COOPERATIVE EXTENSION UNIVERSITY OF CALIFORNIA

California Turfgrass Culture

Volume 48, Nos. 1 & 2, 1998

Movement of Nitrogen Fertilizer in a Turfgrass System

Victor A. Gibeault[1], Marylynn Yates[2], Jewel1 Meyer[2], and Mathew Leonard[1]

Nitrogen is the nutrient supplied by fertilization that is used the most by turfgrasses, and it is the nutrient that is supplied most frequently and in the largest amount by turfgrass managers. It is needed for many plant processes and components and is basic to the growth and development of all turfgrasses and to the appearance and recuperative ability of those grasses. Nitrogen is supplied to turf sites at various rates and frequencies and from various sources. The movement of the nitrogen applied is important because nitrogen is a mobile nutrient; it can move from the site where applied to ground and surface waters or to the atmosphere by leaching and runoff or by volatilization and thereby create a possible environmental concern. Understanding the movement of nitrogen used in turfgrass systems is, therefore, important as is understanding optimum cultural practices to ensure the efficient use of nitrogen by the turfgrass sward.

Nitrogen fertilizer is applied as fast-release sources, such as ammonium sulfate, or as slow-releases sources, such as synthetic organic or natural organic nitrogen carriers. When the nitrogen from these sources, or from residual soil organic sources, is in the nitrate form (either from nitrate fertilizers directly or from the mineralization/nitrification of organic nitrogen carriers), it is not bound to soil or organic colloids. Being in the soil-water, it is mobile and can be taken up by turfgrass and other plant roots, or it can move from the immediate turfgrass system by leaching or runoff. In contrast, when a nitrogen source experiences rapid mineralization, ammonia is produced. If the ammonia is not quickly dissolved in water, it can be lost to the atmosphere. Gaseous nitrogen loss can also be caused by the chemical reduction of nitrate in a saturated soil by microorganisms, producing elemental nitrogen and nitrous oxides which are subject to loss. Therefore, losses of nitrogen from the "system" can occur in the nitrate, ammonia, elemental nitrogen and nitrous oxide forms.

It was the objective of this study to monitor the movement of nitrogen below the root system of cool-season turfgrasses when the nutrient was applied at high rates and frequent intervals.

Materials and Methods

The study was conducted at the Turfgrass Research Project located at the Agricultural Experiment Station at the University of California, Riverside. The study site was a mature sward of mixed Kentucky bluegrass *(Poa pratensis* L. 'Rugby') and perennial ryegrass *(Lolium perenne* L. 'Pennant') growing on soil classified as Hanford fine sandy loam. Soil pH was neutral.

Fertilizer treatments evaluated were part of a larger screening trial of organic nitrogen sources initiated January 25, 1989. Nitrogen sources were applied at a rate of 2.5 lb N/1000 ft^2 using a hand-held shaker jar and were reapplied approximately every eight weeks, thereafter. The study was laid out as a randomized complete block with three replications. Individual treatment plots measured 4 ft. x 6 ft. Plots were mowed weekly at a height of 2 in. with a rotary mower.

[1] Extension Environmental Horticulturist, and formerly Staff Research Associate, Dept. of Botany and Plant Sciences, University of California, Riverside, respectively.
[2] Ground Water Specialist and formerly Extension Soil and Water Specialist, Dept. of Environmental Sciences, University of California, Riverside, respectively.

Clippings were collected. Sprinkler irrigation replaced soil moisture based on estimated evapotranspiration as calculated by the CIMIS (California Irrigation Management Information System) weather station located nearby. Irrigation scheduling was also based on a 50% soil moisture depletion.

Nitrogen sources selected for testing of nitrate leaching potential were granular urea (46-O-O), sulfur-coated urea (SCU, 37-0-0, 30% dissolution rate), and blood meal (13-0-0). These sources, classified as soluble, slow-release, and natural organic, respectively, were judged to represent the possible range of nitrate leaching potential. An untreated check treatments were also monitored.

Suction lysimeters (Irrometer Co.) were used to collect leachate. Suction lysimeters consisted of a 36-in. polyvinyl chloride tube (0.5 in. inside diameter) with a porous ceramic cup bonded to one end. The other end was sealed with a rubber stopper. A flexible plastic tube passed through a hole in the stopper and extended down the interior of the suction lysimeter to the porous cup. After insertion of the suction lysimeter in the soil, air could be evacuated through this tube to create a vacuum which would draw moisture through the ceramic tip from the surrounding soil. Accumulated leachate was also drawn from the suction lysimeter through this tube using a syringe.

A total of 24 suction lysimeters were installed in 12 plots on April 11, 1990. The top of each suction lysimeter was located slightly below the original soil surface where they could be covered with a PVC cap without interfering with regular mowing.

Leachate samples were obtained by first using a syringe to draw a vacuum on the suction lysimeter, clamping the access tube, and then waiting one week. The vacuum was then broken by releasing the clamp and the accumulated leachate was extracted using the syringe. After samples were taken, the syringe was used to reestablish the vacuum for the next week's sample. Thus, two samples were collected per plot each week. Samples of tap water (same source as irrigation water) and deionized water were included with each batch of leachate samples as additional checks.

