

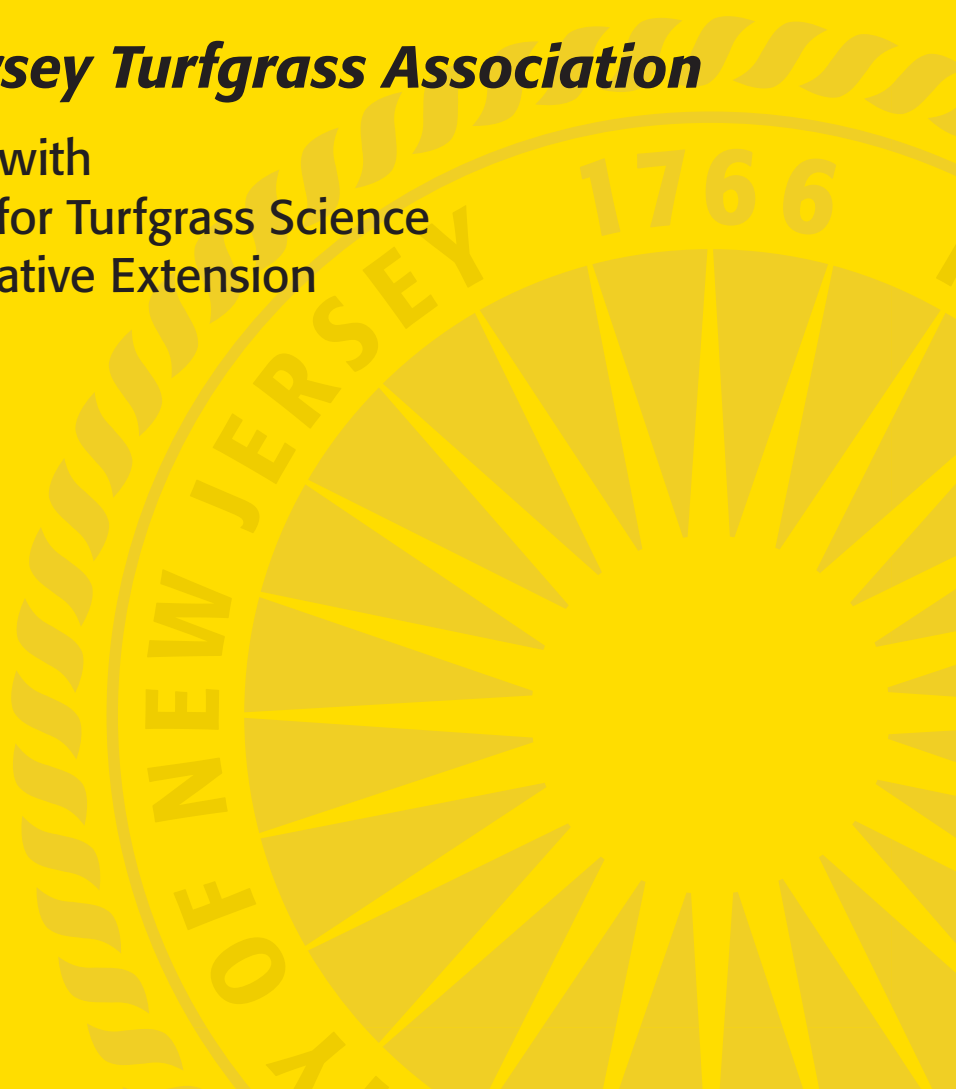
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The New Jersey Turfgrass Association

In Cooperation with
Rutgers Center for Turfgrass Science
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The Rutgers Turfgrass Proceedings is published yearly by the Rutgers Center for Turfgrass Science, Rutgers Cooperative Extension, and the New Jersey Agricultural Experiment Station, School of Environmental and Biological Sciences, Rutgers, The State University of New Jersey in cooperation with the New Jersey Turfgrass Association. The purpose of this document is to provide a forum for the dissemination of information and the exchange of ideas and knowledge. The proceedings provide turfgrass managers, research scientists, extension specialists, and industry personnel with opportunities to communicate with co-workers. Through this forum, these professionals also reach a more general audience, which includes the public.

