requirements differ between species: *japonicas* behave as long day plants, while *Z. matrellas* and *Z. tenuifolias* tend to be day-neutral.

Because a polycross nursery will be utilized to determine heritability, uniform cross-compatibility and simultaneous flowering among genotypes is necessary. However, in addition to the *Z. japonica* polycross nursery, individual crosses will be attempted between several *Z. matrella* accessions and the *Z. japonicas*. The progeny resulting from these crosses will be evaluated for salt gland density.

Fifteen *japonica* genotypes have been selected, representing a broad range of salinity tolerance and salt gland density (previously determined from work at Texas A&M University). These are: *CROWNE, K162, J2-1, K157, PALISADES, BELAIR, EL TORO, J3-2, J94-5, KOREAN COMMON, JS23, P58, SUNRISE, MEYER*, and *K12*. These genotypes have been increased from single sprigs in a greenhouse (a slow process), and the replicated polycross nursery will be established next month, with 10 replications per genotype. Growth is being accelerated by supplemental lighting and liquid fertilization. Flowering of the *Z. japonicas* is expected in the late spring at which time polycrosses will be made.

Identification of Genetic Insect and Mite Pest Resistance in Turfgrasses

Texas A&M University

James Reinert

Start Date: 1998
Number of Years: 5
Total Funding: $125,000

Objectives:

1. *Establish a Regional Center to identify genotypes of Cynodon, Zoysia, Buchloe, Paspalum, Agrostis, and Poa with genetic resistance to insects and mites (fall armyworms, black cutworm, sod webworms, greenbug and host specific eriophyid mites) for use in cooperating turf breeding programs.*
2. *Bioassay resistant line with insect diets to characterize the mechanisms of resistance and determine their biochemical nature.*
3. *Develop effective and efficient procedures to accommodate screening and identify typical breeding populations-heretofore unavailable to the plant breeder.*

The Project has established a Regional Center to screen and evaluate turfgrass germplasm for resistance to insect and mite pests. The primary goal of the project is to identify genetic lines of bermudagrass, zoysiagrass, buffalograss, seashore paspalum, bentgrass, and bluegrass with resistance to the primary pests; caterpillars (fall armyworms, black cutworms, sod webworms) and host specific eriophyid mites, and characterize the mechanisms of resistance.

Work was initiated on elite bermudagrass germplasm *(Cynodon spp.)* from Dr. Charles Taliaferro's breeding program at Oklahoma State University, and with commercial cultivars under culture at the TAMU-Dallas Center.

Thirty-two bermudagrass hybrids and nine commercial cultivars were evaluated by feeding four day-old larvae on them in no-choice feeding studies. Among the hybrids, *4200W 49-17, 4200W 53-1*, and *4200W 55-5* (Table 9) produced the highest mortality with from 42 to 52 percent mortality, identified as failure of the individuals to emerge as adults from the pupa stage. Also, *3200W 70-18* provided 37 percent mortality at adult emergence with *3200W 94-2, 4200W 38-2, 3200W 18-11* and *3200W 30-20* each producing 33 percent mortality. These same grasses with the exceptions of *4200W55-5* and *4200W 38-2*, usually produced the smaller larvae when weighed at 10 days. At the other end on the gradient, *CCB 24-4* and *3200W 6-12* were the most susceptible hosts and produced only 4 percent mortality of the fall armyworm larvae.

Among the commercial bermudagrass cultivars, mortality was 8.25 percent or less at 17 days for all of the cultivars and 20.6 percent or less at adult emergence. Fall armyworm development was slowest with the smallest larvae and pupa on Common, but this experiment supports previous experiments that Common is not resistant and is a relatively good host for this insect pest. None of the cultivars of bermudagrass in this experiment or in the above experiments exhibits an acceptable level of resistance to the fall armyworm. These experiments support the hypotheses that new cultivars may be developed that are superior to existing cultivars in pest resistance.

Residential landscapes are frequently invaded by large populations of grasshoppers that develop in adjacent landscapes or in agricultural lands. These invasions occur annually in late summer to autumn in some areas, but high populations tend to cycle every three to five years across the southern or southwestern states. Representative cultivars of cool and warm season turfgrasses (Tall fescue, *REVEILLE* hybrid bluegrass, Syn1 Texas bluegrass, *TIFWAY* bermudagrass, *COMMON* bermudagrass, *RALEIGH* St. Augustinegrass, *MEYER* zoysiagrass, *CAVALIER* zoysiagrass, *PRAIRIE* Buffalograss and Johnsongrass) were evaluated for feeding preference or resistance to adult feeding by the differential grasshopper *(Melanoplus differentialis)*. The degree of feeding was ranked (rank = 0 – 5, 0 = no feeding during the test period, 5 = near complete consumption of ration) and measured by the number and weight of fecal pellets produced during the feeding period.

Based upon ranked feeding and the number and weight of fecal pellets after 2-days of feeding, tall fescue was the most preferred host evaluated. *REVEILLE* hybrid bluegrass, *TIFWAY* and *COMMON* bermudagrass, Syn1 Texas bluegrass and *MEYER* zoysiagrass were also highly preferred hosts based upon fecal pellet weights. *PRAIRIE* buffalograss and *CAVALIER* zoysiagrass were resistant to the grasshoppers and exhibited very low feeding damage, and fecal pellets. These trends held true throughout the 8-day feeding period of the test.

