1986 ANNUAL RESEARCH REPORT

DEVELOPMENT OF DRYLAND WESTERN TURFGRASS CULTIVARS

Submitted by

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Executive Summary

Colorado State University, with principal support from the United States Golf Association, has continued research and selective breeding efforts in the development of new cultivars with improved turf performance of four western grass species. The species being evaluated and improved are alkaligrass (*Puccinellia* spp.), blue grama (*Bouteloua gracilis*), fairway wheatgrass (*Agropyron cristatum*) and inland saltgrass (*Distichlis stricta*). Changing economic conditions and increasing demands upon limited water supplies make a strong demand upon breeders to supply special purpose grass cultivars for golf courses, parks, lawns and other turf applications. The species under study possess some unique and promising characters that will allow the breeding project to develop new cultivars for minimum maintenance turf on such problem areas as salt affected, poorly drained or droughty soils.

Alkaligrass, a species highly tolerant of salt and waterlogged soils, has been evaluated this year in a nursery of approximately 900 individual plants from six western states and five foreign countries. Two turf seeding test plots also serve to evaluate seeding rates and the performance of various sources in a turf maintenance situation. Seed production of these plants was good, and in 1987 we should select elite parent plants for production of the first generation improved plants.

Blue grama is the dominant drought tolerant grass in many of the western grasslands, and an improved turf type cultivar should do well on the alkaline western soils with a minimum of care. Collections from three western states have been evaluated, and in 1986 twenty-seven superior plants were selected from the nurseries and moved to an isolated block which will produce seed in 1987 for the first generation of the population of improved plants.

Fairway wheatgrass is another drought tolerant grass commonly found in wild stands in the west. It evolved in Eurasia but has proven to be well adapted to our continent since its importation in the 19th century. The grass does not normally spread by rhizomes (underground horizontal shoots) as in such turf species as Kentucky bluegrass. We have evaluated 650 plants from Turkey, Iran and this country that do show a certain amount of rhizome growth. Based upon that characteristic and other selection criteria, 78 individuals were selected in 1986 to act as parents in an isolated block to produce the first improved turf type plants in 1987.

Inland saltgrass is a species that spreads vigorously by rhizomes to form dense stands that will tolerate salty, waterlogged or droughty soils. Collections from eight western states have been evaluated as space-planted individuals and in a turf planting. Selections will be made in 1987 from the nursery in order to produce the first advanced generation from the most promising and adaptable material.

Introduction

The Colorado State University breeding project to develop new turfgrass cultivars from some nontraditional grasses continued to focus during 1986 on the promising species alkaligrass (*Puccinellia* spp.), blue grama (*Bouteloua gracilis*), fairway wheatgrass (*Agropyron cristatum*) and inland saltgrass (*Distichlis stricta*). This year's efforts were concentrated primarily in three areas: maintaining and evaluating the generation 0 field evaluation nurseries, establishing and evaluating turf maintenance tests of alkaligrass and fairway wheatgrass, and selecting and transplanting superior plants from the generation 0 nurseries to cycle 1 crossing blocks for blue grama and fairway wheatgrass. Our turf maintenance test plots of all four species were observed by interested turf professionals and others attending the Rocky Mountain Regional Turfgrass Field Day in June 1986.

We continue to feel that each of the four species possess some unique and promising turf characters that support their continuation in the project. All four have the ability to produce an acceptable turf under minimum maintenance conditions and on poor soils. Blue grama and fairway wheatgrass are highly drought tolerant species. Alkaligrass and saltgrass are tolerant of salt and poorly drained soils. Details of progress on each species follow.

I. Alkaligrass The alkaligrass generation 0 field evaluation nursery of 47 accessions was planted in the late summer of 1985. This germplasm collection has representatives from six western states and five foreign countries in Europe and Asia. The western states collection consists of vegetative selections from harsh sites which frequently were highly saline. All the accessions are spaced as individuals at the Agronomy Research Center where they received cultivation and irrigation. Almost all the individuals survived the winter season and have been evaluated for winter hardiness, spring and midsummer color, spread (basal area), flowering date, morphological growth habit of leaves and culms, and disease resistance.

The spaced plants did very well putting on good fall growth in 1985 and most of the accessions that were started from seeds had basal areas over 3 inches in diameter by late March 1986. The plants flowered from late May through late June and most produced abundant seed which yielded an average of approximately 15 grams of clean seed per plant.

In the fall of 1985 a test of three alkaligrasses ('Fults' Puccinellia distans, P. lemmoni and P. airoides) at two seeding rates (2 and 4 pure live seeds per square inch = 1/8 and 1/4 pound per 1000 square feet) was started at the Horticulture Research Center. This test established fairly well although the seed was not of very high quality and was quite old. The test plot was given minimum care during 1986 (6 mowings, 2 summer irrigations and no fertilizer) and we

judged the turf as of acceptable quality with the higher seeding rate looking best all year.

