ITM 9926-134

Executive summary
DEVELOPMENT OF MINIMAL INPUT
BEST MANAGEMENT PRACTICES FOR PASPALUM:
INSECT RESISTANCE

University of Georgia

S. Kristine Braman

The encompassing objective is to develop and refine best environmentally-oriented paspalum management practices for long-term maintenance on golf courses. Of particular interest is the determination of ecotype tolerance to important stresses, including insects. In the humid southeast, insects of particular importance include both 1) subterranean feeders and 2) surface feeding insect pests.

In this project, seashore paspalum ecotypes are screened for potential resistance to a guild of insect pests that limit turfgrass growth, establishment or appearance. Insect tolerance assessments are sometimes a critical component lacking in final management plans for new releases.

Turfgrass selections including 21 paspalums (*Paspalum vaginatum* Swartz) and 12 zoysiagrasses (*Zoysia* sp.) were compared with susceptible 'KY31' tall fescue (*Festuca arundinacea* Schreb.) and more resistant common bermudagrass (*Cynodon dactylon* Pers.) and common centipedegrass [*Eremochloa ophiuroides* (Munro.) Hack]) for potential resistance to fall armyworm [*Spodoptera frugiperda (J.E. Smith)*], an occasionally serious pest of managed turf. Turfgrass and pasture grasses annually suffer sporadic damage by this pest, often severe in the Gulf Coast states. Resistant grasses offer an alternative management tool for the fall armyworm, reducing the need for pesticide use. Laboratory evaluations assessed the degree of antibiosis and nonpreference present among more than 30 turfgrass genotypes to first and third instar fall armyworms, respectively. Zoysiagrasses exhibiting high levels of antibiosis included 'Cavalier', 'Emerald', DALZ8501, DALZ8508, 'Royal', and 'Palisades'. Paspalum selections demonstrating reduced larval or pupal weights or prolonged development times of fall armyworm included 561-79, Temple-2, PI-509021, and PI-509022.

Additional evaluations were initiated in March, 2000 screening 64 turfgrass genotypes, including 18 seashore paspalum ecotypes. Four trials have been conducted during 2000. The zoysiagrasses continue to demonstrate the best resistance to FAW, while several bermudagrasses appear promising.

White grub evaluations were conducted during June/September, 1999 and June/September 2000. A total of 29 turfgrass genotypes were assessed for Japanese beetle larval infestation in September, 1999 following exposure to egg-laying adults in June in the entomology screen house facility. Grub densities among the eighteen seashore paspalums included in that trial varied Highest grub densities were found on Adalayd and Taliaferro paspalums and 'Royal' zoysiagrass. No grubs at all were found in any of the 10 reps of six of the 18 paspalums included in the study. This evaluation was repeated during 2000 and expanded to include 45 turfgrass selections.

UNIVERSITY OF GEORGIA

DEVELOPMENT OF MINIMAL INPUT BEST MANAGEMENT PRACTICES FOR PASPALUM: INSECT RESISTANCE

1998-2003 Research Grant
(Third Year of Support)
2000 Annual Report

Dr. Kris Braman subcontract
Dr. Ron Duncan PI

Assessment of seashore paspalum for resistance to insect pests in the southeastern United States

The encompassing objective is to develop and refine best environmentally-oriented paspalum management practices for long-term maintenance on golf courses. Of particular interest is the determination of ecotype tolerance to important stresses, including insects. In the humid southeast, insects of particular importance include both 1) subterranean feeders and 2) surface feeding insect pests.

In this project, seashore paspalum ecotypes are screened for potential resistance to a guild of insect pests that limit turfgrass growth, establishment or appearance. Insect tolerance assessments are sometimes a critical component lacking in final management plans for new releases. The four studies included in this project are:

Study 1. Evaluation of seashore paspalum for resistance to mole crickets.

Paspalum (*Paspalum vaginatum)* genotypes were evaluated in laboratory, greenhouse and field experiments for potential resistance to the common turfgrass pests, tawny mole cricket *(Scapteriscus vicinus* Scudder) and southern mole cricket (*Scapteriscus borellii* Giglio-tos). Potential resistance among 21 seashore paspalums to both insects in an environmental chamber at 27 °C, 85% RH, and 15:9 h (l:d) revealed that Glenn Oaks 'Adalayd' was least tolerant of cricket injury, while 561-79, HI-1 and 'Excalibur' were most tolerant. Nymphal survival was not influenced by turf grass type. Plant selections that maintained the highest percentage of their normal growth after 4 weeks of feeding by tawny mole crickets over three separate greenhouse trials were 561-79, HI-1, HI-2, PI-509018, 'Excalibur', and SIPV-1 paspalums,. Although none of the tested genotypes was highly resistant to tawny mole cricket injury 561-79 (Argentine) seashore paspalum was most tolerant.