The fertilizer study was sampled through two consecutive application periods. The first began May 29, 1990, and ran until July 19, 1990, when the next fertilizer treatments were applied. The final samples were taken on September 4, 1990. Nitrate analysis was performed using a Technicon Autoanalyzer II.

Results

The concentrations of nitrate given in parts per million (ppm or mg/l) in collected leachate from the four fertilizer treatments are presented in Figure 1. The time line is from late May through early September 1990, with samples collected approximately every two weeks. The arrows indicate fertilizer application times. Several times during the study, the tap water used for irrigation was tested for nitrate content, and it ranged from 6.1 to 6.5 ppm nitrate during those test times.

It was found that the urea source of nitrogen resulted in the highest concentration of nitrate found in the leachate, with the peak noted 10 to 14 days following fertilizer application. The June peak with urea was approximately 3 ppm nitrate higher than tap water and the early August peak was approximately 1 ppm nitrate higher than tap water. At no time did nitrate leachate exceed federal safety limits (10 ppm as NO,-N). SCU treatments resulted in significantly less leaching of nitrate than urea during urea peak leaching times. Although SCU regularly had more evidence of leaching, with higher rankings, than blood meal or the untreated control treatment, there was no significant difference among the three treatments at any rating date during the study.

This study showed that even at very high nitrogen fertilization rates, there was little probability of significant nitrate leaching from any of the tested sources. Only urea fertilization gave levels of nitrate leachate that were above the tap water content, but still below federal guidelines. The slow-release sources, particularly the natural organic source (blood meal), presented the lowest potential for nitrate leaching.

Discussion

Other studies found similar, very low levels of nitrogen leaching. A Michigan State University researcher (Branham) reported that less than 0.2% of the nitrogen applied was recovered below the turfgrass root system and that the nitrogen detected was at least 10 times below the drinking water standard. A Nevada study (Bowman) reported a total leachate loss at 1% or less for tall fescue and bermudagrass turf. Nitrogen leaching in a Cornell study (Petrovic) was found to be minimal, with practically all samples being considerably below the drinking water standard.

In contrast, a project conducted by Drs. Brauen and Stahnke at the Washington State University Puyallup Research and Extension Center found that nitrates could leach from newly constructed sand putting greens. It was the objective of their work to quantify the effect of rooting medium, fertilization interval and annual nitrogen rate on nitrate movement from creeping bentgrass putting greens. They found that nitrogen leaching was greater during the first year of the study than the second; that the leaching in the first year was related to nitrogen application rate and was strongly modified by rooting medium and frequency of nitrogen application; and that nitrogen concentration leached from pure sand was greater than nitrogen leached from a sand-peat medium. They found that the combination of modified sand rooting medium, moderate levels of total annual nitrogen applications and frequent nitrogen applications gave the lowest nitrogen leaching loss (3-5% of nitrogen applied on an annual basis) in the first year of a newly constructed sand based green. In the second year, nitrate concentration in the leachates was greatly reduced from those observed in the first year of the study. As an example, nearly zero concentration was found in the summer and early fall time periods of the second year, irrespective of treatments. The researchers suggested that the results observed in the second season was due to more extensive rooting, increased thatch and increased organic matter in the root zone.

Gaseous loss of nitrogen can occur if rapid mineralization of a recently applied nitrogen source, such as urea, results in the release of ammonia, and the ammonia is not dissolved in water to produce the ammonium ion. It has been clearly shown, however, that gaseous loss of nitrogen can be minimized by applying water immediately after the application of fertilizer; Dr. R. Hull reported that only about 1% of the nitrogen volatilized in his studies when "watering -in" was practiced. Gaseous nitrogen loss can also be caused by the chemical reduction of nitrate in a saturated soil by microorganisms, producing elemental nitrogen and nitrous oxides which are gases and subject to loss. Interestingly, the above mentioned Michigan State University project (Branham) estimated that a considerable amount of the applied nitrogen may have volatilized and this avenue of nitrogen loss should be considered further from a research perspective.

In summary, it has been found that most nitrogen applied to turfgrass usually stays in the "turfgrass system." Analysis of nitrogen in turfgrass clippings, verdure, thatch and soil show that the "system" is dynamic, because the high level of surface organic matter associated with turfgrass swards supports a high level of microbial activity. Microorganisms in turn use nutrients for their growth and return those organic bound nutrients to the "system" upon death. Fertilizer nitrogen applied to a dense, mature and well-maintained turf is normally rapidly used by the turfgrass plant and by soil microorganisms. There appears to be little chance of downward movement of nitrogen, other than on pure sand with immature turf present, however cultural practices should be followed to minimizes such a possibility. Those practices would include, but not be limited to, the following: **water-in fertilizer immediately following application; apply nitrogen when turfgrass roots can use the nutrient and when nitrate levels are expected to be low; use low nitrogen rates or slow release sources on sands or very leachable soils; and avoid overirrigation closely following fertilization and avoid runoff.**

References:

From: ***USGA Green Section Record,*** **Jan/Feb., 1995**

D. Bowman, D. Devitt and W. Miller. The Effect of Salinity on Nitrate Leaching from Turfgrass. 45-49 pp.

B. Branham, E. Miltner and P. Rieke. Potential Groundwater Contamination from Pesticides and Fertilizers Used on Golf Courses. 33-37 pp.

