

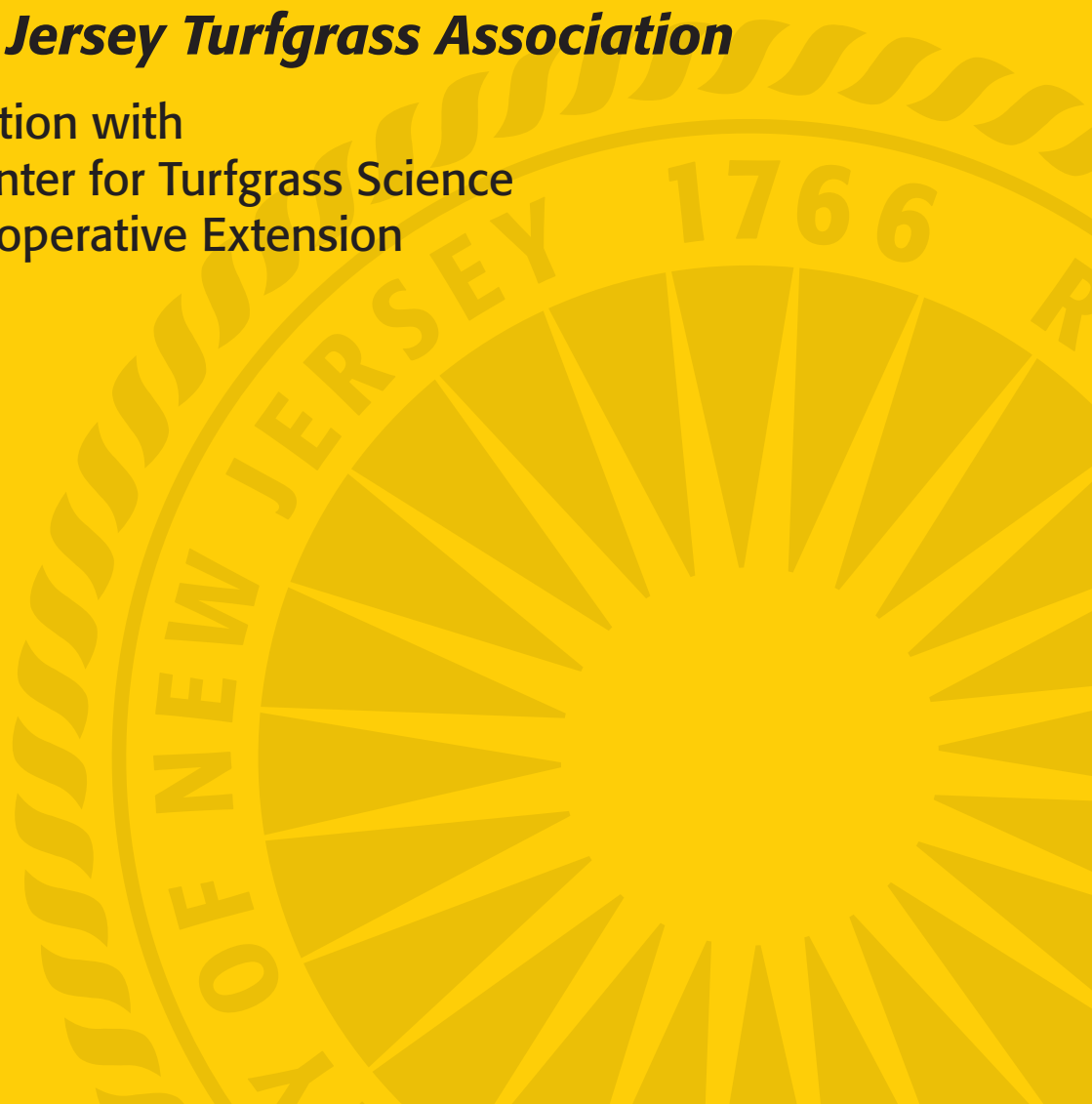
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The Rutgers Turfgrass Proceedings is published yearly by the Rutgers Center for Turfgrass Science, Rutgers Cooperative Extension, and the New Jersey Agricultural Experiment Station, School of Environmental and Biological Sciences, Rutgers, The State 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 2011 GREEN EXPO Turf and Landscape Conference. Publication of these lectures provides a readily available 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.

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

MANAGEMENT OF SUMMER PATCH ON KENTUCKY BLUEGRASS TURF WITH SELECTED FUNGICIDES AND BIORATIONAL PRODUCTS, 2011

Bruce B. Clarke, Pradip R. Majumdar, Andra Pitonak, Samantha Flatley, Stephanie Alea, Connor Estler, Mark Peacos, Tracy J. Lawson, Charles Schmid, James Hempfling, Katherine Clarke, Ruying Wang, William K. Dickson, and Joseph B. Clark¹

Fungicides were evaluated in 2011 for their ability to control summer patch (caused by *Magnaporthe poae*) on Kentucky bluegrass (*Poa pratensis* cv. Baron) at the Rutgers Turf Research Farm in North Brunswick, NJ. Turf was established in September 2002 on a Norton loam soil with a pH of 6.7. Mowing was performed two times weekly at a height of 1.5 inches with clippings returned. The site was irrigated as needed to prevent drought stress and to encourage disease. Turf was inoculated on 15 May 2004 by removing 3-inch diameter x 3-inch deep circular sod cores with a cup cutter, placing 25 cc of oat grains infested with *M. poae* isolate OAK A-5 into each hole, replacing the cores, and irrigating the site to encourage rooting. Three inoculations (1.5 ft apart) were made per plot. Plots were 3 x 9 ft and treatments were arranged in a randomized complete block with four replications.