Results of this study were accepted for publication in HortScience.

Study 2. Evaluation of seashore paspalum for resistance to fall armyworms.

Turfgrass selections including 21 paspalums (*Paspalum vaginatum* Swartz) and 12 zoysiagrasses (*Zoysia* sp.) were compared with susceptible 'KY31' tall fescue (*Festuca arundinacea* Schreb.) and more resistant common bermudagrass (*Cynodon dactylon* Pers.) and common centipedegrass [*Eremochloa ophiuroides* (Munro.) Hack]) for potential resistance to fall armyworm [*Spodoptera frugiperda (J.E. Smith)*], an occasionally serious pest of managed turf. Turfgrass and pasture grasses annually suffer sporadic damage by this pest, often severe in the Gulf Coast states. Resistant grasses offer an alternative management tool for the fall armyworm, reducing the need for pesticide use. Laboratory evaluations assessed the degree of antibiosis and nonpreference present among more than 30 turfgrass genotypes to first and third instar fall armyworms, respectively. Zoysiagrasses exhibiting high levels of antibiosis included 'Cavalier', 'Emerald', DALZ8501, DALZ8508, 'Royal', and 'Palisades'. Paspalum selections demonstrating reduced larval or pupal weights or prolonged development times of fall armyworm included 561-79, Temple-2, PI-509021, and PI-509022.

Results of this study were accepted for publication in HortScience.

New evaluations were initiated in March, 2000 screening 64 additional turfgrass genotypes, including 18 seashore paspalum ecotypes.

Four greenhouse trials have been conducted and are in various stages of analysis. The zoysiagrasses continue to demonstrate the best resistance to FAW, while several bermudagrasses appear promising.

Results for one of four trials: for Fall armyworms Days to Develop (DTD), Larval weights (LWT), and Pupal Weights (PWT) were as follows:

General Linear Models Procedure

Dependent Variable: DTD

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	86	7762.67336540	90.26364378	36.86	0.0001
Error	607	1486.27187956	2.44855334		
Corrected Total	693	9248.94524496			

	R-Square	C.V.	Root MSE	DTD Mean
	0.839304	6.208330	1.56478540	25.20461095

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	22	652.92097132	29.67822597	12.12	0.0001
CV	64	7109.75239407	111.08988116	45.37	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	22	1348.00849805	61.27311355	25.02	0.0001
CV	64	7109.75239407	111.08988116	45.37	0.0001

General Linear Models Procedure

Dependent Variable: PWT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	86	567.66409968	6.60074535	4393.13	0.0001
Error	606	0.91052380	0.00150251		
Corrected Total	692	568.57462347			

R-Square	C.V.	Root MSE	PWT Mean
0.998399	18.98326	0.03876228	0.20419192

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	22	8.36796127	0.38036188	253.15	0.0001
CV	64	559.29613841	8.73900216	5816.25	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	22	0.02185002	0.00099318	0.66	0.8786
CV	64	559.29613841	8.73900216	5816.25	0.0001

General Linear Models Procedure

Dependent Variable: LWT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	89	0.32479722	0.00364941	7.85	0.0001
Error	1100	0.51165678	0.00046514		
Corrected Total	1189	0.83645400			

R-Square	C.V.	Root MSE	LWT Mean
0.388303	71.47252	0.02156716	0.03017546

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	24	0.01918312	0.00079930	1.72	0.0171
CV	65	0.30561410	0.00470176	10.11	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	24	0.01067439	0.00044477	0.96	0.5234
CV	65	0.30561410	0.00470176	10.11	0.0001

Fall Armyworm Trials 2000

code	genotype	% surv to pupal stage	Mean 10-day larval weights gms	Mean pupal weights gms	Mean days to devel
1	**Zoysiagrasses** Cavalier	20	.0048	.1300	39.20
2	Crowne	4	.0027	.1265	36.0
3	Diamond	28	.0079	.1254	33.78
4	Palisades	4	.0010	.1390	39.0
5	Royal	20	.0029	.3380	31.86
6	4365	4	.0033	.1170	18.0
7	4366	4	.0050	.1010	44.33
8	4373	4	.0010	.1420	37.0
9	4375	0	.0040	....	....
10	4377	8	.0033	.1267	33.40
11	9601	4	.0020	.1320	36.0
12	**Bermudagrass** Tifdwarf	64	.0337	.1423	25.32
13	Tifeagle	76	.0400	.1558	22.43
14	Tifgreen	48	.0132	.1337	24.93
15	Tifsport	32	.0114	.1838	25.90
16	Tifway	44	.0085	.1623	26.75
17	97-1	40	.0273	.1484	24.43
18	97-3	44	.0251	.1664	24.57
19	97-4	32	.0140	.1458	25.00
20	97-6	76	.0247	.1613	25.65
21	97-7	24	.0334	.1558	24.67