S. Brauen and G. Stahnke. Leaching of Nitrate from Sand Putting Greens. 29-32 pp.

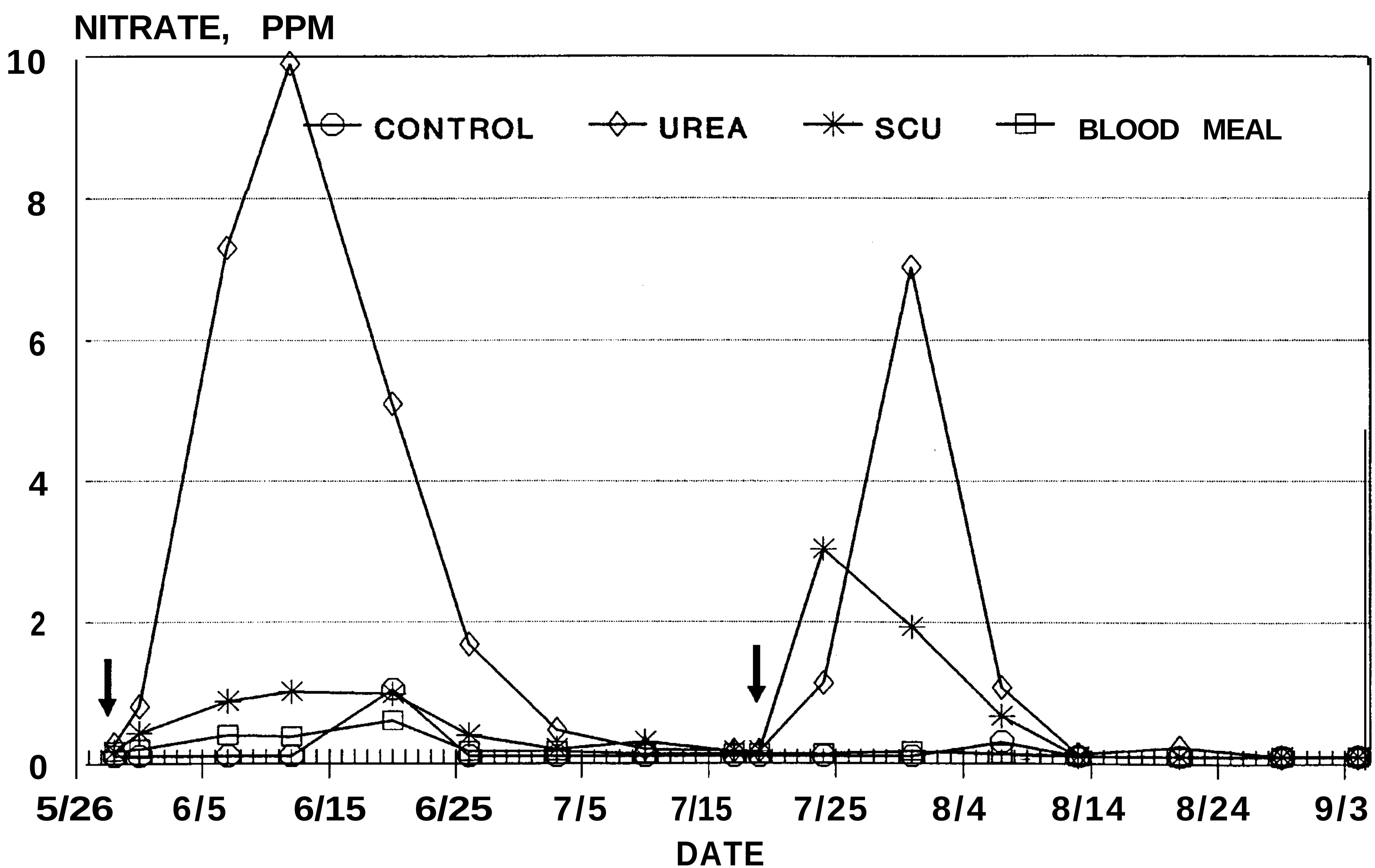
M. Petrovic. The Impact of Soil Type and Precipitation on Pesticide and Nutrient Leaching from Fairway Turfs. 38-41 pp.

M. Yates. The Fate of Pesticides and Fertilizers in a Turfgrass Environment. lo-12 pp.

From: ***TurfGrass Trends,*** **Vol. 4, Issue 9. Sept. 1994**

Hull. Nitrogen Fate: What Happens to it and Where Does it Go? l-10 pp.

Fig. 1. Concentration of nitrate in collected leachate over time. Arrows indicate fertilizer applications.



Bermudagrass, Buffalograss, Zoysiagrass and Tall Fescue Cultivar Performance

Victor A. Gibeault[1], Stephen T. Cockerham[2], and Richard Autio[1]

In the subject area of turfgrass and its management, one of the most important decisions that must be made is the selection of turfgrass to be established, or reestablished following renovation. Strongly influencing the decision are issues such as the USE the facility will receive, the ENVIRONMENTAL CONDITIONS of the site (both climate and soil), and the LEVEL OF MAINTENACE that will be practiced. Characteristics such as heat and drought tolerance, recovery from wear, shade and salinity tolerance, as well as mowing height adaptation, establishment rate and leaf blade texture are examples of considerations leading to the selection of a grass for a given site. Cultivar selection of the chosen species is based on the grass performance in an area, with performance including characteristics such as color, texture, density, uniformity, and pest resistance.

