FIFTH

ANNUAL PROGRESS REPORT

concerning

BREEDING AND DEVELOPMENT

OF ZOYSIAGRASS

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Jointly Sponsored by:

The United States Golf Association

and

The Texas Agricultural Experiment Station

1 November 1988

VOL. 88-2Z

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BREEDING AND DEVELOPMENT OF ZOYSIAGRASS

EXECUTIVE SUMMARY
FIFTH ANNUAL ZOYSIA PROGRESS REPORT
ZOYSIAGRASS BREEDING AND DEVELOPMENT

Principle Investigator: Dr. M. C. Engelke

Research Assistant: Ms. Melinda Quick

Research Period: 1 November 1987 to 1 November 1988

The zoysiagrass breeding program is in its fifth year with the financial support of the United States Golf Association. Major Regional Field Trails were initiated as early as 1986, with cooperators from several states providing comparative evaluation of four experimental DALZ zoysia varieties with four commercially available zoysiagrass cultivars, including 'Meyer', 'Emerald', 'Belair', and 'El Toro'. Additional trials have been established to evaluate sod production potential (Ferris, Texas), and under the Linear Gradient Irrigation System (LGIS) at TAES - Dallas. The first full moisture gradient will be applied to the experimental zoysiagrasses during 1989.

DALZ8501 and DALZ8502 have been identified for their superior regrowth and recovery ability due to highly rhizomatous growth characters. Neither of these clones have sufficient winterhardiness to fit the mid-continent states, based on regional trials conducted the past 2 years in that area. However, as they are grown further south, along the Gulf Coast States and in California, they demonstrate superior performance in winter color, density of stand, and quality of turf. Recognizing their primary area of adaptation is a crucial element in the development of all turfgrass varieties. Trials will be established in Florida and Georgia in 1988/89. Both DALZ8501 and DALZ8502 are fine textured and highly rhizomatous selections. DALZ8502 has potential for use in the deep south for putting green. It retains an excellent winter growth characteristic, has been identified as a low water user and has a relatively low nutritional requirement. Additional testing will be initiated for its potential use as a putting surface. Breeder/Foundation production fields (0.5 acres) of both DALZ8501 and DALZ8502 were planted on fumigated ground in June 1988 with the assistance of the Texas Sod Producers Association. Both fields are in excellent condition going into the winter and should reach nearly full coverage by midsummer 1989. DALZ8501 will be further expanded to cover a full 20,000 sq ft in early spring 1989.

Numerous selections have been identified in the Oriental Collection for turf quality, color retention, greenup, drought hardiness, seed production potential, and numerous desirable agronomic traits. Considering the cold susceptibility of DALZ8501, and DALZ8502, it will be necessary to concentrate on identifying and developing accessions with considerably

more winter hardiness. Dr. Lin Wu, University of California - Davis, has completed the electrophoresis studies on the initial group of DALZ lines which included DALZ8501 and DALZ8502. This information was presented in the spring report (Semiannual 1988) and will be used in conjunction with field performance data as documentation of plant variety release and plant patenting.

FIFTH ANNUAL ZOYSIAGRASS REPORT 1988

M. C. Engelke and M. R. Quick

ZOYSIAGRASS BREEDING AND DEVELOPMENT

I. INTRODUCTION

The contract for Breeding and Development of Zoysiagrass is established through the Texas A&M Research Foundation. This is the fifth annual report, and is submitted, as required in the contract, for the period 1 November 1987 through 1 November 1988. Ms. Jo Ann Treat, President, Texas Research Foundation, and Mr. Charles Smith, Director of Administration and Services for the United States Golf Association, signed the original contract agreement effective May 1984. Annual reports have been submitted and are on file for September 1984, and for November 1985, 1986, and 1987. Semiannual reports were submitted for May 1985, 1986, 1987 and 1988.

II. TECHNICAL SUPPORT PERSONNEL

The support position of Research Assistant for the Zoysiagrass Breeding project is held by Ms. Melinda Quick (Vitae provided May 1986). The halftime Technical Assistant position is held by Mr. George Wehrmaker.

III. IMPLEMENTATION

A. GREENHOUSE STUDIES

1. GERMPLASM MAINTENANCE

The Zoysia sp. germplasm of over 1000 unique accessions continues to be maintained in Deepots in the greenhouse to insure individual integrity. All plant materials are fertilized, watered, clipped and provided chemical pest control to maintain optimum plant health.

2. SCREENING FOR MITE RESISTANCE

INTRODUCTION: Previous reports detail the significant problem of the mite Eriophyes zoysiae, infestations on Zoysiagrass. Resistance to the mite in newly developed cultivars will be highly desirable, and emphasized in the breeding program.

OBJECTIVE: Develop an effective and efficient greenhouse screening technique to identify biotic resistance in the Zoysiagrass germplasm to the mite Eriophyes zoysiae.

PROGRESS: Procedures attempted to November 1987 have

been detailed in previous reports.

FUTURE WORK: Propagation of select accessions of elite DALZ lines has been initiated to provide Drs. James A. Reinert, Entomologist, and Resident Director for Research, and Robert Crocker, Urban Entomologist, with sufficient planting stock to screen for mite resistance. Since the mite is most active under greenhouse conditions during Mid-February to early April, more in-depth studies are targeted for spring 1989.

3. PROPAGATION - THIN-LAYER SOD AND CONTAINERIZED TURF PRODUCTION

INTRODUCTION: The advanced stages of variety testing requires an adequate supply of planting stock of each of the experimental accessions. Previously, limited quantities of stock was provided to the cooperator, which required further increase prior to planting. This additional step of further increasing the plant material prior to field planting has resulted in: 1) fewer willing cooperators due to limited greenhouse space and labor required for increase, and 2) frequent contamination between accessions or loss of identity during vegetative increase. In order to circumvent these problems, we have initiated a program of propagating and maintaining individual accessions to provide adequate material for each cooperator to make direct field plantings. Since considerably more planting stock is required, and genetic integrity still remains the primary concern, we are investigating several approaches to accelerate production while maintaining purity. Consideration is also given to developing production procedures which may be applicable to commercial production, especially of genotypes which otherwise may prove inefficient to produce and market by conventional methods.

OBJECTIVE: Develop alternate methods of turfgrass propagation which will accelerate production time, maintain genetic integrity of planting stock and possibly have commercial appeal. Investigations will include consideration of production time, shelf life and establishment ease.

PROGRESS: Several media have been evaluated for potential use in sod production on plastic using a thin layer of media - hereafter, referred to as **THIN-LAYER** production (FIGURE 1). To date, both sand and rice hulls have been used alone or in combination with peat moss. Generally, pure sand or pure rice hulls were inadequate for water/nutrient retention or in promoting growth when compared to using them in combination with

peat and/or peat/vermiculite. Various water absorbing gels and other media are presently being evaluated. Initial results suggests this media type can greatly decreased the time necessary to develop a harvestable crop.

FUTURE WORK: Other media bases will be examined, including sewage sludge, composted rice hulls and composted cotton burs. The shelf life of thin-layer produced sod can be extended, if necessary, by reestablishing the thin-layer sod to trays with a deeper media base. In a preliminary study, when thin-layer sod was transferred to trays with different media, the rooting acceptance of thin-layer sod was significantly higher for the Rediearth media, than for sand, whereas clay was intermediate. This would suggest that lighter based growth media could also be used to reduce bulk weight and therefore transportation cost while extending shelf-life.