This publication includes lecture notes of papers presented at the 2006 New Jersey Turfgrass Expo. Publication of these lectures provides a readily avail-

able source of information covering a wide range of topics and includes technical and popular presentations of importance to the turfgrass industry.

This proceedings also includes research papers that contain original research findings and reviews of selected subjects in turfgrass science. These papers are presented primarily to facilitate the timely dissemination of original turfgrass research for use by the turfgrass industry.

Special thanks are given to those who have submitted papers for this proceedings, to the New Jersey Turfgrass Association for financial assistance, and to Barbara Fitzgerald and Marlene Karasik for administrative and secretarial support.

Dr. Ann Brooks Gould, Editor
Dr. Bruce B. Clarke, Coordinator

IMPACT OF CHEMICAL AND BIOLOGICAL FUNGICIDES FOR THE CONTROL OF GRAY LEAF SPOT IN PERENNIAL RYEGRASS

Bruce B. Clarke, Pradip R. Majumdar, Lindsay Jepsen, Mark Peacos, Amy Matlack, Annmarie Scholz, Dennis Fitzgerald, Sam Camuso, John Inguagiato, and Tracy J. Lawson¹

Fungicides were evaluated in 2006 for their ability to control gray leaf spot (caused by *Pyricularia grisea*) at the Rutgers Turf Research Farm in North Brunswick, NJ on perennial ryegrass (*Lolium perenne* cv. Paragon). Turf was established 8 August 2006 with 5.5 lb seed/1000 ft² on a Norton loam with a pH of 5.8. The pre-emergence herbicide Tupersan 4.7G (2.5 lb/1000 ft²) was applied at seeding to suppress weed ingress. Mowing was performed weekly at a height of 3 inches with clippings returned. The site was irrigated as needed to prevent drought stress and to encourage disease. Fertilizer was applied as 16-4-8 at establishment on 8 August (0.7 lb nitrogen (N)/1000 ft²) and on 15 August (0.6 lb N /1000 ft²). Subdue 0.97G (28.8 oz/1000 ft²), Banol 6L (1.3 fl oz/1000 ft²), and Chipco Signature 80WG (4.0 oz/1000 ft²) were applied to the entire test area on 8, 17, and 29 August, respectively, to suppress Pythium blight. Plots were 3 x 5 ft and were arranged in a randomized complete block with four replications. The test site was artificially inoculated with *P. grisea* on 6 September with a very low concentration of conidia (8 x 10³ conidia/ml) in 2 gal water/1000 ft² to supplement natural infection.

Fungicides were applied in water equivalent to 2 gal/1000 ft² with a CO₂ powered sprayer at 30 psi using TeeJet 8003VS flat fan nozzles. Treatments (trt) were initiated on 22 August when environmental conditions were conducive to gray leaf spot development. Fungicides were reapplied as indicated in Table 1. Turf was visually evaluated for percent turf area infested with *P. grisea* on 13 and 22 September, 4, 16, and 26 October, and 10 November. Data were subjected to analysis of variance and means were separated using the Waller-Duncan *k*-ratio *t*-test (*k* = 100).

Gray leaf spot developed on 1 September and became uniformly distributed throughout the green by 13 September. Disease severity peaked on September 22 (90% turfgrass area infested on non-fungicide treated turf). Due to the rapid development and extreme severity of this epidemic, only Heritage TL 0.8ME + Daconil Weather Stik 6F (trt 4), EXC 990 SC (trt 6), Concert 4.3SE (trt 9), Tebuconazole 45W (trt 31), 3336 4F (trt 43), Program #1 (trt 47), RU21196A-06 (trt 50), and RU21196E-06 (trt 53) provided adequate control of gray leaf spot throughout the study. Heritage TL 0.8ME + Daconil Weather Stik 6F (trt 5), V-10116 50WDG (trt 13), and RU21196E-06 (trt 51) also afforded excellent protection during the application period (22 August to 31 October).

