KENTUCKY BLUEGRASS FLORAL INDUCTION AND CULTIVAR RESPONSE TO MECHANICAL REMOVAL OF HARVEST RESIDUE

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ABSTRACT
Open-field burning of post-harvest residue from Kentucky bluegrass (*Poa pratensis L.*) seed fields is being phased out in Washington, USA and may be banned in Idaho. Burning encourages early fall regrowth and timely completion of fall floral induction. Cultivars have different floral induction requirements and respond differently to mechanical residue removal. Our objective was to determine if length of fall floral induction requirement was related to seed yield when post-harvest residue was removed by crewcut vacuum sweeping. Floral induction requirements were not related to first-or second-year seed yields. Third-year seed yield of cultivars with long floral induction requirements declined more than third-year seed yields of cultivars with short floral induction requirements. Turf type, aggressive cultivars usually have longer floral induction requirements than non-aggressive cultivars. Exceptions suggest that turf type cultivars with short floral induction requirements can be developed. Cultivar selection will be important for sustained yields with mechanical residue removal.

KEYWORDS
Crewcut vacuum sweeping, cultivars, bluegrass, seed yield

INTRODUCTION
Burning of Kentucky bluegrass seed fields in Washington will be phased out by 1998. Burning bans are likely in Idaho. The first seed crop of Kentucky bluegrass is produced without removal of post-harvest residue. Open field burning after the first seed crop enhances production by suppression of weeds and diseases, and by enhancing fall regrowth and completion of juvenility (Chastain et al., 1994). Sylvester, 1995, has shown that the transition of a juvenile to an adult meristem begins in summer before harvest. Completion of juvenility is required before meristems can respond to vernalization (Heide, 1989; Meijer, 1984). Vernalization and juvenilty requirements are cultivar dependent, take weeks after fall regrowth begins for completion under field conditions (Canode and Perkins, 1977; Murray and Swensen, 1994; Murray, et al., 1992), and up to 27 weeks for completion under controlled conditions (Carlson et al., 1995; Dibble, et.al., 1994)

Cultivars respond differently to mechanical residue removal and have different fall floral induction requirements (Murray and Swensen, 1994). Aggressive and moderately aggressive cultivars showed earlier floral induction than non-aggressive cultivars (Murray et. al., 1992)

The purpose of this study was to categorize cultivar seed yield and floral induction relationships with post-harvest residue removal by crewcut vacuum sweeping.

METHODS
In 1992, 16 cultivars of Kentucky bluegrass were established at three locations in northern Idaho. Following the first seed harvest in 1993, post-harvest residue was removed mechanically with a crewcut vacuum sweeper in 1994 and 1995. Five 10 cm diameter plant cores per variety were removed from the field at about two-week intervals, from late October through April. The base of the largest tiller of that core was examined for apical meristem development. Meristem elongation was used as an indicator of floral induction. The remaining cores were transplanted to the greenhouse with 16-hr light periods and 15-22C temperatures. Panicle expression indicated completion of floral induction. Panicle number and seed yield were obtained from the field from each variety. Varieties were replicated four times in a randomized complete block design.

RESULTS AND DISCUSSION
Data from the Moscow, Idaho location is presented. Apices of the largest tillers at time of field collection, October through March, did not show elongation or other evidence of floral induction in any year.

In 1993-94, floral induction, as measured by panicle exertion from field grown plants that were transferred to the greenhouse, occurred between 29 Nov and 6 Jan (Table 1). Cultivars with longer floral induction requirements usually had higher aggressivity ratings than cultivars with lower aggressivity. South Dakota, aggressivity rating 2, completed floral induction by 29 Nov while Glade, aggressivity rating 7, did not complete floral induction until 6 Jan.

Second-year (1993-94) seed yield, first year after crewcut vacuum sweeping, was not related to either length of fall floral induction period or aggressivity (Table 1). Maximum panicle number of plants collected from the field from October through March were not good indicators of seed yield in the field.

Third-year (1994-95) seed yield, following two years of crewcut vacuum sweeping, was lower than second-year seed yields for most cultivars and was related to length of floral induction requirements. Cultivars Ram I and Glade had the longest floral induction requirements of all cultivars tested and had third-year seed yields 83% lower than second-year seed yields. Third-year seed yield of other cultivars with long fall floral induction requirements was reduced 55 to 73% compared to second-year seed yields. One exception was the low yielding cultivar Wabash. Third-year seed yield of Wabash, a cultivar with relatively long floral induction requirements and aggressivity rating 6, was higher than second-year seed yield.

In contrast, two cultivars with short floral induction requirements, South Dakota and Newport had third-year seed yields 16 and 33% higher than second-year seed yields, respectively (Table 1). While one cultivar, Cheri, with short floral induction requirements showed reduced third-year seed yields of 79%, the other cultivars with short floral induction requirements showed yield reductions of 18 to 66%. Floral induction was delayed 20 to 63 days in 1994-95 compared to 1993-94 because of dry conditions after harvest (Table 1). However, cultivars with lower aggressivity ratings again completed floral induction requirements sooner than cultivars with high aggressivity ratings. Most cultivars, aggressivity rating, 2 to 5, completed floral induction by 11 Jan. Cultivars Ram I and Glade, aggressivity rating 6 and 7, respectively, did not complete floral induction until 17 Mar and 21 Feb, respectively.