B. FIELD EVALUATION AND PRODUCTION TRIALS

1. MANAGEMENT FIELD TRIAL

INTRODUCTION: Zoysiagrass is one of the least utilized warm season turfgrasses in the United States. This is partially due to the limited number of available cultivars, slow establishment, and relatively high production cost in comparison to other warm season grasses. In the recent past, interest in Zoysia sp. has increased as new cultivars have been developed and the potential of several experimental selections has become apparent. However, the acceptance and utilization of these new cultivars of zoysias is also dependent on the development of efficient managerial strategies which produce superior zoysiagrass turf. Emphasis will be placed on determining the minimum and optimum requirements for producing superior turf, with particular attention given to water requirements (See section on LGIS), turf quality, persistence, and thatching tendency relative to fertilization and mowing height requirements.

OBJECTIVE: Develop and define cultural strategies and practices that optimize turf quality and resource efficiency for existing and newly developed zoysiagrass cultivars for the southern regions of the United States.

PROGRESS: During the winter 1987/88, plant material was increased in the greenhouse to accommodate a 1:36 (1 f.s. = 36 f.s.) field planting expansion ratio. The planting stock consisted of 4 cm plugs established from sprigs in 72 cell flats. The cultivars included

in this management trial are: DALZ8501, DALZ8502, DALZ8508, DALZ8516, Meyer, Emerald, El Toro and Belair (the same material that has been distributed to REGIONAL FIELD TRIAL sites). In addition, two proprietary selections have been included under the designations, TAES3372 and TAES3477. The field plot design is a randomized complete block, consisting of three replications of the 10 varieties. Plot size is 5.8 m x 4.2 m (19 ft. x 14 ft.). Once established. each plot will be subdivided into nine units of 1.9 m x 1.4 m (6.3 ft. x 4.6 ft.) to allow for three fertilization rates and three mowing heights imposed in a split-plot arrangement. Field planting was accomplished by June, 1988. Fertilization has been uniform for all entries, at a rate of 1# N/growing month, and will continue to be until plant material fully covers all plots. Notes on establishment rates were initiated 15 days after planting, and will continue through full coverage (Table 1). TAES3477 demonstrated rapid initial growth as early as 15 days after planting. Sixteen weeks (119 days) after planting both TAES3477 and El Toro were 93-95% covered, with Meyer and DALZ8501 being just 65% covered. DALZ8502 and DALZ8516 are among the slowest to cover, having just 30 and 20 percent coverage respectively by October, 1988 (FIGURE 2).

FUTURE: Fertilization differentials will be imposed once complete coverage is attained, mid summer 1989. Liquid fertilizer will be applied by means of a CO2 sprayer to insure rate uniformity. Individual rates will be made in split applications, in such a manner that all subplots receive fertilizer at the same time. Mowing height differentials will also be initiated once the plots are solid. Mowing will be on an all-at-once, routine basis. Plant response notes to be taken during the course of the study include: density, weed infestation, color, uniformity, quality, spring green up, fall color retention, length of season/fertilization relations, and winter color retention/fertilization relations. A minimum of 2-3 years of data will be necessary for statistical comparison. In the third and fourth years wear tolerance, persistence, and thatching will be evaluated. Methodology in these areas greatly depends on the types of equipment available at that time.

2. LINEAR GRADIENT IRRIGATION SYSTEM (LGIS)

Explanations of purpose, construction and establishment of the Linear Gradient Irrigation System (LGIS) have been provided in previous reports.

PROGRESS: TAES3477, a proprietary variety was planted

on LGIS in early September as 8 cm plugs placed on 20 cm centers. Full coverage is expected for this entry by mid-June 1989. All other plots were planted as sprigs in July 1987, and have fully covered, with the exception of DALZ8513, DALZ8522 and DALZ8523. The moisture gradient is expected to be imposed on the plots during the summer of 1989.

3. ZOYSIAGRASS PUTTING GREEN

PROGRESS: The elite selection DALZ8502 was planted August 1987 as a greens cover, on the 1987 green which has a 80/20 modified sand/peat soil base. Preliminary mowing studies indicated DALZ8502 could tolerate mowing under greens conditions, developed very little thatch at relatively high nitrogen levels and maintained good winter color. Although establishment appeared slow, approximately 25% coverage was attained by the end of the growing season. A combination of late season/peak stress planting, high wind/sand duning and micronutrient deficiencies are suspect in the slowness of development. In late April 1988, fertilization and soil stabilization practices were implemented to accelerate growth. The area currently receives 1# N in the form of Milorganite, and 1/2# N in the form of ammonium nitrate (34-0-0), monthly. Mowing, at 10 mm (3/8 in.), was preformed twice weekly. In addition the area was rolled twice monthly. Full cover was attained in late August. At that time, topdressing was initiated, and the mowing height lowered to 6 mm (1/4 in). In mid-September, half of the area was verticut, and low areas were topdressed. Mowing height differentials will be implemented and putting quality assessed beginning in the spring 1989.

4a. SHADE TOLERANCE TRIALS

INTRODUCTION: Zoysiagrasses are intermediate among warm season grasses in their ability to persist under heavily shaded conditions. Determination of light requirements for newly developed cultivars and experimental selections will be essential in defining utilization parameters.

PROGRESS: In cooperation with the City of Richardson, Texas, Parks and Recreation Department, a shade evaluation trial was established in mid-July, 1988. The planting site is under densely shaded conditions from live oaks and elms for roughly 8 hours per day. (FIGURE 3). Nineteen of the elite DALZ selections along with 5 domestic varieties (Meyer, Emerald, El Toro, FC13521 and Belair) were planted as 10 cm plugs on 0.6 m centers using a replicated randomized complete

block design. A similar planting was completed under full sun conditions (Refer to SUN STUDY section). Periodic data was collected on rate of spread, color, density of stand and number of rhizomes/stolons produced. After 11 weeks under heavy shade, significant differences were evident for density (Table 2a.), degree of spread (Table 2b.) and turf color (Table 2c.) among entries being evaluated. Several entries appeared to have lost density (Table 2a.) over time (7/26-9/30), such as 'Meyer', 'El Toro' and DALZ8512. In contrast, other entries showed an improvement in density over the same time period such as DALZ8502 (FIGURE 4), DALZ8514, DALZ8517, DALZ8524 and DALZ8701. Significant differences were also noted among entries for their ability to expand their area of coverage (Table 2b.) over the 11 week period. DALZ8516, a highly stoloniferous, low growing selection, and DALZ8510 expressed the best spread rate, closely followed by DALZ8507, DALZ8515 AND DALZ8508. This data suggests these genotypes may encroach into densely shaded areas, which would permit sprigging or plugging. In contrast DALZ8502 maintains excellent density once established but generally must be considered a weak spreader, which would suggest solid sodding into heavily shaded areas. This constitutes a single years data, and must not be considered conclusive. Additional time and observations are essential before drawing conclusions. Notes will continue to be collected through the growing season.