With respect to the QoI fungicides, it is interesting to note that azoxystrobin (Heritage TL 0.8ME @ 1.0 fl oz every 14 days; trt 1) provided good to excellent control on most rating dates, whereas Heritage 50WG @ 0.4 oz every 14 days (trt 38) or fluoxastrobin (Disarm 480SC @ 0.18 and 0.36 fl oz every 14 days; trts 17 and 18) were relatively ineffective throughout the trial. Similarly, there was a range in activity for the DMI fungicides, with propiconazole (Banner MAXX 1.3ME @ 1.0 fl oz every 14 days (trt 26) affording little protection from gray leaf spot and Tebuconazole 45W and V-10116 50WDG (an experimental DMI fungicide currently called Tournay 50 WDG) providing excellent control at the highest product rates tested (trts 13 and 31, respectively). No phytotoxicity was observed for any of the products tested.

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Table 1. Impact of chemical and biological fungicides for the control of gray leaf spot in perennial ryegrass: New Brunswick, NJ, 2006.

Treatment	Rate (per 1000 sq ft)	Spray Interval (days) ²	Turf Area Infested (%) per Plot ¹						
			13 Sept.	22 Sept.	4 Oct.	16 Oct.	26 Oct.	10 Nov.	
1 Heritage TL 0.8ME	1.0 fl oz	14	0.0 a	2.5 a	18.5 d-g	5.0 ab	7.5 a-d	8.8 a-e	
2 Daconil Weather Stik 6F	2.0 fl oz	14	6.3 a-d	3.8 ab	26.0 f-i	14.3 b-g	8.8 a-e	12.5 a-h	
3 Daconil Weather Stik 6F	3.6 fl oz	14	1.3 ab	0.5 a	16.0 c-f	8.8 a-d	10.0 a-f	18.8 c-j	
4 Heritage TL 0.8ME	1.0 fl oz	14	0.0 a	0.0 a	6.3 a-d	3.8 ab	10.0 a-f	8.8 a-e	
+ Daconil Weather Stik 6F	2.0 fl oz	14	0.0 a	0.0 a	6.3 a-d	3.8 ab	10.0 a-f	8.8 a-e	
5 Heritage TL 0.8ME	1.0 fl oz	14	0.0 a	0.0 a	3.0 a-c	2.5 ab	7.5 a-f	16.3 b-j	
+ Daconil Weather Stik 6F	3.6 fl oz	14	0.0 a	0.0 a	3.0 a-c	3.8 ab	3.8 ab	2.5 ab	
