1993 Annual Research Report

Development of Dryland Western Turfgrass Cultivars

Submitted by

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USGA Report from Colorado for 1993

EXECUTIVE SUMMARY

Production of Breeder's Seed has been increased in 1993 for all three grasses in our program of improvement of native or adapted grasses for turf. An agreement has been made with a company to grant an exclusive license for further widespread testing and quantity seed production leading to commercial release for alkaligrass, Puccinellia distans. Licenses have not yet been granted for the other two but a decision is closer on blue grama, Bouteloua gracilis, which is the dominant dryland grass of the Great Plains, and is in demand for xeriscapes because of its drought tolerance. The other dryland grass, Fairway crested wheatgrass (Agropyron cristatum), has reached final stage in formulation of six Breeder's Seed blocks for experimental strains with rhizomatous tendency and/or narrow leaf width; turf tests of these strains show great promise.

The 12-family Breeder's Seed plot for alkaligrass was rogued for some off-color and undesirable prostrate (flat-growing) plants, and also 3 families were cut out. The remaining 9 families were allowed to flower and set seed, which was harvested as a bulk of each family. This seed, as well as previous seed-lots of both European and Western U.S. types was sent to International Seeds Inc. (ISI) as part of the exclusive license agreement under which they will do seed production testing and increase in the Pacific N.W. They will put out more widespread turf tests in this country and with their contacts in N.W. Europe, because of keen interest in this salt-tolerant, but not very heat-tolerant, turfgrass. ISI expects to commercialize one or two cultivars from our germplasm. Some unusual semi-dwarf plants and color variants might also show possibilities.

The blue grama breeding program has been brought to the point at which a release of germplasm of the 'Elite' darker green variety to a company is possible. We have 4 lb of pure Breeder's seed of 'Elite' and are currently negotiating with the seed industry to get a company to multiply, release, promote, and market this new turf-adapted blue grama for use where water is a limiting factor. We could also release some or all of the 25 parental clones as basic stock. Turf plots have shown attractive, dense green growth from May to late September. Blue grama has several advantages over buffalograss in its quick germination, lack of unwanted spread, and ability to tolerate several mowing heights. An alternative strain from our nurseries called 'Plus' was again harvested by hand.

The need to move Fairway crested wheatgrass recombinations from the old Agronomy Farm to the new Agricultural Research Development and Education Center (ARDEC) caused much work and little seed from the 'Red' and 'Pink' strains. These narrow leaf, somewhat rhizomatous types are now in four 12-replication crossing blocks at ARDEC, with six parental clones in each of the diploid and tetraploid versions. The two 'Gray' strains growing at South Farm did not have to be moved but were rogued for disease, undesirable glaucous color or seedhead type, and we harvested 34 clones (4 replications) of Gray tetraploid and 18 clones (4 reps.) of diploid. This created wheatgrass survives drought well with a quick on-off dormancy mechanism and can be mowed at 3/4 to 3" at moderate frequency with attractive results.

1993 USGA Annual Report (Colorado)

A. BREEDING PLOTS

1) Alkaligrass

The Eurasian accessions continued to excel most of the season, being best in spring and fall, and only showing some dormancy in the heat of summer, when Fults and some of the native collections may have an equal or slightly better appearance. Since the decision had been made early in 1990 to concentrate on the Eurasian types we planted our biggest nursery in May 1992 with 12 families. This nursery was maintained (cultivated, fertilized, hoed, irrigated) and rogued as a Breeder's Seed nursery, scoring for colors (blue, blue-green and green) plant-habit (erect, semi-prostrate) and flowering traits. Undesired plants were cut off just before flowering, and 3 families were cut-out entirely, to remove their pollen from the parentage.