4b. SUN EVALUATION TRIALS

PROGRESS: This study is a duplicate of the SHADE TOLERANCE TRIAL, planted in full sun in late July. Data collection was initiated in mid-August. Density of stand (Table 3a.) was highest across time for DALZ8502, DALZ8524, DALZ8508, DALZ8511, DALZ8507, DALZ8516, DALZ8503, DALZ8701, Emerald and Belair, with all rating 7.0 or higher, where 9 = highest. Among those having the lost density over time were, 'Meyer', 'El Toro', DALZ8504, DALZ8505, DALZ8512 and DALZ8522. Considerable differences were also noted for the degree of spread (Table 3b.), and the number of new growing points observed to include stolons and/or rhizomes (Table 3c.). Notably El Toro is recognized for its rapid rate of coverage and rated high in degree of spread (6.3, Table 3b.), and number of growing points produced (10.3, Table 3c.). In comparison several of the DALZ selections preformed as well as or better in new growth under full sun. DALZ8701 topped the group for rate of spread and number of growing points which were predominately rhizomes and not stolons. Several of the DALZ selections demonstrate good development potential. As stated earlier, these represent

preliminary data with additional data required prior to drawing conclusions.

5. REGIONAL FIELD TRIALS

PROGRESS: During the fall/spring 1986/87, four elite experimental selections (DALZ lines 8501, 8502, 8508, and 8516) and four commercially available cultivars (Meyer, Emerald, El Toro, and Belair) were released to numerous research programs throughout the United States for extensive REGIONAL FIELD TRIALS. A list of cooperators, site locations, and trial types are specified in the 1987 annual report. Reports were requested from all sites. Those received prior to printing have been included as an appendix to this text. Thus far contact has been made with Dr. John Dunn, University of Missouri, Columbia, to continue serving as a test site and will be submitted for contract evaluation trials in the spring of 1989. As noted from Dr. Dunn's report (See appendix), both DALZ8501 and DALZ8502 failed to survive during 1987/88. Additional experimentals will be submitted for winter survival evaluation in Missouri. Additional contacts will be made this fall and winter for REGIONAL EVALUATION TRIAL sites for more extensive cultivar evaluation with proposal to be submitted to the committee in the early spring 1989.

Additional field trials will be established in West Palm Beach, FL in the Fall of 1988 in cooperation with Mr. Dan Jones, Banyon Country Club, as well as with Mr. Paul Latshaw, Augusta National in Georgia. Primary emphasis on these two locations will be to assess the greens potential of the fine textured selections such as DALZ8501 and DALZ8502.

Data continues to be taken on a monthly basis at the Ferris, TX site. In July, all plots were subdivided and harvest in solid blocks or by leaving strip between cuts in each plot. The sod harvester was set at a 1.25 cm (1/2 in) soil depth. Data collection on regrowth characteristics were initiated in mid-August, and data was collected at roughly 30 day intervals (Table 4). The initial note at 28 days from harvest, revealed significantly faster regrowth from DALZ8501, DALZ8502 and Emerald regardless of the method of harvest. Slowest regrowth was Belair, DALZ8516, and Meyer.

At 66 days following harvest, El Toro had caught up with DALZ8501, DALZ8502, Emerald, in regrowth regardless of the method of harvest. Whereas, DALZ8508, and Meyer were similar to the previous entries when harvested in strips but not from solid

harvest. Figure 5 shows the difference between DALZ8501 and Meyer at 66 days.

By the 94th day, sufficient regrowth had occurred on all plots following harvest. Significant differences and ranking were unchanged. Notes will continue to be collected until all plots have re-attained full coverage.

6. FIELD PERFORMANCE ORIENTAL COLLECTION

INTRODUCTION: The Oriental collection of zoysias was initially established in replicated field plots in 1984 following a lengthy quarantine period. Numerous field notes have been recorded over the past few years and had provided much needed information in the identification and assessment of the potential of these accessions. The plots have become overgrown with each other and further value as individual plots is questionable.

OBJECTIVE: Identify the genetic variability present within the Oriental collection of zoysiagrasses, and identify those individuals with superior agronomic, morphological and biological traits.

PROGRESS: Trials were established in 1984 and have been evaluated annually for numerous traits. The plots have begun to overgrow each other. Many of the selections have been dominated by or are dominating adjacent plots. This trial is therefore in its last year. In May, the Oriental field plots were evaluated for seedhead production. Potentially high seed yielding types were selected to be used as a parent population in future work (see Table 1. appendix). Sod was removed in strips from the Oriental field plots in mid-July. Data collection was initiated three weeks later, and collected at roughly three week intervals. Currently this data is in the process of being analyzed. Results will be included in the May 1989 semiannual report.

7. FOUNDATION FIELDS ESTABLISHED

INTRODUCTION: The release of any plant material into the commercial industry requires the availability of planting stock for the commercial producer. This planting stock must be of the highest genetic purity, and available in a quantity sufficient enough to ensure adequate acreage can be produced commercially to meet the demand.

OBJECTIVE: Two elite accessions of zoysiagrass identified as DALZ8501 and DALZ8502 have been selected for increase with excellent potential for commercial release within the next 12 to 24 months. The objective, therefore, is

to increase, under Foundation Production Standards, sufficient plant material for release for certified production within this time frame.

PROGRESS: Plant material is being increased using the breeder stock of each of these accessions. Greenhouse propagation was initiated in the fall of 1987 with continued increase throughout the winter months until approximately 75 sq ft of planting stock of each accession was available.

Field sites were tilled and fumigated with Methyl Bromide in late April 1988. The Texas Department of Agriculture is the regulatory agency for controlling Foundation and Certified crop production. Their standards require fumigated field sites which are being established to Foundation Class to be inspected 30 days following fumigation, and prior to planting. In mid-June half acre field plantings of DALZ8501 and DALZ8502 was accomplished through the cooperation of the Texas Sod Producers Association (TSPA). The TSPA provided considerable labor for hand planting of the fields, as well as the portable irrigation pipe to maintain adequate moisture on the fields. The plant material was hand separated into individual sprigs of 4 - 10 node sections and planted on 18 in. centers. The fields received 1 1/2 # N/1000 f.s. per growing month, through the summer.

FUTURE: Full cover is expected by the end of the growing season 1989. The necessary paper work for patenting of the varieties, and the official release papers will be prepared and submitted this fall and winter. Breeder/Foundation sod will be available for released for Certified production by mid-late 1989, early spring 1990.

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Table 1 ZOYSIA MANAGEMENT STUDY - ESTABLISHMENT RATE FOR 1988
PLANTED JUNE 21, 1988 AT TAES-DALLAS

Percent coverage following establishment with 10 cm plugs

ENTRY	Days following planting				AVG.	PHENOTYPIC STABIITLY
	15	54	84	119		
EMERALD	5.0	13.3	21.7	41.7	20.4	
MEYER	5.0	16.7	33.3	65.0	30.0	
ELTORO	5.0	23.3	51.7	92.7a	43.2	1
BELAIR	5.0	11.7	21.7	46.7	21.3	
DALZ8501	5.0	11.7	23.3	65.0	26.3	
DALZ8502	5.0	11.7	18.3	30.0	16.3	
DALZ8508	5.0	10.0	25.0	63.3	25.8	
DALZ8516	5.0	10.0	15.0	20.0	12.5	
TAES3372	5.0	11.7	25.0	45.0	21.7	
TAES3477	9.0a	36.7a	70.0a	95.7a	52.8	4

Means followed by "a" are in the highest statistical rating group according to Duncan/Waller K ratio t test. Phenotypic stability is the frequency of occurrence in the highest rating group.