6 EXC 990 SC	4.0 fl oz	14	0.0 a	0.0 a	6.5 a-d	5.0 ab	11.3 a-g	8.8 a-e	
7 EXC 991 SC	2.5 fl oz	14	0.0 a	0.0 a	22.0 e-h	7.0 ab	8.8 a-e	5.0 a-c	
8 Concert 4.3SE	3.0 fl oz	14	3.8 a-d	2.5 a	4.5 a-c	0.0 a	6.3 a-c	6.3 a-d	
9 Concert 4.3SE	5.4 fl oz	14	0.0 a	0.0 a	70.8 t-w	31.3 i-q	26.3 h-q	18.8 c-j	
10 Insignia 20WG	0.9 oz	28	7.5 a-e	31.3 j-p					
11 Insignia 20WG	0.9 oz	28	0.0 a	2.5 a	22.8 e-h	10.0 a-e	22.5 e-p	6.3 a-d	
+ Manicure 82.5WDG	3.2 oz	14	7.5 a-e	15.0 b-g	23.3 e-h	13.5 b-g	8.8 a-e	5.0 a-c	
12 V-10116 50WDG	0.18 oz	14	5.0 a-d	6.3 a-c	4.8 a-c	5.0 ab	6.3 a-c	18.8 c-j	
13 V-10116 50WDG	0.37 oz	14	16.3 e-g	40.0 o-s	68.0 f-w	35.0 l-q	18.8 c-m	10.0 a-f	
14 V-10190 2.5FL	0.26 fl oz	14	12.5 c-g	50.0 rs	70.0 s-w	31.3 i-q	18.8 c-m	12.5 a-h	
15 V-10190 2.5FL	0.52 fl oz	14	16.3 e-g	72.5 vw	75.3 v-x	36.3 m-q	20.0 c-n	10.0 a-f	
16 V-10190 2.5FL	0.78 fl oz	14	18.8 fg	63.8 uv	76.8 wx	41.3 q	22.5 e-p	18.8 c-j	
17 Disarm 480SC	0.18 fl oz	14	12.5 c-g	61.3 tu	74.8 v-x	37.5 n-q	13.8 a-i	12.5 a-h	
18 Disarm 480SC	0.36 fl oz	14	1.3 ab	18.8 d-i	22.0 e-h	11.3 a-f	3.8 ab	6.3 a-d	
19 Disarm 480SC	0.18 fl oz	14	0.0 a	2.5 a	29.8 g-j	13.8 b-g	3.8 ab	10.0 a-f	
+ Banner MAXX 1.3ME	1.0 fl oz	14	5.0 a-d	27.5 h-n	57.0 o-s	32.5 j-q	21.3 d-o	20.0 d-k	
20 Disarm 480SC	0.18 fl oz	14	1.3 ab	6.3 a-c	25.3 f-i	13.8 b-g	12.5 a-h	7.5 a-e	
+ Daconil Ultrex 82.5WDG	1.8 oz	14	0.0 a	2.5 a	29.8 g-j	13.8 b-g	3.8 ab	10.0 a-f	
21 Disarm 480SC	0.18 fl oz	14	5.0 a-d	27.5 h-n	57.0 o-s	32.5 j-q	21.3 d-o	20.0 d-k	
+ Endorse 2.5W	2.0 oz	14	1.3 ab	6.3 a-c	25.3 f-i	13.8 b-g	12.5 a-h	7.5 a-e	
22 Disarm 480SC	0.18 fl oz	14	1.3 ab	6.3 a-c	25.3 f-i	13.8 b-g	12.5 a-h	7.5 a-e	
+ Banner MAXX 1.3ME	1.0 fl oz	14	1.3 ab	6.3 a-c	25.3 f-i	13.8 b-g	12.5 a-h	7.5 a-e	
+ TM-90109	4.0 fl oz	14	1.3 ab	6.3 a-c	25.3 f-i	13.8 b-g	12.5 a-h	7.5 a-e	