Bids were requested in March and by the May 5 deadline we had one bid from International Seeds, Inc. (ISI) of Halsey, Oregon. Their breeder, Stephen Johnson, came in early June to help in the rogueing of the Breeder's Seed nursery. We sent older seed stocks of 12 families of Eurasian origin, and 14 families of western US origin to ISI in mid-June, and in September we sent new seed of the 9 chosen families in greater quantity. Seed was harvested by family and bulked in each replicate from up to 20 plants. From the seed received by ISI, they are going to put out seed production trials and fields for multiplication in Oregon, and some turf plots in areas of the country not yet sampled by us, such as the Pacific and Atlantic seaboards, and the salt-prone highway shoulders of the midwest. Because of known differences in

regional adaptation, they will try the Western materials as well as the Eurasian ones. It is possible that two or three alternative cultivars may be necessary to serve different markets.

Since Steve Johnson is vitally interested in the success of this project for USGA, ISI, and CSU, he and I have shared about 8 other materials which are outcrosses between the Eurasian and the US sources, in the hope that a combined adaptation to hotter and cooler seasons might emerge. Other unusual plants seen in the nursery in June were: dwarf, semi-dwarf, yellow flower, and airoides type panicle (more erect and robust but also more stemmy). These might have special uses, and 60 individual plants in the nursery were harvested separately, not included in the 9 bulks.

Infestations of stem rust were seen in late June on the culms of the July-harvested families, and plants were rated on the stubble in late July from 0 (no rust) to 5 (heavy rust with even some black teliospores). All 1620 plants that had been harvested, not cut off in early June, averaged 1.99 rust-score, but families varied from 2.27 to 1.53. This disease does not show any correlation with the leaf-rust affected plants of September 1992; it may however have some relation to the die-off of seed-bearing plants noted previously as "biennial habit." We shall follow the fate of these, and rogue in late fall, and early Spring 1994, to remove all unwanted types. The 1994 harvest will be the last for this nursery and will be shared with ISI for the

commercialization phase. At their request we will move dwarfs and semidwarfs to other isolated plots to interpollinate within these types in 1994.

2) Blue grama

The 'Elite' Breeder's Seed plot (25 parental clones in 62 replications) was maintained and kept weed-free for maximum purity of the bulk to be harvested from its 1550 spaced plants. Flowering started in July and continued through late August; by early September some of the earliest clones began to shed their ripe seed, from first-formed spikes. Bulk harvest by air/brush combine was scheduled for the second week of September. Harvest in 1992 was processed at Los Lunas, NM (Plant Materials Center) and clean seed yield was 4 lb.

The 'Plus' nursery was hand-harvested from Aug. 20-Sept. 10 by individual plants. (24 parents in 4 replications). The 1992 seed of Plus has been cleaned but not yet composited for new turf plots, and the 1993 seed will be added to it for May 1994 turf tests as may be needed.

A recombination block of 'Narrow' was preserved by transplanting in Fall 1992 to the greenhouse, and thence in June 1993 to the new ARDEC farm location. This block of 6 parents in 8 replications has not yet produced adequate seed for turf tests but should in 1994. Another recombination stemming from clones labelled 'Nice' has given seed from 30 progeny plants but this strain is "on hold," pending our choice of an industry cooperator.

There are several companies who have been invited to bid on commercializing the 'Elite' cultivar and some of our contacts showed interest but as of October 1993 we are still awaiting a contract. The 1991 seed crop of Elite was (in its first year) about 1 lb. and was delivered to Mead, Nebraska in June 1992 but could not be planted until Spring 1993. Turf tests in Fort Collins have continued to show the same good performance of Elite and Plus as reported in 1992. It should be noted that these two potential cultivars do not go dormant until the very end of September, about 10 days before Hachita and Alma, and with the same spring green-up date as those types. We like the summer and winter color of Elite and Plus better than the forage cultivars, and are anxious to finalize their adoption by the industry.

3) Fairway crested wheatgrass

Harvest of 1992 seed was processed and there was significant plant-to-plant variation for seed yield and ergot incidence, so selections were made for yield and against ergot. Also selections were made against other traits: leaves too glaucous or broad, susceptible to leaf spot disease, or clump disease (which causes lodging of seed stalks prior to harvest).