The seed collected from the field evaluation nursery was cleaned, and in September 1986 was used to plant a progeny test at the Horticulture Research Center. Thirty-two entries of seed collected from our western states vegetative collections and thirteen entries of seed from other accessions (mainly European and Asian collections) were planted in this replicated test at 4 pure live seeds per square inch (approximately 1/4 pound per 1000 square feet). The progeny test has established well this fall and will be managed next year under minimum maintenance conditions to evaluate the turf performance of the separate accessions.

The evaluations made on individual plants and the results of the progeny turf test should allow us to select some elite individual plants in 1987. Those plants will be moved to an isolated location to serve as parents for the production of the first generation of improved plants.

II. Blue Grama The blue grama generation 0 accessions have been maintained at the Agronomy Research Center as space-planted individuals. These accessions represent collections from three western states and altitudes up to about 9000 feet. The plants were evaluated during 1984 and 1985 for such characters as spread of the basal area, leaf height and color, seed head formation, flowering date, fertility, seed

production, winterhardiness and disease resistance.

Based upon the field evaluations, we selected 27 superior plants from the nurseries to serve as parents in a replicated crossing block to produce the first generation of improved plants. The crossing block was established with cloned pieces from the 27 plants in June 1986. All the plants survived, made good growth and produced some seed. Because the normal flowering synchrony was disrupted by the transplanting, we harvested this seed to be held only as insurance against a catastrophic loss of the crossing block. Seed representing generation 1 should be harvested from this block in 1987 to complete the first cycle of selection. That seed can be grown in the greenhouse and the generation 1 plants will then be ready for field testing in 1988.

We had plans to establish a second turf planting of blue grama with seed progeny from the original accessions during 1986. Unfortunately a construction project to install a new underground sprinkler system at the Horticulture Research Center forced us to postpone that planting until it was too late in the season to plant warm season grass seed. That progeny test turf planting is now scheduled for 1987.

III. Fairway Wheatgrass The generation 0 field evaluation nursery of 650 spaced plants was evaluated for its second full year in 1985 prior to selecting elite individuals from

it in 1986. The nursery has been maintained at the Agronomy Research Center and represents selections from Turkey and Iran as well as the cultivars 'Ruff' (broad based plants) and 'Ephraim' (rhizomatous tendencies). These plants have been evaluated for greenup date, color, leaf width and height, growth habit, tiller spread, rhizomatous spread, disease resistance, flowering date, seed production, and resistance to lodging. The plants show good spread and many have more rhizomatous spreading tendencies than 'Ephraim'.

In April 1986 a crossing block of elite individuals cloned from the generation 0 nursery was successfully established. The plants have spread well this year and are already showing rhizome spread. Seventy-eight selected plants in that block will produce the first usable seed in 1987 (although we made an "insurance" harvest in 1986) which will represent the generation 1 improved population. Those generation 1 progenies will be evaluated as spaced plants in the field in 1988 after greenhouse testing during the winter. We also hope to be able to start a turf performance test in 1987 with that generation 1 seed.

A turf seeding rate test of the Fairway wheatgrass cultivars 'Ruff' and 'Ephraim' was started in the fall of 1985. The plots established well and were able to be mowed in May 1986. Minimum care was given (6 mowings, 2 summer irrigations totaling approximately 3 inches, and no fertilizer) and we judged the turf appearance to be quite good for a high cut turf (usually cut at 3 1/2 inches). The

stand density was better at the higher seeding rate of 4 pure live seeds (pls) per square inch than at the 2 pls rate (2.2 and 1.1 pounds per 1000 square feet).

IV. Inland Saltgrass The generation 0 field evaluation nursery at the Agronomy Research Center is now complete with the final transplantings of individuals having been finished in the spring of 1986. Genetic diversity from eight western states is now represented by over 500 individuals within 48 accessions. These plants have shown a remarkable ability to become established and spread extensively by strong rhizomes within the first year of their transplanting.

Individual plants have been evaluated for greenup date (mid-April), spread, stand density, growth habit, color, sex, flowering date, seed production (1 gram per plant average) and date of fall dormancy (mid-October). It has not been expedient in the breeding program to calculate accession means for most of the characters studied, but instead selections are made from individual plant ratings in each species. We have however, calculated means of some characters for the oldest portion of the inland saltgrass nursery which are presented in Table 1 to show the type of information gathered and the range of variability among accessions and individuals.

Excavations in the late fall of 1985 showed that the majority of rhizomes were located at a depth of between 2 and 6 inches and that plants could be successfully cloned

for greenhouse propagation from plants dormant in the field. We anticipate moving elite individuals, based upon the results of the field ratings, to a crossing block for the first cycle of recombination in 1987.

