# Seed Production of Diverse Kentucky Bluegrass Germplasm with Various Alternative Residue Management Systems

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## Introduction

**In the Pacific Northwest, Kentucky bluegrass (KBG) (*Poa pratensis* L.) seed production has traditionally included open-field burning following harvest to remove residue and stimulate seed production the following year. Field burning, however, produces air pollution of increasing public concern (Fig. 1). As alternative, non-thermal seed production systems are developed, it is critical that germplasm be identified that maximizes seed production while maintaining turfgrass quality.**

**The objectives of this study were to: 1) determine seed production of diverse germplasm in alternative residue management systems while evaluating for turfgrass potential and 2) relate turf, morphological, and phenological yield factors.**

## Materials and Methods

**Field studies to evaluate the USDA-ARS collection of KBG were initiated in 1994 on 228 accessions along with 17 commercial turfgrass cultivars representing diverse morphological groups (Johnston et al., 1997) (Fig. 2). Ward's hierarchical cluster analysis was completed and a core collection subset was developed.**

**Along with the Ward core subset (22 accessions) and nine commercial cultivars, 17 additional PI accessions with high seed yield and turf potential were selected for additional studies. The 48 entries were planted in 1996 at the Washington State University Turfgrass Research Area to evaluate seed production (Fig. 3). Individual plots were 4 ft wide x 21 ft long with seven rows spaced 7 inches apart. Beginning fall 1997, accession/cultivar plots were divided into treatments of open-field burned, post-harvest residue baled, and residue retained on plots. Plots were evaluated yearly for several agronomic characteristics and harvested for seed yield (Fig. 4).**

**Turfgrass evaluation plots with the same 48 entries were also established (Fig. 5). Individual turf plots were 5 x 4 ft. Turfgrass quality factors were rated according to criteria developed by the National Turfgrass Evaluation Program (NTEP).**

## Results and Discussion

**The purpose of developing a core subset was to represent a large portion of the diversity in the USDA-ARS KBG collection with a relatively small number, approximately 10%, of the total accessions. The core collection subset was then studied in greater detail.**

**The agronomic core collection, along with selected accessions and check cultivars, showed a wide range of values for turf quality and seed production parameters (Tables 1). Compared to open-field burning, 1998-2000 average seed yield reduction was 27% when plots were baled and 51% when no residue was removed. For more detailed information see Johnston and Johnson (2000).**

**Selected turf and morphological factors correlated with seed production parameters are given in Table 2. Morphological and production factor correlated with phenological factors for bluegrass growing across various management systems are given in Table 3.**

**Several years of research has shown that seed yield is negatively correlated with date of harvest; i.e., early crop development enhances seed yield. Turf quality and seed yield were negatively correlated. Commercial cultivar means when were 405 and 553 lb/acre when baled or burned, respectively, and for seed yield and 5.7 for turfgrass quality. A few accessions approached these "benchmark" values (Table 1). Although the combination of high seed yield and high turf quality is rare, selection of individual accessions with both good turf quality and improved seed yield is possible.**.

Fig. 1. Open-field burning bluegrass post-harvest residue.

Fig. 3. Germplasm (background); seed production (foreground).

Fig. 5. Turfgrass plots.

Fig. 2. Germplasm evaluation.

Fig. 4. Seed production plots.

**Table 2. Pearson correlation coefficients for selected turfgrass and seed production parameters, 1998-1999, at Pullman, WA. (n=44).**

| *Turf factors* | Yield | Seed weight | Seed/panicle | Panicles/m sq |
|---|---|---|---|---|
| Leaf texture | 0.37* | ns | ns | ns |
| Leaf color | -0.40* | ns | -0.56** | ns |
| Spring green-up | 0.37* | ns | 0.61** | ns |
| Turf quality | -0.48** | ns | -0.55** | ns |

| *Morthological factors* | Yield | Seed weight | Seed/panicle | Panicle/m sq |
|---|---|---|---|---|
| Leaf habit | 0.75** | ns | 0.80** | ns |
| Agressiveness | ns | ns | ns | ns |
| Panicle height | 0.61** | ns | 0.84** | ns |

**Table 3. Pearson correlation coefficients for morphological and seed production parameters, 1998-1999, at Pullman, WA. (n=262, yield; or 265 for other parameters).**

| GDD[1] | Yield | Seed weight | Leaf habit | Panicles height |
|---|---|---|---|---|
| Heading | -0.32** | ns | -0.32** | ns |
| Anthesis | -0.16** | ns | ns | 0.36** |
| Harvest | -0.48** | ns | -0.34** | ns |
| Heading to anthesis | 0.30** | ns | 0.45** | 0.57** |
| Anthesis to harvest | -0.49** | ns | -0.38** | -0.16** |
| Heading to harvest | -0.33** | ns | -0.17** | ns |

[1]Growing Degree Days from Jan.1 to parameter of for interval of parameters.

