative Extension educational programs that are needed by home horticulture audiences.