Table 2a ZOYSIAGRASS SHADE EVALUATION TRIALS - ESTABLISHED JULY 12, 1988
COTTONWOOD PARK, RICHARDSON, TEXAS

DENSITY OF STAND

ENTRY	DATE 7-26	DATE 8-13	DATE 8-26	DATE 9-13	DATE 9-30	AVE.	PHENOTYPIC STABLIITY
EMERALD	7.2	8.4	9.0a	7.2a	6.0a	7.5	3
MEYER	7.2	8.4	8.4a	6.6a	4.3a	6.9	3
ELTORO	6.6	7.8	8.4a	6.6a	5.0a	6.8	3
BELAIR	6.6	7.8	7.8a	6.0a	5.0a	6.6	3
FC13521	5.4	6.6	9.0a	7.2a	5.3a	6.7	3
DALZ8501	3.6	6.6	8.4a	3.6	4.6a	5.3	2
DALZ8502	3.6	7.2	7.8a	7.2a	8.0a	6.7	3
DALZ8503	4.8	7.2	7.8a	6.0a	4.3a	6.0	3
DALZ8504	4.2	6.6	5.4	6.3a	3.8	5.2	1
DALZ8505	3.6	6.0	5.4	3.6	2.0	4.1	0
DALZ8506	6.0	7.8	6.0	6.3a	4.5a	6.1	2
DALZ8507	5.4	7.2	6.6	6.0a	4.3a	5.9	2
DALZ8508	4.2	7.2	6.6	6.6a	5.0a	5.9	2
DALZ8510	4.2	6.6	6.0	5.4	5.0a	5.4	1
DALZ8511	5.4	6.6	6.0	4.8	4.6a	5.4	1
DALZ8512	5.4	6.6	5.4	4.8	3.3	5.1	0
DALZ8513	3.6	5.4	4.8	4.8	2.6	4.2	0
DALZ8514	4.2	6.6	7.2	5.4	6.0a	5.8	1
DALZ8515	6.0	7.2	7.2	5.4	5.0a	6.1	1
DALZ8516	5.4	8.4	7.8a	7.2a	6.3a	7.0	3
DALZ8517	3.6	6.0	7.2	5.4	7.0a	5.8	1
DALZ8522	3.6	6.0	4.2	4.8	2.3	4.1	0
DALZ8523	4.2	6.6	4.8	5.4	5.6a	5.3	1
DALZ8524	6.0	7.2	7.2	7.2a	7.5a	7.0	2
DALZ8701	3.6	6.0	6.0	5.4	5.3a	5.2	1

Means followed by "a" are in the highest statistical rating group according to Duncan/Waller K ratio t test. Phenotypic stability is the frequency of occurrence in the highest rating group. Plots were rated on a scale of 1-9 where 9 is highest.

Table 2b ZOYSIAGRASS SHADE EVALUATION TRIALS - ESTABLISHED JULY 12, 1988
COTTONWOOD PARK, RICHARDSON, TEXAS

DEGREE OF SPREAD

ENTRY	DATE 7-26	DATE 8-13	DATE 8-26	DATE 9-13	DATE 9-30	AVE.	PHENOTYPIC STABILITY
EMERALD	0.0	0.0	0.0	0.0	0.0	0.0	
MEYER	0.0	0.0	0.6	0.0	0.0	0.1	
ELTORO	0.0	0.0	0.0	0.0	0.0	0.0	
BELAIR	0.0	0.0	0.0	0.0	0.0	0.0	
FC13521	0.6	0.6a	0.6	0.6a	0.6a	0.6	3
DALZ8501	0.0	0.0	0.6	0.0	0.0	0.1	
DALZ8502	0.6	1.2a	1.2	0.0	0.6a	0.7	2
DALZ8503	1.2	0.6a	0.6	0.6a	0.6a	0.7	3
DALZ8504	1.2	0.6a	1.2	0.9a	0.9a	0.9	3
DALZ8505	0.6	0.6a	0.6	0.6a	0.0	0.4	2
DALZ8506	1.2	1.8a	1.2	0.9a	0.9a	1.2	3
DALZ8507	1.8	2.4a	1.2	1.8a	1.2a	1.6	3
DALZ8508	1.2	1.2a	1.2	0.6a	1.2a	1.0	3
DALZ8510	0.6	0.0	1.2	0.9a	1.8a	0.9	2
DALZ8511	0.6	0.6a	0.6	0.6a	0.6a	0.6	3
DALZ8512	0.6	0.0	0.6	0.0	0.6a	0.2	1
DALZ8513	0.0	0.0	0.0	0.0	0.0	0.0	
DALZ8514	0.0	0.0	0.6	0.6a	0.0	0.2	1
DALZ8515	1.2	1.2a	1.2	1.2a	1.2a	1.2	3
DALZ8516	1.8	1.8a	1.8	1.8a	1.8a	1.8	3
DALZ8517	0.0	0.0	0.6	0.0	0.0	0.1	
DALZ8522	0.6	0.6a	0.0	0.0	0.0	0.2	1
DALZ8523	1.2	1.2a	0.6	0.0	0.0	0.6	1
DALZ8524	0.6	0.6a	0.0	0.0	0.0	0.2	1
DALZ8701	0.0	0.0	0.6	1.2a	0.6a	0.4	2

Means followed by "a" are in the highest statistical rating group according to Duncan/Waller K ratio t test. Phenotypic stability is the frequency of occurrence in the highest rating group. Plots were rated on a scale of 1-9 where 9 is highest.