Fertilizer was applied as 15.5-0-0 (0.60 lb nitrogen (N) per 1000 ft²) on 10 May and 16-4-8 (0.67 lb N per 1000 ft²) on 26 June and 7 November. Dimension 2EW (10.7 fl oz per A) was sprayed on 18 April and 10 June for pre-emergence weed control. Broadleaf weeds were controlled with Trimec Classic 1.3L (1.5 fl oz per 1000 ft²) and Drive 75DF (1 lb per A) on 18 April and 13 September. Insect pests were suppressed with Merit 75WSP (0.17 oz per 1000 ft²) on 16 June. Yellow nutsedge was controlled with Manage 75WG (1.0 oz per A) on 19 June. Daconil Ultrex 82.5WDG (13.6 lb per A) was applied to the entire test area on 6 May to control dollar spot (caused by *Sclerotinia homoeocarpa*).

Fungicides were applied in water equivalent to 4 gal per 1000 ft² with a CO₂ powered sprayer at 30 psi using TeeJet 8003VS flat fan nozzles. Treatments (trt) were initiated on 27 May when the maximum soil

temperature at a 2-inch depth exceeded 65°F for five consecutive days. Fungicides were reapplied at the appropriate intervals as indicated in Tables 1A to 1C. Turf area exhibiting foliar symptoms of summer patch was assessed as a disease severity index (DSI) on 20 and 29 July, 11 and 22 August, and 2, 12, and 22 September. The DSI was calculated by multiplying the patch diameter of each infection center by the disease intensity of that patch. Disease intensity was assessed on a 0 to 3 scale, where 0 = no visual foliar necrosis, 1 = 1 to 33% necrotic foliage, 2 = 34 to 66% necrotic foliage, and 3 = 67 to 100% necrotic foliage within each patch. Patch diameter was recorded as the mean of two perpendicular measurements per infection center. Disease severity values were averaged for each plot. Turf quality was rated on 24 June, 22 July, 19 August, and 16 September using a 1 to 9 scale, where 9 = best turf quality and 5 = acceptable quality. Color of foliage was visually estimated on 30 June, 22 July, 19 August, and 16 September using a 1 to 5 scale, where 1 = very chlorotic turf, 2 = slight reduction in green color, 3 = normal green color of healthy turf, 4 = slight dark green color, and 5 = very dark green color. Phytotoxicity was determined on 22 June using a 1 to 5 scale, where 1 = no foliar discoloration, 2 = slight chlorosis or necrosis, 3 = moderate chlorosis or necrosis, 4 = severe chlorosis or necrosis, and 5 = all turf dead. Data were subjected to analysis of variance and means were separated by Waller-Duncan *k*-ratio *t*-test (*k* = 100).

Summer patch symptoms were first noticed on 9 July but did not become uniformly distributed throughout the study area until 20 July (Table 1A). The epidemic peaked at a DSI of 77 for untreated turf (trt 47) on 12 September, which was considered a severe summer patch infestation. A DSI of less than 15 was considered an acceptable level of disease control.

¹Extension Specialist in Turfgrass Pathology, Senior Laboratory Technician, Research Assistant, Research Assistant, Research Assistant, Research Assistant, Senior Greenhouse and Field Technician, Research Farm Supervisor I, Graduate Assistant, Graduate Assistant, Research Assistant, Graduate Assistant, Turfgrass Research Farm Supervisor, and Principal Laboratory Technician, respectively, New Jersey Agricultural Experiment Station, School of Environmental and Biological Sciences, Rutgers, The State University of New Jersey, New Brunswick, NJ 08901-8520.

