

AMERICAN GINSENG (*Panax quinquefolium*)
Alternaria blight; *Alternaria panax*

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Evaluation of spray programs and various fungicides against Alternaria blight on three-year-old ginseng, 2021.

This study was conducted at a grower cooperator's farm in Marathon County, WI on three-year-old ginseng plants grown under 80% shade-cloth. Plant beds were 4 ft wide with 1 ft between beds. Treatment blocks consisted of a 10-ft bed with a 2-ft buffer on each end. Treatments were replicated four times in a randomized complete block design. Weed control and fertilization were made according to commercial production standards. *Phytophthora cactorum* was controlled with bi-weekly applications of Presidio (4 fl oz/100 gal) or Orondis Ultra (8 fl oz/100 gal). Fungicides were applied with a CO₂ backpack boom sprayer equipped with four TeeJet 8004VS flat fan nozzles, spaced 18 in. apart, operating at 35 psi, and delivering 50 gal/A. All treatments were initiated on 3 Jun. The treatments were reapplied as listed in the table below. The incidence (%) of plants with *A. alternata* lesions was estimated and disease severity (0-10; see below table) was collected on 15, 23, and 29 Jul, and 11 Aug. Data were analyzed using SAS PROC GLIMMIX. The standard error and degrees of freedom correction were predicted using the Kenward-Roger option. The normality assumption of each data set was investigated by observing studentized residuals plots, residuals versus predicted means plots, and percentage of residual distribution histogram. Homogeneity assumption was checked using Levene's test ($P < 0.05$). Least-square means comparisons were performed using Fisher's protected least significant difference (LSD) at ($P < 0.05$).

On the first rating date (15 Jul), disease incidence for all treatments was significantly lower than the untreated control with the exception of Rovral 4F Flowable 1.5 pt + Bravo WeatherStik SC 2 pt alt. Dexter MAX DF 2.1 lb alt. Fontelis SC 16 fl oz + Bravo WeatherStik SC 2 pt alt. Rovral 4F Flowable 1.5 pt + Roper DF Rainshield 2 lb alt. Dexter MAX DF 2.1 lb. For the 23 and 29 Jul rating dates, disease incidence for the untreated control increased to 22% and 32.5%, respectively, which was significantly greater than all other treatments. On the final rating date (11 Aug), disease incidence in the Quadris SC (36.3%) and Azoxy 2SC (35.0%) treated plots were similar to the untreated control whereas all other treatments significantly limited disease. According to the AUDPC data for disease incidence, all treatments were significantly better than the untreated control. Treatments that included Aprovia Top alone or in a program that included combinations and alternations at 10-day intervals were more effective than Quadris SC and Azoxy 2SC. On the first (15 Jul) and last (11 Aug) according to disease severity assessments, all treatments limited disease severity compared to the untreated control except for Quadris SC. For the intermediate assessment dates of 23 and 29 Jul, all treatments limited disease severity compared to the untreated control. For the assessment dates of 23, 29 Jul, and 11 Aug, the treatment program that included Aprovia Top at 10-day application intervals, was significantly more effective than applications of either Azoxy 2SC or Quadris SC. According to the AUDPC data for disease severity, all treatments significantly limited the disease compared to the untreated control. The AUDPC data for disease severity illustrated the high efficacy of Aprovia Top as any treatment that included this fungicide was significantly more effective than either Azoxy 2SC or Quadris SC.