Table 2c ZOYSIAGRASS SHADE EVALUATION TRIALS - ESTABLISHED JULY 12, 1988
COTTONWOOD PARK, RICHARDSON, TEXAS

COLOR RATING

ENTRY	DATE 7-26	DATE 8-13	DATE 8-26	DATE 9-13	DATE 9-30	AVE.	PHENOTYPIC STABILITY
EMERALD	7.2a	7.2a	8.4a	7.2a	7.2	7.4	4
MEYER	7.2a	7.2a	7.8a	6.6a	7.2	7.2	4
ELTORO	6.6	6.6a	8.4a	6.6a	6.6	6.9	3
BELAIR	7.8a	7.8a	9.0a	8.4a	9.0a	8.4	5
FC13521	7.2a	7.2a	7.2	7.2a	5.4	6.8	3
DALZ8501	5.4	6.0	7.2	3.6	6.3	5.7	
DALZ8502	6.0	6.0	6.6	7.8a	9.0a	7.0	2
DALZ8503	6.0	6.0	7.8a	6.6a	6.6	6.6	2
DALZ8504	5.4	6.0	6.6	6.3a	6.3	6.1	1
DALZ8505	5.4	5.4	6.6	5.4	4.8	5.5	
DALZ8506	6.0	6.0	7.2	7.2a	7.2	6.7	1
DALZ8507	6.0	6.0	6.6	6.0a	6.0	6.1	1
DALZ8508	5.4	6.0	7.2	6.6a	6.0	6.2	1
DALZ8510	5.4	5.4	6.0	6.3a	6.3	5.8	1
DALZ8511	7.2a	6.6a	5.4	6.0a	7.2	6.4	3
DALZ8512	5.4	5.4	6.0	4.2	5.4	5.2	
DALZ8513	4.8	4.8	5.4	4.2	4.8	4.8	
DALZ8514	5.4	6.6a	8.4a	6.6a	7.8a	6.9	4
DALZ8515	5.4	6.6	6.6	6.0a	6.6	6.2	1
DALZ8516	7.2	7.8	8.4a	7.2a	8.4a	7.8	3
DALZ8517	5.4	4.3	6.6	7.2a	8.4a	6.3	2
DALZ8522	4.2	4.2	5.4	4.2	5.4	4.6	
DALZ8523	6.0	6.6	5.4	6.0a	7.2	6.2	1
DALZ8524	7.2a	7.2a	5.4	7.2a	9.0a	7.2	4
DALZ8701	5.4	5.4	5.4	6.0a	6.0	5.6	1

Means followed by "a" are in the highest statistical rating group according to Duncan/Waller K ratio t test. Phenotypic stability is the frequency of occurrence in the highest rating group. Plots were rated on a scale of 1-9 where 9 is highest.

Table 3a ZOYSIA SUN EVALUATION TRIAL - ESTABLISHED JULY 28, 1988 AT TAES-DALLAS

DENSITY OF STAND

ENTRY	DATE 8-26	DATE 9-13	DATE 9-30	AVERAGE	PHENOTYPIC STABILITY
EMERALD	7.8a	7.8a	7.2a	7.6	3
MEYER	7.2a	6.0	5.0	6.1	1
ELTORO	6.6a	6.0	5.3	5.9	1
BELAIR	7.8a	7.8a	7.2a	7.6	3
FC13521	6.6a	6.6a	5.8a	6.3	3
DALZ8501	6.6a	6.6a	6.7a	6.6	3
DALZ8502	9.0a	9.0a	9.0a	9.0	3
DALZ8503	7.2a	7.2a	7.2a	7.2	3
DALZ8504	6.6a	6.0	5.0	5.9	1
DALZ8505	6.0	5.4	4.0	5.1	
DALZ8506	7.2a	7.2	6.3a	6.9	2
DALZ8507	7.8a	7.8a	8.0a	7.9	3
DALZ8508	8.4a	8.4a	8.3a	8.4	3
DALZ8510	6.6a	5.4	6.2a	6.0	2
DALZ8511	8.4a	7.8a	8.5a	8.2	3
DALZ8512	7.2a	6.0	5.0	6.0	1
DALZ8513	7.2a	7.2a	7.2a	7.2	3
DALZ8514	6.6a	7.2a	6.7a	6.8	3
DALZ8515	5.4	5.4	5.3	5.4	
DALZ8516	7.8a	7.8a	7.7a	7.7	3
DALZ8517	7.2a	6.6a	6.7a	6.8	3
DALZ8522	5.4	5.4	5.0	5.3	
DALZ8523	6.0	6.6a	6.2a	6.3	2
DALZ8524	9.0a	9.0a	8.7a	8.9	3
DALZ8701	7.2a	7.2a	7.2a	7.2	3

Means followed by "a" are in the highest statistical rating group according to Duncan/Waller K ratio t test. Phenotypic stability is the frequency of occurrence in the highest rating group. Rating is on a scal of 1-9 where 9 is highest.

Table 3b ZOYSIA SUN EVALUATION TRIAL - ESTABLISHED JULY 28, 1988 AT TAES -DALLAS

DEGREE OF SPREAD

ENTRY	DATE 8-26	DATE 9-13	DATE 10-30	AVE.	PHENOTYPIC STABILITY
EMERALD	1.8	1.8	1.0	1.5	
MEYER	1.8	1.8	1.0	1.5	
ELTORO	3.6	4.8a	6.3a	4.9	2
BELAIR	1.8	1.8	1.0	1.5	
FC13521	2.4	3.0	3.5a	3.0	1
DALZ8501	3.0	3.6a	4.5a	3.7	2
DALZ8502	1.8	2.4	1.8	2.0	
DALZ8503	3.0	4.8a	5.3a	2.8	2
DALZ8504	3.0	4.2a	4.3a	3.8	2
DALZ8505	2.4	2.4	4.5a	3.1	1
DALZ8506	1.8	3.6a	2.7	2.7	1
DALZ8507	3.0	3.6a	5.0a	3.9	2
DALZ8508	3.0	3.6a	4.0a	3.5	2
DALZ8510	3.0	3.6a	4.5a	3.7	2
DALZ8511	1.8	1.8	4.0a	2.5	1
DALZ8512	3.0	4.6a	5.3a	4.3	2
DALZ8513	3.0	3.6a	5.3a	3.9	2
DALZ8514	3.6	4.2a	4.5a	4.1	2
DALZ8515	2.4	2.4	2.3	2.4	
DALZ8516	1.8	2.4	2.7	2.3	
DALZ8517	2.4	3.0	3.2	2.9	
DALZ8522	2.4	4.2a	4.8a	3.8	2
DALZ8523	3.0	4.2a	5.8a	4.3	2
DALZ8524	1.8	1.8	1.0	1.8	
DALZ8701	3.0	5.4a	7.2a	5.2	2

Means followed by "a" are in the highest statistical rating group according to Duncan/Waller K ratio t test. Phenotypic stability is the frequency of occurrence in the highest rating group. Rating is on a scal of 1-9 where 9 is highest.

Table 3c ZOYSIA SUN EVALUATION TRIAL - ESTABLISHED JULY 28, 1988 AT TAES -DALLAS

MEAN OF GROWING POINTS OF EITHER STOLONS OR RHIZOMES

ENTRY	DATE 8-26	DATE 9-13	DATE 10-30	AVE.	PHENOTYPIC STABILITY
EMERALD	0.0	1.0	1.3	1.2	
MEYER	0.0	1.7	2.3	2.0	
ELTORO	2.3	9.3a	10.3a	7.3	2
BELAIR	0.3	3.0	4.0	2.4	
FC13521	1.3	5.3	9.3a	5.3	1
DALZ8501	1.3	6.3a	9.3a	5.6	2
DALZ8502	0.3	3.7	5.0	3.0	
DALZ8503	2.0	8.0a	11.3a	7.1	2
DALZ8504	2.0	7.0a	10.3a	6.4	2
DALZ8505	1.0	3.7	5.3a	3.3	1
DALZ8506	0.7	7.0a	10.3a	6.0	2
DALZ8507	2.3	9.7a	13.7a	8.5	2
DALZ8508	2.3	6.7a	12.3a	7.1	2
DALZ8510	2.0	8.0a	12.3a	7.4	2
DALZ8511	0.7	3.3	6.7	3.5	
DALZ8512	2.3	7.7a	10.3a	6.8	2
DALZ8513	2.7	8.7a	13.7a	8.2	2
DALZ8514	2.7	8.7a	10.7a	8.2	2
DALZ8515	1.0	3.3	4.7	3.0	
DALZ8516	0.7	4.3	5.7	3.6	
DALZ8517	1.7	5.3	9.3a	5.4	1
DALZ8522	1.3	7.7a	11.3a	6.8	2
DALZ8523	2.3	7.3a	11.7a	7.1	2
DALZ8524	0.0	2.3	3.7	2.0	
DALZ8701	2.3	11.7a	15.3a	9.8	2

Means followed by "a" are in the highest statistical rating group according to Duncan/Waller K ratio t test. Phenotypic stability is the frequency of occurrence in the highest rating group.