Six recombinations were dealt with in 1993, four of which had to be transplanted from Agronomy farm to new ARDEC farm, with much labor and attention because of dry spring, malfunction of new irrigation, and summer weed growth. There are 6 clones in each of these four recombinations (see Table 1) after the

Table 1. Recombinations of Fairway crested wheatgrass

Name	Leaf Width	Spread	Original recomb. No. of plants	Original recomb. Seed yield 92	Revised recomb. No. of plant	Revised recomb. Seed yield[1]	Repl.
				(g)		(g)	
Red diploid	Narrow	Rhiz.	12	18.4	6	24.8	12
Red tetraploid	Narrow	Rhiz.	15	9.4	6	11.9	12
Pink diploid	Narrow	less Rhiz.	9	18.7	6	21.5	12
Pink tetraploid	Narrow	less Rhiz.	12	14.1	6	24.2	12
Gray diploid	Medium	Rhiz.	30	22.1	18	27.8	4
Gray tetraploid	Medium	Rhiz.	60	17.7	34	25.4	4

[1]Estimated in g/pl from the 1992 seed yields of the individuals selected for the revised recombination.

selection process. The new blocks did not yield much seed because time of transplant, dictated by ARDEC problems, was too late in spring.

The other two recombinations were also rogued as shown, down to 18 clones in the 'Gray' diploid and 34 clones in the 'Gray' tetraploid. Undesired plants were cut back and desired plants set seed which was harvested in August. Processing of seed could not start before November because of assignment of our limited help to alkaligrass seed work. As shown in Table 1, tetraploids yield less than diploids in general but our selections should have improved the yield potential of all six strains.

The turf test at Fort Collins under strictly limited watering has performed well. We could still use more tendency to dark green (less-glaucous) plants and will continue to look for more expression of rhizomes as a turf-thickening trait. Meanwhile we will prepare a request for proposals for developmental research (including widespread geographical turf tests) and marketing by exclusive license.

4) Inland saltgrass

This species, Distichlis spicata was part of our original research proposal but had to be put on quasi-inactive status because the other three species called for more effort, and saltgrass was the most difficult to handle. Nevertheless we have continued to give minimal maintenance to the nursery and have saved pieces of the ten or twelve most promising clones, at present in the green house awaiting transplant to a crossing block. Saltgrass, like buffalograss, has male and female plants and could be handled so the best two parents could be found for seed production. Recent

interest in the species includes a specification by Colorado Department of Highways to use saltgrass on certain freeway intersections. They will transplant 200 one-gallon containers with saltgrass propagules in a Denver location. We will keep aware of this project vis-a-vis need for better germplasm. Saltgrass could certainly be valuable for roughs in salty, not necessarily dry, places on golf courses.

B. TURF TEST PLOTS

1) Alkaligrass

This species possesses great potential as a medium- to high-quality fairway turf, but under some fairly specific situations. First, it appears to be quite non-competitive against broadleaf weed invasion, as well as intrusion by other perennial grasses, under non-saline soil conditions. It is not clear if alkaligrass actually becomes more vigorous under saline conditions, or if other species simply do not tolerate salinity as well (and thus do not compete with the alkaligrass). The salinity levels on our research facility could be termed low to moderate (6-9 mmhos/cm, depending on time of year, irrigation regime, fertilization levels, etc.). It has become quite clear over the past few growing seasons, however, that this species performs best when heavily-irrigated (1-2 inches per week during hot, dry weather) and where soils are saline. It can tolerate fairway-height mowing conditions quite well (1/2 to 3/4 inch), assuming the appearance of a fine fescue fairway. Under low mowing heights, alkaligrass can form a very good golf playing surface. It does not appear to form thatch very quickly. Disease problems (mainly rust in the late summer and fall) appear if it is under-

fertilized (less than 2 pounds of N per 1000 square feet per growing season). The CSU Eurasian accessions look best in spring and fall, tending to become somewhat dormant during very warm mid-summer conditions. Conversely, 'Fults' looks fairly good during the summer (although it takes on a gray-green appearance when stressed by heat), but not as good as the CSU accessions early and late in the year.

