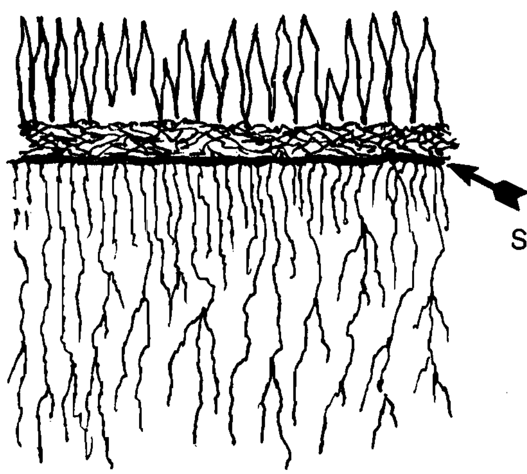
TURFGRASS RESEARCH CONFERENCE AND FIELD DAY



SEPTEMBER 17, 1991

UNIVERSITY OF CALIFORNIA

RIVERSIDE

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SUSCEPTIBILITY OF BUFFALOGRASS AND KIKUYUGRASS TO ROUNDUP

J.M. Henry, M.K. Leonard, V.A. Gibeault and S.T. Cockerham[1]

Attempts to eradicate kikuyugrass (Pennisetum clandestinum Hochst. ex Choiv.) or replace it with a less aggressive species have had little success. In a greenhouse study conducted at the University of California, Riverside, pots of kikuyugrass and Buffalograss [Buchloe dactyloides (Nutt.) Engelm. 'Highlight 17'] were treated with rates of glyphosate (Roundup) ranging from 0 to 2 lbs per acre. Surfactant rates were kept constant for all treatments, except for the Check (0 lbs glyphosate, 0% surfactant). Visual ratings of plant injury were made weekly for five weeks. Plant injury increased with treatment rate for both species. Maximum injury occurred approximately 15 days after treatment (Figure 1). Buffalograss survived all treatments. Kikuyugrass was completely controlled by the highest rate (2 lbs per acre).

From this greenhouse study, glyphosate appears to provide a method for selective control of kikuyugrass in Buffalograss stands. Follow-up field studies will need to be conducted to confirm the practicality of this method for long-term control of kikuyugrass in southern California.

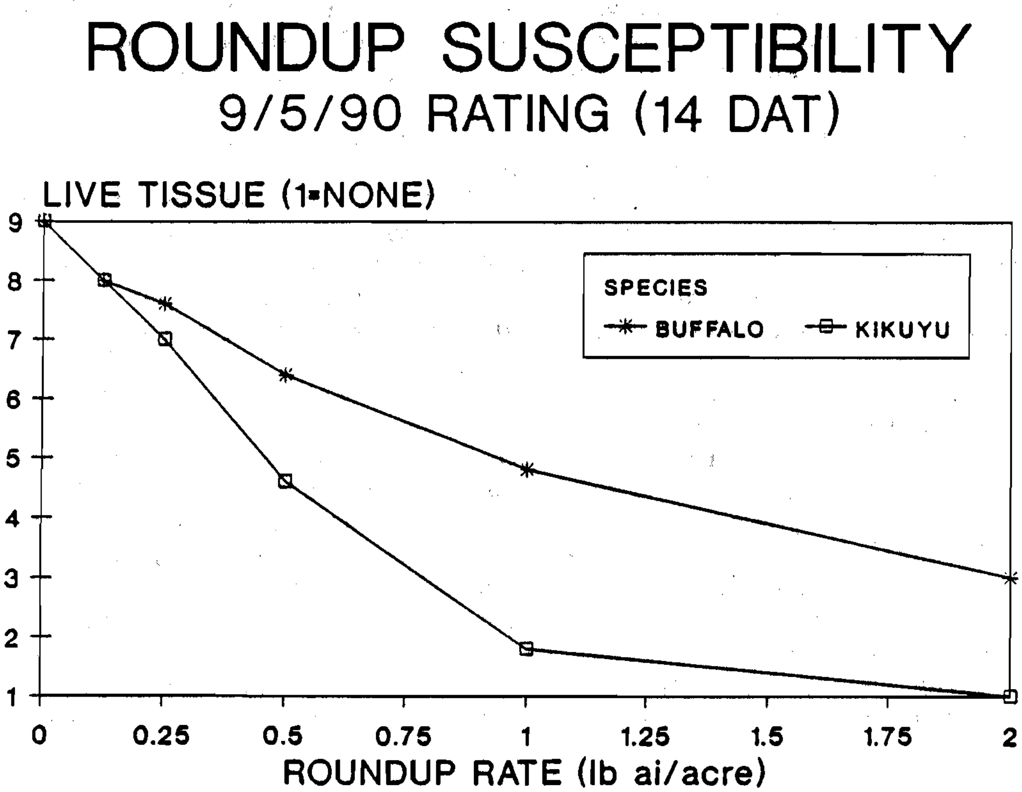

Figure 1:
Comparison of Buffalograss and Kikuyugrass phytotoxicity after treatment with Roundup, 14 days after treatment. Less damage resulted to Buffalograss compared to Kikuyugrass at rates used. Live tissue visual ratings are from 0 = totally killed to 9 = no damage to plant tissue.

1 County Director, Coop. Ext., Orange County; Staff Research Associate, Botany and Plant Sci. Dept., UC Riverside; Extension Environmental Horticulturist, Botany & Plant Sci. Dept., UC Riverside; Supt., Agricultural Operations, UC Riverside.

KIKUYUGRASS CONTROL STUDIES IN SOUTHERN CALIFORNIA

D.W. Cudney, J.A. Downer, V.A. Gibeault, C.L. Elmore and J.S. Reints[1]

Kikuyugrass has been found to be one of the most serious problems for turf production in the coastal areas of southern and central California. Currently, no chemical control method has proved adequate. However, repeated applications of herbicides which limit the growth of kikuyugrass relative to the desirable turf species may prove helpful. For the last three years, studies have been conducted to evaluate this method.

Six turfgrass cultivars (perennial rye, tall fescue, bluegrass, common Bermuda, hybrid Bermuda, and zoysia) were plugged into a nine month old stand of established kikuyugrass. Four 4-inch plugs were placed in 5 x 5 ft sections of the sward. After a six week establishment period, the plots received their first herbicide treatment. These treatments have continued from the fall of 1990 through the spring and summer of 1991. Six applications have been made thus far.

The herbicide treatments consisted of MSMA, triclopyr, and MSMA plus triclopyr. The application rate of MSMA and triclopyr was 2 and 0.5 lbs ai/A.

Evaluations are being made by measuring the diameter of the plugs to distinguish the competitive relationship between the kikuyugrass and the six turf species. Where kikuyugrass was most competitive, plug diameters have decreased and where the turf variety is more competitive, plug diameter has remained constant or increased depending on whether the turf cultivar was a bunch type or formed rhizomes.

There are significant differences for herbicide treatment, turf cultivars and the interaction of turf cultivars and herbicide treatments. All of the herbicide treatments reduced the competitiveness of the kikuyugrass relative to the turf species. Common Bermuda was injured by triclopyr treatment, however, none of the other turf species was injured by herbicide treatment. This trial has shown that sequential herbicide treatment could be used to alter the competitive relationship between kikuyugrass and turf species and could be effective for kikuyugrass control.

An additional study was completed in 1990 where eight kikuyugrass biotypes collected from Riverside, Los Angeles, Seal Beach, Palo Alto, La Jolla, Ramona, and Salinas each received repeated herbicide treatments (three treatments spaced about four weeks apart). The kikuyugrass biotypes did not respond similarly to herbicide treatment. Some biotypes were less susceptible. However, all biotypes were significantly limited by repeated herbicide treatment.

Two new herbicides are also being evaluated for kikuyugrass suppression: quinchlorac and fenoxaprop-ethyl. Quinchlorac significantly suppressed kikuyugrass growth after three treatments in a 1990 evaluation. Both of these herbicides are being compared in two trials in 1991. Single and multiple applications are being compared with triclopyr, MSMA, and the triclopyr-MSMA combination.

[1] Extension Weed Scientist, Dept. of Botany & Plant Sci., UC Riverside; Farm Advisor, Univ. of Calif., Coop. Ext., Ventura County; Extension Environmental Horticulturist, Botany & Plant Sci., UC Riverside; Weed Scientist, Botany Dept., UC Davis; Staff Research Associate, Botany & Plant Sci., UC Riveside.

CONCLUSIONS:

Kikuyugrass has been shown to be highly competitive with six turfgrass types when left untreated. When multiple herbicide treatments are used to suppress the aggressive nature of kikuyugrass, recovery of more desirable turf types was possible. Kikuyugrass biotypes collected from eight different areas of the state responded somewhat differently to herbicide treatment. Additional herbicides are being evaluated and single and sequential treatments.

ZOYSIAGRASS IMPROVEMENT FOR CALIFORNIA TURFED SITES

Matthew K. Leonard[1]

Zoysiagrass (Zoysia sp.) has good potential for use as turf in southern California. It is a warm season grass with good heat and drought tolerance that produces dense, quality turf. Unfortunately, very slow establishment and extensive winter dormancy has discouraged the use of zoysiagrass in this area.

'El Toro' zoysia, developed by the late Dr. Vic Youngner, was released by the University of California in the mid-1980's. This variety exhibits much greater growth vigor and faster establishment than other commercially available zoysia varieties.

In 1984, a new round of zoysia breeding and selection was initiated at UC Riverside. Seed was produced by hybridizing El Toro and other selected lines under greenhouse conditions. This hybrid seed was germinated and seedlings were cultured individually in the greenhouse. In September 1984, 300 selections were planted in a non-replicated field trial. These selections were evaluated for a number of characteristics, particularly rate of establishment, winter color, and turf quality. After four years of evaluation, 14 selections were chosen for further testing.