Table 4. FERRIS ZOYSIA REGIONAL TRIAL SOD REGROWTH EVALUATION JULY 19, 1988 WHERE SOD WAS SOLID CUT AND STRIP HARVESTED .

Percent Regrowth following harvest

ENTRY	SOLID CUT SOD Days after harvest 28	66	94	AVG.	STRIP CUT SOD Days after harvest 28	66	94	AVG.	PHEN. STAB
EMERALD	63.3a	95.3a	97.0a	85.2	56.7a	98.3a	98.3a	84.4	6
MEYER	6.7	51.7a	53.3a	37.2	5.7	20.0	26.7	17.5	2
ELTORO	32.0	61.7a	65.0a	52.9	32.7	61.0a	63.3a	52.3	4
BELAIR	14.0	40.0	40.0	31.3	12.7	36.7	38.3	29.2	
DALZ8501	63.3a	97.7a	97.7a	86.2	60.0a	98.3a	98.3a	85.5	6
DALZ8502	66.7a	97.0a	97.0a	86.9	56.7a	96.3a	97.0a	83.3	6
DALZ8508	28.3	70.0a	73.3a	57.2	33.3	38.3	40.0	37.2	2
DALZ8516	13.3	30.0	33.3	25.5	18.3	26.7	30.0	25.0	.

Means followed by "a" are in the highest statistical rating group according to Duncan/Waller K ratio t test. Phenotypic stability is the frequency of occurrence in the highest rating group. Ratings are on a scale of 0-99 where 99 is highest.

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Figure 1. Ten week old DALZ8502 grown in the greehouse using THIN-LAYER production. Restricted root zone encourages rapid foliar development and faster generation time. Note the healthy root mat and number of visible rhizomes.

Figure 2. Zoysiagrass managment trials established June 21, 1988 at TAES-Dallas. Aerial photo taken October 11, 1988. Significant differences exist in rate of initial coverage among DALZ commercial and properitary zoysiagrass accessions.

Figure 3. Cottonwood Park, City of Richardson, Texas. Site of the zoysiagrass shade nursery. Area receives heavy shade 8 or more hours per day.

Figure 4. Zoysia plugs after 10 weeks under heavy shade, differences in density of stand and color are apparent. DALZ8502 (lr), DALZ8503 (ll), DALZ8513 (ul) and DALZ8512 (ur).

Figure 5. Sod production trials, Quality Turf Sod Farm, Ferris, Texas. Significant differences in rate of regrowth exist between entries in the ZOYSIA REGIONAL TRIAL. Pictured here are DALZ8501 (front) and 'Meyer' (back). Plots were harvested leaving strips of sod for regrowth (left), and solid harvested (right).

APPENDIX

Table 1. Appendix. The following Oriental accessions were selected based on field performance and seed head production. These will serve as the initial breeding material for developing a seeded zoysiagrass for the turf industry.

ENTRY#	COUNTRY OF ORIGIN	ENTRY#	COUNTRY OF ORIGIN
TAES1966	Japan	TAES1685	Japan
TAES1975	Japan	TAES1541	Phillippines
TAES1985	Japan	TAES1835	Japan
TAES2045	Japan	TAES1833	Japan
TAES2036	Japan	TAES1876	Japan
TAES1984	Japan	TAES1872	Japan
TAES1975	Japan	TAES1869	Japan
TAES1576	Japan	TAES1865	Japan
TAES1588	Japan	TAES1891	Japan
TAES1636	Japan	TAES1895	Japan
TAES1640	Japan	TAES1918	Japan
TAES1656	Japan	TAES1812	Japan
TAES1655	Japan	TAES1882	Japan
TAES1703	Japan	TAES1811	Japan
TAES1730	Japan	TAES2083	Korea
TAES1751	Japan	TAES2097	Korea

Zoysiagrass Variety Evaluation

Ali Harivandi
University of California Cooperative Extension

To evaluate the suitability and performance of zoysiagrass commercial and experimental varieties, a trial was initiated at the UC Field Station in Santa Clara located at the south end of San Francisco Bay on June 23, 1987. Five varieties ('Belair', 'Meyer', 'Emerald', Sun burst' and BK-7) were spot sodded, 'Korean Common' was seeded at two seeding rates (1 and 2 lbs/1000 ft^2) and 'El Toro' was sodded on 9' x 8.5' plots. Plots were replicated three times in a randomized complete block design. On August 6, 1987, four experimental varieties from Texas A & M (DALZ 8501, 8502, 8508 and 8516) were plugged on the same location. At planting time, all plots (except the 'El Toro' and 'Korean Common' plots) received Ronstar G at 5 lb/1000 ft^2; all plots received nitrogen at the rate of 0.5 lb/1000 ft^2/growing month. Plots are mowed weekly (to 3 inches) and watered as needed. Some observations:

- 'Korean Common' germination was very slow and plots were severely infested with both summer and winter annual weeds. Nevertheless, the few seedlings are very aggressive growers.

- The sodded 'El Toro' has performed well. It is, however, coarse textured and light colored.

- None of the Texas experimental varieties went completely dormant in winter. DALZ 8501 and 8502 especially retained their green color all winter (average soil temperature of 51°F for December through February). Among other varieties, 'Emerald' recovered fastest from dormancy.

- Texas varieties and 'Sun burst' exhibited the fastest lateral growth.

- For grasses not sodded, weed control appears to be the major problem in zoysiagrass establishment.

WRCC-11 (Turfgrass) Meeting
Dallas, Texas
August 10 - 12, 1988

Ali Harivandi
University of California
Cooperative Extension

Zoysiagrass Trial

	Color* 1/25/88	3/2/88	3/23/88	Lateral Growth**
El Toro	1	3	9	---
Belair	1	3	8	4
Meyer	1	4.6	9	3
Emerald	2.3	7	9	3
Sun Burst	1	5	9	1
BK - 7	1	4.6	9	3
Korean Common	---	---	---	5
DALZ 8501	7	7.6	9	2
DALZ 8502	5	7.3	9	2
DALZ 8508	4	8	9	1
DALZ 8516	4	8	9	1

* 1-9 (1 = dormant)