The following products in this study, most of which contain a DMI and/or a QoI fungicide, provided good to excellent disease control throughout the evaluation period (27 May to 22 September; Tables 1A and 1B): Pillar 03F 0.81G (trts 2, 3), Heritage 0.31G (trts 4, 5), RU 21196-11A @ 0.472 fl oz (trt 9), RU 21196-11E (trt 10), RU 21196-11C (trt 11), SP8010-DEC LC + Banner Maxx 1.3ME (trt 17), Heritage 50WG (trt 25), FPS-2011 5ALC @ 6.2 fl oz + FPS-2011 5B LC @ 4.0 oz (trt 31), FPS-2011 5A LC @ 6.2 fl oz + FPS-2011 5B LC @ 6.0 oz (trt 32), Torque 3.6SC (trts 34, 35), RU 192514-11L + RU 192514-11ZB (trt 38), and the Quali-Pro 2011 SP Program #4 (trt 45). Other treatments provided good control throughout most of the study except for one or two evaluation dates when the level of disease was slightly above the acceptable disease threshold of 15 DSI [i.e., Honor 28WG (trt 12), Insignia 2.1 SC + Trinity 1.67SC (trt 13), Velista 50WDG + Heritage 50WG (trt 27), FPS-2011 5ALC @ 3.1 fl oz + FPS-2011 5B LC @ 6.0 oz (trt 30), Torque 3.6SC + 3336 4F (trt 36), QP Tebuconazole 3.6F + Foursome 100 SL (trt 41), and Banner MAXX 1.3ME (trt 46)].

Turf quality was acceptable (greater or equal to 5.0) for most entries in this study. In general, turf treated with products that provided poor summer

patch control, such as NB37904 20 SC (trt 21), Segway 3.3SC (trt 22), IKF-205 28WP (trt 24), Velista 50WDG + Daconil Ultrex 82.5WDG (trt 26), Velista 50WDG (trt 29), CX-42 1.73SC (trt 33), RU 192514-11ZE SC + RU 192514-11ZB (trt 37), and 16-2-7 25% SRN LC @ 9 fl oz + Manganese 5% LC @ 3 fl oz + FloThru 2403 LC @ 3 fl oz (trt 40), exhibited poor turf quality on at least half of the evaluation dates (Table 1B).

Several treatments resulted in visually darker green foliage (greater or equal to a color rating of 4) on at least 50% of the evaluation dates [i.e., RU 192514-11ZE SC + RU 192514-11ZB (trt 37), RU 192514-11L + RU 192514-11ZB (trt 38), and the Quali-Pro 2011 SP Programs #1 to 4 (trts 42 to 45)], presumably because they contained either a pigment and/or a plant growth regulator (Table 1C).

Slight foliar necrosis was observed on turf treated with RU 192514-11L + RU 192514-11ZB (trt 38) on 22 June, but the injury was temporary and the turf recovered within 10 days (Table 1C). No other phytotoxicity was observed in this study.

Table 1A. Management of summer patch on Kentucky bluegrass turf with selected fungicides and biorational products: Rutgers University, 2011.

Treatment	Rate per 1000 sq ft	Application Schedule (days) ³	Disease Severity Index ^{1,2}					
			20 July	29 July	11 Aug.	22 Aug.	2 Sept.	12 Sept.
1 Pillar 00F 0.81G.....	48.0 oz	28 ⁴	9.8 bc	12.2 c-e	23.4 a-c	26.3 d-l	9.8 i-n	16.3 g-p
2 Pillar 03F 0.81G.....	48.0 oz	28 ⁴	6.7 bc	6.1 c-e	13.4 bc	10.8 e-l	4.9 l-n	2.8 m-p
3 Pillar 03F 0.81G.....	48.0 oz	14 ⁴	3.3 bc	1.5 e	2.3 c	2.8 i-l	1.3 n	0.0 p
4 Heritage 0.31G.....	48.0 oz	28 ⁴	2.7 bc	3.2 de	5.8 c	2.2 kl	3.3 mn	0.0 p
5 Heritage 0.31G.....	48.0 oz	14 ⁴	1.8 bc	2.2 e	0.8 c	0.0 l	0.0 n	0.0 p
6 RU 21196-11B.....	0.21 fl oz	28	1.3 bc	13.4 c-e	30.1 a-c	32.8 c-i	29.0 d-l	29.3 d-j
7 RU 21196-11B.....	0.262 fl oz	28	0.8 c	9.3 c-e	23.9 a-c	31.0 c-k	25.3 e-n	17.7 f-p
8 RU 21196-11A.....	0.34 fl oz	28	5.3 bc	10.4 c-e	17.9 a-c	17.9 d-l	19.4 f-n	12.3 j-p
9 RU 21196-11A.....	0.472 fl oz	28	0.0 c	1.3 e	12.9 bc	5.3 h-l	9.6 i-n	1.8 op
10 RU 21196-11E.....	1.1 oz	28	7.7 bc	4.8 c-e	11.1 bc	6.0 g-l	0.0 n	2.1 n-p
11 RU 21196-11C.....	2.0 fl oz	28	2.4 bc	5.4 c-e	15.8 a-c	13.3 e-l	0.0 n	0.0 p
12 Honor 28WG.....	1.1 oz	28	12.0 a-c	14.7 c-e	20.3 a-c	14.6 d-l	9.9 i-n	2.0 n-p
13 Insignia 2.1 SC.....	0.54 fl oz	—						
+ Trinity 1.67SC.....	1.0 fl oz	28	12.1 a-c	15.4 c-e	25.3 a-c	13.0 e-l	12.0 i-n	0.0 p
14 Reserve 4.8SC.....	2.8 fl oz	28	21.0 ab	43.9 ab	73.3 a	44.7 b-d	44.3 c-f	33.0 d-g
15 Tartan 2.4SC.....	2.0 fl oz	—						
/Triton Flo 3.1SC.....	0.6 fl oz	28-ALT ⁵	5.0 bc	16.4 c-e	31.8 a-c	31.6 c-k	37.9 d-h	31.1 d-h
16 Triton Flo 3.1SC.....	0.6 fl oz	28	3.6 bc	12.0 c-e	35.8 a-c	33.7 c-h	55.1 a-c	42.8 cd
17 SP8010-DEC LC.....	1.44 fl oz	—						
+ Banner Maxx 1.3ME.....	2.0 fl oz	14 ⁶	5.4 bc	3.1 e	11.8 bc	12.8 e-l	3.8 l-n	2.9 l-p
18 SP8010-DEC LC.....	2.88 fl oz	14	9.1 bc	21.6 b-e	39.0 a-c	38.0 c-f	30.9 d-k	30.3 d-j
19 SP8010-DEC LC.....	5.76 fl oz	14	6.8 bc	14.0 c-e	28.0 a-c	32.5 c-j	27.3 e-m	22.8 e-k
20 NB37904 20 SC.....	0.75 fl oz	28 ⁷	12.0 a-c	17.2 b-e	32.3 a-c	27.7 d-l	21.6 f-n	14.0 h-p
21 NB37904 20 SC.....	1.1 fl oz	28 ⁷	9.4 bc	19.3 b-e	19.1 a-c	34.8 c-h	41.3 c-g	35.7 c-f
22 Segway 3.3SC.....	0.55 fl oz	28	27.8 ab	31.0 bc	31.0 a-c	73.0 ab	54.3 a-d	71.8 ab
23 Endorse 2.5WP.....	4.0 oz	28	0.0 c	12.7 c-e	20.4 a-c	28.5 d-l	34.9 d-i	32.9 d-g
24 IKF-205 28WP.....	1.1 oz	28	14.7 a-c	23.8 b-e	45.0 a-c	40.7 c-e	35.0 d-i	20.8 e-m
25 Heritage 50WG.....	0.4 oz	28	3.3 bc	8.6 c-e	6.3 c	2.3 j-l	0.0 n	0.0 p
26 Velista 50WDG.....	0.3 oz	—						
+ Daconil Ultrex 82.5WDG.....	3.25 oz	14	17.8 a-c	30.1 b-d	67.3 ab	59.0 a-c	54.0 a-d	53.5 bc