The 14 selections were reestablished in 1988 in a new replicated field trial that included four commercially available zoysia varieties for comparison purposes. Once again evaluation emphasized rate of establishment, winter color, and turf quality. None of the new selections established as quickly as El Toro, but most exhibited improved winter color and turf quality. Four selections have been added to the new National Zoysiagrass Variety Trial sites in Riverside, Irvine and Santa Clara.

[1] Staff Research Associate, Botany & Plant Sciences Dept., UC Riverside.

EFFLUENT WATER--A VALUABLE IRRIGATION RESOURCE

Ali Harivandi[1]

In arid and semi-arid regions and in highly populated metropolitan areas, water is becoming a more limited natural resource. In such areas, the concept of irrigation with reclaimed water is increasingly attractive as shortages and/or costs of fresh water rise, and as more and better quality treated water becomes available for reuse.

In California, where most of the population lives close to the coastline, more than two-thirds of all reclaimed water goes directly into the ocean or estuaries where, mixed with salt water, there is no way to reclaim or reuse it. Much of the remaining one-third is returned to fresh water streams or spread on land.

Most reclaimed water not dumped into the ocean is used for groundwater recharge, industrial use, control of salt water intrusion, or agricultural use. Agriculturally used reclaimed water is applied to: 1) pasture; 2) fodder, fiber and seed crops; 3) crops that grow well above the ground such as fruits, nuts and grapes; 4) crops that are processed so that pathogenic organisms are destroyed prior to human consumption; and 5) parks, roadsides, landscapes, golf courses, cemeteries and athletic fields.

Although there is not much competition for use of effluent at this time, such competition is anticipated in the near future. Parks, golf courses and other forms of nonfood agriculture will clearly be a better position to compete for reclaimed water than for fresh water. Although the ultimate users of effluent water will be influenced greatly by state and local laws and regulations, there are several arguments favoring use of this water on golf courses, parks, cemeteries, etc., instead of for food-related agriculture: 1) turfgrasses are generally "heavy feeders," and, if available, can pick up relatively large amounts of nitrogen and other nutrients. This characteristic would greatly decrease the chances of groundwater contamination by these elements in reclaimed water. 2) Reclaimed water is produced continuously, and any use of it, therefore, also needs to be continuous. A turfgrass "crop" is continuous (i.e., uninterrupted by cultivation, seeding or harvest, all of which mean stopping irrigation for considerable periods). 3) Most expanses of irrigated turf are located adjacent to cities where the effluent water is produced; thus, transportation costs will be minimal. 4) Potential health problems related to the use of reclaimed water are lower when the water is applied to turf than when it is applied to food crops. 5) Soil-related problems that might develop due to the use of reclaimed water will have less social and economic impact if they develop where turf is cultivated than if they develop where food crops are grown.

The concept of effluent water irrigation for turf and landscape is not new. Many turf and landscape managers have been using this water for the past two decades and have demonstrated that "suitability" is not a problem if the water is properly applied. Following is a list of various factors that should be evaluated if effluent water is to be used for turf and landscape irrigation:

1. Health considerations
2. Seasonal and annual variation in water quality
3. Storage of water
4. Irrigation system design
5. Water salinity, sodicity, pH, etc.
6. Water cost
7. Nutrient content
8. Plants to be irrigated

[1] Farm Advisor, Univ. of Calif., Coop. Ext., Alameda County.

EFFECT OF WATER-ABSORBING POLYMERS AND ORGANIC SOIL AMENDMENTS ON PERFORMANCE OF COOL-SEASON TURFGRASSES

Jim Downer[1]

Situation and Introduction

Drought has severely affected California landscapes during recent years. In 1990 large and valuable trees, shrubs, and other plantings died from lack of water in Santa Barbara County; turfgrass also died in the landscapes. As we grapple with difficult options during drought periods, it is important to consider the potential water savings afforded by the use of water-holding polymers.

The promise of polymers is to create an artificial reservoir in the soil to hold additional water then release it to the plant when needed. There have been many claims of efficacy for various brands of polymers, yet most of these are supported by testimonials, not replicated research trials in controlled situations, or are reports of preliminary research findings (Blodgett et al., Prior, Rakow and Smith, Wang, and Wofford and Koski). Scientific journal papers are scant.

Blodgett et al. found that hydrophilic polymers and wetting agents improved water uptake and retention in potting mixes and that time to wilting for Astilbe x 'Hyacinth' was longer if polymers or wetting agents were used. None of the treatments showed any differences among media, wetting agents, or polymers and the differences that were observed were not great. Orzolek and Scott found that highest yields of cauliflower occurred in rows which were sidebanded with polymers. Keever et al. found that addition of hydrophilic polymers did not affect irrigation frequency of containerized landscape plants. Shoot and root growth were reduced or not affected by increasing rates of the polymer. Evans (personal communication 1991) found that polyacrylamide polymers did not affect time to wilting of oleander in field situations but did show some effect in container media.

There is a considerable dispute about the correct rate of polymer to use in field situations. According to Wofford, Koski and Piper (personal communication) polymers should be applied at rates of 15 to 30 pounds per thousand feet. This will give an additional .5 to 1 inch of water storage. Figuring that when evapotranspiration rates are greatest (July/August) at up to .25 inch per day, you would expect to lengthen your irrigation cycle by two to four days. However, this assumes a full 400x absorption of water by the polymer.

Other researchers (Bowman et al.) found that water uptake is prevented by calcium and magnesium salts. Wang found all polymers tested (including polyacrylamide types) retained less water in the presence of metal ions or fertilizers. Iron (Fe_2) salts most affected polymer water uptake. Potting media required up to ten irrigations to gain maximum water retention and media water-holding capacity declined after repeated fertilization. Wofford and Koski maintain that salt inactivation of polymers in the field has not been demonstrated and that rainwater will reinstate the efficacy of the polymers if salts have been a problem. Most all researchers agree that polymers work best in low- or no-salt environments.

[1] Farm Advisor, Univ. of Calif., Coop. Ext., Ventura County.

Despite the high rates recommended by Wofford and others, industry representatives often recommend the use of polymers at relatively low rates: four pounds per thousand square feet and less. Fry and Butler found polyacrylamides (2-4 #/1000 ft^2) ineffective in alleviating water stress in tall fescue turfgrass in field and pot studies; they concluded that fine textured soils would need rates 80 times this to be effective.

Confusion exists on how to apply the materials. Pre-incorporation before the turf is established should be best. Uniformity is important so that "mushy" spots do not occur. A number of manufacturers have developed applicators or "polymer planters" to place polymers in established turf, while others maintain that some kinds of polymer may be applied over the top of turf and watered in.

Although polymer planters allow application of polymers to established turf, they may also cause considerable harm to turfgrass by cutting established root systems. Turfgrasses such as tall fescue, which may have root systems several feet deep, will require considerable time to regenerate. Is the trade off of polymer presence in the soil worth losing several feet of turfgrass roots? Several feet of soil should hold more water than a few pounds of polymer.

A Preliminary Study

A preliminary study was designed to test the water-saving effectiveness of two different kinds of cross-linked polymers and three application methods. A single, low rate (4 #/1K ft^2) of polymer was used.

On June 13, 1990, a randomized complete block design was arranged with five-foot by ten-foot blocks of established tall fescue turfgrass comprising each experimental unit. Polymer treatments consisted of a cross-linked polyacrylamide and a polyacrylate polymer. The polymers were applied in four ways: no application (check), applied with drop spreader, applied with drop spreader over previously-aerated turf, and applied with a polymer planter. After a one month recovery period was allowed with full irrigations, drought was instated; irrigations were ceased. When the turfgrass was visibly depreciating in quality, soil moisture was measured and quality ratings were given.

No statistical difference between treatments were detected (Table 1). No benefits or detriments could be associated with polymer use in this preliminary study. These studies are being continued at higher rates in newly-planted turfgrass.

Table 1. Turfgrass performance under various polymer application regimes.

Treatment (Simi Valley CA 6/13/90)		Data Taken 7/31/90	
Polymer	Application Method	Soil Moisture Reading[3]	Turf Score[4]
Polyacrylamide[1]	surface applied to aerated plots	82.2	4.7
" "	polymer planter applied	80.2	4.3
" "	surface applied	68.8	3.7
Polyacrylate[2]	surface applied to aerated plots	77.3	3.0
" "	polymer planter applied	83.3	4.0
" "	surface applied	79.0	2.3
no polymer		78.2	5.7
no polymer	aerated turfgrass	73.7	4.3
no polymer	polymer planter	85.7	5.0

1. Cross-linked polyacrylamide (Hydrohold) applied 4 #/1000 ft^2.
2. Polyacrylate (Hydrozorb) applied 4 #/1000 ft^2.
3. Soil moisture measured by the Aquatere moisture meter. Data correlated with tensiometer readings (r^2=0.91): 0=dry, 100 is wet.
4. Turf scores are on 1-10 scale: 1=dead turfgrass, 10 is ideal.

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IRRIGATION SYSTEMS EFFICIENCY FOR WATER CONSERVATION

Jewell L. Meyer[1]

The water use of turfgrass varies from 24" to about 32" depth of water for warm or cool season turfgrass in the Inland Empire climate zone.

Some of the questions that continually require answers are:

1. How much water does turfgrass need?
2. When does turfgrass need irrigation?
3. How much stress can be tolerated?
4. Can a lawn watering system be highly efficient?

