THIRD

ANNUAL PROGRESS REPORT

concerning

BREEDING AND DEVELOPMENT OF ZOYSIAGRASS

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EXECUTIVE SUMMARY
THIRD ANNUAL ZOYSIA PROGRESS REPORT
ZOYSIAGRASS BREEDING AND DEVELOPMENT

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Research Assistant: Ms. Melinda Quick

Research Period: November 1, 1985 to November 1, 1986

The TAES zoysiagrass germplasm nursery continues to be maintained in both the greenhouse and in replicated field plots. The winter of 1985/86 was relatively mild, with very few of the zoysia accessions actually going dormant. Environmental parameters are being continuously monitored and visual observations recorded on relative plant performance.

Considerable emphasis was directed in 1985/86 toward identifying unique genotypes within the Oriental and Domestic zoysiagrass collections which appeared to be well adapted to turf conditions in the Southern United States. In the fall of 1985, several experimental zoysiagrass genotypes were selected from the 1980 turf trials, as well as from the Oriental Zoysiagrass collection for inclusion in an accelerated field testing program. These genotypes have been and will be designated as DALZ lines, to signify elite genetic resources. Of particular interest are two lines, designated DALZ8501 and DALZ8502 which are accessions obtained from the Plant Introduction Station, Experiment Ga. in 1981. Data is presented in TABLE 5 to demonstrate the superior regrowth characteristics of these accessions over commercial or other experimental varieties. These two clones along with approximatley 20 others are being increased in the greenhouse to provide sufficient plant material for establishment and extensive field testing beginning in 1987.

The Linear Gradient Irrigation System (LGIS) was completed in the fall of 1986 and will be used as the major site for the field testing program (See May 1986 Zoysia Report). Replicated field plots will be established by hydrosprigging in early May 1987, with full establishment anticipated by fall. The first imposition of a moisture gradient should occur during the summer of 1988. These LGIS plots and production plots established on a sod farm near Dallas in September 1986 will provide information of establishment, rate of spread, production potential as well as to provide additional plant material for advanced testing. The production plots will be harvested with commercial harvesting equipment in late summer 1987 to evaluate full production potential, and to examine regrowth and recovery. Additional plots will be established on local golf courses using four of the 'best' DALZ lines along with commercial varieties 'Meyer', 'Emerald', 'El Toro' and 'Belair'. Of specific interest will

be the turfs performance under natural traffic conditions on tees and fairways. DALZ8502 will be evaluated under greens conditions to determine is potential for the northern transition in place of the more winter susceptible bermudagrasses. Thus far texture and density appear favorable.

The occurrence of a rather severe nematode infestation resulted in a major delay in vegetative propagation of plant material. The nematode was identified as <u>Meloidogyne</u> sp. (root knot nematode), which apparently is relatively common on zoysiagrass. Regardless, the incident resulted in delayed planting of the experimental plots.

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ANNUAL REPORT NOVEMBER 1986

BREEDING AND DEVELOPMENT OF ZOYSIAGRASS

I. INTRODUCTION

The research contract for Breeding and Development of Zoysiagrass is established through the Texas A&M Research Foundation. This is the third annual report, and is submitted, as required in the contract, for the period of November 1, 1985 through November 1, 1986. 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 November 1985. Semi-annual reports were submitted May 1985, and May 1986.

II. PERSONNEL

The support position for the Zoysiagrass Breeding project was reclassified as a Research Assistant with the promotion of Ms. Melinda Quick (Vitae provided May 1986). Ms. Sherrie Anderson resigned from her position as the half-time Technical Assistant effective October 30, 1986. In spite of the hiring freeze with the State of Texas, this position has been approved for rehire and a search is presently underway for refilling this support position.

III. GREENHOUSE GERMPLASM

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

A. GREENHOUSE - Screening for Mite Resistance

INTRODUCTION: Previous investigations have determined the mite *Eriophyes zoysiae* to be the causal agent for a unique leaf roll and curl (buggy whip - Photos in previous reports) in zoysiagrass. This malady is the third most significant pest problem on zoysiagrass in South Korea. The potential exists for spreading the problem within the United States, since preliminary test conducted in both the field and greenhouse indicate 'Meyer-Z52' is highly susceptible. It will be highly desirable for newly developed cultivars to be resistant to the mite.