Reported in this article are the cultivar performance characteristics of bermudagrasses, buffalograsses, zoysiagrasses and tall fescues. The four studies were conducted in cooperation with the National Turfgrass Evaluation Program (NTEP), an organization that provides leadership in turfgrass evaluation and improvement by linking the public and private sectors of the industry through their common goals of grass development, improvement and evaluation. In California, NTEP studies of the commonly used warm- and cool-season turfgrass species are conducted at the UC Riverside Turfgrass Research Facility, at the UC South Coast Research and Extension Center in Irvine, and at the UC Bay Area Research and Extension Center in Santa Clara.

The Grasses Tested

Bermudagrass is a warm-season or subtropical grass which grows best under extended periods of high temperatures. Generally, mild winters prevail in these regions. The subtropical turfgrass zone in California includes the low elevation areas from the Mexican border to the north end of the Sacramento Valley. Bermudagrass can also be grown successfully in the transitional zone along the southern coast and in certain areas surrounding San Francisco Bay. Both common and hybrid bermudagrasses are used in California and are included in the study reported.

Zoysiagrass, also a warm-season species, is well adapted to much of Southern California and the Central Valley. Zoysiagrasses are tolerant of heat, drought, salinity and heavy traffic. They have moderate shade tolerance. In the areas of adaptation, zoysiagrasses are considered to have a lower maintenance requirement than most other turfgrasses, requiring less water, mowing and fertilizer than cool-season turfgrasses. Although used to a limited extent in California, zoysiagrasses can be used for home lawns, golf courses, playgrounds and parks.

Buffalograss is a native grass to the prairie and rangelands of the mid-west and western United States where it grows as a warm-season, short statured grass. Because of its low water requirement, drought tolerance and low nutritional requirement, it has been considered as a low-input or alternative turfgrass species. Turfgrass selection and breeding programs attempt to improve the turfgrass quality characteristics of this low-density grass that has an extended dormancy period each winter.

Tall fescue is a cool-season turfgrass that is well adapted to California. It is especially useful in the transition zone because of its high tolerance of warm temperature and its ability to grow, without winter dormancy, in relatively cool, but not severe, winter conditions. Because tall fescue stays green throughout the year in most of the state, and because it has high temperature tolerance, tall fescue is also often used for general turf sites in the inland, high temperature zones of California where warm-season turfgrasses are well adapted.

Methods

The following methods were performed with each of the four separate cultivar studies.

[1] Extension Environmental Horticulturist and Staff Research Associate, Dept. of Botany and Plant Sciences, University of California, Riverside, respectively.
[2] Superintendent, Agricultural Operations, University of California, Riverside.

Bermudaerass: The bermudagrass studied were established on June 18, 1992 at the University of California, Riverside Turfgrass Research Facility (UCR) and on June 26, 1992 at the University of California South Coast Research and Extension Center in Irvine, California. In both locations the 6ft x 6ft plots were arranged in a randomized complete block design and there were three replications for each grass. Vegetative cultivars were planted from 2in plugs on lft centers. Seeded cultivars were seeded at the rate of 0.85 lbs. seed per 1000sq ft. When mature, the grasses were mowed at 3/4 in. with a reel mower twice weekly during the growing season. Nitrogen was applied at the rate of 41b nitrogen per 1000sq ft per year, with individual applications being made at 1/2 lb. nitrogen per 1000sq ft in the months of February, April, May, June, July, August, October and December. Irrigation was supplied throughout the study according to calculated water use from the California Irrigation Management Information System (CIMIS), to prevent stress.

Zovsiagrass: The methods used were identical to those described for the bermudagrass study.

Buffalograss: The buffalograss study was established in August of 1991 at UCR. Plot size was 5.5ft x 6ft with each grass replicated three times. A randomized complete block design was used. All grasses were established vegetatively from one-inch plugs on one-foot centers. Mowing was at the height of 2in with a rotary mower once a week. Nitrogen was applied at the rate of 31b nitrogen per 1000sq ft per year, in applications of 1/2 lb. nitrogen per 1000sq ft for the months February, April, June, August, October and December. Irrigation was supplied based on calculations from CIMIS, to prevent stress.

Tall Fescue: The tall fescue study was established in October of 1992 at UCR. Plot size was 5ft x 5ft, with the grasses replicated three times and the layout being a randomized complete block design. Mowing was done weekly with a rotary mower at a 2in cutting height. Four lbs. nitrogen per 1000sq ft were applied annually with each application being 1/2 lb. nitrogen per 1000sq ft applied in January, February, April, May, July, September, October and November. Irrigation was supplied based on calculations from CIMIS, to prevent stress.

Ratings were made on a monthly basis following NTEP accepted protocol. Quality, which integrated all aspects of turfgrass quality, was on a l-9 scale, with 9 best; genetic color reflected inherent color of the genotype when not under stress, with a l-9 scale, 9 being dark green; fall color was the average of color during autumn; greenup reflected the relative rate of breaking dormancy, with a l-9 scale, 9 being fast; seedling vigor reflected the relative establishment rate, on a l-9 scale, with 9 being fast; seedhead reflected relative seedhead coverage, with a l-9 scale, 9 being no seedheads; and scalping reflected relative mower damage, on a l-9 scale, with 9 being no damage.