The water use of turfgrass swards has been determined in this area by very careful research sponsored by UC Cooperative Extension and the Metropolitan Water District. CIMIS, the California Irrigation Management Information System, through its 85 weather stations estimates the crop reference (ETo) in all areas of California. The reference ET (ETo) is multiplied by a crop coefficient of the turfgrass sward being used and is .8 for cool season grasses and .6 for warm season grasses.

When the application rate in inches per hour of a particular sprinkler system is divided into the needs, then minutes of run time can be calculated, for example:

$$\text{ETgrass} = \frac{\text{ETo x KC}}{\text{Application Rate}} = \text{minutes or hours}$$

This seems rather simple, but in the real world, soils vary, irrigation systems aren't perfect, and maintenance is often a serious problem.

Turfgrass needs irrigation every few days, depending upon the soil texture and its water holding capacity. Often, clay soils can be watered twice a week and sandier soils every other day.

The amount of water applied may be the same, the interval is soil dependent. Sandy soils often only hold 1/2" available water, loams 1 1/4", and clay soils 1 3/4-2".

Turfgrass quality and its resistance to wear relates to the degree of stress one can tolerate by stretching irrigation intervals. Warm season grasses can receive 20-40% less water and survive, but cool season grass can only survive on about 20% less than actual ET.

The final and most difficult question is the uniformity or efficiency of the distribution system itself. All sprinkler systems distribute more water near the head and less toward the outer edges.

The most uniform systems may be designed with 90% uniformity. They have the following characteristics:

1. Vertical heads. Heads clear of turfgrass.
2. Coverage from head to head. No overspray of hard surfaces.
3. Matched precipitation rate between 1/4, 1/2, and full circle nozzles.
4. Sprinklers are stream rotors or impact rotary heads.

The actual run time of a system requires continuous monitoring.

[1] Irrigation & Soils Specialist, Dept. Soil & Env. Sci., UC Riverside.

OPTIMUM, DEFICIT AND SURVIVAL WATER REQUIREMENT OF TURFGRASS

Victor A. Gibeault[1]

California has a mediterranean climate characterized by long, hot, dry summers, and turfgrass must be watered to survive under these conditions. Water is becoming scarce in the state as demand continues to rise and Californians must learn how to use it efficiently.

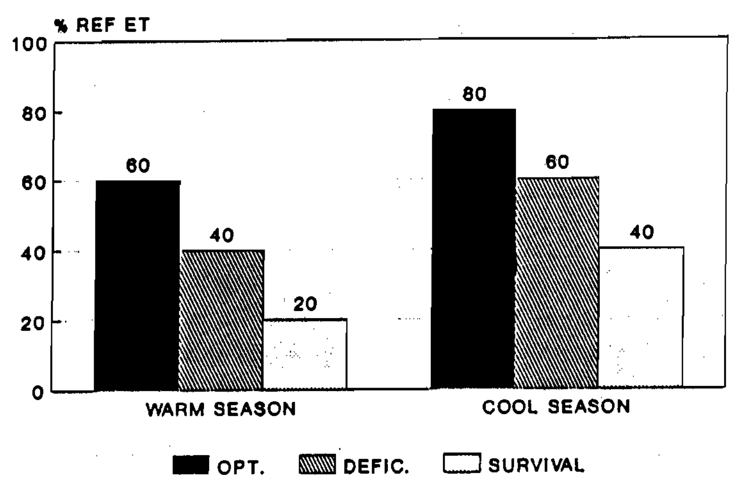
Warm-season grasses and cool-season grasses are used as turfgrass in California based on their climatic adaptability. The warm-season species include common and hybrid bermudagrasses, St. Augustinegrass, seashore paspalum, zoysiagrass and kikuyugrass. These grasses are used in the San Joaquin Valley, southern California and parts of the greater San Francisco Bay Area. The cool-season grasses used include Kentucky bluegrass, perennial ryegrass, tall fescue, fine-leaved fescue in mixes, and specialty grasses such as creeping bentgrass, roughstalk bluegrass and annual ryegrass.

Turfgrasses can be irrigated at different levels. Optimum irrigation is the amount of water needed for most efficient growth, maximum quality and best appearance of the respective turfgrasses. Deficit irrigation provides sufficient water to maintain adequate turfgrass appearance with less growth. In contrast, survival irrigation provides only enough water to allow survival and potential recovery of the desired species when adequate water is again available. Under survival irrigation, growth and quality are drastically reduced.

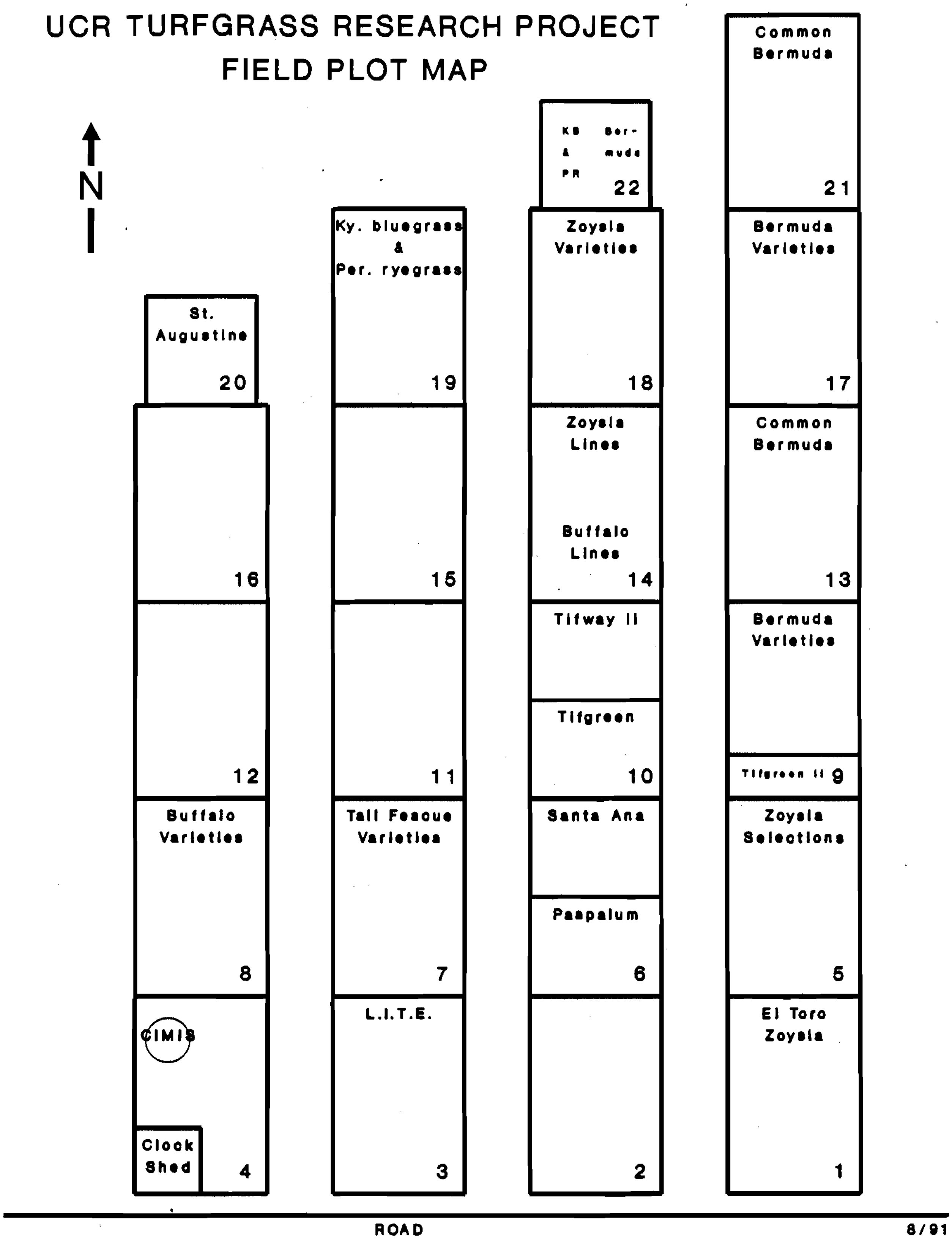
Figure 1 presents the percentage of California Irrigation Management Information System (CIMIS) reference evapotranspiration (ETo), relative to the three irrigation levels for warm- and cool-season turfgrasses. Figure 1 also shows that both cool-season and warm-season turfgrasses, if irrigated at deficit levels, can save 25 to 30 percent of irrigation water applied. Irrigation at a survival rate would be at 30 percent of optimum for warm-season turfgrasses and about 50 percent of optimum for cool-season turfgrasses.

If water rationing is needed, both cool-season turfgrasses and warm-season turfgrasses can be irrigated at less than optimum levels.

Fig. 1. Turfgrass Water Requirements at Optimum, Deficit, and Survival Levels of Irrigation



[1] Extension Environmental Horticulturist, Botany & Plant Sci. Dept., UC Riverside.


UCR TURFGRASS RESEARCH PROJECT
FIELD PLOT MAP
N
Common Bermuda 21
KB & PR
Ber- muda
22
St. Augustine 20
Ky. bluegrass & Per. ryegrass 19
Zoysia Varieties 18
Bermuda Varieties 17
16
15
Zoysia Lines
Buffalo Lines 14
Common Bermuda 13
12
11
Tifway II
Tifgreen 10
Bermuda Varieties
Tifgreen II 9
Buffalo Varieties 8
Tall Fescue Varieties 7
Santa Ana
Paspalum 6
Zoysia Selections 5
CIMIS
Clock Shed 4
L.I.T.E. 3
2
El Toro Zoysia 1
ROAD
8/91

UCR - TURFGRASS RESEARCH CENTER - PROJECT SUMMARY

Starting Date Oct 1990 Project No. ______
Completion Date Oct 1991 Plot No. 16H

Title: Cool Season Overseeding of Kikuyugrass

Objective: Determine if kikuyu can be suppressed by overseeding with cool season turf species in combination with mechanical renovation.