** 1-5 (1 = fastest)

Ali Harivandi
University of California
Cooperative Extension

Soil & Air Temperatures: June 1987 - May 1988
UC Santa Clara Field Station

Month	Air Temperature °F			Soil Temperature °F		
	Average Max.	Average Min.	Mean	Max.	Min.	Average
June	79.9	57.0	68.4	73	67	70
July	77.9	57.0	67.4	75	69	72
Aug.	82.1	59.2	70.6	74	70	72
Sept.	81.2	58.2	69.7	74	68	71
Oct.	76.2	57.5	66.8	71	62	66.5
Nov.	64.3	47.6	55.9	64	52	58
Dec.	57.4	46.1	51.7	58	46	52
Jan.	60.2	43.8	52.0	54	46	50
Feb.	68.0	44.7	56.3	58	48	53
Mar.	70.5	46.7	58.6	60	54	57
Apr.	71.5	52.5	62.0	65	58	61.5
May	74.2	52.5	63.4	70	58	64
Average	71.9	51.9	61.9	66.3	58.1	62.2

Ali Harivandi
University of California
Cooperative Extension

Zoysiagrass Trial

No.	Variety	Planting Date	Planting Method
1	El Toro	6/23/87	Sodded
2	Belair	6/23/87	Spot Sodded
3	Meyer	6/23/87	Spot Sodded
4	Emerald	6/23/87	Spot Sodded
5	Sun burst	6/23/87	Spot Sodded
6	BK-7	6/23/87	Spot Sodded
7	Korean Common	6/23/87	Seeded 1lb/1000 ft^2
8	Korean Common	6/23/87	Seeded 2lb/1000 ft^2
9	DALZ 8501	8/26/87	Plugged
10	DALZ 8502	8/26/87	Plugged
11	DALZ 8508	8/26/87	Plugged
12	DALZ 8516	8/26/87	Plugged

Ali Harivandi
University of California
Cooperative Extension

Zoysiagrass Plot Soil Analysis

pH	EC	Ca	Mg	Na	ESP	B	P	K	NH_4-N	NO_3-N	SO_4-S
	ds/m		me/l		%				ppm		
6.8	1.61	7.8	5.4	2.9	1	<0.14	53	370	3.8	57	47

Ali Harivandi
University of California
Cooperative Extension

UNIVERSITY OF MISSOURI-COLUMBIA

COLLEGE OF AGRICULTURE

DEPARTMENT OF HORTICULTURE
1-40 Agriculture Building
Columbia, Missouri 65211
Telephone: (314) 882-7511

August 17, 1988

Dr. Milton C. Engelke
TAMU Research and Extension Center
17360 Coit Road
Dallas, Texas 75252-6599

Dear Milt:

It has been over a year since we planted your TX-Dallas zoysias and I owe you a letter on how they have fared. The attached copy from our Field Day Research Report gives the procedure and bottom line results after one year.

And the bottom line is that the TX zoysias did not come through our average winter of 87-88 in very good shape. Two selections, 8501 and 8502, are showing no life at all. Sprigs of selection 8508 survived and have covered an average 40% of the plot area of 2 of 3 replications by mid August -- no life in one rep. Occasional sprigs of TX 8516 survived and that one now covers about 12% of the plot area of 2 reps -- no survival in one rep.

Among the standards for comparison, 'Belair', 'El Toro', and 'Meyer' cover about 100% of their intended plot areas after one year. 'Emerald' is about 95% filled in.

We plan to continue evaluating zoysia selections in mid-Missouri. Do you have any additional material that you would like to send us?

With best regards.

Sincerely,

John H. Dunn
Professor of Horticulture

JHD/hw
cc: Melinda Quick

encl.

UNIVERSITY OF MISSOURI-COLUMBIA

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DEPARTMENT OF HORTICULTURE
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Columbia, Missouri 65211
Telephone: (314) 882-7511

September 8, 1988

Dr. Milton Engelke
Research and Extension Center
17360 Coit Rd.
Texas A&M University
Dallas, TX 75252-6599

RE: Zoysiagrass Trials

Dear Milt:

Enclosed you will find a summary of the zoysiagrass evaluations at Columbia for 1988.

You should already have a letter that I sent in August outlining our procedure along with a brief note on results.

With best regards.

Sincerely,

John H. Dunn
Professor of Horticulture

JHD/sj
cc: Ms. Melinda R. Quick

Zoysia Evaluation Results

1. Rate of Spread: the most rapidly spreading entries were 'El Toro' and 'Belair'. These cultivars covered 95% and 70% of their designated plot area, respectively, by September 17, 1987, less than 4 months from the planting date (Table 1). Coverage by the remaining entries ranged from 33% (DAL Z8516), to 67% (8501) by September 17.
2. Fall Color: the slower spreading entries generally retained the best fall color on November 17, compared with 'Belair', 'El Toro', and DAL Z8501, the most rapidly spreading entries (Table 2). An exception was 'Meyer', which received a color rating of only 5.0. More extensive areas of bare soil between slow spreading entries may have had a warming effect that influenced color retention.
3. Spring Greenup and Summer Quality: 'Belair' was the earliest of the entries to greenup followed by 'Meyer' and 'Emerald'. Leaves of 'El Toro' browned by spring frost and showed only 15% greenup by April 9, but the cultivar recovered by early May. DAL Z8508 was severely winter injured but surviving sprigs in 2 of 3 replications covered 60% of the plot area on September 1, 1988. Occasional surviving sprigs (2 reps) of DAL Z8516 covered about 15% of the plots by September. DAL Z8501 and 8502 were winter killed.

   Coverage by 'Belair', 'Meyer', and 'El Toro' was 100% by September 1, 1988. 'Emerald' is 95% filled-in. Quality of all the surviving zoysias was good to excellent during summer, 1988.

Table 1. Rate of spread (July) and estimated cover (Sept.) of zoysiagrass cultivars and selections, Columbia, Mo.

Entry	[1]Rate of Spread 7/8/87	Estimated Cover 9/17/87 (%)
El Toro	18.7	95
Belair	14.7	79
DAL Z8501	8.6	67
Emerald	13.9	63
Meyer	8.7	63
DAL Z8502	8.8	53
DAL Z8508	7.3	48
DAL Z8516	9.8	33
$LSD_{.05}$	3.9	17

[1]A quantitative estimate utilizing number (shown under "Rate of Spread" column) of 1 inch square surface units into which the entry has spread.

Table 2. Fall color and spring greenup of zoysiagrass cultivars and selections, Columbia, Mo.

Entry	Color 11/17/87 9=best	Greenup 4/9/88 (%)
Belair	4.7	72
DAL Z8501	5.0	0
DAL Z8502	7.3	0
DAL Z8508	6.3	2
DAL Z8516	7.0	3
El Toro	4.0	15
Emerald	7.0	53
Meyer	5.0	63

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Melinda — Please note correction below
John Dunn

October 12, 1988

Melinda Quick
Research and Extension Center
Texas A & M University
17360 Coit Road
Dallas, TX 75252-6599

RE: Zoysiagrass Trial Reports

Dear Melinda:

Attached you will find temperature date for our research farm in Columbia, MO. The other items requested in your letter of September 15, are as follows:

1. Fertilization: average of approximately 2.5 lb N/1000 sq. ft. (urea 46-0-0) during the growing seasons of 1987 and 1988. Phosphorus and potassium both test "high".

2. pH: ~~6.4~~ 6.0

3. Soil: Mexico silt loam (Udallic Ochraqualf).

The summary of results was sent to you in September. Please call if you need additional information.