(Continued)

Table 1A (continued).

Treatment	Rate per 1000 sq ft	Application Schedule (days) ³	Disease Severity Index ^{1,2}					
			20 July	29 July	11 Aug.	22 Aug.	2 Sept.	12 Sept.
27 Velista 50WDG.....	0.3 oz	—						
+ Heritage 50WG.....	0.2 oz	14	4.4 bc	10.3 c-e	20.0 a-c	8.7 f-l	3.0 mn	2.5 m-p
28 Velista 50WDG.....	0.3 oz	14	4.9 bc	13.2 c-e	23.8 a-c	35.9 c-g	32.1 d-j	34.4 d-g
29 Velista 50WDG.....	0.5 oz	14	12.5 a-c	13.4 c-e	36.4 a-c	30.4 c-k	27.4 e-m	18.7 f-o
30 FPS-2011 5A LC.....	3.1 fl oz	—						
+ FPS-2011 5B LC.....	6 oz	14	7.8 bc	15.6 c-e	18.8 a-c	10.8 e-l	3.8 l-n	4.2 l-p
31 FPS-2011 5A LC.....	6.2 fl oz	—						
+ FPS-2011 5B LC.....	4.0 oz	14	0.0 c	0.0 e	0.0 c	0.0 l	0.0 n	0.0 p
32 FPS-2011 5A LC.....	6.2 fl oz	—						
+ FPS-2011 5B LC.....	6.0 oz	14	2.3 bc	0.0 e	0.0 c	0.0 l	0.0 n	0.0 p
33 CX-42 1.73SC.....	0.50 fl oz	14	9.6 bc	14.6 c-e	19.5 a-c	18.5 d-l	18.3 g-n	20.2 e-n
34 Torque 3.6SC.....	0.6 fl oz	14 ⁸	0.0 c	3.2 de	8.3 c	9.3 f-l	9.6 i-n	0.0 p
35 Torque 3.6SC.....	0.9 fl oz	14 ⁸	6.8 bc	2.1 e	11.7 bc	0.0 l	0.0 n	0.0 p
36 Torque 3.6SC.....	0.6 fl oz	—						
+ 3336 4F.....	3.0 fl oz	14 ⁸	5.2 bc	13.3 c-e	27.8 a-c	11.0 e-l	7.1 j-n	3.8 l-p
37 RU 192514-11ZE SC.....	4.5 fl oz	—						
+ RU 192514-11ZB.....	0.6 fl oz	28	8.4 bc	19.4 b-e	14.8 bc	19.5 d-l	6.5 k-n	0.0 p
38 RU 192514-11L.....	1.6 fl oz	—						
+ RU 192514-11ZB.....	0.3 fl oz	14	1.1 bc	0.0 e	0.0 c	0.0 l	0.0 n	0.0 p
39 16-2-7 25% SRN LC.....	12 fl oz	—						
+ Manganese 5% LC.....	6 fl oz	—						
+ Flo Thru 2403 LC.....	3 fl oz	14	12.8 a-c	15.0 c-e	21.7 a-c	24.6 d-l	48.3 b-e	37.9 c-e
40 16-2-7 25% SRN LC.....	9 fl oz	—						
+ Manganese 5% LC.....	3 fl oz	—						
+ Flo Thru 2403 LC.....	3 fl oz	14	4.2 bc	26.3 b-e	57.0 a-c	60.6 a-c	74.5 a	53.3 c
41 QP Tebuconazole 3.6F.....	0.6 fl oz	—						
+ Foursome 100 SL.....	0.4 fl oz	28	5.8 bc	8.7 c-e	15.7 a-c	13.5 e-l	16.7 g-n	12.5 i-p
42 2011 SP Program #1.....	Quali-Pro	14-ALT ⁹	6.6 bc	12.1 c-e	37.7 a-c	24.8 d-l	13.4 h-n	8.9 k-p
43 2011 SP Program #2.....	Quali-Pro	14-ALT ¹⁰	3.0 bc	16.5 c-e	27.5 a-c	14.5 d-l	25.1 e-n	21.2 e-l
44 2011 SP Program #3.....	Quali-Pro	14-ALT ¹¹	4.0 bc	17.4 b-e	26.3 a-c	30.6 c-k	25.4 e-n	30.7 d-i