As in 1993-94, maximum panicle number developed by plants collected from the field in fall 1994 through spring 1995, did not reflect either aggressivity rating, panicle number in the field (data not shown) or seed yield measured in the field (Table 1). The more desirable turf cultivars were less likely to produce adequate seed yields with crewcutting, especially after the second seed crop. When dry fall conditions delay floral induction, as in 1994-95, cultivars with long floral induction requirements are even less likely than

cultivars with short floral induction requirements to produce adequate seed yields.

Under both dryland and irrigated conditions, mechanical residue removal can delay fall floral induction by modification of temperature experienced by plants. Daytime temperatures are higher during the day and lower at night in fields that have been burned than in field with residue remaining on the surface (Murray, unpublished data). Plants in burned fields should complete juvenility and vernalization faster than plants in unburned fields. In addition, burning thins stands more than mechanical residue removal which allows faster completion of juvenility.

Selection for aggressive desirable turf cultivars appears to have inadvertently selected for long floral induction requirements. Long floral induction requirements can be a disadvantage for good seed yield with mechanical removal of residue, especially under dryland conditions where floral induction can be delayed by lack of moisture. Aggressive cultivars with relatively short floral induction requirements were found. Understanding the basis for floral induction and aggressivity may provide culitvars with desirable turf qualities, shorter floral induction requirements and better yields with mechanical residue removal. Cultivar choice, development of turf type cultivars with shorter floral induction requirements, and mechanical residue removal techniques that thin stands are needed for sustained seed yields without burning.

Table 1
Floral induction, aggressivity, panicle number, and seed yield of Kentucky bluegrass with harvest residue removed with a crewcut vacuum sweeper.

Cultivars	Floral induction			Panicle no.(m^{-2}) [z]		Seed yield(kg ha^{-1})	
	1993-94	1994-95	Aggressivity[y]	1993-94	1994-95	1994	1995
South Dakota	29 Nov	11 Jan	2	40	29	617	714
Argyle	29 Nov	19 Dec	3	42	27	1106	902
Kenblue	29 Nov	19 Dec	3	56	41	1090	543
Newport	29 Nov	1 Feb	3	53	35	577	770
Huntsville	29 Nov	11 Jan	4	39	29	1157	399
Suffolk	29 Nov	19 Dec	4	60	38	825	586
Baron	29 Nov	11 Jan	5	66	44	1074	803
Cheri	29 Nov	11 Jan	5	70	25	1420	304
Liberty	29 Nov	11 Jan	5	62	33	1058	838
Adelphi	29 Nov	1 Feb	6	51	35	1186	455
Julia	16 Dec	11 Jan	6	33	19	1041	468
Midnight	16 Dec	21 Feb	6	50	25	1160	378
Ram I	6 Jan	17 Mar	6	38	8	820	138
Wabash	16 Dec	1 Feb	6	25	24	328	438
Glade	6 Jan	21 Feb	7	42	14	1062	185

[x] First date of field collection with plants that developed panicles in greenhouse.
[y] Aggressivity ratings from National Turf Trials. 2-9, with 9 being most aggressive.
[z] Calculated maximum number from plant samples

REFERENCES

Canode, C.L., and M. Perkins. 1977. Floral induction and initiation in Kentucky bluegrass cultivars. Crop Sci. **17**: 278-282.

Carlson, J.M., N.J. Ehlke, and D.L. Wyse. 1995. Environmental control of floral induction and development in Kentucky bluegrass. Crop Science. **35**: 1127-1132.

Chastain, T.C., W.C. Young III, C.J. Garback, and B.M. Quebbeman. 1994. Residue management practices for grassland seed crops in the Willamette Valley. Seed Production Research, Oregon State University, Ext/CrS 102, Apr 95: 1-5.

Dibble, M.S., J.D. Griffin, G.A. Murray, and J.B. Swensen. 1994. Juvenility and vernalization requirements of Kentucky bluegrass cultivars. Agron. Abstr. P. 138.

Heide, O.M. 1989. Poa. CRC Handbook of Flowering. Vol VI. Abraham H. Halevy editor. CRC Press, Inc. Boca Raton, Florida. pp. 538-545.

Meijer, W.J.M.. 1984. Inflorescence production in plants and in seed crops of *Poa pratensis L.* and Festuca rubra *L.* as affected by juvenility of tillers and tiller density. Netherlands Journal of Agricultural Science. **32**:119-136.

Murray, G.A., S.M. Griffth. G. Banowetz. 1992. Do primary floral induction requirements limit seed yield of aggressive turf-type Kentucky bluegrass cultivars? Int. Herb. Seed Prod. Newsletter. **17**: 12-14.

Murray, G. A., and J. B. Swensen. 1994. Panicle expression and seed yield of Kentucky bluegrass with mechanical residue removal. Agron. Abstr. p. 138. Amer. Soc. of Agron. Nov. 13-18, Seattle

Sylvester, A. 1995. Identification of morphological markers for the transition to flowering in Kentucky bluegrass as an aid to the establishment of crop management systems. Grass Seed Cropping Systems for a Sustainable Agriculture. Progress Reports.41-44. Oregon State University, Corvallis, Ore.