2) Blue grama

In many respects, this species performs much like buffalograss. This is true for the length of its growing season, color (both when dormant and actively growing), vertical growth rate, and mowability. It does possess some advantageous characteristics (over buffalograss). This weakly rhizomatous species stays where it is planted, not displaying the potentially objectionable invasive growth habit of buffalograss. This is viewed as a definite benefit in homeowner and formal landscape situations. This lack of invasiveness would also be favored in certain golf course situations, such as around sand traps (reduced edging) and if it were used as a rough species (maintaining the delineation between rough and fairway.

The CSU accessions thrive under the low-water conditions (1 inch applied every 2 weeks, at a single date) on our evaluation plots. The species appears to do well with less than 2 lbs. of N per 1000 square feet per growing season, and would likely perform adequately if fertilized in alternate years. It apparently tolerates the moderate salinity levels at our research facility. Blue grama can not tolerate (long-term) close (less than 1 inch) mowing, thus making it better-adapted as a rough species and for

homeowner/landscape uses. If the problems associated with seeding this species could be overcome (pelletizing, etc.), it would be more widely used because of its rapid germination rate (5-7 days, under warm, moist soil conditions).

3) Fairway crested wheatgrass (FCW)

This species has proven to be very drought resistant, but very drought sensitive. It begins to go dormant relatively quickly under drying conditions - more quickly than turf-type tall fescues and Kentucky bluegrass. However, upon the return of moisture, it literally jumps out of dormancy and regains its former vigor and density. Where effluent water would be used for irrigation purposes (and amount of water used might be less of an issue), FCW could perform well as both a rough grass, or as a moderate quality fairway grass. The documented tolerance of the wheatgrasses to salinity would also make FCW attractive as a species to use with effluent irrigation water. It appears to tolerate lower mowing heights (3/4 inch) well if it is adequately irrigated. Under very warm summer conditions, its tolerance to low mowing will decline.

This is a very early-greening species in the spring. The species displays the potential for a wide variety of colors, everywhere from bright green to a glaucous blue-gray. Its N requirements would appear modest, somewhere in the area of 2 pounds of N per 1000 square feet per growing season, depending on use. This species seems to be very resistant to weed invasion, by all types of weed species.

C. FUND REQUEST FOR 1994 TASKS

In order to fulfil the expectations of this project including the desires of the Research Committee for a commercial sponsor to be found for the remaining species, and the obligations spelled out in the licenses, we will need some financial support. We were able to do what is described above in 1993 only through some funding received in 1992 from the Rocky Mountain Turfgrass Research Foundation, the USGA support having been cut off. A renewed support of $10,000 for 1994 would enable us to do what remains on our list of tasks, by paying for technical help.

Alkaligrass

Finish cleaning seed of 1994 harvest	Nov-March
Assess disease, death, and undesirable pl.	Nov-April
Rogue nursery one more time by early	April
Transplant dwarfs, semidwarfs, etc.	April
Harvest main nursery	July
Harvest small recombinations (dwarf, etc.)	July
Confer with ISI on progress, and hand over remaining germplasm	May-Nov

Blue grama

Finish processing 1993 seed	Nov-March

Get a company bid on exclusive license	Jan
Maintain and harvest Elite nursery	May-Sept
Maintain and harvest Plus nursery	May-Sept
Continue cutting height and turf test	May-Sept

Fairway crested wheatgrass

Process 1993 seed and tabulate yields	Nov-March
Prepare and issue request for license	March
Maintain 6 recombination blocks	Apr-July
Harvest 6 recombination blocks	July-Sept
Process seed of recombinations for forwarding to licensee	Sept-Oct
Plant turf test to compare narrowleaf strains (Red, Pink) more thoroughly, using 1992 seed	April-Sept

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