

GSCSSA Progress Report 2005

Title: Development of High Yielding Kentucky Bluegrass for Non-thermal Seed Production

Objectives:

1. Assess the within and among variation in agronomic and molecular attributes of selected accessions and select different individual plant genotypes for high seed weight, high seeds per panicle, high panicles per unit area, and high overall seed yield using accessions with potential value in non-thermal seed production.
2. Determine the selection response for seed yield and yield components by testing the resulting selections in Objective 1 for seed production in on-farm testing under a residue removed (baled) management system in diverse environments and over years. In addition, test the selections for turf quality factors in different environments and years.

Principal Investigator: Dr. William J. Johnston, Professor/Agronomist, Department of Crop and Soil Sciences, Washington State University, Pullman, WA (0.1 FTE allocated)

Cooperators:

Dr. Richard C. Johnson, Research Agronomist, Western Regional Plant Introduction Station, Pullman, WA. Will provide laboratory facilities and personnel for molecular analyses and assist in field evaluations for plant growth and seed yield.

John Burns, WSU Cooperative Extension, Pullman, WA. Will assist in decimation of results to grass seed growers.

John Holman, Univ. of Idaho, Moscow, ID. Will assist in decimation of results to grass seed growers.

Abstract of 2005 Progress: One hundred plants of each Accession/selection x parameter and original population were established in a seed increase nursery (5000 plants) at the USDA research farm at Central Ferry, WA. The nursery was evaluated during 2005. Seed production was poor due to late fall planting in 2004. In September 2005 all accessions except for Accession 7, and possibly Accession 4, were quite robust. An excellent bluegrass seed yield is anticipated for remaining accessions in July 2006. Ample seed should be obtained for on-farm field trials for seed production and turfgrass quality in 2007.

Justification: A ban on burning has been implemented in Washington State, and restrictions are in place in Idaho and Oregon. Our previous research showed that without post-harvest burning bluegrass seed yield decreased over time. This has forced growers to use shorter rotations to maintain economically viable seed yields. What are needed are bluegrasses that will maintain high seed yield over several years without burning. In a multi-year study we previously identified germplasm that had improved seed production without burning. This germplasm needs seed increase for on-farm seed yield trials and university turfgrass evaluations. Ultimately, high yielding, turf-type bluegrasses that can be successfully grown without burning will be released to growers.

Progress: Field data was recorded on Kentucky bluegrass space plants during 2002 and 2003 at Pullman, WA. Data recorded for each plant were: heading date, vegetative spread, anthesis date, plant height, leaf texture, leaf color, and harvest date. Powdery mildew and rust were also rated when noted.

During 2004, seed yield components and seed yield data was obtained on 840 space plants at Pullman, WA. The 1680 samples (two harvest years) had been stored in paper bags at low temperature and RH since harvest. For each sample the number of panicles per plant was recorded. Panicles were then hand threshed (belt thresher), cleaned with a seed blower, and total seed weight was recorded. A subsample was taken and 100 seed were counted. This was used to obtain 1000 seed weight. The data were analyzed for 1000 seed weight, seed per panicle, panicles per cm², and yield (g per cm²). There was considerable variation between and within accessions and we were able to identify the highest contributing single plant within each accession for each parameter (Table 1). Seed of each selected plant (from a composite of equal amount of seed from each replication) and remnant seed of the original population for each accession were germinated in vermiculite and 100 individual plants of each selection were then established in flats in the greenhouse. In October 2004, the 100 greenhouse plants of each selection x parameter and remnant seed of the original population for each accession were transplanted into a seed increase nursery the USDA research farm at Central Ferry, WA. The nursery consisted of 5000 plants.

Leaf tissue was extracted from each space plant and the extracted DNA was used in AFLP analysis. The gels will be scored in 2005-2006 as new software is purchased. Thus, the agronomic and molecular variation within and among entries will be assessed in 2006.

The bluegrass nursery at Central Ferry was evaluated during 2005 (Table 2). Seed production was poor due to the late fall planting in 2004. The nursery was last observed September 2005 and all accessions except for Accession 7, and possibly Accession 4, were quite robust. Accessions 4 and 7 maybe eliminated from further evaluation in 2006. An excellent seed yield is anticipated for remaining accessions in July 2006. Ample seed should be obtained for on-farm field trials for seed production and turfgrass quality in Objective 2.

