Development of Kentucky Bluegrass for Non-burn Seed Production

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FINAL REPORT

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Abstract

Open-field burning of Kentucky bluegrass (*Poa pratensis* L.) post-harvest residue, which maintains grass seed yield and stand longevity, has been eliminated in Washington and is restricted in Oregon and Idaho. The objective of this study was to develop bluegrasses that have sustainable seed yield without post-harvest field burning and still maintain acceptable turfgrass quality. The study consisted of eight PI accessions and two commercial check cultivars ('Kenblue' and 'Midnight'). PI accessions were previously selected for both seed yield without field burning and turfgrass quality. In a space-plant nursery at Pullman, WA, several agronomic yield parameters were evaluated over a 2-year period and individual plants were re-selected within each accession, or check, with the highest seed weight, highest seeds panicle^{-1}, highest panicle number unit area^{-1}, and highest seed yield. These, plus remnant seed from the original population, were planted in a seed increase nursery that was harvested in 2006 and 2007. At Pullman, WA, turfgrass plots were established in 2006 and irrigated and non-irrigated seed production plots were established in 2007. The turfgrass trial was evaluated monthly from 2007 to 2010 according to National Turfgrass Evaluation Program protocol for turfgrass quality. Seed production plots were harvested 2008 to 2011. Selection for seed yield components had a variable response and yield was often more dependent on accession. Accession PI368241 showed promise of being able to provide excellent seed yield under both irrigated and non-irrigated non-burn management over multiple years while maintaining good turfgrass quality. Under non-irrigated seed production, selection within Kenblue for seeds panicle^{-1} had good seed yield and turfgrass quality. These studies will be followed for one to two additional harvests to determine if a non-burn Kentucky bluegrass can be developed for sustainable grass seed production for the Pacific Northwest.

Justification

A ban on burning has been implemented in Washington, and restrictions are in place in Idaho and Oregon. Our previous research showed that without post-harvest burning bluegrass seed yield decreased over time (Johnson et al., 2003). 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 (Johnston, 2000). This germplasm needs long-term seed yield trials and turfgrass evaluations. Ultimately, bluegrasses that can be successfully grown for multiple harvests without burning will be released to growers.

Objectives

1. Assess the variation in agronomic 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-burn seed production. Increase the seed in a nursery to have ample seed to carry out Objective 2 (*completed*).

2. Determine the selection response for grass seed yield and yield components by testing the resulting selections in Objective 1 for seed production under a residue removed (baled) management system in diverse environments over several years. In addition, test the selections for turfgrass quality over several years (*initiated 2007-2009; continued 2009-2011, Current Report*).

Progress

Previous Research.

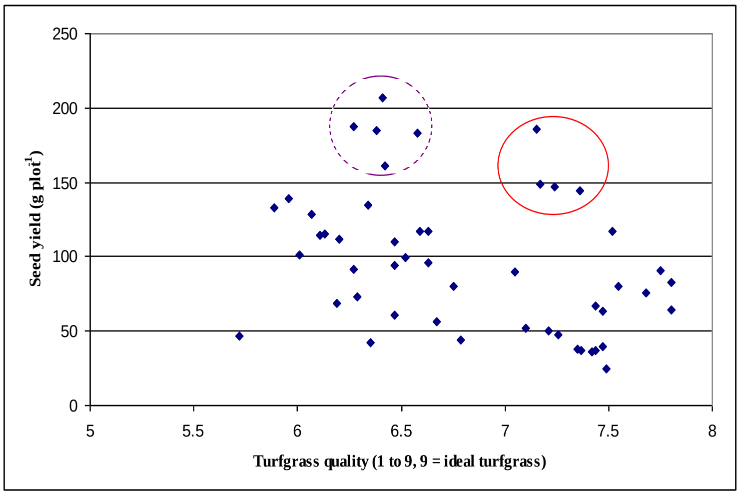
During prior research in 2004, seed yield components and seed yield data was obtained on 840 space plants at Pullman, WA. For each sample [1680 samples (two harvest years)] the number of panicles per plant was recorded. Panicles were then hand threshed (belt thresher), cleaned with a seed blower, and total seed weight was recorded. The data were analyzed for 1000 seed weight, seed per panicle, panicles per cm^2, and yield (g per cm^2). 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 (Johnston, 2004). Seed of each selected plant and remnant seed of the original PI 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 at the USDA research site at Central Ferry, WA. The nursery consisted of 5000 plants. Seed production was poor due to the late fall planting in 2004. In September 2005, all accessions except for PI371768, and possibly PI349188, were quite robust.