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

PROGRESS: The semi-annual report details procedures attempted up to May 1986. Since 1986, expression of mite damage has been minimized under greenhouse conditions, or were very sporadic. This inconsistency in performance has made progress in developing screening procedures difficult. Based on previous experience, the mite expression under greenhouse conditions is more pronounced during the winter and spring. Additional progress is anticipated in the coming year. Due to the erradic response of the mite, and as an alternative, a chemical pest control schedule was implemented in April 1986. Kelthane and diazinon were use on alternating weeks. This treatment seems to have reduced the mite population in the greenhouse. Currently, all accessions known to have been infested with the mite appear to be mite free. Beginning November 1 1986, all chemical pest controls will be terminated for a period up to 2 months to allow for plant regrowth. In early January a note will be taken to evaluate the accessions for mite infestations. At that time it will be possible to determine if the mite is being controlled by the chemical treatments. Notes are continually recorded of the susceptibility of the individual plants in the germplasm pool in both the greenhouse and the field. (See FIELD NOTES - THE MITE - page 9.)

B. GREENHOUSE - Propagation Technique Study

Introduction: Zoysiagrass has received only marginal acceptance throughout the turf industry, primarily due to the higher cost associated with establishing the species. Zoysiagrass sod can cost $2 - 5 per square yard more than alternative warm season grasses. Generally, this higher cost is associated with slow growth and a comparatively long growth cycle. Rather than solid sodding, alternative methods of lawn establishment such as plugging, strip sodding, or sprigging could reduce cost and stimulate wider acceptance and use for domestic lawns and recreational turfs. Techniques which will accelerate zoysiagrass sod production need to be investigated.

OBJECTIVE: Investigate alternative production/establishment procedures and determine the influence of post-harvest temperature treatment on shelf-life and establishment characteristics of sod, and sprigs of zoysiagrass. Studies were initiated to determine the effect of low temperature storage of zoysia plant material on tiller, rhizome and stolon production.

PROGRESS: A previous study of the effect of chilling temperatures on 'Emerald' zoysia tiller formation, conducted at TAES-Dallas, determined that plant material exposed to 5 C for 12 & 18-hours and ambient (22 C) plant material indicated modest increases in tiller number over those plants exposed to chilling temperatures for 6-hours. The increase in tiller number at 18-hours at 5 C was significantly higher when compared to 6-hours at 5 C. Based on the information provided by the initial study, a second study was conducted.

the original and heat treated populations revealed significant differences for all characters studied which included: number of stolons, number of nodes, tillers per plant, total stolon length per plant, and total stolon weight. In January 1986 a study was initiated to characterize the rooting behavior and determine the relevance of the morphological traits in zoysiagrass that may influence natural adaptation and utility. Selections from KCZ, and two populations from KCZ selected for root heat tolerance (RHT) which are designated KCZ-RHT(A), and KCZ-RHT(B) and other elite germplasm selections from the domestic and oriental collections which have demonstrated superior performance were included in the study.

OBJECTIVE: Define primary rooting characteristics of heat tolerant and elite zoysiagrass germplasm.

PROGRESS: Individuals from KCZ and the two KCZ-RHT populations A and B as well as 'Belair', Meyer, 'FC13521', Emerald and three experimental accessions designated as DALZ8501, DALZ8502, and DALZ8508 were planted in root tubes 10 January 1986. The tubes were a rigid clear acrylic plastic measuring 3.17 cm diameter and 1220 mm in length, containing a pure sand media. Each of the plant selections were prerooted in sand and then transplanted to the tubes. Each root tube was mounted vertically inside a 3.8 cm diameter PVC sleeve and topped with a colored plastic cap to inhibit light penetration from the top. The tillers were water misted frequently until an established root was observed. Once established, irrigation was provided to prevent wilting. Fertilization was supplied at an equivalent rate of 0.50 kg/are (1 # N/1000 f. s.) per month. Stolon growth was removed halfway through the study to encourage root growth. The development of the roots was observed on a regular basis, and abnormalities recorded. The study was harvested mid-June by extracting roots from the sand culture in running water. Care was exercise to insure maximum harvest of roots and to diminish root loss. The harvested plant materials were sealed in plastic bags under high humidity and stored at 5 C to prevent growth and/or dessication of tissue. Root length and root numbers, and oven dried root mass and tiller mass were recorded. Statistical differences were apparently obsecured by a heavy anaerobic bacterial infestation which suppressed both root and tiller development. This study will be repeated in 1986/1987 using 600 mm length tubes, and replications increased to 5.