Investigator(s):
Name V.A. Gibeault Dept. Bot & Pl Sci Phone X3575
Name M.K. Leonard Dept. Bot & Pl Sci Phone X3898

Species/Cultivars: Kikuyugrass (Pennisetum clandestinum), 'Manhattan II,' Perennial ryegrass (Lolium perenne), 'Jaguar' Tall fescue (Festuca arundinacea)

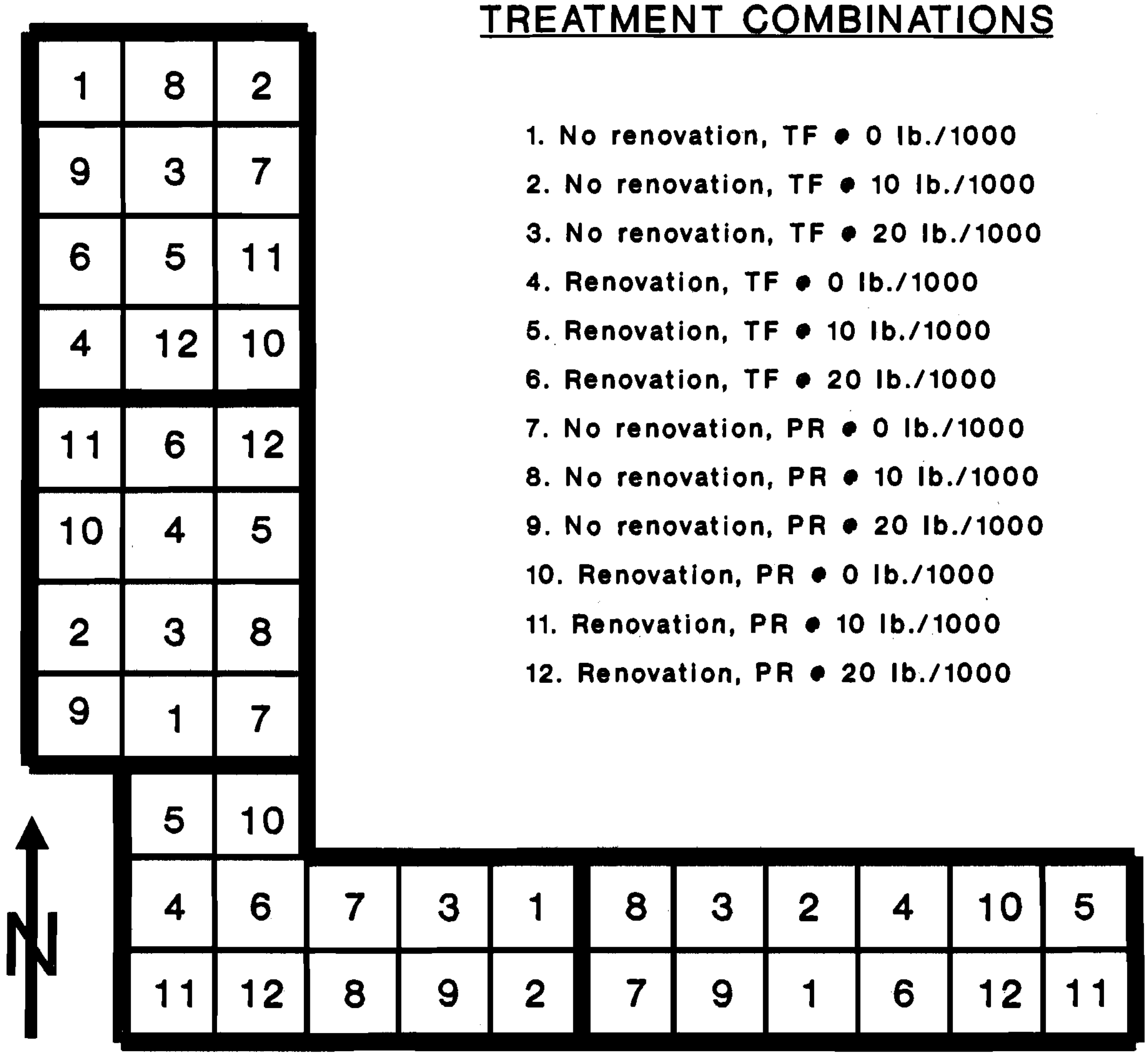
Management: Mowing Frequency 1 x/Wk. Height 2 in.
Fertilizer-Material Urea Rate 1# N/2 months
Irrigation - /_/ as needed 80 % ET_o /_/Other (Specify Below)
Special ______

Experimental Design: /_/ CRD /_/ RCB /X/ SPLT /_/ Other ______
No. of Reps 4 Size of Rep. 5' x 7' Total Plot - x -
Treatments: See plot map.

Data Collection: 1) Variable Percent Kikuyu Frequency Spring/Summer/Fall
2) Variable ______ Frequency ______
3) Variable ______ Frequency ______

Special Instructions/Comments: ______

KIKUYU OVERSEEDING STUDY



TREATMENT COMBINATIONS

1. No renovation, TF ● 0 lb./1000
2. No renovation, TF ● 10 lb./1000
3. No renovation, TF ● 20 lb./1000
4. Renovation, TF ● 0 lb./1000
5. Renovation, TF ● 10 lb./1000
6. Renovation, TF ● 20 lb./1000
7. No renovation, PR ● 0 lb./1000
8. No renovation, PR ● 10 lb./1000
9. No renovation, PR ● 20 lb./1000
10. Renovation, PR ● 0 lb./1000
11. Renovation, PR ● 10 lb./1000
12. Renovation, PR ● 20 lb./1000

UCR - TURFGRASS RESEARCH CENTER - PROJECT SUMMARY

Starting Date June 1988 Project No. ______
Completion Date Dec 1990 Plot No. ______

Title: Shade Study

Objective: To evaluate the performance of 8 turfgrass species under heavy shade.

Investigator(s):
Name V. A. Gibeault Dept. Bot & Plant Sci Phone X3575
Name R. Autio Dept. Bot & Plant Sci Phone X4430

Species/Cultivars: Common Bermuda, zoysia, St. Augustine, creeping fescue, tall fescue, poa trivialis, perennial rye, Kentucky bluegrass

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Management: Mowing Frequency 1 x/Wk. Height 1½ in.
Fertilizer-Material ______ Rate 1# N/M/6 wk.
Irrigation - /X/ as needed ______ % ET_0 / /Other (Specify Below)
Special ______

Experimental Design: / / CRD /X/ RCB / / SPLT / / Other ______
No. of Reps 4 Size of Rep. 20 x 80 Total Plot 80 x 80
Treatments: ______

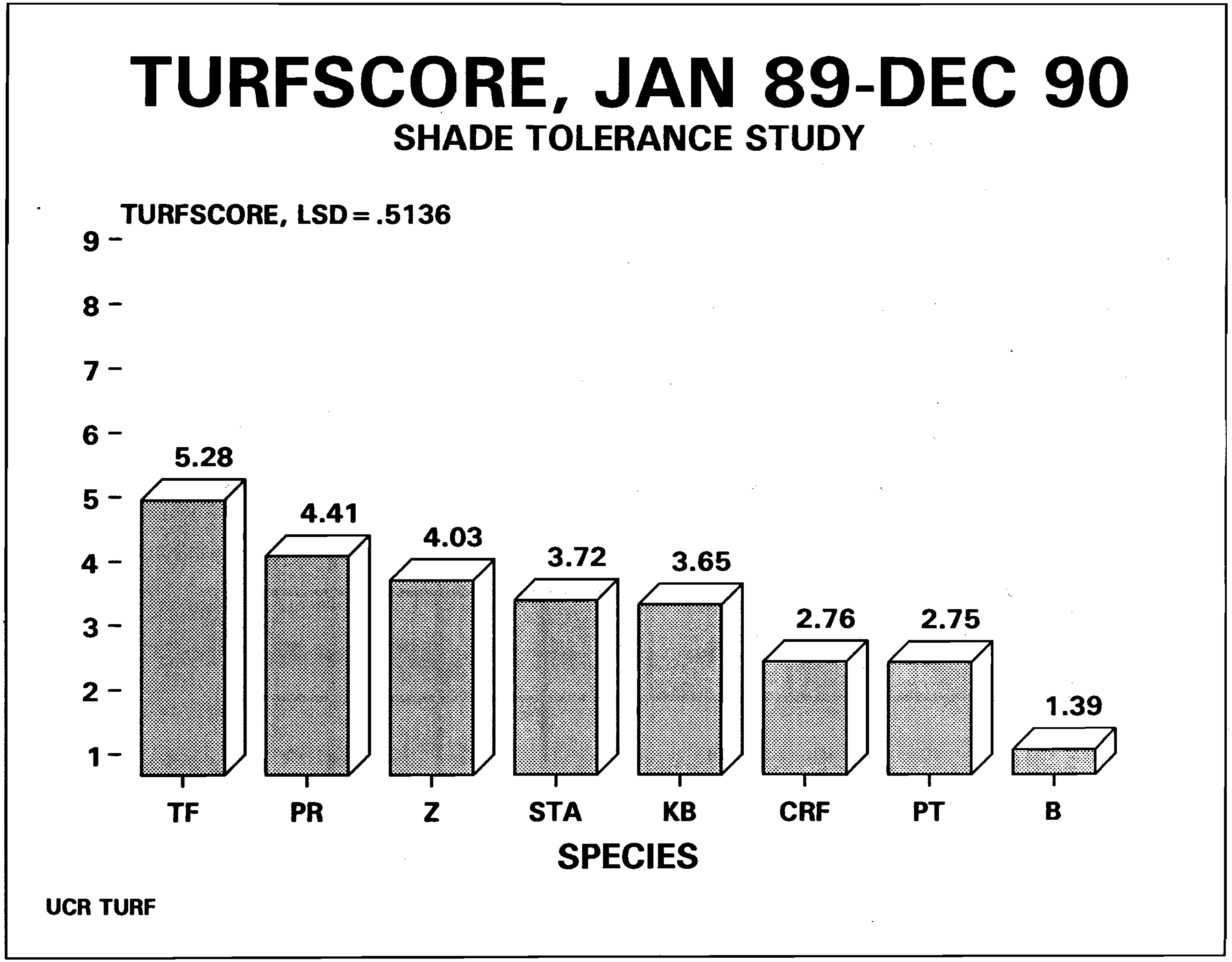
Data Collection: 1) Variable Turfscores Frequency Monthly
2) Variable ______ Frequency ______
3) Variable ______ Frequency ______