(Continued)

Table 1 (continued).

Treatment	Rate (per 1000 sq ft)	Spray Interval (days) ²	Turf Area Infested (%) per Plot ¹					
			13 Sept.	22 Sept.	4 Oct.	16 Oct.	26 Oct.	10 Nov.
23 Disarm 480SC	0.18 fl oz	Alt ³	3.8 a-d	26.3 g-m	51.5 n-q	41.3 q	23.8 f-q	7.5 a-e
/Banner MAXX 1.3ME	1.0 fl oz	14	0.0 a	1.3 a	41.3 j-n	31.3 i-q	31.3 l-t	30.0 j-o
24 Daconil Ultrex 82.5WDG	1.8 oz	14	0.0 a	0.0 a	14.8 b-f	8.8 a-d	10.0 a-f	18.8 c-j
25 Daconil Ultrex 82.5WDG	3.2 oz	14	5.0 a-d	32.5 k-p	48.5 l-p	28.8 h-p	37.5 q-v	20.0 d-k
26 Banner MAXX 1.3ME	1.0 fl oz	14	10.0 a-f	37.5 m-q	52.8 n-q	27.5 h-o	22.5 e-p	16.3 b-j
27 Endorse 2.5W	2.0 oz	14	0.0 a	3.8 ab	4.5 a-c	7.5 a-c	18.8 c-m	21.3 e-l
28 Disarm 480SC	0.2 fl oz	14	3.8 a-d	16.3 c-h	25.0 f-i	20.0 d-i	27.5 i-r	20.0 d-k
+ Tebuconazole 45W	0.28 oz	14	5.0 a-d	7.5 a-d	6.5 a-d	5.0 ab	18.8 c-m	17.5 c-j
29 Disarm 480SC	0.2 fl oz	14	0.0 a	6.3 a-c	0.5 a	1.3 a	7.5 a-d	2.5 ab
/Tebuconazole 45W	0.28 oz	14	12.5 c-g	36.3 l-q	52.8 n-q	40.0 p-q	36.3 p-v	26.3 h-n
30 Tebuconazole 45W	0.28 oz	14	6.3 a-d	21.3 f-k	37.5 l-l	31.3 i-q	30.0 k-t	18.8 c-j
31 Tebuconazole 45W	0.6 oz	14	2.5 a-c	7.5 a-d	10.3 a-e	10.0 a-e	21.3 d-o	15.0 b-i
32 CL-EXP-4 W	1.0 oz	21	0.0 a	0.0 a	0.0 a	2.5 ab	12.5 a-h	15.0 b-i
33 CL-EXP-4 W	2.0 oz	21	8.8 a-e	27.5 h-n	45.3 k-o	20.0 d-i	22.5 e-p	10.0 a-f
34 CL-EXP-9	0.6 oz	14	0.0 a	1.3 a	6.5 a-d	6.3 ab	16.3 a-k	11.3 a-g
35 CL-EXP-9	1.2 oz	14	5.0 a-d	21.3 f-k	56.0 o-r	37.5 n-q	28.8 j-s	17.5 c-j
36 Endorse 2.5W	4.0 oz	14	1.3 ab	12.5 a-f	31.5 g-j	23.8 g-l	15.0 a-j	0.0 a
37 Headway 1.39EC	2.25 fl oz	28	11.3 b-g	25.0 g-l	49.3 l-p	26.8 h-n	25.0 g-q	15.0 b-i
38 Heritage 50WG	0.4 oz	14	6.3 a-d	15.0 b-g	38.0 i-m	28.8 h-p	17.5 b-l	5.0 a-c
39 Heritage 50WG	0.4 oz	14	7.5 a-e	16.3 c-h	31.8 g-j	20.0 d-i	20.0 c-n	2.5 ab
40 NF-166 48WDG	0.25 oz	14	0.0 a	0.0 a	0.5 a	1.3 a	6.3 a-c	7.5 a-e
41 NF-166 48WDG	0.5 oz	14	10.0 a-f	16.3 c-h	46.5 l-o	38.8 o-q	31.3 l-t	15.0 b-i
42 NF-166 48WDG	1.0 oz	14	20.0 g	45.0 q-s	73.3 u-w	36.3 m-q	37.5 q-v	17.5 c-j
43 3336 4F	4.0 fl oz	14	20.0 g	42.5 p-s	63.3 q-v	35.0 l-q	36.3 p-v	17.5 c-j
44 Chipco 26GT 2SC	4.0 fl oz	14 ⁴	0.0 a	0.0 a	0.0 a	0.0 a	2.5 a	0.0 a
45 ProStar 70W	2.2 oz	21	6.3 a-d	10.0 a-f	54.0 n-q	32.5 j-q	30.0 k-t	11.3 a-g
46 Chipco Signature 80WG	4.0 oz	14	2.5 a-c	2.5 a	1.3 ab	0.0 a	25.0 g-q	16.3 b-j
47 Program #1	—	14						
48 Heritage 50W	0.3 oz	21						
49 RU21196A-06	0.53 fl oz	14						

(Continued)

Table 1 (continued).