## Summary

**The development of a core subset permitted a study of the wide diversity of the entire USDA-ARS KBG collection for seed production and turfgrass potential to an extent that would have otherwise been impractical. Several accessions when baled maintained yields that were similar to post-harvest field burning. A few accessions showed good turfgrass quality with above average grass seed yield. Thus, it appears that losses associated with non-thermal residue removal can be mitigated through germplasm selection and plant breeding. Continued work will determine how new germplasm can best be managed to improve seed yield utilizing alternative non-thermal residue management and what developmental factors are key to seed yield and turfgrass qualtiy.**

**Table 1. Kentucky bluegrass seed yield (pounds/acre) and turfgrass quality (mean of 1998 – 2000) at Pullman, WA.**

| | Residue treatment | | | |
|---|---|---|---|---|
| PI Accession/CV | Retained | Baled | Burned | Turf Quality* |
| 204491 | 152 | 191 | 535 | 4.5 |
| 206725 | 133 | 239 | 373 | 4.9 |
| 226667 | 387 | 584 | 1115 | 4.4 |
| 227381 | 103 | 120 | 613 | 4.5 |
| 229721 | 310 | 617 | 992 | 5.2 |
| 230132 | 595 | 1045 | 1555 | 4.6 |
| 236924 | 20 | 16 | 130 | 5.0 |
| 237282 | 316 | 330 | 669 | 4.7 |
| 286381 | 310 | 379 | 539 | 5.5 |
| 298098 | 179 | 308 | 425 | 5.2 |
| 303053 | 352 | 456 | 695 | 5.2 |
| 303056 | 195 | 383 | 403 | 5.7 |
| 303058 | 517 | 819 | 958 | 4.8 |
| 314734 | 631 | 958 | 1266 | 4.9 |
| 346021 | 575 | 705 | 856 | 4.1 |
| 349160 | 32 | 60 | 54 | 5.6 |
| 349178 | 270 | 345 | 539 | 5.5 |
| 349188 | 416 | 577 | 652 | 5.7 |
| 349195 | 404 | 739 | 719 | 4.7 |
| 349220 | 170 | 262 | 259 | 5.3 |
| 349223 | 238 | 363 | 440 | 5.0 |
| 349225 | 163 | 233 | 262 | 5.0 |
| 368233 | | | | 5.4 |
| 368241 | 772 | 1066 | 1244 | 4.7 |
| 371768 | 108 | 163 | 135 | 6.7 |
| 371769 | 167 | 168 | 283 | 5.6 |
| 371771 | 75 | 120 | 105 | 5.8 |
| 371775 | 275 | 431 | 454 | 5.5 |
| 372738 | 141 | 153 | 328 | 4.8 |
| 372741 | 119 | 169 | 346 | 5.1 |
| 374742 | 108 | 153 | 166 | 6.1 |
| 380992 | 196 | 240 | 268 | 4.2 |
| 440601 | 181 | 239 | 271 | 3.5 |
| 440608 | 790 | 1070 | 1601 | 4.5 |
| 499557 | 401 | 564 | 1043 | 4.3 |
| 505898 | 430 | 600 | 878 | 5.3 |
| 539057 | 315 | 473 | 790 | 5.3 |
| 539059 | 555 | 731 | 910 | 5.0 |
| 574523 | 86 | 232 | 68 | 6.2 |
| Dawn | 281 | 330 | 483 | 5.5 |
| Eclipse | 207 | 276 | 273 | 5.8 |
| Julia | 316 | 396 | 424 | 5.9 |
| Kenblue | 355 | 551 | 820 | 5.0 |
| Midnight | 222 | 340 | 348 | 7.2 |
| Monopoly | 276 | 432 | 654 | 5.2 |
| Mystic | 186 | 215 | 682 | 5.7 |
| Park | 279 | 538 | 737 | 5.3 |
| Victa | 300 | 570 | 552 | 6.1 |
| Mean | 290 | 424 | 594 | 5.2 |

*Mean monthly rating during growing season. Rated 1-9; 9 = highest turfgrass quality.

## References Cited

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