Development of Kentucky Bluegrass for Non-burn Seed Production

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INTRODUCTION

A ban on burning has been implemented in Washington and Idaho, and restrictions are in place in Oregon, USA. Without post-harvest burning, Kentucky bluegrass (*Poa pratensis* L.) seed yield decreases over time (Lamb and Murray, 1999; Johnson et al., 2003). This has forced growers to use shorter rotations to maintain seed yields. In a multi-year study we identified germplasm that had improved seed production without burning (Johnson et al., 2003). This germplasm needs further selection and evaluation. Ultimately, bluegrass that can be grown without burning will be released.

OBJECTIVES

I. Assess the variation in agronomic attributes of selected accessions and identify individual plants with high seed weight, high seed per panicle, high panicles per unit area, and high overall seed yield.

II. Determine the selection response for seed yield and yield components by testing the resulting selections in Objective I for seed production in on-farm testing and turf trials. Ultimately, release a variety.

MATERIALS AND METHODS

PHASE I - Evaluation of the USDA-ARS Kentucky Bluegrass Collection

In 1994, a Kentucky bluegrass nursery was planted using 228 accessions and 17 commercial cultivars (checks) (Fig. 1). The accessions were characterized for 17 agronomic parameters.

Fig. 1 USDA-ARS Kentucky bluegrass collection evaluation

PI accessions were differentiate using an agronomic core (cluster analysis using unweighted pair-group method using arithmetic averages).

PHASE II – Residue Management and Turf Evaluation

The core sub-set was used to select accessions having high seed yield without burning and good turf quality. The seed plot treatments included burning, baling, and full residue; 20 core collection accessions, 16 "free picks", and 9 checks were evaluated (Fig. 2). In addition, adjacent plots were evaluated for turf attributes (Fig. 3).

Fig. 2 Seed plot treatments: burning; baling; full residue

Fig. 3 Turfgrass evaluation: turf quality; texture; color; etc.

PHASE III - Selection for Diversity in Seed Yield Components

A nursery for plant agronomic characterization was established with a total of 10 entries (8 PI and 2 checks); 28 plants per entry; 3 replications (Fig. 4). The plants were harvested for 2 years. Agronomic variations within accessions were measured.

Fig. 4 Space-plant nursery for individual plant characterization

For each entry, 100 seed were obtained from 4 selected plants and from the original population of each accession.

Selection Parameters

A. Plant with highest yield
B. Plant with highest seed weight
C. Plant with highest seed per panicle
D. Plant with highest panicles per unit area
E. Seed from the original population

PHASE IV – Seed Increase

One hundred plants of each accession x parameter (10 accessions x 5 parameters) were established in flats in the greenhouse. In October 2004, the 5000 plants were transplanted into a seed increase nursery. In June 2006, plots were swathed (Fig. 5), threshed, and seed was cleaned.

Fig. 5 Swathing bluegrass at the USDA-ARS research site at Central Ferry, WA

PHASE V – Turfgrass and Seed Production Trials

In August 2006, a National Turfgrass Evaluation Program (NTEP)-type trial was established with the 50 entries at Pullman, WA (Fig. 6). On-farm seed production trials were established at 3 sites in eastern Washington in the spring of 2007.

Fig. 6 Turfgrass evaluation at Pullman, WA

RESULTS

PHASE I – Evaluation of the USDA-ARS Kentucky Bluegrass Collection

- Agronomic data could be used to differentiate among accessions.
- A Kentucky bluegrass core was developed.

PHASE II – Residue Management and Turf Evaluation

- Accessions were identified that maintained good seed yield when post-harvest residue was baled and possessed good turf quality.
- Turf quality was negatively correlated with seed yield (Table 1).
- Panicles m^{-2} increased yield but did not affect turf quality, presenting a potential selection opportunity.

Table 1. Correlation between turf quality and seed yield factors at Pullman, WA during 1998 and 1999.

	Turf quality	Biomass	Yield	Harvest index	Weight seed^{-1}	Seed panicle^{-1}	Panicles m^{-2}
Texture[1]	-0.33*	0.32*	0.37*	-0.12ns	-0.20ns	0.30ns	0.25ns
Color[2]	0.67**	-0.56**	-0.40*	0.43**	0.23ns	-0.56**	-0.17ns
Quality[3]	-----	-0.53**	-0.48**	0.22ns	0.15ns	-0.55**	-0.26ns
Yield	-0.48**	0.84**	-----	0.12ns	0.05ns	0.76**	0.66**

[1]Leaf texture was rated 1 to 9; 9 = fine.
[2]Genetic color was rated 1 to 9; 9 = dark green.
[3]Turfgrass quality was rated 1 to 9; 9 = excellent.

PHASE III – Selection for Diversity in Seed Yield Components

- Variation between and within accessions was identified (Johnston, 2005).
- For each accession, the individual plant with highest yield, seed weight, seed per panicle, and panicles per unit area were selected, as well as material from the original population.

PHASE IV – Seed Increase

- The nursery at Central Ferry, WA was harvested (June 2006) and sufficient clean seed was obtained to carry out Phase V.

PHASE V – Turfgrass and Seed Production Trials

- A turfgrass evaluation trial was established at Pullman, WA (August 2006). Plots are currently being evaluated for turfgrass parameters.
- On-farm seed production trials were established at 3 sites in eastern WA in May 2007. The 1st harvest will occur summer 2008.

OUTCOMES & CONCLUSIONS

- The USDA-ARS Kentucky bluegrass collection was evaluated for diversity and a core collection was developed.
- Accessions with good seed yield without burning and good turf quality were identified.
- Variation within accessions for seed production parameters was found, so the potential exists for plant selection and enhancement.
- Seed increase was completed and on-farm seed production and turfgrass trials are on-going.

LITERATURE CITED

Johnson, R.C., W.J. Johnston, and C.T. Golob. 2003. Crop Sci. 43:1091-1099.

Johnston, W.J. 2005. USDA-ARS Grass Seed Cropping System for a Sustainable Agriculture. FY 2005 Progress Reports, p. 13-16.

Lamb, P.F., and G.A. Murray. 1999. Crop Sci. 39:1416-1423.

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