Cultivar differences are based on use of Least Significant Difference (LSD) statistics for mean separation. The LSD value is located at the bottom of each table. To determine whether a cultivar's performance is truly different from another, subtract one entry's mean from another entry's mean. If this value is larger than the LSD value, the observed difference in cultivar performance is significant and did not happen by chance.

The results from each study are presented in the following tables.

Table 1. Bermudaarass aualitv summaries at UC Riverside (UCR), the UC South Coast Research and Extension Center (SCREC), and the NTEP National Summary Mean, 1993-l 996.

Cultivar	Southern California Mean		NTEP
seeded	SCREC	UCR	MEAN
Mirage	5.2	5.2	5.4
OKS 91-1 1	5.2	5.3	5.3
J-27	5.1	5.2	5.2
Jackpot	4.9	5	5.2
Guymon	5.1	5.2	5
Sultan	4.8	4.9	5
Sundevil	4.8	5.1	5
FMC 5-91	4.9	5.1	4.9
OKS 91-1	4.5	4.7	4.8
FMC 3-91	4.0	5	4.7
FMC 2-90	4.0	4.9	4.7
Sahara	4.7	4.9	4.6
Cheyenne	4.5	4.9	4.5
Sonesta	4.6	4.8	4.5
Primavera	4.5	4.8	4.4
AZ Common	4.5	4.7	4.2
LSD	0.2	0.3	0.2
vegetative			
Baby	5.7	6.1	6.3
Tifgreen	5.6	5.7	6.1
Tifway	5.9	6.1	6
Midlawn	5.3	5.6	6
Midiron	5.4	5.8	**5.9**
Midfield	5.5	5.7	**5.9**
STF-1	5.4	5.2	5.5
Texturf 10	5.6	5.5	5.4
Floradwarf	4.6	5	4.5
AZ Common	4.3	4.4	4
LSD	0.3	0.3	0.2
Overall LSD	0.3	0.3	0.2

Table 2. Bermudagrass genetic color, winter color, spring greenup, and scalping at UC Riverside (UCR) and UC South Coast Research and Extension Center (SCREC), 19931996.

Grass	Genetic Color		Winter Color		Spring Greenuo		Scaloing	
seeded	SCREC	UCR	SCREC	UCR	SCREC	UCR	SCREC	UCR
OKS91-11	8	7.4	5.3	1	6.7	5.5	6.2	6
Jackpot	7	7	7	3.7	5.7	6	6.3	6
Sultan	6.7	6.7	6	3	5.7	6	6.2	6
J-27	7	7.3	5.7	2	5.0	6	6.3	6.4
Mirage	7	6.8	7	3	6	6.3	6.3	6.5
FMC591	6.7	6.5	6	3.3	5.7	6	6.4	7.1
FMC2-90	7.3	6.8	6.3	3	6.2	6	6.2	6.4
Guymon	6.7	7.3	6	2	5.3	6	6	5.8
OKS91-1	7	6.3	6	3	5	6	6.1	7.1
FMC3-91	7	6.7	6.3	3.7	5.8	6	6.4	6.8
Sahara	7	7	6.3	3.7	5.3	6	6.2	6.1
Sundevil	7	6.5	6	4	5.5	6	6.4	7.1
Sonesta	7	6.2	5.3	3.3	5.7	5.7	5.7	7.2
Primavera	6.7	6.3	5.3	3.7	5.3	6	6	6.9
Cheyenne	6.7	6	6.3	4	5.5	6	5.7	7.6
AZ Common	6.7	5.8	6	3.3	5.0	6	6.1	6.7
LSD	0.6	0.5	1	0.8	1.8	0.4	1.7	1.3
vegetative								
Baby	0	7.2	5.3	3.7	6.2	6.7	6.5	7.3
Tifgreen	7	7.5	5	2.7	5.7	6.7	6.3	6.4
Tifway	a.3	7.5	0	5	7.5	6.7	6.3	7
Midiron	7	7.2	3	1.7	5.3	7	6.1	6.8
Midlawn	6.7	7	4	1	5	5	5.1	5.1
Midfield	6.3	6.8	5	1.3	5.3	5.3	5.9	6.7
STF-1	7	6.6	5.3	2	5.7	6.5	5.0	6.4
Texturf 10	8.3	7.5	7.3	2.7	6.3	6	6.4	7.1
Floradwari	8	8.3	3.3	2.7	5.2	6	7.5	7.0
AZ Common	7	6	6	3.7	5.2	6.3	6.1	6.5
LSD	0.9	0.8	1.2	1.1	2.6	1.2	1.1	I.3
Total LSD	0.8	0.7	1	0.9	2.1	0.8	1.2	1.3

Table 3. Zoysiagrass quality summaries at UC Riverside (UCR) and UC South Coast Research and Extension Center (SCREC), and the NTEP National Summary Mean, 1993-l 996.