During 2006, the seed increase nursery (50 plots of 100 plants = 5000 plants) at the USDA research farm at Central Ferry, WA was evaluated for several agronomic traits and turfgrass potential (non-replicated data). In June 2006, the plots were harvested, air dried, threshed, and cleaned. Clean seed weight was obtained.

To evaluate turfgrass quality, a National Turfgrass Evaluation Program (NTEP) protocol turf trial was planted in August 2007 with the 50 entries in a RCB experimental design with three replications at the Turfgrass and Agronomy Research Center (TARC) at Pullman, WA. Individual plot size was 5 ft x 5 ft and was seeded at 2.2 lb per 1000 ft^2. Also, dryland and irrigated seed production plots (150 per trial) were established at the WSU TARC at Pullman, WA on 18 May and 17 Aug. 2007, respectively.

The turfgrass trial was evaluated monthly during the growing season according to NTEP protocol for establishment, turf quality, color, texture, chlorophyll index, and spring green-up

(Dodson, 2008). In 2008, seed production plots were evaluated for seed yield, 1000 seed weight, seed yield per plant, seed per panicle, and panicle number per unit area. Selection for seed yield components had a variable response and appeared to be dependent on accession (Dodson, 2008). The best characteristics of Kentucky bluegrass germplasm for seed production under non-burn conditions are early spring green-up, medium panicle height, many panicles per area, lighter seed weight, and a high number of seed per panicle (Dodson, 2008). In 2008, two accessions, PI371775 and PI368241 showed promise of being able to provide good turfgrass quality and seed yield under non-burn management (Fig. 1).



Solid circle are selections from accession PI 371775.

Dashed circle are selections from accession PI 368241 and one selection from Kenblue.

Fig. 1. Kentucky bluegrass seed yield (2008) vs. turfgrass quality (mean of 2007 and 2008) for accession x selection components at Pullman, WA.

2009-2011 Research; Current Report.

In 2009, non-irrigated and irrigated seed production plots planted in 2007 were harvested for the second year. Turfgrass trials were evaluated for the third year. In 2009, as in 2008, the selection for yield components had a variable response and appeared to be dependent on accession. Overall, there was an increase in seed yield due to irrigation; however, regardless of non-irrigated or irrigated seed production, accession PI368241 continued to show promise of being able to provide good turfgrass quality and good seed yield under non-burn residue management (Fig. 2 and 3). Under non-irrigated seed production, selection within Kenblue for seed head^{-1} had good seed yield and turfgrass quality (Fig. 2).

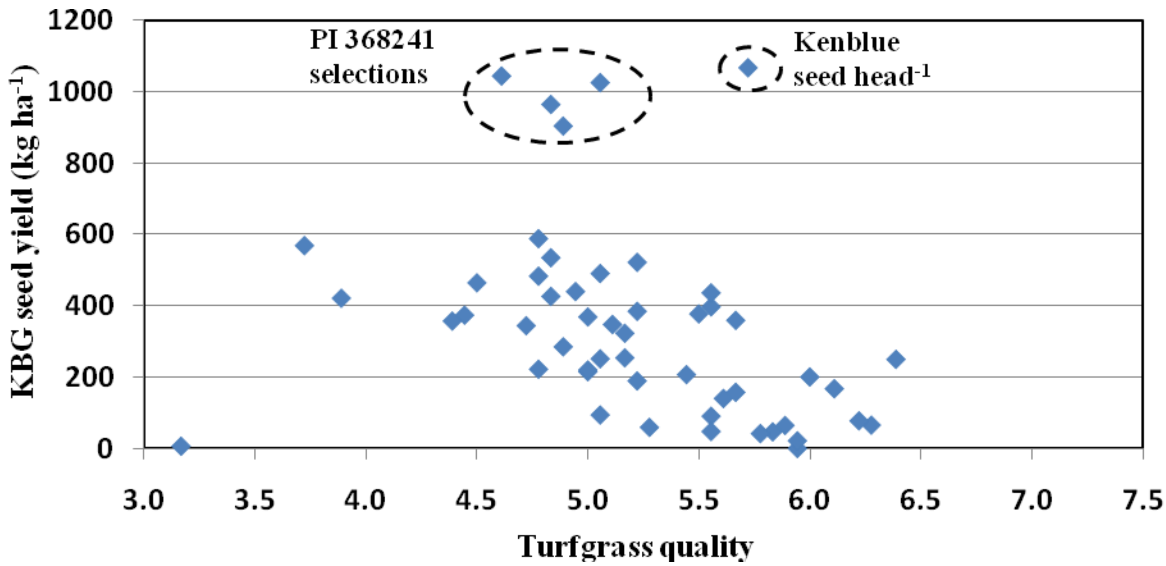


Figure 2. Kentucky bluegrass non-irrigated seed yield vs. turfgrass quality (rated 1-9; 9 = excellent quality) at Pullman, WA, 2009.