D. GREENHOUSE - NEMATODE INFESTATION

INTRODUCTION: Several experimental zoysias being increased under greehouse conditions for field trials displayed secere chlorosis in mid-May. Through a diligent nutritional program, nutrient deficiencies were ruled out. With the assistance of Dr. Phil Colbaugh, consideration of any major disease organism was discounted. Soil cores were then pulled and examined revealing a deformed and stunted root systems caused by a nematode.

Samples of infested root tissue was sent to Dr. Robin Gibbling-Davis at the University of Florida - Fort Lauderdale for identification. It was determined to be a root-knot nematode of the Meloidogyne sp.

OBJECTIVE: Reduce or eliminate the nematode infestation load on experimental accessions to insure clean planting stock is available for field planting.

PROGRESS: An application of aldicarb (Temik) was applied at the recommended rate, and samples were evaluated on a weekly basis to observe the chemicals effectiveness. After 3 weeks little gain had been made in controlling the nematode, and another application of aldicard was applied at a rate five times greater than had previously been used. After 2 weeks a substantial reduction in nematode numbers was recorded. This plant material continues to be monitored for nematodes. In discussion with other researchers on the Zoysia sp., the root knot nematode is a relatively common pest of zoysiagrass. Not all accessions appear to have suffered from the infestation. Further studies will be initiated in 1986/87 to determine if host resistance is present in the germplasm collection. All of the accessions were repropagated in newly constructed flats with sterilized media. Planting stock consisted of strickly stolons with no roots, in attempts to isolate clean planting stock. These accessions will be fully established by Spring 1987.

E. GREENHOUSE and FIELD - GERMPLASM SELECTION AND PROPAGATION

INTRODUCTION: The Zoysia Breeding Program to date has concentrated on limited hybridization with greater emphasis concentrating on selection of the more desirable germplasms and doing more extensive evaluation.

OBJECTIVE: Select and propagate elite germplasm lines, and establish a field testing program to effectively and expediciously evaluate their regional adaptability and utility.

PROGRESS - Selection: To date a total of 24 elite selections have been made based on greenhouse, laboratory and field performance. All of the selections are being increased under controlled conditions in the greenhouse or field flats at TAES-Dallas (Figure 4). Three of these selections (DALZ8501, DALZ8502, and DALZ8503) are introductions obtained from the USDA Plant Introduction Station in June 1981. Six of the selection were obtained from Dr. Phil Busey, and Dr. Al Dudeck, University of Florida (DALZ8509 through DALZ8514). Three of the selections were from Mr. Jack Murray (DALZ8518, DALZ8519, and DALZ8520). The remainder of the plant material (11 selections) are direct introductions from the Oriental Collection Trip. Four selections have been identified for accelerated field evaluation, these include DALZ8501, THE MITE: In addition, the plots exhibited considerable infestation from the mite Eriophyes zoysaie. A monthly note has been recorded throughout the season and will be continually monitored in order to identify potential sources of resistance and best time of year for cultivar evaluation. To date, an artificial inoculation, evaluation procedure has been difficult to define.

MITE CONTROL: Several commercially available mitecides for turfgrass have been applied according to label directions. None appear to be effective in controlling the pest. In May, an application of Komite, a miticide labeled for control of Eriophyes sp. on cotton, was applied to all infested areas at a rate of 0.9 liters ec/hectare. For a period of 3 weeks the symptoms were greatly reduced, then slowly began to reappear. Other chemicals being evaluated for effectiveness include: Omite ec, and Dimilin wp. Omite was equal in preformance to Komite, while Dimilin was less effective. None of the products eradicated the mites after one application. Future work will include multiple applications of these and other miticides.