Cultivar	Southern California Mean		NTEP
seeded	SCREC	UCR	MEAN
TGS-WI0	**4.9**	5.3	5.1
TGS-B10	5.3	5.3	5.1
JZ-1	4.9	4.0	4.6
Korean Common	4.8	4.8	4.6
LSD Value	0.3	0.4	0.1
veaetative			
Cavalier	5.7	**5.9**	**5.9**
Marquis	5.6	**5.9**	**5.9**
Sunburst	5.5	5.6	5.8
TC 5018	5.4	5.5	5.8
Emerald	5.6	5.9	5.8
Omni	5.3	5.6	5.7
QT 2004	5.3	5.6	5.6
DALZ8508	5.5	5.9	5.6
Palisades	5.6	5.7	5.6
Royal	5.5	5.8	5.6
Crowne	6.0	5.0	5.6
El Toro	5.9	5.8	5.5
CD259-13	5.4	5.3	5.4
Meyer	5.1	5.4	5.4
QT 2047	4.7	4.8	5.3
Belair	4.7	5.0	5.2
DAL2851 6	4.8	5.6	4.9
Diamond	5.6	5.8	4.4
DALZ8501	5.0	4.9	4.3
DALZ8701	5.8	5.7	3.0
LSD Value	0.6	0.5	0.2

Table 4. Zoysiagras grsenup, fall color, genetic color, sesdhsad formation, and scalping at UC Rivsrslde (UCR) and UC South Coast Research and Extension Center (SCREC), 1992-1995. ('Victoria', 'De Anza', and Z88-3 included in Southern Callfornia Results.)

	GreenUp		Ealb l o r		Genetlc Color		SeedHead		Scalping	
Grass	UCR	SCREC	UCR	SCREC	UCR	SCREC	UCR	SCREC	UCR	SCREC
Victoria	6	7	5.3	7	7	7	a.3	7	7.7	7.6
288-3	5.7	5.7	5.3	7	a	a.3	4.7	a.3	6.9	7.3
De Anza	7	6.3	4.3	7	7.3	7	7.7	7	6.1	7.5
Cavalier	7	7.7	4.3	6	a-	7.2	6	9	5.4	6.5
Royal	7.3	a	3.3	5.7	7.7	7.0	8.7	9	6.3	5.0
DAL28508	7.3	a	3	a	7.7	7.6	9	9	6.9	5.7
Marquis	7.3	6.7	3	6	7.3	7	4.7	a	6.7	7.3
Diamond	7.3	a	5.3	7	7	7.3	a.7	7	6.2	5.7
DALZ851 6	7	7.7	3.7	6	a	7.0	0.7	9	6.7	7.3
DALZ8701	6.7	6.7	2.7	6.7	7	7	7.3	5.7	6.3	5.3
Omni	5.7	7	2.7	6.7	7	5.8	9	9	5.6	7.9
Crowne	7	7	4.3	6.3	7.3	7.2	a.7	6.7	6.9	7.5
El Toro	7	7.3	3.7	7	7	7.2	a.7	3	6.1	7
Emerald	7.7	a	3.3	5.3	7.7	7.2	a.7	9	6.6	6.8
QT 2004	7	5.7	2	6	7	6.7	9	9	5.4	8.1
Palisades	7	7.3	3.3	6.3	7	7	8.7	4.7	6.1	6.4
Z88-1 1	6.3	5.3	6	6.7	6.7	6.3	7.7	7	6.6	7.6
Meyer	5.7	6.7	1	6.3	7.7	7	5	a.5	6	7.1
Sunburst	7	7.3	1.3	6.3	7	6.3	a.7	a	6.7	7.0
TC5018	7	7.3	1	5	7	7.3	9	6.3	6.4	7.6
CD259-13	6.7	6.7	1	3.7	7.3	7.2	7.7	a	5.7	7.7
TGS-WI0	5.7	6	1.3	5	7.3	7	3.3	7.7	6.3	a.3
TGS-BIO	5.3	7	1	4	7.3	7.3	4.3	5.7	5.7	7.9
Belair	6	6	1	6	7.3	7.0	5.7	7.5	6	7.0
DALZ8501	6.7	6.3	4.3		6.3	6.3	9	a	5.7	4
JZ-1	5.7	7	1.3	365	7	6.3	a.3	6	6.3	7.3
Kor. Corn.	6.3	6.3	1	4	7	6.5	a	6	6.9	7.8
QT 2047	5	7	1	2	7	6.8	6.7	7	5.4	6.2
LSD	2.3	1.2	1.4	1.2	0.6	0.8	1.8	1.7	2.3	0.7

Table 5. Buffalograss quality at UC Riverside, including UCR mean quality, and NTEP mean from all reporting locations (1992-1995).

Grass seeded	UCR mean	NTEP Mean
NTG-5	4.7	5.4
NTG-2	4.8	5.4
NTG-3	4.9	5.3
Tatanka	4.0	5.2
NTG-4	4.9	5.2
Too Gun	4.7	4.9
Sharps Improved	4.7	4.9
Plains	4.5	4.0
Texoka	4.4	4.8
Rutgers	5.5	4.8
Bison	4.6	4.0
LSD	0.3	0.2
veastatlve		
378	5	5.0
315	5.1	5.7
Buffalawn	5.7	5.5
NE 84-436	4.7	5.4
AZ143	5	4.3
609	5	5.2
Prairie	5.4	5.2
Highlight 4	5.5	5
NE 04-45-3	4.6	4.9
Highlight 15	5.6	4.9
Highlight 25	5.6	4.8
LSD	0.3	0.2
Overall LSD	0.3	0.2

Table 6. Buffalograss fall and early winter color at UC Riverside (UCR) for 1992.1995.