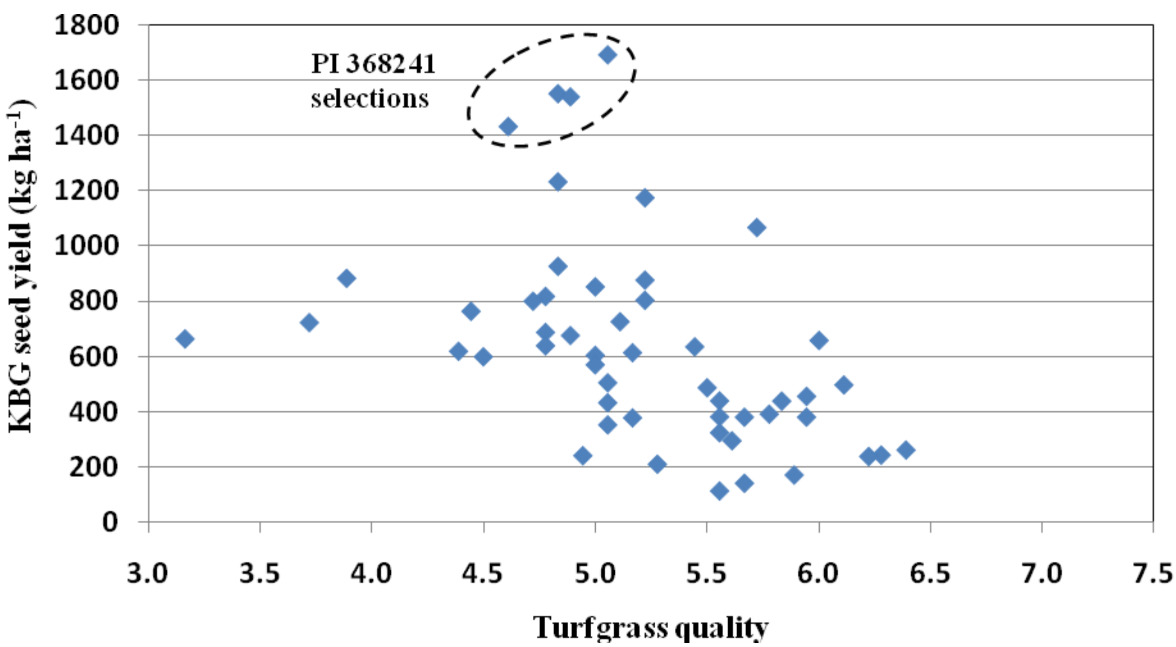


Figure 3. Kentucky bluegrass irrigated seed yield vs. turfgrass quality (rated 1-9; 9 = excellent quality) at Pullman, WA, 2009.

In 2010, non-irrigated and irrigated seed production plots planted in 2007 were harvested for the third year. Turfgrass trials were evaluated for the fourth year. Overall, there was an increase in seed yield due to irrigation; however, regardless of non-irrigated or irrigated seed production, accession PI368241 continued to show promise of being able to provide good turfgrass quality and good seed yield under non-burn residue management (Fig. 4 and 5). Under non-irrigated seed production, selection within Kenblue for seed head^{-1} had good seed yield and turfgrass quality (Fig. 4). It is critical to follow these studies for several additional harvests to determine if a non-burn Kentucky bluegrass can be developed for sustainable grass seed production in the Pacific Northwest.