(Continued)

Table 1A (continued).

Treatment	Rate per 1000 sq ft	Application Schedule (days) ³	Disease Severity Index ^{1,2}					
			20 July	29 July	11 Aug.	22 Aug.	2 Sept.	12 Sept.
45 2011 SP Program #4..... Quali-Pro		14-ALT ¹²	4.3 bc	8.4 c-e	15.4 a-c	13.5 e-l	13.0 h-n	7.1 k-p
46 Banner MAXX 1.3ME.....2.0 fl oz		14	2.0 bc	3.5 de	10.5 bc	6.8 g-l	12.0 i-n	9.2 k-p
47 Untreated check..... –		–	30.5 a	58.4 a	50.1 a-c	82.3 a	73.5 ab	77.3 a
		INT ¹³	DAT ¹⁴	DAT	DAT	DAT	DAT	DAT
		14	12	7	6	17	28	38
		28	26	7	20	37	48	58

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 ($k=100$). All fungicides were applied in 4.0 gal H₂O per 1000 sq ft with a CO₂ compressed air sprayer, T-Jet nozzle 8003E, at 30 psi.

² Disease severity index = patch diameter × disease intensity. Disease intensity was rated on a 0 to 3 scale, where 0 = no visual foliar necrosis, 1 = 1 to 33% necrotic foliage, 2 = 34 to 66% necrotic foliage, and 3 = 67 to 100% necrotic foliage. Patch diameter was recorded as the mean of two perpendicular measurements per infection center. Three locations were inoculated per 3 x 9 ft replicate plot with *Magnaporthe poae* isolate OAK A-5 on 15 May 2004. Disease severity values were averaged for each plot.

³ Fungicides were applied on 27 May (all treatments), 10 June (14-day treatment), 24 June (14- and 28-day treatments), 8 July (14-day treatment), 22 July (14- and 28-day treatments), and 5 August (14-day treatment).

⁴ Treatments 1 to 5 were applied to dry foliage and then immediately irrigated with 1.0 gal of water per plot.

⁵ ALT= Alternation treatment, where treatment 15 consisted of Tartan 2.4SC (2.0 fl oz) applied on 27 May and Triton Flo 3.1SC (0.6 fl oz) applied on 24 June and 22 July.

⁶ Treatment 17 consisted of SP8010-DEC LC (1.44 fl oz) applied on 27 May and then SP8010-DEC LC (1.44 fl oz) + Banner MAXX 1.3ME (2.0 fl oz) every 14 days thereafter.

⁷ Treatment 20 was applied on 27 May (0.41 fl oz), 24 June (0.75 fl oz), and 22 July (0.75 fl oz); Treatment 21 was only applied on 27 May (0.82 fl oz) and 24 June (1.1 fl oz).

⁸ Treatments 34 to 36 were irrigated with 1 gal water per 1000 sq ft immediately after application.

⁹ ALT = Alternation treatment, where treatment 42 (Quali-Pro 2011 SP Program #1) consisted of QP Tebuconazole 3.6F (0.6 fl oz) + Foursome 100SL (0.4 fl oz) applied on 27 May, 24 June, and 22 July, and QP Ipro 2SE (4 fl oz) + Foursome 100SL (0.4 fl oz) on 10 June, 8 July, and 5 August.