Sincerely,

John Dunn

John H. Dunn
Professor of Horticulture

JHD/sj

Average monthly maximum-minimum air temperatures zoysiagrass study, Univ. of Missouri South Farms, 1987-1988.

		Minimum	Maximum
		°F	
1987	*June	61.5	86.8
	July	67.4	88.7
	August	61.1	88.5
	September	51.8	78.7
	October	37.7	62.7
	November	37.4	54.4
	December	27.7	43.5
1988	[1]January	16.7	35.5
	[2]February	15.7	38.3
	March	31.8	54.0
	April	40.4	66.0
	May	54.0	78.0
	June	61.9	88.9
	July	66.2	88.9
	August	66.9	90.3

*Initiation of study.

[1] Minimum air temperatures Jan. 5 - Jan. 11 ranged from 4°F to -2°F. Zoysiagrass was partially protected by an uneven, ½ inch snow cover beginning on day 3 of this stress period.

[2] Zoysiagrass was subjected to air temperatures ranging from -16 -1°F min. to + 6°F max. for about 36 hr. in early February with only a "dusting" (.02 inches) of snow cover.

EXPERIMENTAL ZOYSIAGRASS VARIETY TRIAL

Dr. Mike Kenna, Turfgrass Extension and Research
Kellie Curry, Turfgrass Research Technician

Zoysiagrass is a warm-season, sod-forming perennial grass which produces both stolons and rhizomes. It is grown in the United States from the mild coastal sections of New England, south to Florida, and west to the Great Plains. It has excellent wear tolerance and a slow growth rate which makes zoysiagrass well suited for high traffic, low maintenance areas.

The genus Zoysia includes three different species which are used as turfgrasses. Identification of these species is based on leaf texture, general vigor, and cold hardiness. The improved cultivars recommended for use in Oklahoma include 'Meyer' and 'Emerald'. Meyer is a medium textured, winter hardy Z. japonica. Meyer was released by the Agriculture Research Service (ARS), USDA, and the USGA Green Section in 1957. It has better shade tolerance than bermudagrass (tolerates 1/2 shade), and has excellent cold tolerance.

Emerald zoysiagrass was released by the Georgia Agriculture Expeirment Station and ARS-USDA in 1955. It is a hybrid between Z. japonica and Z. tennuifolia and is vegetatively propagated. Emerald is characterized by finer leaves, greater density, and dark green color. Emerald has better shade and frost tolerance than bermudagrass, but lower cold tolerance than Meyer.

Two recently released zoysiagrasses are 'Belair' and 'El Toro'. These new varieties have medium to coarse texture, but a slightly more aggressive growth rate than Meyer. Belair was released from the USDA-ARS station in Beltsville during 1985. El Toro was released in 1986 from the University of California Agiculture Experiment Station.

Four experimental zoysiagrasses under evaluation at the Turfgrass Research Center include DALZ 8501, DALZ 8502, DALZ 8508, and DALZ 8516. These accessions were developed at the Texas Agriculture Experiment Station (TAES) in Dallas, Texas. The texture for these experimental varieties ranges from very fine to coarse.

Meyer, Emerald, El Toro, and Belair were established in spring 1987 along with four experimental varieties from the Texas Agriculture Experiment Station in Dallas. The experimental area receives 3 lb. actual N/1000 $ft.^2$ annually and was mowed at 0.75 inches. Percent cover, spring greenup, turfgrass quality, texture, and density were evaluated in 1987 and 1988. El Toro and Meyer had faster greenup rates than the experimental varieties from TAES-Dallas. El Toro, Meyer, DALZ8502, and DALZ8501 were among the best varieties for percent coverage during summer 1987. The TAES experimental lines had finer texture, but their overall turf quality was not significantly better than the commercial cultivars when mowed at 3/4 inches.

Table 7. Zoysiagrass Experimental Variety Trial.
Summer 1987 and 1988.
Oklahoma Turfgrass Research Center, Stillwater, OK.

Entry	Cover[z]				Texture[y]	Quality[x] 1988		
	7/11/87	8/22/87	6/22/88	7/13/88	6/16	6/16	7/13	8/23
DALZ8502	17	28	80	87	8	6	7	6
DALZ8501	13	27	87	88	8	6	6	6
DALZ8516	13	18	88	95	6	5	7	7
DALZ8508	13	18	95	98	8	6	7	7
El Toro	22	33	100	100	3	8	8	8
Emerald	10	18	100	100	6	7	8	7
Meyer	17	27	100	100	4	7	8	8
Belair	10	17	100	100	4	7	8	7
LSD (0.05)	7	8	13	11	4	2	2	1
CV %	26	20	8	6	37	13	14	6

[z] Coverage determined by the percent of plot area with turf.
[y] Texture rated 1 to 9 where 1 = coarse and 9 = fine.
[+] Quality rated 1 to 9 where 1 = poor and 9 = excellent.

Table 8. Zoysiagrass Variety Spring Greenup.
Spring 1988.
Oklahoma Turfgrass Research Center, Stillwater, OK.

Entry	Spring Greenup[z]									
	4/05	4/08	4/12	4/15	4/19	4/22	4/26	4/29	5/10	5/13
	%									
DALZ8502	10	10	10	12	17	22	28	32	50	57
DALZ8501	8	8	10	13	22	25	32	33	57	63
DALZ8516	10	10	12	15	17	20	23	28	43	45
DALZ8508	13	15	15	18	30	37	48	58	75	85
El Toro	23	28	30	35	52	62	72	80	90	95
Emerald	20	23	25	27	43	47	57	65	85	93
Meyer	23	27	32	37	50	57	67	77	90	95
Belair	18	20	20	23	32	37	40	52	72	78
LSD (0.05)	9	9	10	11	19	21	30	29	30	30
CV %	33	29	29	29	33	31	37	31	25	22

[z] Spring greenup was estimated by the percent of the plot area that was green.

TEXAS A&M UNIVERSITY
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October 28, 1988

Mr. Bill Bengeyfield
National Director
USGA Green Section Chairman,
Box 3375
Tustin, CA 92681

Dear Bill:

The 1988 Annual reports for both the Bentgrass and the Zoysiagrass Breeding programs are being transmitted to you with this letter. We have had a good year all things considered and look forward to making even greater progress to our primary goal of developing and releasing new turfgrass varieties. I am quite appreciative of the decision made by your committee concerning support for regional testing of these new varieties.

As always, we are appreciative of the support from the United States Golf Association, Golf Course Superintendents Association of America, and Bentgrass Grass Research Inc. for your continued support.

Sincerely,

M. C. Engelke
Associate Professor
Turfgrass Breeding and Genetics

enc.
cc:
Dr. Neville P. Clarke, Director
Texas Agricultural Experiment Station
Dr. James A. Reinert, Resident Director, TAES-Dallas
Ms. Joanne Treat, President, Texas A&M Research Foundation
USGA/GCSAA Research Committee
Bentgrass Research, Inc. Executive Committee (Bent)
Ms. Virginia Lehman, Research Associate (Bent)
Ms. Melinda R. Quick, Research Assistant (Zoysia)
Dr. Phil Colbaugh, Turf Pathologist
Dr. James B. Beard, Turf Physiologist
Dr. Garald L. Horst, Turf Physiologist