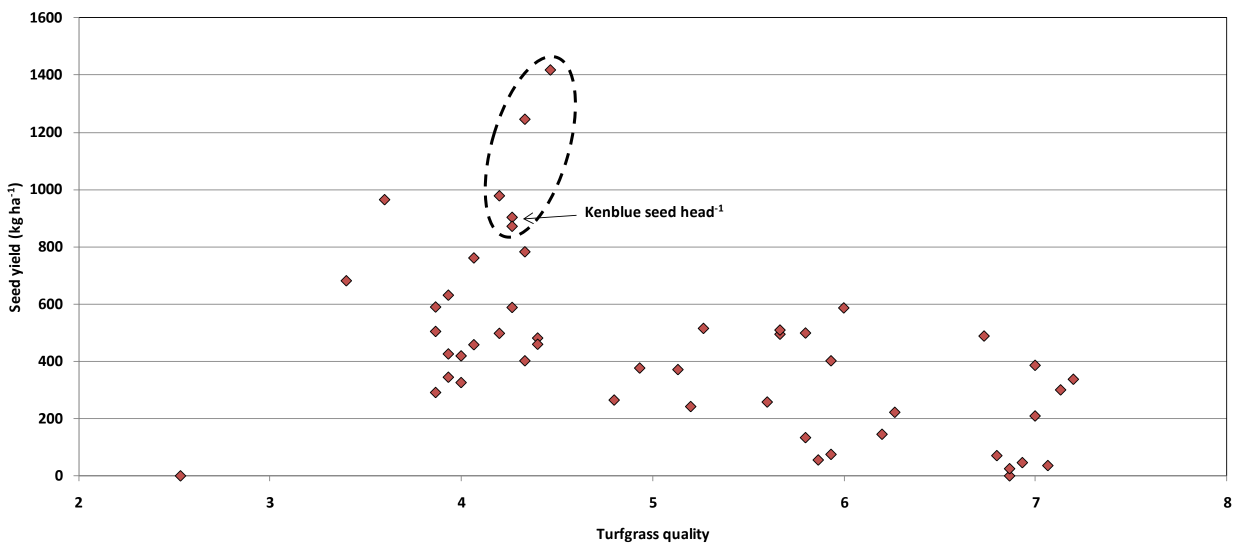


Figure 4. Kentucky bluegrass non-irrigated seed yield vs. turfgrass quality (rated 1-9; 9 = excellent quality) at Pullman, WA, 2010. Circle is PI368241 and one selection of Kenblue.

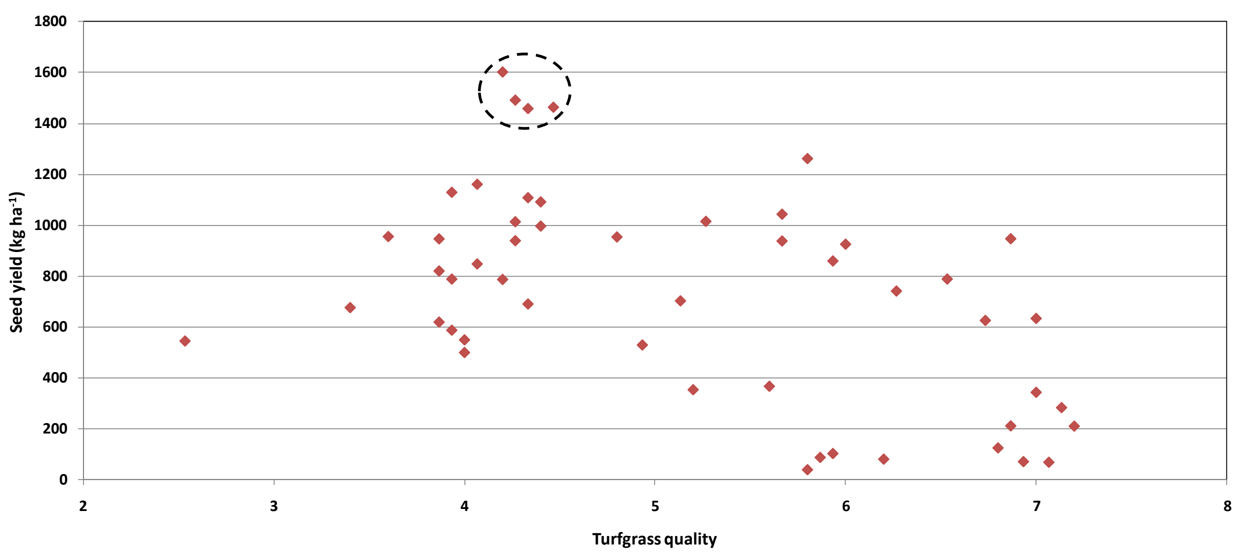


Figure 5. Kentucky bluegrass irrigated seed yield vs. turfgrass quality (rated 1-9; 9 = excellent quality) at Pullman, WA, 2010. Circle is PI368241.

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