¹⁰ ALT = Alternation treatment, where treatment 43 (Quali-Pro 2011 SP Program #2) consisted of QP Tebuconazole 3.6F (0.6 fl oz) + Foursome 100SL (0.4 fl oz) applied on 27 May, 24 June, and 22 July, and QP Chlorothalonil 82.5DF (3.2 oz) + Foursome 100SL (0.4 fl oz) on 10 June, 8 July, and 5 August.

(Continued)

Table 1A (continued).

¹¹ ALT = Alternation treatment, where treatment 44 (Quali-Pro 2011 SP Program #3) consisted of QP Tebuconazole 3.6F (0.6 fl oz) + Foursome 100SL (0.4 fl oz) applied on 27 May, 24 June, and 22 July, and QP TM/C 66.7 WG (4 oz) + Foursome 100SL (0.4 fl oz) on 10 June, 8 July, and 5 August.

¹² ALT = Alternation treatment, where treatment 45 (Quali-Pro 2011 SP Program #4) consisted of QP Tebuconazole 3.6F (0.6 fl oz) + Foursome 100SL (0.4 fl oz) applied on 27 May, 24 June, and 22 July, and QP TM Flo 4.5F (2 fl oz) + Foursome 100SL (0.4 fl oz) on 10 June, 8 July, and 5 August.

¹³ Spray interval in days.

¹⁴ Days after the last treatment.

Table 1B. Management of summer patch on Kentucky bluegrass turf with selected fungicides and biorational products: Rutgers University, 2011.

Treatment	Rate per 1000 sq ft	Application Schedule (days) ⁴	Disease Severity Index ^{1,2}	Turf Quality ³			
				22 Sept.	24 June	22 July	19 Aug.
1 Pillar 00F 0.81G.....	48.0 oz	28 ⁵	22.0 f-k	6.5 fg	5.5 ab	5.6 i-m	6.5 a-e
2 Pillar 03F 0.81G.....	48.0 oz	28 ⁵	1.5 kl	7.5 b-e	5.5 ab	6.3 e-j	6.3 b-f
3 Pillar 03F 0.81G.....	48.0 oz	14 ⁵	0.0 l	7.0 d-g	6.3 ab	7.3 b-f	6.4 b-e
4 Heritage 0.31G.....	48.0 oz	28 ⁵	0.0 l	7.8 a-d	5.3 ab	7.1 c-g	7.0 a-c
5 Heritage 0.31G.....	48.0 oz	14 ⁵	0.0 l	7.5 b-e	6.8 a	8.4 ab	7.0 a-c
6 RU 21196-11B.....	0.21 fl oz	28	38.9 c-f	7.8 a-d	4.8 ab	5.0 k-p	6.0 c-f
7 RU 21196-11B.....	0.262 fl oz	28	32.8 e-g	6.8 e-g	6.3 ab	5.5 i-n	5.5 e-h
8 RU 21196-11A.....	0.34 fl oz	28	5.5 j-l	8.0 a-c	6.0 ab	5.9 h-l	6.5 a-e
9 RU 21196-11A.....	0.472 fl oz	28	0.0 l	7.8 a-d	6.8 a	6.1 f-k	6.8 a-d
10 RU 21196-11E.....	1.1 oz	28	1.3 kl	7.5 b-e	6.3 ab	6.5 d-i	6.3 b-f
11 RU 21196-11C.....	2.0 fl oz	28	0.0 l	7.8 a-d	6.5 ab	7.1 c-g	6.4 b-e
12 Honor 28WG.....	1.1 oz	28	0.0 l	8.0 a-c	5.3 ab	6.0 g-l	6.0 c-f
13 Insignia 2.1 SC.....	0.54 fl oz	—					
+ Trinity 1.67SC.....	1.0 fl oz	28	4.5 j-l	7.8 a-d	5.3 ab	5.4 i-o	7.0 a-c
14 Reserve 4.8SC.....	2.8 fl oz	28	34.9 d-g	7.0 d-g	5.0 ab	4.4 n-r	5.5 e-h
15 Tartan 2.4SC.....	2.0 fl oz	—					
/Triton Flo 3.1SC.....	0.6 fl oz	28-ALT ⁶	29.4 e-i	8.0 a-c	5.3 ab	4.3 o-r	5.8 d-g
16 Triton Flo 3.1SC.....	0.6 fl oz	28	56.5 a-d	7.3 c-f	6.0 ab	5.0 k-p	5.8 d-g
17 SP8010-DEC LC.....	1.44 fl oz	—					
+ Banner Maxx 1.3ME.....	2.0 fl oz	14 ⁷	0.0 l	7.8 a-d	5.5 ab	6.3 e-j	6.0 c-f
18 SP8010-DEC LC.....	2.88 fl oz	14	29.8 e-i	7.3 c-f	5.0 ab	3.3 rs	5.3 f-i
19 SP8010-DEC LC.....	5.76 fl oz	14	33.2 e-g	6.5 fg	5.8 ab	4.1 p-r	5.3 f-i
20 NB37904 20 SC.....	0.75 fl oz	28 ⁸	8.6 i-l	7.3 c-f	5.3 ab	5.1 j-p	5.5 e-h
21 NB37904 20 SC.....	1.1 fl oz	28 ⁸	30.5 e-h	7.0 d-g	5.0 ab	4.5 m-q	4.8 g-j
22 Segway 3.3SC.....	0.55 fl oz	28	66.0 ab	6.3 g	4.5 ab	2.9 s	4.3 ij
23 Endorse 2.5WP.....	4.0 oz	28	32.8 e-g	7.3 c-f	5.8 ab	4.9 l-p	6.0 c-f
24 IKF-205 28WP.....	1.1 oz	28	27.8 f-i	7.5 b-e	5.5 ab	3.5 q-s	4.5 h-j
25 Heritage 50WG.....	0.4 oz	28	0.0 l	7.8 a-d	6.0 ab	7.4 b-e	7.3 ab