Treatment and rate/50 gal	Application interval; # applications	Disease incidence (%)				
		15 Jul	23 Jul	29 Jul	11 Aug	AUDPC
Untreated control		13.0 a*	22.0 a	32.5 a	50.0 a	857.3 a
Aprovia Top 13.5 fl oz + Roper DF Rainshield 2 lb alt. Switch WDG 14 oz + Bravo WeatherStik SC 2 pt alt. Luna Sensation SC 7.6 fl oz + Roper DF Rainshield 2 lb alt. Fontelis SC 16 fl oz + Bravo WeatherStik SC 2 pt alt. Merivon SC 5.5 fl oz + Roper DF Rainshield 2 lb	10-day; 9 apps	1.5 b	1.8 b	1.8 c	2.3 c	51.1 c
Aprovia Top 13.5 fl oz	21-day; 4 apps	3.0 b	3.0 b	3.5 bc	2.8 c	87.1 c
Aprovia Top 13.5 fl oz + Roper DF Rainshield 2 lb alt. Switch WDG 14 oz + Bravo WeatherStik SC 2 pt alt. Luna Sensation SC 7.6 fl oz + Roper DF Rainshield 2 lb alt. Fontelis SC 16 fl oz + Bravo WeatherStik SC 2 pt	17-day; 5 apps	4.0 b	4.3 b	4.3 bc	11.5 c	165.0 bc
Bravo WeatherStik SC 2 pt	7-day; 13 apps	3.3 b	5.3 b	8.0 bc	17.5 c	243.8 bc
Rovral 4F Flowable 1.5 pt + Bravo WeatherStik SC 2 pt alt. Dexter MAX DF 2.1 lb alt. Fontelis SC 16 fl oz + Bravo WeatherStik SC 2 pt alt. Rovral 4F Flowable 1.5 pt + Roper DF Rainshield 2 lb alt. Dexter MAX DF 2.1 lb	10-day; 9 apps	6.8 ab	8.5 b	9.8 bc	10.8 c	256.6 bc
Echo 720 SC 2 pt	7-day; 13 apps	4.0 b	7.3 b	11.0 bc	18.8 bc	298.8 bc
Quadris SC 15 fl oz	7-day; 13 apps	6.3 b	8.3 b	11.3 bc	36.3 a	432.5 b
Azoxy 2SC 15 fl oz	7-day; 13 apps	4.0 b	8.8 b	13.8 b	35.0 ab	441.8 b
<i>P</i> -values		0.0418	0.0015	0.0001	<.0001	0.0002

*Column means with a letter in common are not statistically different (LSD; $P=0.05$).

Treatment and rate/50 gal.	Application interval; # applications	Disease severity*				
		15 Jul	23 Jul	29 Jul	11 Aug	AUDPC
Untreated control		3.3 a**	4.0 a	4.7 a	6.5 a	130.4 a
Aprovia Top 13.5 fl oz + Roper DF Rainshield 2 lb alt. Switch WDG 14 oz + Bravo WeatherStik SC 2 pt alt. Luna Sensation SC 7.6 fl oz + Roper DF Rainshield 2 lb alt. Fontelis SC 16 fl oz + Bravo WeatherStik SC 2 pt alt. Merivon SC 5.5 fl oz + Roper DF Rainshield 2 lb	10-day; 9 apps	0.8 b	1.0 c	1.0 d	1.0 e	26.9 d
Aprovia Top 13.5 fl oz	21-day; 4 apps	1.3 b	1.5 bc	1.5 cd	1.3 e	39.3 cd
Aprovia Top 13.5 fl oz + Roper DF Rainshield 2 lb alt. Switch WDG 14 oz + Bravo WeatherStik SC 2 pt alt. Luna Sensation SC 7.6 fl oz + Roper DF Rainshield 2 lb alt. Fontelis SC 16 fl oz + Bravo WeatherStik SC 2 pt	17-day; 5 apps	1.5 b	1.5 bc	1.5 cd	2.0 de	45.3 cd
Rovral 4F Flowable 1.5 pt + Bravo WeatherStik SC 2 pt alt. Dexter MAX DF 2.1 lb alt. Fontelis SC 16 fl oz + Bravo WeatherStik SC 2 pt alt. Rovral 4F Flowable 1.5 pt + Roper DF Rainshield 2 lb alt. Dexter MAX DF 2.1 lb	10-day; 9 apps	1.8 b	2.0 bc	2.3 b-d	2.3 de	58.9 b-d
Bravo WeatherStik SC 2 pt	7-day; 13 apps	1.3 b	2.0 bc	2.3 b-d	3.3 cd	63.1 bc
Echo 720 SC 2 pt	7-day; 13 apps	1.3 b	2.0 bc	2.5 bc	3.5 cd	67.1 bc
Azoxy 2SC 15 fl oz	7-day; 13 apps	1.3 b	2.3 b	3.3 b	4.5 bc	82.6 b
Quadris SC 15 fl oz	7-day; 13 apps	2.0 ab	2.3 b	2.8 bc	5.3 ab	86.1 b
<i>P</i> -value		0.0233	0.0037	0.0004	<.0001	0.0002

*Disease severity was rated on a 0-10 scale; 0=no disease, 1-9=increased levels of infection observed, 10=100% plant defoliation.

**Column means with a letter in common are not statistically different (LSD; $P=0.05$).