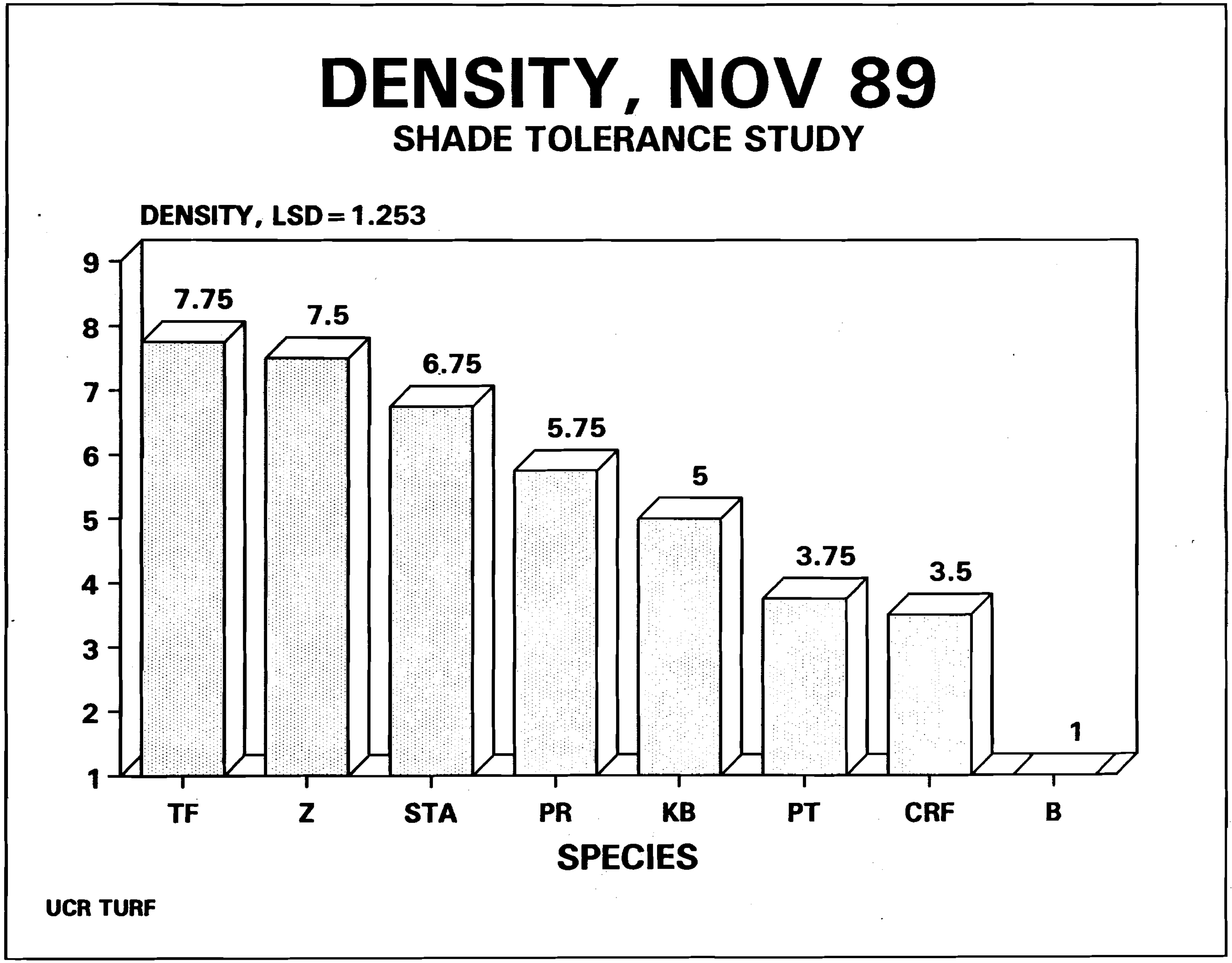
Special Instructions/Comments: ______

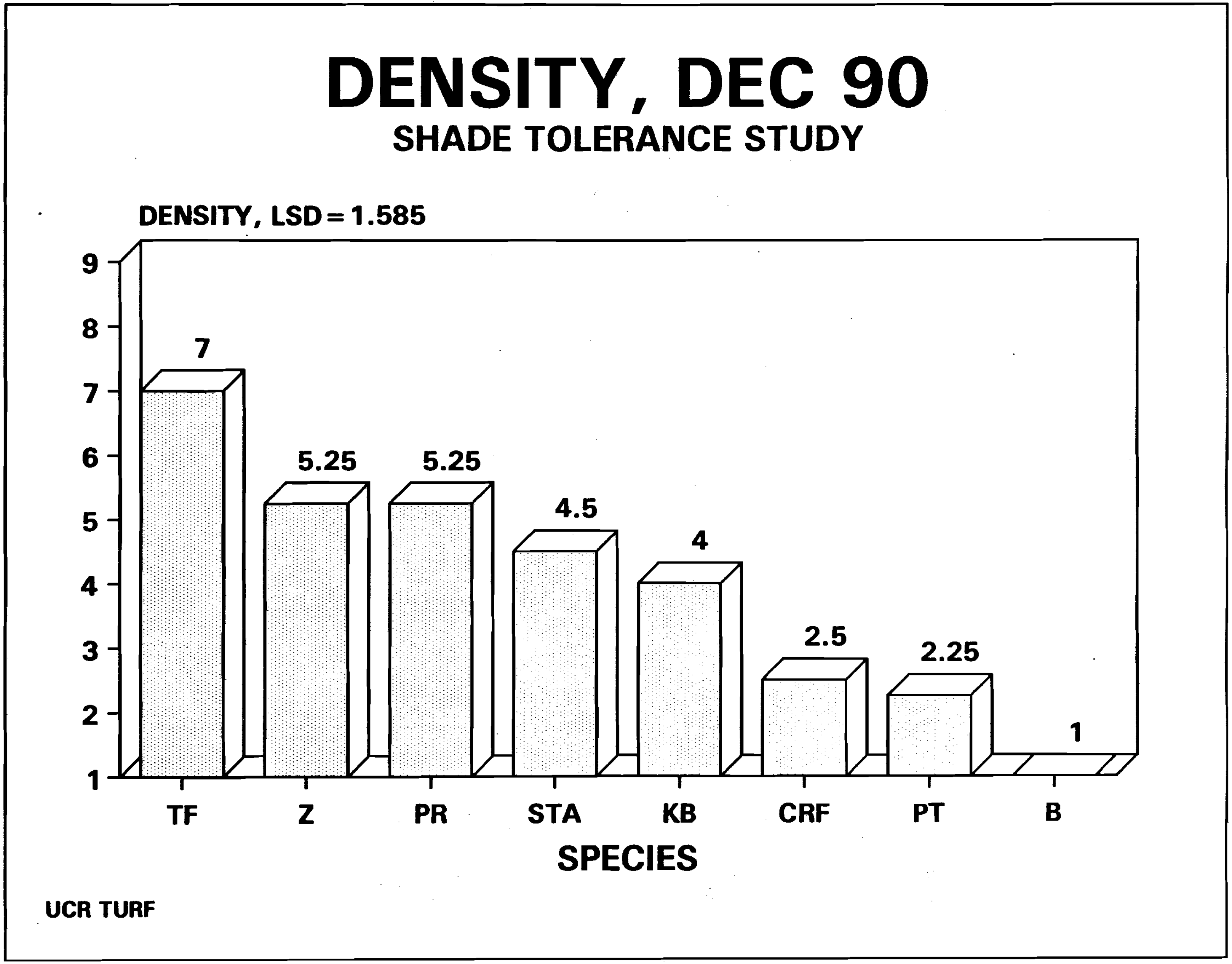
SHADE STUDY

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

1. COM. BERMUDA
2. ZOYSIA
3. ST. AUGUSTINE
4. CR. RED FESCUE
5. TALL FESCUE
6. POA TRIVIALIS
7. PER. RYE
8. KENT. BLUE


TURFSCORE, JAN 89-DEC 90
SHADE TOLERANCE STUDY
TURFSCORE, LSD=.5136
9
8
7
6
5
4
3
2
1
5.28
4.41
4.03
3.72
3.65
2.76
2.75
1.39
TF
PR
Z
STA
KB
CRF
PT
B
SPECIES
UCR TURF