(Continued)

Table 1B (continued).

Treatment	Rate per 1000 sq ft	Application Schedule (days) ⁴	Disease Severity Index ^{1,2}	Turf Quality ³				
				22 Sept.	24 June	22 July	19 Aug.	16 Sept.
26 Velista 50WDG.....	0.3 oz	—						
+ Daconil Ultrex 82.5WDG.....	3.25 oz	14	55.8 a-d	8.0 a-c	4.5 ab	2.9 s	4.3 ij	
27 Velista 50WDG.....	0.3 oz	—						
+ Heritage 50WG.....	0.2 oz	14	0.0 l	8.0 a-c	5.5 ab	7.5 a-d	6.8 a-d	
28 Velista 50WDG.....	0.3 oz	14	35.7 d-g	8.0 a-c	5.0 ab	4.5 m-q	5.5 e-h	
29 Velista 50WDG.....	0.5 oz	14	23.4 f-j	8.0 a-c	4.8 ab	4.3 o-r	5.8 d-g	
30 FPS-2011 5A LC.....	3.1 fl oz	—						
+ FPS-2011 5B LC.....	6 oz	14	0.0 l	7.5 b-e	4.5 ab	6.9 c-h	6.3 b-f	
31 FPS-2011 5A LC.....	6.2 fl oz	—						
+ FPS-2011 5B LC.....	4.0 oz	14	0.0 l	7.5 b-e	5.5 ab	7.9 a-c	7.0 a-c	
32 FPS-2011 5A LC.....	6.2 fl oz	—						
+ FPS-2011 5B LC.....	6.0 oz	14	0.0 l	7.3 c-f	5.5 ab	8.6 a	7.5 a	
33 CX-42 1.73SC.....	0.50 fl oz	14	20.5 f-l	7.5 b-e	4.8 ab	4.9 l-p	5.8 d-g	
34 Torque 3.6SC.....	0.6 fl oz	14 ⁹	2.0 j-l	7.3 c-f	6.8 a	6.1 f-k	6.5 a-e	
35 Torque 3.6SC.....	0.9 fl oz	14 ⁹	0.0 l	7.5 b-e	5.3 ab	6.3 e-j	6.3 b-f	
36 Torque 3.6SC.....	0.6 fl oz	—						
+ 3336 4F.....	3.0 fl oz	14 ⁹	5.7 j-l	8.0 a-c	5.0 ab	5.6 i-m	5.5 e-h	
37 RU 192514-11ZE SC.....	4.5 fl oz	—						
+ RU 192514-11ZB.....	0.6 fl oz	28	0.0 l	6.8 e-g	4.3 b	4.3 o-r	5.8 d-g	
38 RU 192514-11L.....	1.6 fl oz	—						
+ RU 192514-11ZB.....	0.3 fl oz	14	0.0 l	6.3 g	6.3 ab	7.8 a-c	7.0 a-c	
39 16-2-7 25% SRN LC.....	12 fl oz	—						
+ Manganese 5% LC.....	6 fl oz	—						
+ Flo Thru 2403 LC.....	3 fl oz	14	49.6 b-e	6.8 e-g	5.3 ab	4.4 n-r	5.5 e-h	
40 16-2-7 25% SRN LC.....	9 fl oz	—						
+ Manganese 5% LC.....	3 fl oz	—						
+ Flo Thru 2403 LC.....	3 fl oz	14	58.3 a-c	7.8 a-d	5.0 ab	3.5 q-s	4.8 g-j	

(Continued)

Table 1B (continued).