code	genotype	% surv to pupal stage	Mean 10-day larval weights gms	Mean pupal weights gms	Mean days to devel
22	97-8	36	.0140	.1447	28.0
23	97-9	52	.0222	.1386	24.87
24	97-12	36	.0356	.1594	23.25
25	97-13	52	.0246	.1437	26.00
26	97-14	36	.0171	.1506	26.87
27	97-22	40	.0136	.1775	25.23
28	97-23	56	.0322	.1578	24.28
29	97-28	16	.0190	.1710	25.33
30	97-39	36	.0120	.1680	26.60
31	97-40	16	.0150	.1680	26.33
32	97-45	56	.0257	.1657	25.06
33	97-51	24	.0110	.1522	26.72
34	97-54	36	.0169	.1707	24.86
35	98-7	28	.0290	.1578	26.27
36	98-10	36	.0280	.1463	25.64
37	98-11	28	.0225	.1570	26.73
38	98-15	44	.0176	.1585	26.20
39	98-16	52	.0346	.1574	25.65
40	98-17	52	.0258	.1491	25.15
41	98-30	48	.0101	.1501	25.65
42	98-34	40	.0337	.1811	24.59
43	98-45	16	.0153	.1850	27.0
44	98-46	24	.0409	.1578	24.00

code	genotype	% surv to pupal stage	Mean 10-day larval weights gms	Mean pupal weights gms	Mean days to devel
45	98-49	44	.0311	.1621	25.29
46	Fescue Tulsa	24	.0406	.2340	24.87
47	diet Control	72	.0240	.2899	23.5
48	Seashore Paspalums Sullivan 2	70	.0649	.1765	23.17
49	Prince	50	.0596	.2015	22.0
50	Wailua	80	.0450	.2018	22.60
51	Kaihuna	80	.0533	.1765	22.25
52	Woerner	50	.0411	.2040	22.67
53	Cloister	50	.0255	.2343	23.0
54	Q36315	60	.0566	.1816	22.67
55	Salam	70	.0628	.1980	22.50
56	Adalayd	90	.0272	.2130	24.00
57	Sea Isle 2000	90	.0684	.1912	24.75
58	Sea Isle 1	60	.0508	.1505	23.25
59	561-79	50	.0289	.2167	22.58
60	HI 101	70	.0491	.2145	24.0
61	K 8	70	.0290	.1940	22.60
62	Hi 32	70	.0484	.2342	22.44
63	HI 26	80	.0446	.1865	23.0
64	Hyb 7	70	.0524	.1860	22.22
65	Temple 1	90	.0442	.1682	23.44

code	genotype	% surv to pupal stage	Mean 10-day larval weights gms	Mean pupal weights gms	Mean days to devel
	LSD (.05)		.0205	.0642	1.745

Study 3. Twolined spittlebug response to seashore paspalum

Greenhouse assessments of comparative development and survival of twolined spittlebug were conducted using 56 turfgrass genotypes. Diminished insect survival and/or extended development times during this two year study were observed on Excalibur, HI-1, Temple-1, HI-25, AP-14, AP-10, Glenn Oaks Adalayd, SIPV-2, PI299042, PI-509018, PI-509022, K-8, HI-39, 561-79 and several zoysiagrass taxa compared with susceptible centipedegrass selections. Three spittlebug preference evaluations were also completed. Field confirmation of rankings based on greenhouse assessments was also demonstrated.

Study 4. Seashore paspalum tolerance of Japanese beetle grub feeding injury

White grub evaluations were conducted during June/September, 1999 and June/September 2000. A total of 29 turfgrass genotypes were assessed for Japanese beetle larval infestation in September, 1999 following exposure to egg-laying adults in June in the entomology screen house facility. Grub densities among the eighteen seashore paspalums included in that trial varied Highest grub densities were found on Adalayd and Taliaferro paspalums and 'Royal' zoysiagrass. No grubs at all were found in any of the 10 reps of six of the 18 paspalums included in the study.

This evaluation was repeated during 2000 and expanded to include 45 turfgrass selections. Analysis of final grub numbers is currently ongoing.

Publications resulting from this project:

Braman, S.K., R.R. Duncan, W.W. Hanna, and W.G. Hudson. 2000. Evaluation of turfgrasses for resistance to mole crickets (Orthoptera: Gryllotalpidae). HortScience. 35: 665-668.

Braman, S.K., R.R. Duncan, and M.Engelke. Evaluation of turfgrass selections for resistance to fall armyworms (Lepidoptera: Noctuidae). HortScience. In press.

Proposed research schedule 2001

Armyworm and white grub evaluations will continue. New spittlebug assessments will be initiated with the additional turfgrass selections that have been evaluated for armyworm and whitegrub resistance.