ERGOT RESPONSE OF EARLY-, MIDDLE-, AND LATE-FLOWERING KENTUCKY BLUEGRASS CULTIVARS IN CENTRAL AND EASTERN OREGON

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Introduction

Ergot can be an important disease in irrigated Kentucky bluegrass (KBG) seed production systems of central and eastern Oregon. The disease is caused by *Claviceps purpurea*, a fungus that survives as sclerotia in seed and soil. Sclerotia germinate in the spring and produce airborne ascospores, which infect grass flowers prior to fertilization and result in the formation of sclerotia instead of seed.

In some years, the timing and duration of ascospore production by the pathogen may not coincide with anthesis (the only period of host susceptibility), limiting epidemics. Kentucky bluegrass cultivars that flower before or after periods of typical peak spore production and thus escape infection could be grown as part of an ergot integrated pest management program. The objective of this study was to evaluate KBG cultivars with different anthesis periods for ergot incidence and severity under central and eastern Oregon growing conditions.

Materials and Methods

Plots of 16 KBG cultivars were established at the Central Oregon Agricultural Research and Extension Center (COAREC) and Hermiston Agricultural Research and Extension Center (HAREC) in August 2019. Cultivars were grouped into early-, mid-, and late-flowering cultivar groups according to information provided by the seed suppliers. Plots were 30 feet x 6 feet and were planted at a seeding rate of 8 lb/acre. Each plot was replicated four times, and cultivars were arranged in a randomized complete block design. The borders of the experiment area were artificially infested in October 2019 with ergot sclerotia collected from Oregon seed lots representative of the production region. Plots were irrigated, fertilized, and maintained using standard production practices for each region. A fungicide application was made at HAREC in March to manage powdery mildew, but fungicides were otherwise not applied, especially immediately before or during anthesis.

Disease incidence (the number of infected panicles) and severity (the number of sclerotia in each panicle) were determined from a random sample of 100 panicles collected from each plot at harvest. A Burkard 7-day recording volumetric spore sampler was used to monitor airborne ascospore levels at COAREC and at a commercial perennial ryegrass seed field near Echo, OR. Burkard tape samples were analyzed using quantitative PCR (Dung et al., 2018) to determine the number of ascospores captured each day. Incidence data were subjected to a square-root transformation prior to ANOVA, and multiple comparisons were made using Tukey's test. Severity data were subjected to a Kruskal-Wallis test, and multiple comparisons were performed using a Bonferroni adjustment.

Results and Discussion

In general, most cultivars exhibited greater ergot incidence and severity at COAREC compared to corresponding cultivars at HAREC (Table 1). Significant differences in ergot incidence and severity were observed among KBG cultivars at HAREC but not at COAREC (Table 1). Differences in anthesis length, which were not recorded, may have contributed to the variation among cultivars within early-, mid-, and late-flowering groups. Further research would be needed to determine if the differences in ergot levels among cultivars within a flowering group were due to genetic/physiological resistance to ergot, environmental conditions during anthesis, or other factors.

Cultivars were grouped according to flowering period (early, mid, or late) for analysis. At COAREC, the later-flowering cultivars exhibited more infected panicles than did mid-flowering cultivars (Table 2), and most ascospores (82%) were detected at COAREC in the latter third of the spore monitoring season. At HAREC, late-flowering cultivars exhibited lower ergot incidence and severity than mid-flowering cultivars (Table 2), and spore trapping in the area indicated that fewer ascospores were present during the last third of the cropping season compared to earlier in the year. A previous study evaluating klendusity (disease escape) in perennial ryegrass cultivars at HAREC found a negative correlation between anthesis initiation date and ergot incidence (Kaur et al., 2016), also suggesting the potential for disease escape in perennial ryegrass cultivars that flower later in the season.

It should be noted that physiological resistance was not evaluated in this study and may also play a role

Table 1. Ergot incidence and severity for early-, mid-, and late-flowering Kentucky bluegrass cultivars grown in artificially infested plots in Madras and Hermiston, OR.[1]

Anthesis period	Cultivar	----- Madras, OR (COAREC) ------		----- Hermiston, OR (HARAC)-----	
		Incidence	Severity	Incidence	Severity
		(%)	(no.)	(%)	(no.)
Early	A	28.3	77.5	6.3 cd	7.3 b
	B	25.5	61.0	33.3 a	71.5 a
	C	20.3	70.3	5.0 cd	6.5 b
	D	32.0	126.5	2.5 d	2.8 b
	E	20.8	86.5	17.0 abcd	23.8 ab
	F	24.0	91.5	10.0 abcd	11.8 ab
Mid	G	22.8	56.5	20.5 abcd	34.3 ab
	H	20.3	38.0	8.8 abcd	11.0 ab
	I	29.8	117.8	35.5 abc	69.8 a
	J	15.8	50.3	30.8 ab	62.3 ab
	K	28.0	65.0	12.5 abcd	20.5 ab
Late	L	32.3	69.5	8.5 abcd	11.8 ab
	M	27.5	88.5	7.8 abcd	9.5 ab
	N	35.3	141.0	6.0 bcd	7.0 b
	O	42.8	137.3	2.5 d	3.3 b
	P	32.3	91.8	10.8 abcd	22.0 ab
	P-value	0.6773	0.718	< 0.0001	0.0009

[1]Disease incidence (the number of infected panicles) and severity (the number of sclerotia in each panicle) were determined from a random sample of 100 panicles collected from each plot at harvest. Incidence data were subjected to a square-root transformation prior to ANOVA, and multiple comparisons were made using Tukey's test. Severity data were subjected to a Kruskal-Wallis test, and multiple comparisons were performed using a Bonferroni adjustment. Column means followed by the same letter are not significantly different at LSD ($P < 0.05$).

Table 2. Ergot incidence and severity for early-, mid-, and late-flowering Kentucky bluegrass cultivars grown in artificially infested plots in Madras and Hermiston, OR, and the percentage of the total number of ergot ascospores captured at one representative site in each production region.[1]

Anthesis period	---------- Madras, OR (COAREC) ----------			------- Hermiston, OR (HARAC) --------		
	Incidence	Severity	Spores captured at one site	Incidence	Severity	Spores captured at one site
	(%)	(no.)	(%)	(%)	(no.)	(%)
Early (n = 6)	25.1 ab	85.5	0.6	12.3 b	20.6 ab	24.6
Mid (n = 5)	23.3 b	65.5	17.2	21.6 a	39.6 a	59.9
Late (n = 5)	34.0 a	105.6	82.1	7.1 b	10.7 b	15.6
P-value	0.036	0.115	—	0.003	0.006	—

[1]Disease incidence (the number of infected panicles) and severity (the number of sclerotia in each panicle) were determined from a random sample of 100 panicles collected from each plot at harvest. Incidence data were subjected to a square-root transformation prior to ANOVA, and multiple comparisons were made using Tukey's test. Severity data were subjected to a Kruskal-Wallis test, and multiple comparisons were performed using a Bonferroni adjustment. Column means followed by the same letter are not significantly different at LSD ($P < 0.05$).

in reducing ergot; however, ergot resistance is likely a complex and quantitatively inherited trait (Gordon et al., 2020). Regardless, the results from this and other studies suggest that flowering period could be an important trait contributing to ergot susceptibility or klendusity in KBG cultivars and that this factor could be exploited by plant breeders and grass seed growers to reduce ergot risk in grass seed crops.

References

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