Table 9. Mortality of life stages, weight of larvae and pupa, days-to-pupation and adult emergence for fall armyworms fed as 4-day-old larvae on clippings of bermudagrass cultivars in Spring 1998.

Bermudagrass	% Mortality[1,5]				Weight (mg)[2,3]		Days to[4]	
Entry	7 d	10 d	Pupa	Adult	10 d	Pupa	Pupa	Adult
4200W 74-3	0 ns	0 ns	18.2 abc[6]	27.3 bcd	25.5 abc	104.8 fgh	36.7 a	50.6 a
4200W 49-17	0	0	28.6 ab	52.4 a	28.9 bcd	109.9 e-h	35.3 ab	49.3 abc
Greg Norman-1	0	4.2	17.6 abc	23.5 bcd	20.2 a	108.2 e-h	35.2 abc	49.5 abc
CCB 10-8	0	0	4.6 c	9.1 d	31.4 cde	144.0 bc	34.4 bcd	49.2 abc
4200W 53-1	0	0	39.1 a	52.2 ab	22.6 ab	109.4 e-h	34.2 cd	48.6 a-d
4200W 51-14	0	0	4.6 c	13.6 cd	34.2 d-g	120.5 def	33.8 cde	48.1 c-f
Midlawn	4.2	4.2	13.0 abc	21.7 bcd	38.5 fg	143.8 bc	33.6 de	48.3 bcd
4200W 47-7	0	0	0.0 c	0.0 d	30.7 cde	149.1 b	33.5 de	48.7 abc
Tifton 94	0	12.5	20.9 abc	25.0 bcd	40.5 g	155.7 b	33.0 def	48.2 cde
ERS-Turf	0	4.2	16.7 abc	16.7 cd	51.6 h	145.1 bc	32.6 ef	47.8 c-f
CCB 25-6	0	0	16.7 abc	16.7 cd	39.2 fg	138.6 bcd	32.4 efg	47.6 c-f
4200W 56-14	4.2	8.3	13.6 bc	22.7 cd	52.1 h	127.6 cde	31.7 f	46.4 d-g
4200W 47-1	0	0	5.9 c	11.8 d	49.9 h	118.1 ef	31.1 g	46.0 efg
4200W 55-5	0	0	31.6 abc	42.0 abc	48.4 h	116.7 efg	31.0 g	45.9 fg
CCB 24-4	4.2	4.2	4.2 c	4.2 d	70.5 I	189.9 a	28.6 h	44.6 g

[1] Mean % of larvae alive at 7 and 10 days after egg hatch, % pupation and % that emerged as adults.
[2] Mean weight of surviving 10-day-old larvae after feeding on each genotype for 6 days.
[3] Mean pupa weight for only individuals that pupated (weight taken within one day after pupation).
[4] Mean number of days from egg hatch to pupation and to adult emergence for surviving insects.
[5] Analysis was made on arcsine transformation of the % mortality; % mortality is presented.
[6] Means in a column not followed by the same letter are significantly different by Waller-Duncan k-ratio t test (k = 100, P = 0.05). ns = not significant.

A Turfgrass Genome Project: Integration of Cynodon Chromosomes with Molecular Maps of the Cereals

University of Georgia

Andrew H. Paterson

Start Date: 1999
Number of Years: 5
Total Funding: $125,000

Objectives:

1. *Establish a primary molecular map for the chromosomes of Cynodon.*
2. *Align the chromosomes of Cynodon with those of the major cereals, gaining access to much genetic information.*

We will combine new DNA probes for *Cynodon*, with tools that have been previously mapped in other *Poaceae*, to develop a primary molecular map of the *Cynodon* chromosomes. The map will be useful for investigating many aspects of turfgrass population biology and genetics, and a molecular conduit for turf improvement to benefit from the large body of genetic information now accumulated about cereals and other grasses. *Cynodon* is chosen as a focal point for turf genome analysis due to its importance across the southern United States, and abundance of phenotypic variation. Dr. Wayne Hanna will assist in population development and maintenance.

To our knowledge, this project is the first effort to enable turf improvement to benefit from extensive genetic information available for well-studied grains such as maize and rice. The *comparative approach* will reduce costs, and leverage existing information and tools. Our experience in molecular analysis of complex populations, such as sugarcane and buffelgrass, as well as grain crops such as rice, maize, and sorghum, together with our extensive repertoire of molecular tools, puts us in a strong position to efficiently develop a *Cynodon* molecular map useful for turf improvement.

Progress to Date. While the genetic crosses are being developed for making the maps, we have made significant progress in characterizing DNA clones from bermudagrass and other grasses (especially *Pennisetum* and Sorghum), for their effectiveness in detecting DNA markers in bermudagrass. There exists a high level of DNA polymorphism in bermudagrass, and the establishment of DNA fingerprints unique to individuals will be routine. We have prepared more than 1,000 cDNA clones (mapped in other taxa) to be applied to bermudagrass. DNA extraction protocols for bermudagrass have been optimized. We have initiated screening of these DNA clones on