DENSITY, NOV 89
SHADE TOLERANCE STUDY
DENSITY, LSD = 1.253
9
8
7
6
5
4
3
2
1
7.75
7.5
6.75
5.75
5
3.75
3.5
1
TF
Z
STA
PR
KB
PT
CRF
B
SPECIES
UCR TURF


DENSITY, DEC 90
SHADE TOLERANCE STUDY
DENSITY, LSD = 1.585
9
8
7
6
5
4
3
2
1
7
5.25
5.25
4.5
4
2.5
2.25
1
TF
Z
PR
STA
KB
CRF
PT
B
SPECIES
UCR TURF

ORGANIC NITROGEN SOURCE STUDY

(Plot #19)

N

III	7	9	4
	2	8	12
	1	5	10
	3	11	6
II	3	7	11
	10	2	5
	1	4	9
	12	8	6
I	4	8	12
	3	7	11
	2	6	10
	1	5	9

TREATMENTS

1. Check
2. Feather meal (12.5-0-0)
3. Dry poultry waste (4.9-3-2)
4. Blood meal (13.5-0-0)
5. Nature's Cycle (6-3-2)
6. BM/DPW Blend (7-2-2)
7. BM/DPW Blend (8-2-1)
8. BM/FM/DPW Blend (7-2-2)
9. BM/FM/DPW Blend (8-2-1)
10. Organix (10-2-3)
11. Ringer's Restore (9-4-4)
12. Sulfur-coated urea (37-0-0)

APPLICATION RATE:

2.5 lb. N/1000 sq. ft.
(6 applications/year)

TURF:

'Rugby' Kentucky bluegrass +
'Pennant' Perennial rye

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 in.
Fertilizer-Material ____ Rate 1# N/M/6 wk.
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: ____

ZOYSIA NATIONAL VARIETY TRIAL

(Plot #18)

N

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

Title: NTEP Buffalograss Trial

Objective: To evaluate Buffalograss performance 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: 22 Buffalograss cultivars

Management: Mowing Frequency 1 x/Wk. Height 2 in.
Fertilizer-Material Rate 1# /M/6 wk.
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 24 Total Plot 60 x 80
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
II	11	22	10	17	1	14	4
	13	21	15	18	16	9	2
	8	20	4	10	11	3	16
III	17	21	7	1	8	14	2
	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

SPORT TURF LIGHT INTENSITY TRAFFIC EVALUATION (L.I.T.E.)

S.T. Cockerham, V.A. Gibeault and M. Borgonovo[1]

The L.I.T.E. facility was established at the University of California, Riverside Turfgrass Research Project in the summer of 1990. L.I.T.E. is designed to submit turfgrass cultural-practices plots to four light intensity regimes and simulated sports traffic.

Two sensor packages are set within each light intensity treatment. Each sensor package contains a remote quantum sensor (PAR), temperature probe, and relative humidity probe. The sensor data is transmitted via infrared telemetry to a dedicated computer.

The light intensity variable is provided by using shade cloth rated by the manufacturer at 30%, 55% and 73% shade plus full sun. A one meter line quantum sensor (PAR) on a day that full sun was recorded at 1900 microeinsteins showed the shade cloth to be 33%, 54% and 78%, respectively.

A structure using cables and winches has been built to allow access for turf maintenance and experimental treatment. The shade cloth is lifted completely off the surface to a height above the pattern-throw of the sprinklers. The entire treatment/maintenance procedure including traffic application, mowing, and irrigation can be done by one person in about two hours.

The first "shakedown" study was a performance comparison of Bonsai tall fescue, a mixture of Manhattan II perennial ryegrass plus Jaspar creeping red fescue, Manhattan II perennial ryegrass, and El Toro zoysiagrass all with and without traffic in the four light intensities. Data was taken as visual turf scores, Clegg Impact Test and traction plate.

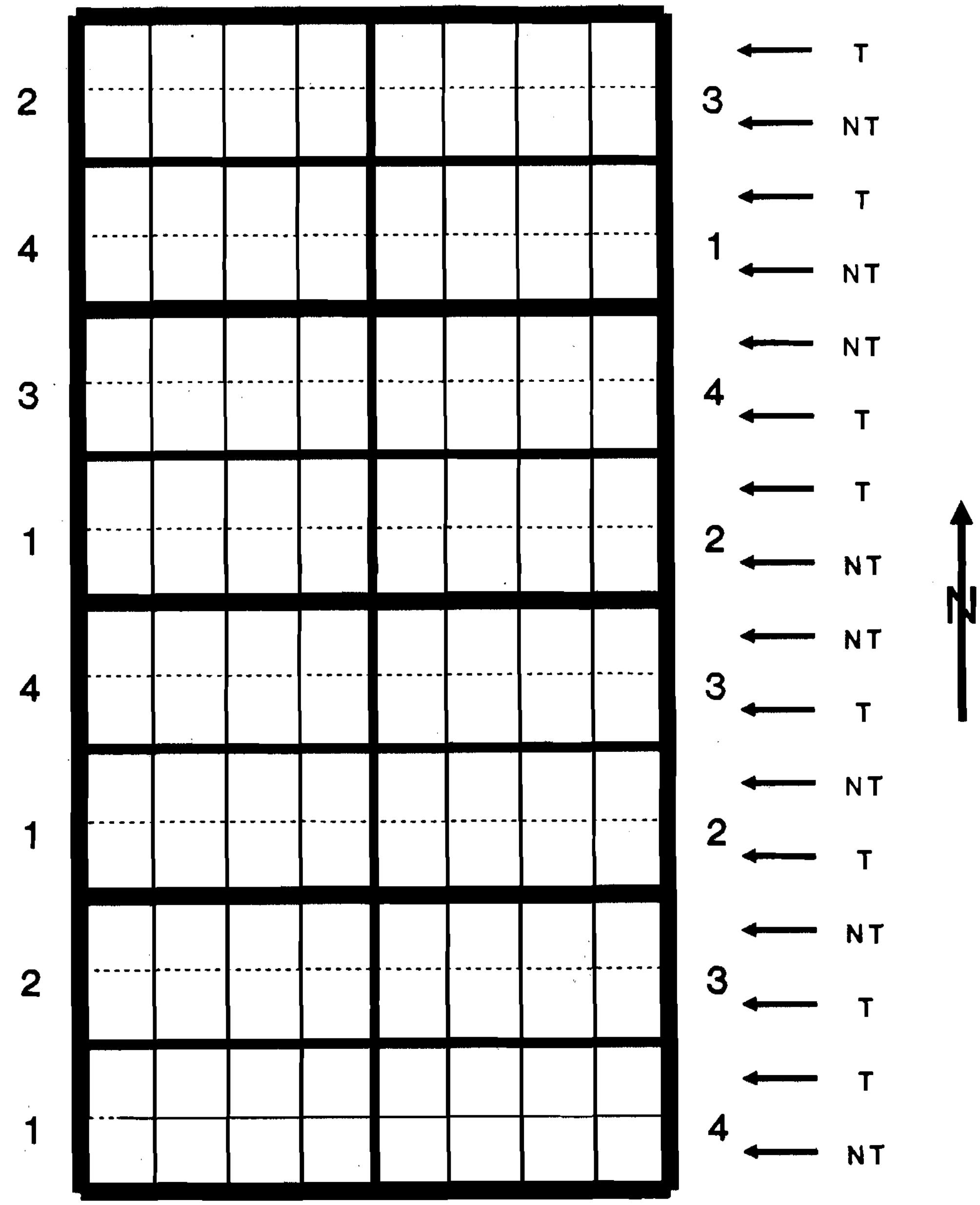
From the data and past information, the site has been seeded to Citation II perennial ryegrass. Future studies in the L.I.T.E. facility will include the evaluation of various cultural practices such as nutrition source and timing, mechanical aeration, mowing, biostimulants and overseeding.

L.I.T.E. is expected to be a useful tool for research into some of the problems of sports turf in situations of limited light intensities.

[1] Superintendent, Agric. Operations, UC Riverside; Extension Environmental Horticulturist, Botany & Plant Sci. Dept., UC Riverside; Senior Agricultural Technician, Agric. Operations, UC Riverside.

LIGHT INTENSITY TURF EVALUATION (L.I.T.E.)

CITATION II PERENNIAL RYE (PLANTED 7/91)



1 = 73% SHADE
2 = 55% SHADE
3 = 30% SHADE
4 = 0% SHADE

8/91

UCR - TURFGRASS RESEARCH CENTER - PROJECT SUMMARY

Starting Date October 87
Completion Date ______

Project No. ______
Plot No. ______

Title: National Tall Fescue Trial

Objective: To evaluate tall fescue in southern California.