Treatment	Rate (per 1000 sq ft)	Spray Interval (days) ²	Turf Area Infested (%) per Plot ¹					
			13 Sept.	22 Sept.	4 Oct.	16 Oct.	26 Oct.	10 Nov.
50 RU21196A-06	0.88 fl oz	14	0.0 a	0.0 a	0.0 a	0.0 a	3.8 ab	6.3 a-d
51 RU21196E-06	0.88 fl oz	14	0.0 a	0.0 a	0.3 a	1.3 a	8.8 a-e	20.0 d-k
52 RU21196E-06	1.32 fl oz	14	0.0 a	1.3 a	0.5 a	0.0 a	11.3 a-g	17.5 c-j
53 RU21196E-06	1.76 fl oz	14	0.0 a	0.0 a	1.0 a	0.0 a	7.5 a-d	7.5 a-e
54 RU21196C-06	0.55 oz	14	13.8 d-g	37.5 m-q	79.8 wx	33.8 k-q	47.5 u-w	32.5 k-o
55 RU21196C-06	0.83 oz	14	13.8 d-g	63.8 uv	87.0 x	40.0 pq	57.5 w-x	35.0 m-o
56 RU21196C-06	1.1 oz	14	5.0 a-d	41.3 p-s	68.3 f-w	30.0 h-q	50.0 v-w	37.5 no
57 PEX60021 4.25F	4.0 fl oz	14	0.0 a	7.5 a-d	30.8 gj	25.0 g-m	33.8 n-u	25.0 g-n
58 PEX60021 4.25F	8.0 fl oz	14	0.0 a	1.3 a	3.0 a-c	6.3 ab	25.0 g-q	28.8 i-n
59 RU16520	29.4 fl oz	14	8.8 a-e	38.8 n-r	58.3 o-t	23.8 g-l	33.8 n-u	21.3 e-l
60 RU16520	29.4 fl oz	14 ⁵	5.0 a-d	20.0 e-j	41.0 j-n	21.3 e-j	36.3 p-v	26.3 h-n
61 RU16520	22.0 fl oz	14 ⁵	10.0 a-f	25.0 g-l	51.8 n-q	22.5 f-k	41.3 r-v	25.0 g-n
62 RU16520	14.7 fl oz	14	11.3 b-g	21.3 f-k	41.3 j-n	32.5 j-q	42.5 s-v	28.8 i-n
63 RU16520	14.7 fl oz	14 ⁵	7.5 a-e	16.3 c-h	33.0 h-k	20.0 d-i	32.5 m-t	13.8 a-h
64 Daconil Ultrex 82.5WDG	3.2 oz	14	1.3 ab	0.0 a	19.3 d-g	11.3 a-f	18.8 c-m	28.8 i-n
65 Program #2	—	14 ⁶	11.3 b-g	38.8 n-r	62.0 p-v	33.8 k-q	36.3 p-v	26.3 h-n
66 Program #3	—	14 ^{5,7}	6.3 a-d	28.8 i-o	61.3 p-u	30.0 h-q	47.5 u-w	33.8 l-o
67 Program #4	—	14 ⁸	8.8 a-e	15.0 b-g	51.3 m-q	28.8 h-p	47.5 u-w	32.5 k-o
68 Program #5	—	14 ^{5,9}	8.8 a-e	21.3 f-k	37.0 i-l	18.8 c-h	30.0 k-t	16.3 b-j
69 Program #6	—	14 ¹⁰	10.0 a-f	17.5 c-i	42.0 j-n	23.8 g-l	31.3 l-t	17.5 c-j
70 Program #7	—	14 ^{5,11}	6.3 a-d	16.3 c-h	21.0 e-h	20.0 d-i	43.8 t-v	26.3 h-n
71 BASF Program	—	14 ¹²	2.5 a-c	8.8 a-e	16.0 c-f	11.3 a-f	35.0 o-u	23.8 f-m
72 Untreated Check	—	—	41.3 h	90.0 x	81.0 wx	38.0 n-q	65.0 x	42.5 o

INT ¹³	DAT ¹⁴	DAT	DAT	DAT	DAT
14	8	3	1	1	10
21	22	10	1	13	17
28	22	3	15	1	24

(Continued)

Table 1 (continued).