The turf planting established from plugs in the fall of 1984 continued to receive traditional turf maintenance and was judged to produce a good alternative type of turf. The nursery seed harvest of 1986, and some accessions by other seed, will be utilized in 1987 to establish a turf progeny test which will be managed with minimum maintenance. We anticipate some difficulty with this seed because of the high dormancy inherent in saltgrass. We have initiated some tests this winter to discover if a pretreatment of seed with heat will have any lingering effect on subsequent germination after storage for several weeks or months.

Table 1. Accession means (and ranges among individuals) for some representative characters in inland saltgrass.

Accession	Origin	Green Color	Leaf Height 1984[1]	Leaf Height 1986[2]	Stand Density 1984[3]	Stand Density 1986[4]	Flowering Date 1986
1	Sunnyside, WA	Light	2.1 (1-3)	1.3	2.3 (1-3)	1.6	June 6
2	Othello, WA	Light	1.7 (1-3)	1.4	2.4 (1-3)	1.9	June 3
3	Sunnyside, WA	Light	2.2 (1-3)	1.7	1.9 (1-3)	1.5	June 10
4	Peers Landing,NV	Light	2.1 (1-3)	1.8	1.9 (1-3)	1.2	June 19
5	Fruita, CO	Light	2.4 (1-3)	1.6	2.1 (1-3)	2.0	June 10
8	Sterling, CO	Dark	2.2 (1-3)	1.0	2.3 (1-3)	2.0	May 20
9	Eads, CO	Dark	1.9 (1-3)	1.0	2.6 (2-3)	1.8	May 22
10	Pueblo, CO	Dark	2.2 (1-3)	1.8	2.5 (1-3)	2.0	May 24
11	Pueblo, CO	Dark	2.7 (2-3)	2.0	2.1 (1-3)	2.0	May 22

1. Uncut 1984 leaf height rating scale: 1 = <8", 2 = 8 to 10" and 3 = >10".
2. Uncut 1986 leaf height rating scale: 1 = <8" and 2 = >8".
3. Stand density (1984) rating scale: 1 (thin) to 3 (very dense).
4. Stand density (1986) rating scale: 1 = good and 2 = superior.

STATEMENT OF EXPENDITURES
U. S. Golf Association

Funding of 2/25/86 - 2/24/87

	Expenses 9/30/86	Encumbered	TOTAL
PERSONNEL			
G. Thor - Salary	5,946	6,233	12,179
G. Thor - PERA, 18.8%	1,118	1,172	2,290
J. Seibert - Salary	-0-	2,743	2,743
TOTAL PERSONNEL	7,064	10,148	17,212
MATERIALS AND SUPPLIES	29	-0-	29
TRAVEL	-0-	-0-	-0-
INDIRECT COST, 16%	1,135	1,624	2,759
TOTAL EXPENDITURES	**$8,228**	**$11,772**	**$20,000**

Colorado's Contribution to Overall Objectives of the USGA/GCSAA Research

Many locations in this country, but particularly the western states, have problem soils in places which are developed as golf courses or have other kinds of amenity turf. It is more effective to treat these problems by planting turfgrasses which have a tolerance to the suboptimal conditions or which will perform acceptably with minimum inputs of water, fertilizer, and pesticides, rather than using traditional grasses of the humid regions. Such tolerant grasses are insufficiently studied, but are the subject of research at Colorado State University.

The breeding of dryland western grasses is expected to provide cultivars which should perform, and will have been tested to be acceptable, in such conditions. Selection of the appropriate parent plants in each of the western target species is being done so as to maximize the seed production without losing sight of the desired turf characteristics. Orderly development toward these two goals, seed productivity and turf adaptation, will require sustained support throughout the decade of research emphasis by the USGA/GCSAA Committee. In view of the different altitudes, microclimates and disease conditions met within Rocky Mountain region golf courses, it will sooner or later be necessary to run trials in several of these sites.

For coordination with other phases of the USGA project, the senior agronomist has corresponded recently with, and visited, the projects of Milt Engelke at Dallas TX and Terry Riordan at Lincoln NE. In previous years he has visited the bermudagrass work of Glenn Burton at Tifton GA and the turfgrass work of Joe Duich at Penn State. While on other business he took the opportunity to visit John Shildrick at the Sports Turf Research Institute, Bingley, England, and spent considerable time with Mervyn Humphreys at the Welsh Plant Breeding Station, Aberystwyth, Wales. In all of these contacts we have discussed the methods and approaches being taken in our Colorado turfgrass breeding work, and we feel we are on the right track with our species, toward the overall goal of reduced maintenance for golf course and other turfgrass uses.

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