Grass seeded	UCR Average 1992 - 1996				
	Aug	Sept	Oct.	Nov.	Dec.
NTG-5	7.2	7.3	3.3	1.6	1
NTG-2	7.3	8	4.3	1.7	1
NTG-3	7	7.3	3.7	1.9	1
Tatanka	7.2	8	3.7	2	1
NTG-4	7.3	8	5.7	2.1	1
Top Gun	6.9	7.7	5	1.9	1
Sharps Improved	7.2	7.3	5	2.3	1.1
Plains	7.2	7.7	4.3	2.4	1
Texoka	6.8	7.3	4	1.9	1
Rutgers	6.5	5.3	5	4.7	2.7
Bison	7.2	7.7	5.3	2.9	1
LSD		0.8	1.4	1.2	0.3
veaetatlve					
370	7.6	a.7	3	1.2	1
315	7	0.3	3	1.2	1
Buffalawn	6.5	6	5.7	5.3	3.1
NE 84-436	7.1	8	3	1.2	1
AZ 143	7.1	7.3	2	1	1
609	7.2	7.3	7	5	2.3
Prairie	6.9	7	6.7	4.9	2.7
Highlight 4	6.5	6	5.7	5.1	2.9
NE 84-45-3	6.9	7	2	1.1	1
Highlight 15	6.3	6.3	6	5.7	3.6
Highlight 25	6.2	6	5.7	5.4	3.3
LSD		1.3	0.7	1.7	0.9
Overall LSD		1.1	1.1	1.5	0.7

Table 7. Buffalograss density and flower head ratings at UC Riverside for various rating dates, 1992-1995.

Grass saeded	Density		Flower Head	
	Spring	Summer	Spring	Summer
NTG-5	7.7	6.7	4	4.3
NTG-2	7	6.3	4	6
NTG-3	7.3	6.7	4.3	4.3
Tatanka	6.7	7	4.3	5.3
NTG-4	6.3	7	3.3	3.7
Top Gun	6.3	6.3	3.3	2.7
Sharps Improved	6.3	7	5	3.7
Plains	6	7	3.3	3.7
Texoka	3	6	5.7	3
Rutgers	9		2	1.3
Bison	6	7.37	3.3	3.3
LSD	1.9	1.3	3.1	2.1
veaetative				
370	6.3	6.7	a.3	a.7
315	7.3	5.7	8.7	6.3
Buffalawn	9	8	9	9
NE 84-436	7	6	7	7
AZ 143	7.3	6	3.7	5.7
609	6.7	6.3	8	8.3
Prairie	a.3	7	9	9
Highlight 4	0.7	7	8.3	8.7
NE 84-45-3	6.3	6	1	3.3
Highlight 15	8.3	7.3	4.7	7
Highlight 25	9	8	9	9
LSD	0.8	1.1	1.6	3.4
Overall LSD	1.4	1.2	2.5	2.8

Density: l-9,9=most dense
Pollen head: l-9, 9=no flower head

Table 6. Tall fescue quality summaries at UC Riverside and the NTEP quality meant (1993-1995); grass genetic color and **seedling vigor at UC Riverside.**

Grass Name	Quality UcR	Quality NTEP	UC Riverside Genetic color	UC Riverside Seedling Vigor
JAGUAR III	6.2	6	7	8.7
FALCON II	6.2	6	6.7	6.3
HOUNDOGV	6.1	5.9	7	7.7
GENESIS	6.2	5.9	7.7	6.3
ISI-AFA	6.2	5.9	7.3	7
SOUTHERNCHOICE	6.2	5.9	7	6
CROSSFIRE II	6.1	5.9	7	6
COYOTE	6.1	5.9	7	7.7
FINELAWN PETITE	6.2	5.9	7.3	7
PIXIE	6.1	5.9	7	6
PST-5DX WENDO	6.2	5.9	7	6.3
REBEL JR.	6.1	5.9	7	6
LANCER	6	5.6	7	6
ATF-007	6.2	5.6	7.3	8.7
CORONADO	6.2	5.6	7.3	7
MARKSMAN	6.2	5.6	7	7.3
RENEGADE	6.1	5.6	7	7.3
TOMAHAWK	6.2	5.6	7	6.3
PYRAMID	6.1	5.6	7	6.3
GRANDE	6.1	5.6	7	7.3
BARLEXAS	6.3	5.6	7.3	7.3
DUSTER	6.1	5.6	7.3	7
EMPRESS	6.1	5.6	7.3	7.7
MICRO DD	6.1	5.6	7	6
APACHE II	6	5.6	7	7
SR 8210	6.1	5.6	7	6
PST-5PM	6.1	5.7	7.3	7.7
FA-19	6.1	5.7	7	a.3
SUN PRO	6.1	5.7	7	6.3
DEBUTANTE	6.1	5.7	7	6
GAZELLE	6.1	5.7	7.3	7.3
PAISADESQ	6.1	5.7	7	6.3
STARLET	6.1	5.7	7	6
PST-54X	6.1	5.7	7.3	7.3
REBEL 3D	6.1	5.7	7	6.3
MONTAUK	6.1	5.7	7	7.3
SR8200	6.1	5.7	7	6.3
TITAN 2	5.7	5.7	6.3	6.7
GUARDIAN	6	5.7	7	8.7
DUKE	6.2	5.7	7	6.7
NINJA	6.2	5.7	7	7.3
VIRTUE	6	5.7	7	6.3
SILVERADO	6	5.7	7	7.7
PST-5VC	6.1	5.7	7.3	7.7
SAFARI	6	5.7	7	6.7
AVALON	5.7	5.7	6.7	6
ELDORADO	6.1	5.7	7	6.3
CHIEFTAN II	6	5.7	7.3	6
ADOBE	6.1	5.7	7	7.7
SHORTSTOP II	6.1	5.7	7	6.7
COCHISE	6.2	5.7	7	6
PRO9178	6.1	5.6	7	6.3
LEPRECHAUN	6.1	5.6	7	6
VEGAS	6	5.6	7	7.3
ISI-CRC	6	5.6	7	6
BAR FA 0855	6.1	5.6	7	9
TRAILBALZER II	6	5.6	7	6
FA-22	6	5.6	6.7	6
BONSAI PLUS	6	5.6	7	8
HERITAGE	5.9	5.6	6.3	8.7
ALAMO	6.2	5.6	7	6.3
SR8300	6.1	5.6	6.7	6
M2	6.1	5.6	6.7	6.7
SHENANDOAH	5.9	5.6	6.7	6
BONANZAii	6.1	5.6	7	a
FAR FA 2 AB	6.1	5.6	7.3	6
MIRAGE	6.2	5.6	7	6.3
403	5.9	5.6	6.7	6
WILDCAT	5.9	5.6	7	9