- ¹ Values are means of four replicates. Means followed by the same letter are not significantly different according to Waller-Duncan k-ratio t-test ($k=100$).
- ² Fungicides were applied on 22 August (all treatments), 5 September (14-day treatment), 12 September (21-day treatment), 19 September (14- and 28-day treatments), 3 October (14- and 21-day treatments), 17 October (14- and 28- day treatments), 24 October (21-day treatment), and 31 October (14-day treatment). Plots were inoculated on 6 September with a very low concentration (8,000 conidia per ml) of *Pyricularia grisea* conidia to supplement natural infection at the test site.
- ³ Alternation of fungicides on a 14-day schedule, where treatment 23 received Disarm 480SC (0.18 fl oz) on 22 August, 19 September, and 17 October and Banner MAXX 1.3ME (1.0 fl oz) on 5 September, 3 October, and 31 October. Treatment 29 received Disarm 480SC (0.2 fl oz) on 22 August, 19 September, and 17 October and Tebuconazole 45W (0.28 oz) on 5 September, 3 October, and 31 October.
- ⁴ Program #1, where treatment 47 consisted of Heritage TL 0.8ME (2.0 fl oz) + Daconil Ultrex 82.5WDG (3.2 oz) on 22 August, 3336 4F (6.0 fl oz) + Daconil Ultrex 82.5WDG (3.2 oz) on 12 September, and Heritage TL 0.8ME (1.0 fl oz) + 3336 4F (4.0 fl oz) on 3 October.
- ⁵ Treatments 60, 61, 63, 66, 68, and 70 were irrigated with 0.5 gal of water per 3 x 5 ft plot immediately after fungicide application.
- ⁶ Program #2, where treatment 65 consisted of RU16520 (7.3 fl oz) on 22 August, RU16520 (14.7 fl oz) on 5 September, RU16520 (22.0 fl oz) on 19 September, RU16520 (29.4 fl oz) on 3 October, RU16520 (29.4 fl oz) on 17 October, and RU16520 (29.4 fl oz) on 31 October.
- ⁷ Program #3, where treatment 66 consisted of RU16520 (7.3 fl oz) on 22 August, RU16520 (14.7 fl oz) on 5 September, RU16520 (22.0 fl oz) on 19 September, RU16520 (29.4 fl oz) on 3 October, RU16520 (29.4 fl oz) on 17 October, and RU16520 (29.4 fl oz) on 31 October.
- ⁸ Program #4, where treatment 67 consisted of RU16520 (7.3 fl oz) on 22 August, RU16520 (14.7 fl oz) on 5 September, RU16520 (22.0 fl oz) on 19 September, RU16520 (22.0 fl oz) on 3 October, RU16520 (22.0 fl oz) on 17 October, and RU16520 (22.0 fl oz) on 31 October.
- ⁹ Program #5, where treatment 68 consisted of RU16520 (7.3 fl oz) on 22 August, RU16520 (14.7 fl oz) on 5 September, RU16520 (22.0 fl oz) on 19 September, RU16520 (22.0 fl oz) on 3 October, RU16520 (22.0 fl oz) on 17 October, and RU16520 (22.0 fl oz) on 31 October.
- ¹⁰ Program #6, where treatment 69 consisted of RU16520 (7.3 fl oz) on 22 August, RU16520 (14.7 fl oz) on 5 September, RU16520 (14.7 fl oz) on 19 September, RU16520 (14.7 fl oz) on 3 October, RU16520 (14.7 fl oz) on 17 October, and RU16520 (14.7 fl oz) on 31 October.
- ¹¹ Program #7, where treatment 70 consisted of RU16520 (7.3 fl oz) on 22 August, RU16520 (14.7 fl oz) on 5 September, RU16520 (14.7 fl oz) on 19 September, RU16520 (14.7 fl oz) on 3 October, RU16520 (14.7 fl oz) on 17 October, and RU16520 (14.7 fl oz) on 31 October.
- ¹² BASF Program, where treatment 71 consisted of Insignia 20WG (0.9 oz) on 22 August, Propiconazole Pro 1.3ME (1.0 fl oz) + Iprodione Pro 2SC (4.0 fl oz) on 5 September, Insignia 20WG (0.5 oz) + Emerald 70WG (0.18 oz) on 19 September, Insignia 20WG (0.5 oz) + Curflan 50DF (1.0 oz) on 3 October, Propiconazole Pro 1.3ME (1.0 fl oz) + Insignia 20WG (0.5 oz) on 17 October, and Insignia 20WG (0.9 oz) on 31 October.
- ¹³ Spray intervals in days.
- ¹⁴ Days after the last treatment.



Cooperating Agencies: Rutgers, The State University of New Jersey, U.S. Department of Agriculture, and County Boards of Chosen Freeholders. Rutgers Cooperative Extension, a unit of the Rutgers New Jersey Agricultural Experiment Station, is an equal opportunity program provider and employer.