DALZ8502: In addition to the superior performance and rapid regrowth of DALZ8502, this fine textured, highly rhizomatous variety appears well suited to closing mowing. Preliminary trials were established on the Bentgrass Green, to determine the response under close mowing. These plots were established by direct transplant in May 1986. By mid August, the plot was completely established. Mowing has been maintained at 0.63 cm (3/8") with mowing three times each week. Notes of concern include dormancy, green-up, flowering, thatching tendency, persistence and mowing quality. DALZ8502 appears to flower in both the spring and fall which may prove undesirable. A plot measuring 3 m x 3 m will be established on the new bentgrass green, to permit more intense evaluation of this variety.

GENERAL MAINTENANCE: All field plots are mowed with a rotary mower on a weekly basis during their peak season of growth. Fertilization is applied at a rate of 0.75 kg/are (1.5 lb N/1000) in two application during the growing season. Pesticides are applied as needed. Irrigation is supplied to prevent wilt.

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TABLE 1. The average number of tillers produced over time according to how the plant material was handled at harvest.

METHOD	3	4	5	6	7	8	9	Avg.
	WEEK							
BAG	1.10b*	1.38a	1.84	2.24b	3.26ab	4.38ab	5.79	2.86b
SOD	1.17a	1.43a	1.87	2.45a	3.56a	4.66a	6.08	3.03a
SPR	1.03c	1.26b	1.72	2.13b	3.11b	4.21b	5.74	2.74c
avg**	1.11g	1.36f	1.82e	2.28d	3.32c	4.42b	5.88a	

* Means followed by the same letter in each column are not significantly different at p=0.05.
** Means followed by the same letter in this row are not significantly different at p=0.05.

TABLE 2. The effect of post-harvest storage time on subsequent tiller production.

TIME	3	4	5	6	7	8	9	Avg.
	WEEK							
0 HRS	1.20a*	1.53a	1.83ab	2.45a	3.78a	4.58ab	5.63bc	3.00ab
6 HRS	1.08b	1.28b	1.65b	2.00c	2.94c	3.95c	5.24c	2.59d
12 HRS	1.08b	1.36b	1.94a	2.44a	3.59a	4.82a	6.51a	3.11a
18 HRS	1.12ab	1.39ab	1.86ab	2.41ab	3.39ab	4.55ab	6.02ab	2.96b
24 HRS	1.08b	1.30b	1.78ab	2.17bc	3.08bc	4.26bc	5.83abc	2.78c
avg**	1.11g	1.36f	1.82e	2.28d	3.32c	4.42b	5.88a	

* Means followed by the same letter in each column are not significantly different at p=0.05.
** Means followed by the same letter in this row are not significantly different at p=0.05.

TABLE 3. Mean dry root weights, and dry tiller weights for post-harvest storage time averaged over all zoysiagrass genotypes 9 weeks after planting.

TIME	Root wgt	Tiller wgt
	(mg)	
0 HRS	393.83ab	297.70b
6 HRS	339.22b	315.86b
12 HRS	430.19a	370.23a
18 HRS	380.69ab	379.07a
24 HRS	360.51b	317.98b

TABLE 4. Mean dry root weights, and fresh tiller weights of four zoysiagrass genotypes 9 weeks after planting.

