

Agronomic Comparison of Commercial Cultivars and Blast Resistance

Annual Ryegrass Experimental Lines

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INTRODUCTION

Annual ryegrass is a major cool-season annual forage crop that sustains the livestock industry in the southern USA. **Ryegrass blast**, also known as gray leaf spot, is caused by the fungus *Pyricularia sp.* This is a major disease that can impact annual ryegrass establishment and yields in the southern USA. Blast incidence commonly occurs in the fall during days with cool nights and high humidity during the day. Some symptoms of blast include small water-soaked lesions that enlarge into gray or tan spots with dark margins. In severe cases, lesions merge, leading to leaf blight that progresses into distortion of the leaves, reduced photosynthetic area, and eventual plant death. The dying leaves develop “fishhook” which helps distinguish this disease from *Pythium* blight or brown patch. At present, there are no commercially available blast resistant cultivars in the market and most of the fungicides are not labeled for use in forage production. **The objective of the study was to determine the agronomic characteristics of blast-resistant annual ryegrass lines under field conditions.**

METHODOLOGY

- **Location:** The study was conducted at the Henry H. Leveck Animal Research Farm at Mississippi State University in a Marietta fine sandy loam (Fine-loamy, siliceous, active, thermic Fluvaquenti Eutrudepts) during 2022-2023 (S1, Season 1) and 2023-2024 (S2, Season 2) annual ryegrass growing season (fall-spring).
- **Experimental Design:** Randomized complete block design replicated four times.
- **Cultivars:** Ten ryegrass cultivars which included four commercially available diploids (‘Dipper,’ ‘Gulf,’ ‘Jackson,’ and ‘Marshall’), three tetraploids (‘Nelson,’ ‘TAMTBO,’ and ‘Tetragrande’), and three blast resistance experimental lines with different cycle of selection from the University of Georgia (GALM 1912T, GALM 1919D, and GALM 2220).
- **Establishment:** The study was established on October 21, 2022, and October 28, 2023.
 - Plots were 6 ft x 10 ft and fertilized with 100 lb N ac⁻¹ in split applications using urea ammonium sulfate (33-0-0-18S).
 - All cultivars were drilled using an Almaco Cone Planter (ALMACO, Nevada, Iowa) at a seeding rate of 20 lb PLS ac⁻¹.
 - Both years of the study suffered severe droughts in the fall and extreme cold temperatures during the winter.
- **Data Collection:**
 - Plots were harvested two times in 2023 (February 22 and April 18) and 2024 (April 5 and May 2).
 - Nutritive value was determined in a Foss DS2500 NIR instrument (Foss North America, Eden Prairie, MN) using the 2023 grass hay equation from the NIRS Forage and Feed Testing Consortium (Berea, KY).

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Figure 1. Mean seasonal biomass production of commercially available cultivars and blast resistant annual ryegrass experimental lines.

Table 1. Influence of harvest yield on annual ryegrass production among commercially available cultivars and blast resistant experimental lines.

Cultivar	Harvest Yield (lb DM/acre)			LSD _{0.05}
	First	Second	Mean	
Dipper	1198	3698	2448	1914
GALM 1912T	1579	4229	2904	2183
GALM 1919D	1223	4206	2714	2123
GALM 2220	1569	3973	2771	2107
Gulf	1769	3350	2559	2144
Jackson	1091	4102	2597	1822
Marshall	1416	4102	2759	2154
Nelson	1772	4010	2891	2014
TAMTBO	1404	4126	2765	1937
Tetragrande	1747	3601	2674	1694
LSD _{0.05}	NS	NS	NS	



RESULTS

- ✓ There were significant differences in seasonal biomass production (P<0.0001) with S1 having a 60% greater biomass (6,680 vs. 4,153 lb DM ac⁻¹).
- ✓ No differences in seasonal biomass production were observed between the commercially available cultivars and the experimental lines.
- ✓ There was a cultivar x harvest yield interaction (P = 0.0165). This was mainly driven by higher biomass production during the second harvest in which harvest indexes range from 85 to 275% when compared to the first harvest.
- ✓ There were significant differences in nutritive value for CP, ADF, NDF, IVTDMD, and WSC. The experimental lines were among the highest in CP with Nelson having the lowest values. Experimental lines were intermediate in ADF, NDF, and WSC concentrations when compared to the commercial cultivars.



Table 2. Mean nutritive value of commercially available cultivars and blast resistant annual ryegrass experimental lines.

Cultivar	CP		ADF		NDF		IVTDMD		WSC	
	Value	CD	Value	ABCD	Value	BC	Value	B	Value	ABC
Dipper	14.1	CD	27.9	ABCD	46.5	BC	88.3	B	14.9	ABC
GALM 1912T	15.7	A	27.7	BCD	46.7	BC	88.4	B	13.5	CD
GALM 1919D	15.1	ABC	27.0	CDE	45.3	CD	89.3	AB	14.7	ABC
GALM 2220	15.3	AB	28.0	ABC	48.1	AB	86.9	C	12.6	D
Gulf	15.0	ABC	29.0	A	48.9	A	86.9	C	12.5	D
Jackson	15.7	A	26.7	DE	45.1	CD	89.4	AB	14.6	ABC
Marshall	14.7	ABDC	26.2	A	43.8	D	89.5	AB	15.9	A
Nelson	13.7	D	28.5	AB	46.3	BC	88.7	B	15.0	AB
TAMTBO	14.4	BCD	28.6	AB	46.6	BC	88.8	B	14.0	BCD
Tetragrande	14.8	ABC	27.0	CDE	45.0	CD	90.5	A	15.0	AB
P value	0.0015		0.0002		<0.0001		<0.0001		0.0002	

CONCLUSIONS

- The damage caused by blast to annual ryegrass seedlings in early fall can have severe economic consequences for the livestock industry in the southern USA. Despite the limitations on field environmental conditions to test the level of blast resistance, the experimental cultivars exhibited agronomic production characteristics similar to other commercially available cultivars (diploid and tetraploid).
- Further research under field conditions across different locations needs to continue to determine how these cultivars could respond to the severity of disease incidence to continue the breeding and selection process.