Investigator(s):
Name V. A. Gibeault Dept. Coop. Ext. Phone X3575
Name R. Autio Dept. Coop. Ext. Phone X4430

Species/Cultivars: 72 tall fescue cultivars

Management: Mowing Frequency 1 x/Wk. Height 1½ in.
Fertilizer-Material ______ Rate 1# N/6/6 wk.
Irrigation - /X/ as needed ______ % ET_0 / /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: ______

CK #7

NATIONAL TALL FESCUE TRIAL

CA3 Riverside

64	30	47	06	01	12	54	63	57	33	38	36
52	72	56	27	59	32	58	60	69	13	35	14
10	17	62	40	68	41	45	05	42	09	08	39
37	18	34	67	24	03	26	46	55	31	66	04
22	20	44	50	29	53	71	15	43	70	02	48
19	28	65	61	23	16	25	07	21	49	11	51
42	08	49	43	19	56	52	47	32	25	53	60
04	48	70	66	61	44	30	50	46	05	24	15
09	69	57	33	10	40	20	37	59	68	58	45
51	55	21	14	62	34	67	72	54	07	23	29
02	39	31	36	17	22	18	06	63	26	03	12
13	35	11	38	64	28	27	65	71	41	01	16
53	03	41	01	49	31	70	09	52	61	10	44
23	60	58	45	02	33	35	21	18	47	20	37
05	46	54	63	43	08	04	48	56	19	27	34
07	68	26	15	42	57	39	38	72	64	30	22
59	32	29	16	11	36	14	66	50	65	28	40
51	24	25	67	71	13	69	55	06	62	17	12

Entry	Name	Entry	Name
1	Adventure	37	PST-5HF
2	BAR Fa 7851	38	Jaguar
3	Trident	39	PST-DBC
4	Titan	40	Olympic
5	Pick DDF	41	Jaguar II
6	Pick 127	42	Monarch
7	Pick 845PN	43	Apache
8	Pick SLD	44	PST-5DM
9	PE-7	45	Pick DM
10	PE-7E	46	Normarc 99
11	Hubbard 87	47	Pacer
12	Syn Ga	48	Carefree
13	Legend	49	Richmond
14	Taurus	50	Tip
15	Aztec	51	Ky-31
16	Sundance	52	Bel 86-1
17	Fatima	53	Bel 86-2
18	Normarc 25	54	PST-5EN
19	Normarc 77	55	PST-5F2
20	KWS-DUR	56	Finelawn 5GL
21	KWS-BG-6	57	Finelawn I
22	Willamette	58	Rebel
23	Chieftan	59	Rebel II
24	Pick GH6	60	Tribute
25	Thoroughbred	61	Arid
26	Pick TF9	62	Wrangler
27	PST-5OL	63	Mesa
28	PST-5D7	64	JB-2
29	Cimmaron	65	Falcon
30	Bonanza	66	5MI + Endophyte
31	PST-5AG	67	5MI
32	PST-5BL	68	517
33	PST-5MW	69	5D6
34	Trailblazer	70	Pick 151
35	PST-5D1	71	DDF MD
36	PST-5AP	72	DDF GP87

Objectives:
To evaluate the suitability of turf-type tall fescue for southern California.

Methods and Materials:
In october, 1987, 72 cultivars of tall fescue were seeded to 5' x 5' plots at a rate of 4.4 #/M. The plots are mowed at 1-1/2", fertilized at 1# N/M every 6 weeks and irrigated as needed.

MEAN TURFGRASS QUALITY RATINGS OF TALL FESCUE CULTIVARS IN THE
1987 NATIONAL TALL FESCUE TEST AT RIVERSIDE, CA
1990 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=BEST

NAME	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	NOV	DEC	MEAN
JB-2	6.3	6.3	7.0	7	7.0	7.0	7.0	7.0	7	7	7	6.9
PE-7	6.0	6.7	7.0	7	7.0	7.0	7.0	7.0	7	7	7	6.9
PST-5BL (SILVERADO)	6.3	6.7	7.0	7	7.0	7.0	6.7	7.0	7	7	7	6.9
ADVENTURE	6.0	6.0	7.0	7	7.0	7.0	7.0	6.7	7	7	7	6.8
ARID	6.0	5.3	7.0	7	7.0	7.0	7.0	7.0	7	7	7	6.8
AZTEC	6.0	6.3	7.0	7	7.0	7.0	7.0	7.0	7	7	7	6.8
BAR FA 7851 (BARNONE)	6.0	6.3	7.0	7	6.7	7.0	6.7	7.0	7	7	7	6.8
BEL 86-2	6.0	6.7	7.0	7	6.7	7.0	7.0	7.0	7	7	7	6.8
CHIEFTAIN	6.0	6.3	7.0	7	7.0	7.0	7.0	7.0	7	7	7	6.8
ENTRY 66	6.0	6.0	7.0	7	7.0	7.0	7.0	7.0	7	7	7	6.8
ENTRY 68	6.0	5.7	7.0	7	7.0	7.0	7.0	6.3	7	7	7	6.8
ENTRY 72	6.0	6.0	7.0	7	7.0	7.0	7.0	7.0	7	7	7	6.8
HUBBARD 87	5.7	6.3	6.7	7	6.7	7.0	7.0	7.0	7	7	7	6.8
JAGUAR	6.0	6.7	7.0	7	7.0	7.0	6.7	6.7	7	7	7	6.8
JAGUAR II	6.0	6.3	7.0	7	6.7	7.0	7.0	6.3	7	7	7	6.8
KWS-DUR	6.0	6.0	7.0	7	7.0	7.0	7.0	6.7	7	7	7	6.8
LEGEND (BRAHMA)	6.0	6.3	7.0	7	7.0	7.0	6.7	6.7	7	7	7	6.8
MONARCH	6.0	6.3	7.0	7	7.0	7.0	6.3	6.7	7	7	7	6.8
NORMARC 25 (AUSTIN)	6.0	6.3	7.0	7	7.0	7.0	6.3	6.7	7	7	7	6.8
NORMARC 77 (PHOENIX)	6.0	6.0	7.0	7	7.0	7.0	7.0	6.7	7	7	7	6.8
NORMARC 99 (VEGAS)	6.0	6.0	7.0	7	7.0	7.0	7.0	6.3	7	7	7	6.8
OLYMPIC	6.0	6.0	7.0	7	7.0	7.0	7.0	6.7	7	7	7	6.8
PE-7E (SHENANDOAH)	6.0	6.3	7.0	7	7.0	7.0	7.0	7.0	7	7	7	6.8
PICK 845PN (GUARDIAN)	6.0	6.3	7.0	7	7.0	7.0	7.0	7.0	7	7	7	6.8
PICK DM (AVANTI)	6.0	5.7	7.0	7	7.0	7.0	7.0	7.0	7	7	7	6.8
PICK TF9 (CROSSFIRE)	6.0	5.7	7.0	7	7.0	7.0	7.0	7.0	7	7	7	6.8
PST-5D7 (MURIETTA)	6.0	6.0	7.0	7	7.0	7.0	7.0	6.7	7	7	7	6.8
PST-5DM (ARRIBA)	5.7	6.0	6.7	7	7.0	7.0	7.0	7.0	7	7	7	6.8
PST-5MW (SAFARI)	6.0	6.0	7.0	7	7.0	7.0	7.0	7.0	7	7	7	6.8
PST-5OL (OLYMPIC II)	6.0	5.7	7.0	7	7.0	7.0	7.0	7.0	7	7	7	6.8
PST-DBC (TRADITION)	6.0	5.7	7.0	7	6.7	7.0	7.0	7.0	7	7	7	6.8
REBEL II	6.0	6.3	7.0	7	7.0	7.0	7.0	6.7	7	7	7	6.8
SUNDANCE	6.0	6.0	7.0	7	7.0	7.0	7.0	7.0	7	7	7	6.8
TRIBUTE	6.0	6.3	7.0	7	7.0	7.0	6.7	6.3	7	7	7	6.8
APACHE	6.0	6.0	7.0	7	6.3	7.0	6.3	6.7	7	7	7	6.7
BEL 86-1	5.7	6.0	7.0	7	6.7	7.0	6.7	6.7	7	7	7	6.7
BONANZA	6.0	5.3	7.0	7	7.0	7.0	6.7	6.3	7	7	7	6.7
CAREFREE	6.0	5.3	7.0	7	7.0	7.0	6.7	6.7	7	7	7	6.7
CIMMARON	6.0	6.0	7.0	7	6.7	7.0	6.7	6.7	7	7	7	6.7
ENTRY 67	6.0	6.0	7.0	7	7.0	7.0	6.3	6.7	7	7	7	6.7
ENTRY 69	6.0	5.7	7.0	7	7.0	7.0	6.3	6.3	7	7	7	6.7
ENTRY 70	5.7	5.7	6.7	7	7.0	7.0	7.0	7.0	7	7	7	6.7
FINELAWN 5GL	6.0	6.0	7.0	7	6.3	7.0	6.7	6.3	7	7	7	6.7
KWS-BG-6 (TWILIGHT)	5.7	5.7	6.7	7	7.0	7.0	7.0	7.0	7	7	7	6.7
MESA	6.0	6.0	7.0	7	6.7	6.7	6.3	6.7	7	7	7	6.7

MEAN TURFGRASS QUALITY RATINGS OF TALL FESCUE CULTIVARS IN THE
1987 NATIONAL TALL FESCUE TEST AT RIVERSIDE, CA
1990 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=BEST