GENOTYPE	Root wgts	Tiller wgts
	(mg)	
MEYER	608.24a	504.73a
8502	320.11b	244.35c
8508	311.29b	325.39b
EMERALD	300.46b	264.62c

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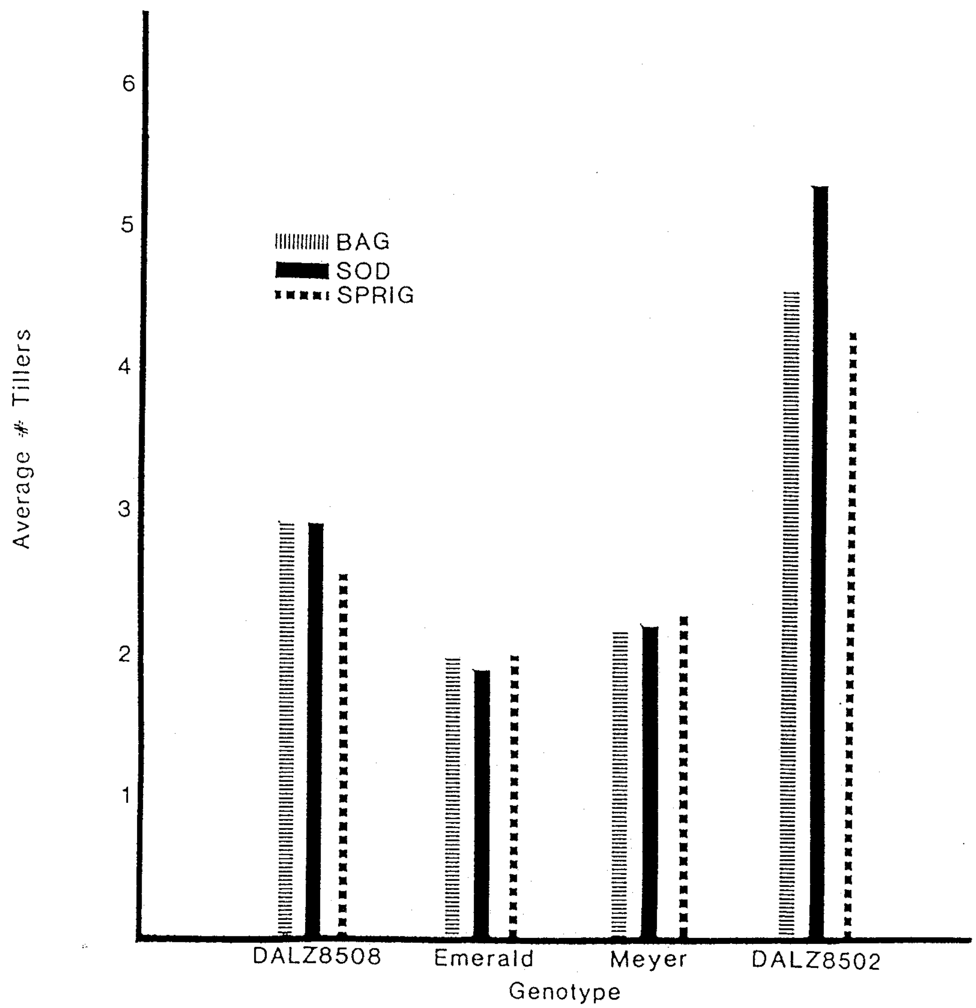

Fig. 1 Average tiller production of each genotype according to post-harvest storage method.