Table 8 continues on page 11

Table 8 Continues . . .

Grass Name	Quality UCR	NTEP	UC Riverside Genetic color	Seedling Vigor
AVANTI	6.1	5.6	7.3	9
PSTF-LF	5.9	5.6	7	8.3
GENERIC	6	5.6	6.7	8.7
KITTYHAWK	5.8	5.5	7	7
AUSTIN	5.8	5.5	6.7	a.7
PST-5STB	6.3	5.5	7	8
OLYMPIC ii	5.8	5.5	6	9
FINELAWN 86	6.1	5.5	6.7	8.7
AZTEC	6.1	5.5	7	7.7
MONARCH	6	5.5	6.7	8.7
BAR FA 214	6	5.5	6.7	7.3
BONSAI	6.1	5.5	7.3	6.7
PHOENIX	5.6	5.5	6.3	8.3
CAS-MA 21	6.1	5.4	7	8
ASTRO 2000	5.7	5.4	6.3	8.3
BONANZA	6	5.4	7	8.7
CAS-LA20	6.1	5.4	7	7
ARID	5.6	5.3	6	6.7
TWILIGHT	6	5.2	7.7	7.7
FALCON	5.3	5.1	4.3	8
ANTHEM	5.3	5	5.7	9
KY-31	4.6	4.4	5.3	9
KY-31 w/endo.	4.4	4.4	5.3	9
LSD	0.3	0.1	0.8	1.4

UC TURF CORNER

UC Turf Corner contains summaries of recently reported research results, abstracts of certain **conference presentations and announcements. The following release** was from the November 1997 issue of "Better Turf Thru **Agronomics," which is an activity of the University of California Turfgrass Research** Advisory Committee (UCRTRAC).

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

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

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

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

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

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

- Saves time and energy. No need to bag, remove, or haul clippings.
- Saves landfill space. Could reduce statewide yard waste by 5-10%.
- Encourages healthier grass stand. Decomposing clippings release nutrients to soil and may enhance soil microbial activity.
- Saves money. Reduces need for nitrogen fertilizer by 20-30% due to nitrogen returned to soil from decomposing clippings.

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

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

WARNING ON THE USE OF CHEMICALS

Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in their original labeled containers in a locked cabinet or shed, away from food or feeds and out of the reach of children, unauthorized persons, pets, and livestock.

Recommendations are based on the best information currently available, and treatments based on them should not leave residues exceeding the tolerance established for any particular chemical. Confine chemicals to the area being treated. THE GROWER IS LEGALLY RESPONSIBLE for residues on his crops as well as for problems caused by drift from his property to other properties or crops.

Consult your County Agricultural Commissioner for correct methods of disposing of leftover spray material and empty containers. Never burn pesticide containers.

PHYTOTOXICITY: Certain Chemicals may cause plant injury if used at the wrong stage of plant development or when temperatures are too high. Injury may also result from excessive amounts of the wrong formulation or from mixing incompatible materials. Inert ingredients, such as wetters, spreaders, emulsifiers, diluents and solvents, can cause plant injury. Since formulations are often changed by manufacturers, it is possible that plant injury may occur, even though no injury was noted in previous seasons.

NOTE: Progress reports give experimental data that should not be considered as recommendations for use. Until the products and the uses given appear on a registered pesticide label or other legal, supplementary direction for use, it is illegal to use the chemicals as described.

Correspondence concerning
California Tutfgrass Culture
should be sent to:

Victor A. Gibeault
Bachelor Hall Extension
University of California
Riverside, CA 92521-0124