Ultimately, high yielding, turf-type bluegrasses that can be successfully grown for several years without burning will be released to growers.

Table 1. Seed production parameters for accessions and single plant selection within an accession from space plants at Pullman, WA during 2002 and 2003.

	1000 seed wt. (g)	Seed per panicle (No.)	Panicles per cm ² (No.)	Yield (g per cm ²)
Accession ¹	370	515	0.67	0.11
Selection ²	444	840	1.82	0.28
Accession 2	318	543	0.70	0.12
Selection	469	743	1.60	0.29
Accession 3	357	586	0.46	0.30
Selection	408	896	0.74	0.62
Accession 4	392	185	0.34	0.02
Selection	483	354	0.67	0.05
Accession 5	335	511	0.35	0.07
Selection	479	764	1.09	0.17
Accession 6	376	337	0.41	0.05
Selection	473	460	0.65	0.08
Accession 7	335	110	0.42	0.02
Selection	386	158	1.21	0.05
Accession 8	285	321	0.32	0.03
Selection	342	568	0.67	0.06
Accession 9 (Kenblue)	377	572	0.47	0.10
Selection	493	718	0.93	0.22
Accession 10 (Midnight)	376	321	0.42	0.04
Selection	458	837	0.81	0.07

¹Accession mean of 28 plants of an accession.

²Selection mean is the single best plant for each parameter within an accession.

Table 2. Seed production selection parameters evaluated on accessions at Central Ferry, WA during 2005.

	Selection parameter				
	Seed wt.	Seed per panicle	Panicles per area	Yield	Base population
Accession 1 Selection	6 ¹	5	7	6	6
Accession 2 Selection	3	6	6	6	6
Accession 3 Selection	4	5	5	4	4
Accession 4 Selection	3	2	3	2	3
Accession 5 Selection	3	6	6	7	5
Accession 6 Selection	4	4	4	4	4
Accession 7 Selection	2	1	2	1	2
Accession 8 Selection	7	7	6	5	3
Kenblue Selection	4	6	6	5	5
Midnight Selection	6	4	5	4	4

¹Rated 1 to 9; 1 = very poor vigor, dormant or potentially dead.

Interaction: During 2005 the PI interacted with the listed cooperators on this project or related grass seed production issues. There was interaction with GSCSSA scientists and international seed scientists at the International Herbage Seed conference at Winchester, England. During the year several presentations were made to regional seed production groups and the Washington Department of Ecology.

Timeline:

Year 2004-2005 (FY04, year 1 funding):

Clean seed obtained for 1680 samples collected from space plants during 2002 and 2003 (completed). Select plants for genotype by environment (location) studies of selection response (completed). Establish seed increase plots in early fall 2004 at the USDA research farm at Central Ferry, WA (completed). Analysis of molecular (in progress) and agronomic data (completed).

Year 2005-2006 (FY05, year 2 funding):

Spring and summer 2005. Collect data on seed increase plots (5000 plants) at Central Ferry, WA (completed).

Year 2006-2007 (FY06, year 3 funding, current proposal):

Summer 2006. Harvest seed increase plots (5000 plants) at the USDA research farm at Central Ferry, WA.

Fall 2006. Clean seed harvested at Central Ferry. Contact growers for on-farm sites for seed yield trials.

Spring 2007. Establish on-farm seed production plots with local growers and turf trials at universities (sites to be determined).

Publish results from Objective 1.

Continue seed production and turfgrass trials as funding permits. Publish results and release a high yielding turf-type Kentucky bluegrass that does not require post-harvest burning to maintain seed production at a later date.

Publications, Reports, and Presentations for Current Year:

Johnston, W. J. 2005. Development of high yielding Kentucky bluegrass for non-thermal seed production. WSU Crops Science seminar, Pullman, October 3.

Johnston, W. J. 2005. Development of high yielding Kentucky bluegrass for non-thermal seed production. Washington DOE Ag Burn Task Force, Walla Walla, June 9.

Johnston, W. J. Development of high yielding Kentucky bluegrass for non-thermal seed production. GSCSSA FY 2004 Progress Reports. p. 20-23.