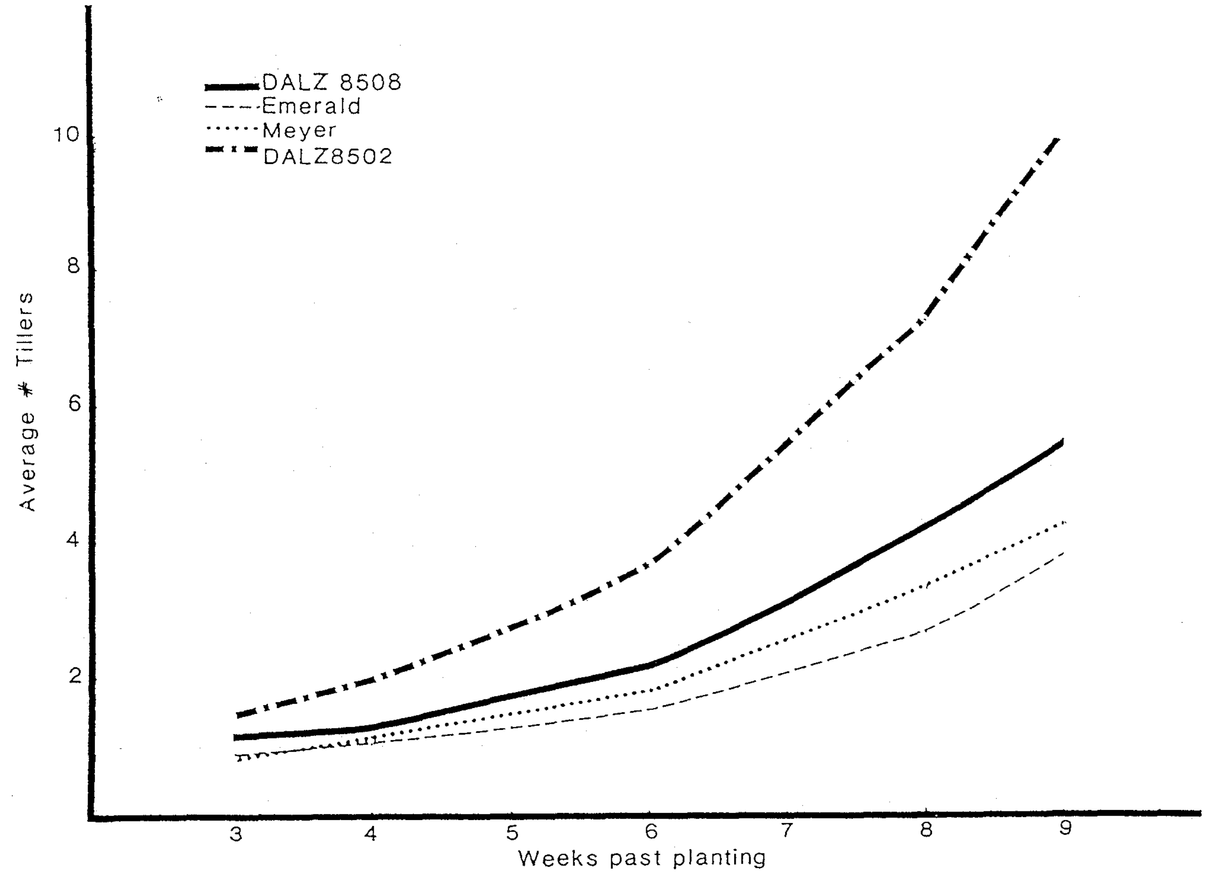

Fig. 2 Average tiller production of individual genotypes through the post-plant period of 9 weeks.