NAME	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	NOV	DEC	MEAN
PICK DDF (SHORTSTOP)	5.7	6.3	6.7	7	6.3	7.0	6.7	6.7	7.0	7	7	6.7
PICK GH6 (MAVERICK II)	6.0	5.7	7.0	7	7.0	7.0	6.7	6.7	7.0	7	7	6.7
PICK SLD (EMPEROR)	6.0	6.0	7.0	7	7.0	7.0	6.7	6.3	7.0	7	7	6.7
PST-5AG	5.7	6.3	6.7	7	6.7	7.0	6.7	6.7	7.0	7	7	6.7
PST-5AP	6.0	6.0	7.0	7	6.7	6.7	7.0	6.7	6.7	7	7	6.7
PST-5D1 (ELDORADO)	6.0	5.7	7.0	7	7.0	7.0	6.3	7.0	7.0	7	7	6.7
PST-5EN	6.0	5.7	7.0	7	7.0	7.0	6.3	6.7	7.0	7	7	6.7
PST-5HF (AMIGO)	6.0	6.7	7.0	7	6.7	7.0	6.7	6.3	6.7	7	7	6.7
REBEL	6.0	5.7	7.0	7	7.0	7.0	6.3	6.7	6.7	7	7	6.7
TAURUS	6.0	5.7	7.0	7	7.0	7.0	7.0	6.3	7.0	7	7	6.7
THOROUGHBRED	6.0	5.7	7.0	7	6.7	7.0	6.7	7.0	7.0	7	7	6.7
TITAN	6.0	5.7	7.0	7	7.0	7.0	6.7	6.7	7.0	7	7	6.7
TRAILBLAZER	6.0	6.0	7.0	7	6.7	7.0	7.0	6.3	7.0	7	7	6.7
TRIDENT	6.0	6.0	7.0	7	7.0	7.0	6.7	6.0	7.0	7	7	6.7
WILLAMETTE	6.0	6.0	7.0	7	6.3	7.0	6.7	6.7	7.0	7	7	6.7
WRANGLER	6.0	5.7	7.0	7	7.0	7.0	6.7	6.3	7.0	7	7	6.7
ENTRY 71	6.0	5.3	7.0	7	6.7	7.0	6.3	6.7	7.0	7	7	6.6
PACER	6.0	6.0	7.0	7	6.7	7.0	6.0	6.0	7.0	7	7	6.6
PICK 127 (COCHISE)	6.0	6.0	7.0	7	7.0	7.0	6.0	6.3	6.3	7	7	6.6
PST-5F2 (WINCHESTER)	6.0	5.7	7.0	7	7.0	7.0	6.3	6.3	6.7	7	7	6.6
RICHMOND	5.7	5.7	6.7	7	7.0	6.0	6.7	7.0	7.0	7	7	6.6
SYN GA (AQUARA)	6.0	5.7	7.0	7	6.7	7.0	6.7	5.7	7.0	7	7	6.6
FATIMA	6.0	5.0	7.0	7	7.0	7.0	6.0	5.7	6.3	7	7	6.5
FINELAWN I	6.0	5.0	7.0	7	7.0	6.3	6.0	6.0	6.7	7	7	6.5
TIP	6.0	5.7	7.0	7	6.3	7.0	6.3	5.3	6.7	7	7	6.5
FALCON	6.0	6.0	7.0	7	6.7	6.3	5.7	6.0	6.0	7	7	6.4
KY-31	5.0	5.0	5.0	5	5.0	5.3	5.3	5.0	5.0	6	6	5.2

UCR - TURFGRASS RESEARCH CENTER - PROJECT SUMMARY

Starting Date May 86 Project No. ____
Completion Date ____ Plot No. ____

Title: National Bermudagrass Trial

Objective: To evaluate Bermudagrass in southern California.

Investigator(s):
Name V. A. Gibeault Dept. Coop. Ext. Phone X3575
Name R. Autio Dept. Coop. Ext. Phone X4430

Species/Cultivars: 32 Bermudagrass cultivars

Management: Mowing Frequency 1 x/Wk. Height 3/4" in.
Fertilizer-Material ____ Rate 1# N/M/6 wk.
Irrigation - /X/ as needed ____% ET_0 / /Other (Specify Below)
Special ____

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

Data Collection: 1) Variable Turfscore Frequency Monthly
2) Variable ____ Frequency ____
3) Variable ____ Frequency ____

Special Instructions/Comments: ____

N

NATIONAL BERMUDAGRASS TRIAL, UCR — Block 17

Planted May 29, 1986

Plot Size 10' x 10'

	32	31	30	24	3	10
	25	7	6	26	15	21
	1	29	12	5	11	16
I	2	19	9	28	13	8
	4	20	27	18	14	17
	22	23	7	3	16	13
	23	2	12	5	29	11
	25	24	9	19	15	27
II	21	14	17	28	8	22

(Common Bermudagrass)

			31	32	18	6
	20	30	26	1	8	2
	30	22	9	27	11	7
	26	6	18	25	5	1
III	12	16	19	14	29	13
	17	15	21	28	24	23
	32	31				

Entry Number	Name
1	CT-23
2	NM 43
3	NM 72
4	NM 375
5	NM 471
6	NM 507
7	Vamont
8	E-29
9	A-29
10	RS-1
11	MSB-10
12	MSB-20
13	MSB-30
14	A-22
15	Texturf 10
16	Midiron
17	Tufcote
18	Tifgreen
19	Tifway
20	Tifway II
21	NMS 1
22	NMS 2
23	NMS 3
24	NMS 4
25	NMS 14
26	Arizona Common
27	Guymon
28	FB-119
29	C19
30	C84
31	Tifgreen II
32	Santa Ana

Objective:
To evaluate Bermudagrass varieties in southern California.

Methods and Materials:
In May, 1986, 1" plugs were placed on 1" centers in 10' x 10' plots. The plots are mowed at 3/4", fertilized at 1# N/M every 6 weeks and irrigated as needed.

MEAN TURFGRASS QUALITY RATINGS OF BERMUDAGRASS CULTIVARS
IN THE 1986 NATIONAL BERMUDAGRASS TEST AT RIVERSIDE, CA
1990 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=BEST

NAME	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
ENTRY 32	4.7	5.0	6.3	7.0	7.0	7.0	5.0	7.0	8.0	8.0	6.0	6.0	6.4
TIFWAY	4.0	4.0	6.3	7.0	7.0	7.0	5.7	6.7	8.3	8.3	7.0	5.7	6.4
TIFWAY II	4.0	4.3	5.7	6.0	6.0	7.3	5.0	7.7	9.0	9.0	7.3	6.0	6.4
MSB-10	4.0	4.0	6.7	7.3	7.3	7.3	5.3	6.7	7.7	7.7	6.3	5.0	6.3
NM 471	4.0	4.0	6.0	7.0	7.0	6.3	6.0	6.3	7.3	7.3	6.3	4.7	6.0
A-22	4.0	4.0	6.7	7.7	7.7	6.7	5.0	7.0	6.7	6.7	5.0	4.0	5.9
CT-23	4.7	4.0	6.0	6.0	6.0	5.7	4.7	6.0	7.3	7.3	6.7	6.0	5.9
MIDIRON	4.0	4.0	7.0	8.0	8.0	7.3	6.0	6.0	5.7	5.7	4.3	4.0	5.8
MSB-30	4.0	4.0	5.3	6.7	6.7	7.0	7.3	7.3	6.3	6.3	5.0	3.7	5.8
NM 43	4.0	4.0	6.0	7.0	7.0	6.7	6.0	6.3	6.3	6.3	5.3	4.0	5.8
E-29	4.0	4.0	6.0	6.7	6.7	7.0	6.0	6.3	6.7	6.7	4.7	4.0	5.7
RS-1	4.0	4.0	5.0	6.0	6.0	8.0	7.0	8.0	6.0	6.0	4.0	4.0	5.7
TUFCOTE	4.0	4.0	6.3	7.0	7.0	6.7	5.3	6.3	6.3	6.3	5.0	4.0	5.7
ENTRY 29	4.0	4.0	6.3	6.7	6.7	6.0	5.3	5.7	6.0	6.0	6.3	4.3	5.6
NM 375	4.0	4.0	6.0	6.0	6.0	6.7	5.7	6.3	6.3	6.3	5.0	4.7	5.6
NM 507	4.0	4.0	6.0	6.7	6.7	7.0	7.7	6.3	5.7	5.7	4.0	4.0	5.6
TIFGREEN	4.0	4.0	6.0	6.3	6.3	5.7	6.0	6.0	7.0	7.0	5.0	4.0	5.6
A-29	4.0	4.0	5.3	6.0	6.0	6.7	6.7	6.7	6.0	6.0	5.0	4.0	5.5
ENTRY 31	3.0	4.3	5.0	6.7	6.7	6.0	6.7	6.3	6.3	6.3	4.7	4.0	5.5
MSB-20	4.0	4.0	6.0	6.3	6.3	6.0	6.0	6.7	6.0	6.0	5.0	4.0	5.5
NMS 3	4.0	4.0	5.3	6.3	6.3	7.0	5.7	7.0	5.7	5.7	4.7	4.0	5.5
TEXTURF 10	4.0	4.0	5.0	5.7	5.7	6.0	6.3	6.3	6.7	6.7	5.0	4.3	5.5
ENTRY 30	3.3	4.0	5.7	6.0	6.0	6.3	5.3	6.0	5.7	5.7	5.7	4.7	5.4
NMS 4	3.0	4.0	5.0	6.3	6.3	6.7	5.7	6.0	6.0	6.0	4.7	3.7	5.3
VAMONT	4.0	4.0	6.0	6.3	6.3	6.0	5.7	5.7	5.3	5.3	4.0	4.3	5.3
FB-119	4.0	4.0	5.3	5.7	5.7	6.0	5.3	6.0	5.3	5.3	5.0	4.3	5.2
GUYMON	4.0	4.0	5.0	5.7	5.7	6.0	6.0	6.3	5.7	5.7	4.3	4.0	5.2
NM 72	2.3	4.0	5.7	6.0	6.0	6.0	6.0	6.0	5.3	5.7	4.3	3.7	5.1
NMS 1 (NUMEX-SAHARA)	4.0	4.0	5.0	5.0	5.0	6.3	6.0	7.0	5.0	5.0	5.0	4.3	5.1
NMS 2	4.0	4.0	5.0	5.0	5.0	6.0	6.0	6.3	5.7	5.7	4.7	4.0	5.1
AZ. COMMON	4.0	4.0	5.0	5.0	5.0	6.0	5.3	5.3	5.0	5.0	4.7	4.7	4.9
NMS 14	4.0	4.0	4.3	4.7	4.7	5.0	5.7	5.7	5.7	5.7	4.0	3.7	4.8