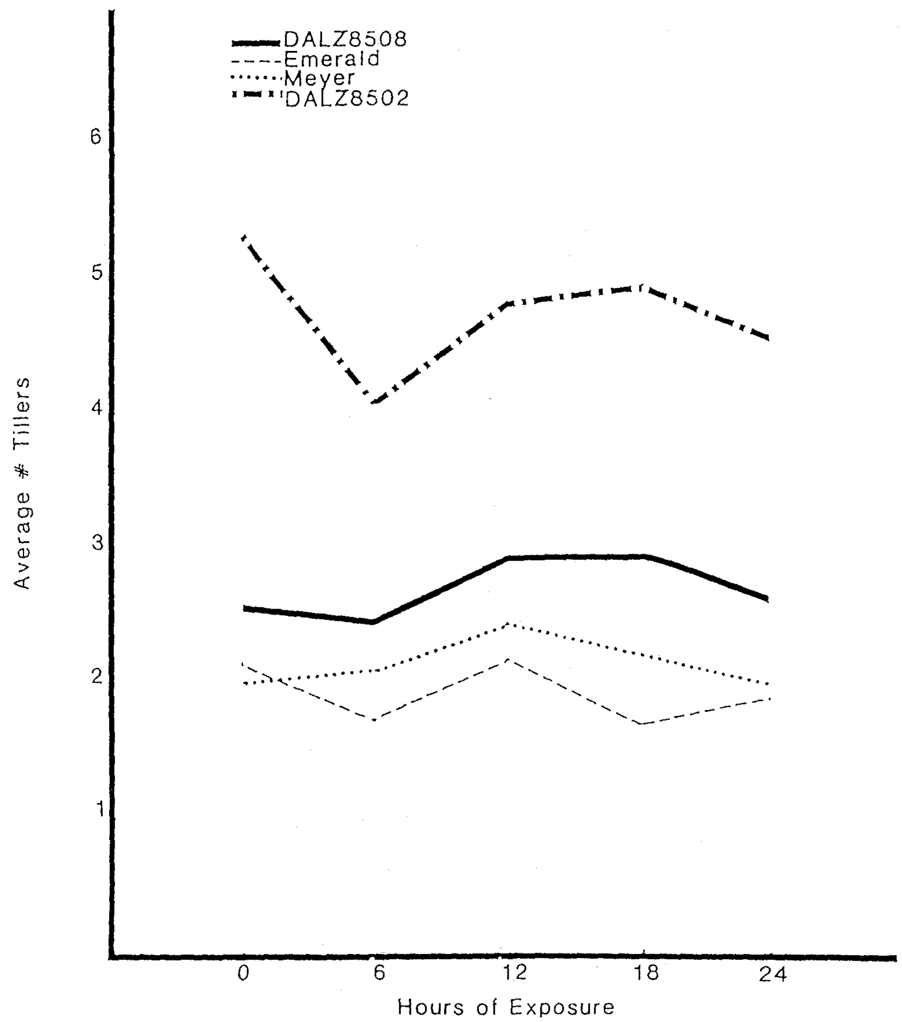

Fig. 3 Average tiller production of each genotype post-harvest according to storage time.

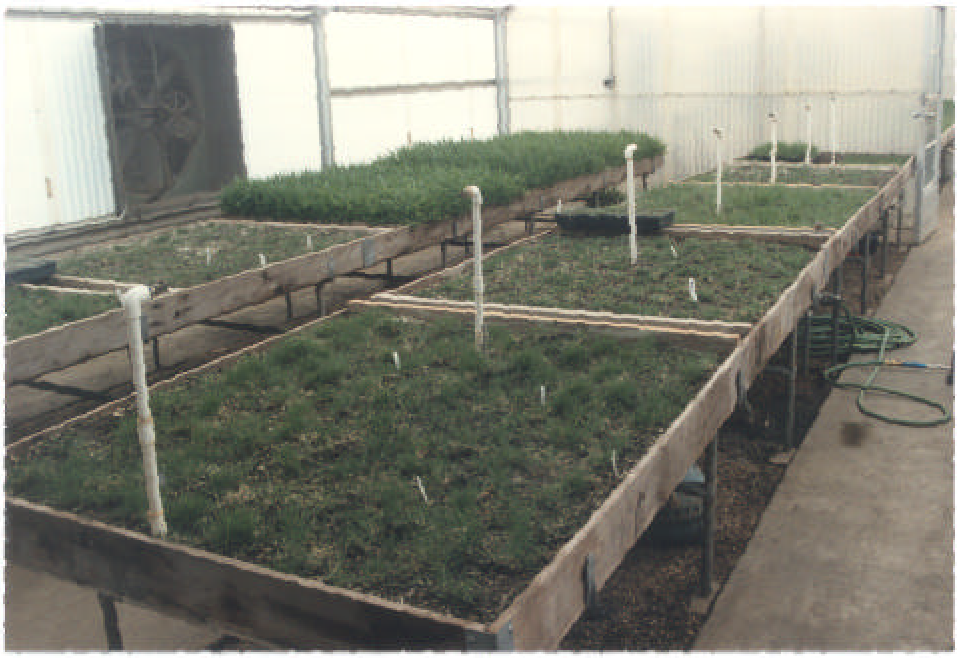

Figure 4. Greenhouse propagation of elite zoysiagrass germplasm lines.

Figure 5. Establishing research production plots of elite zoysiagrass germplasm lines by hydrosprigging.

Figure 6. Space plant nursery of the Oriental zoysiagrass germplasm collection, Summer 1986 at TAES-Dallas.