Treatment	Rate per 1000 sq ft	Application Schedule (days) ⁴	Disease Severity Index ^{1,2}	Turf Quality ³				
				22 Sept.	24 June	22 July	19 Aug.	16 Sept.
41 QP Tebuconazole 3.6F.....0.6 fl oz		–						
+ Foursome 100 SL0.4 fl oz		28	10.5 h-l	7.5 b-e	6.5 ab	6.0 g-l	6.3 b-f	
42 2011 SP Program #1..... Quali-Pro		14-ALT ¹⁰	8.7 i-l	8.5 a	5.5 ab	5.1 j-p	6.0 c-f	
43 2011 SP Program #2..... Quali-Pro		14-ALT ¹¹	22.3 f-k	8.3 ab	5.8 ab	5.5 i-n	6.0 c-f	
44 2011 SP Program #3..... Quali-Pro		14-ALT ¹²	16.8 g-l	8.3 ab	5.3 ab	5.1 j-p	6.0 c-f	
45 2011 SP Program #4..... Quali-Pro		14-ALT ¹³	4.0 j-l	7.8 a-d	6.0 ab	7.0 c-h	6.8 a-d	
46 Banner MAXX 1.3ME.....2.0 fl oz		14	16.3 g-l	8.0 a-c	5.0 ab	5.3 j-p	6.0 c-f	
47 Untreated Check..... –		–	76.3 a	6.3 g	4.5 ab	2.9 s	4.0 j	
		INT ¹⁴	DAT ¹⁵	DAT	DAT	DAT	DAT	
		14	48	14	14	14	42	
		28	62	28	28	28	56	

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). All fungicides were applied in 4.0 gal H₂O per 1000 sq ft with a CO₂ compressed air sprayer, T-Jet nozzle 8003E, at 30 psi.

² Disease severity index = patch diameter × disease intensity. Disease intensity was rated on a 0 to 3 scale, where 0 = no visual foliar necrosis, 1 = 1 to 33% necrotic foliage, 2 = 34 to 66% necrotic foliage, and 3 = 67 to 100% necrotic foliage. Patch diameter was recorded as the mean of two perpendicular measurements per infection center. Three locations were inoculated per 3 × 9 ft replicate plot with *Magnaporthe poae* isolate OAK A-5 on 15 May 2004. Disease severity values were averaged for each plot.

³ Turf quality on a scale of 1 to 9, where 9 = best turf quality and 5 = commercially acceptable quality.

⁴ Fungicides were applied on 27 May (all treatments), 10 June (14-day treatment), 24 June (14- and 28-day treatments), 8 July (14-day treatment), 22 July (14- and 28-day treatments), and 5 August (14-day treatment).

⁵ Treatments 1 to 5 were applied to dry foliage and then immediately irrigated with 1.0 gal of water per plot.

⁶ ALT= Alternation treatment, where treatment 15 consisted of Tartan 2.4SC (2.0 fl oz) applied on 27 May and Triton Flo 3.1SC (0.6 fl oz) applied on 24 June and 22 July.

⁷ Treatment 17 consisted of SP8010-DEC LC (1.44 fl oz) applied on 27 May and then SP8010-DEC LC (1.44 fl oz) + Banner MAXX 1.3ME (2.0 fl oz) every 14 days thereafter.

(Continued)

Table 1B (continued).

⁸ Treatment 20 was applied on 27 May (0.41 fl oz), 24 June (0.75 fl oz), and 22 July (0.75 fl oz); Treatment 21 was only applied on 27 May (0.82 fl oz) and 24 June (1.1 fl oz).

⁹ Treatments 34 to 36 were irrigated with 1 gal water per 1000 sq ft immediately after application.

¹⁰ ALT = Alternation treatment, where treatment 42 (Quali-Pro 2011 SP Program #1) consisted of QP Tebuconazole 3.6F (0.6 fl oz) + Foursome 100SL (0.4 fl oz) applied on 27 May, 24 June, and 22 July, and QP Ipro 2SE (4 fl oz) + Foursome 100SL (0.4 fl oz) on 10 June, 8 July, and 5 August.

¹¹ ALT = Alternation treatment, where treatment 43 (Quali-Pro 2011 SP Program #2) consisted of QP Tebuconazole 3.6F (0.6 fl oz) + Foursome 100SL (0.4 fl oz) applied on 27 May, 24 June, and 22 July, and QP Chlorothalonil 82.5DF (3.2 oz) + Foursome 100SL (0.4 fl oz) on 10 June, 8 July, and 5 August.

¹² ALT = Alternation treatment, where treatment 44 (Quali-Pro 2011 SP Program #3) consisted of QP Tebuconazole 3.6F (0.6 fl oz) + Foursome 100SL (0.4 fl oz) applied on 27 May, 24 June, and 22 July, and QP TM/C 66.7 WG (4 oz) + Foursome 100SL (0.4 fl oz) on 10 June, 8 July, and 5 August.

¹³ ALT = Alternation treatment, where treatment 45 (Quali-Pro 2011 SP Program #4) consisted of QP Tebuconazole 3.6F (0.6 fl oz) + Foursome 100SL (0.4 fl oz) applied on 27 May, 24 June, and 22 July, and QP TM Flo 4.5F (2 fl oz) + Foursome 100SL (0.4 fl oz) on 10 June, 8 July, and 5 August.

¹⁴ Spray interval in days.

¹⁵ Days after the last treatment.

Table 1C. Management of summer patch on Kentucky bluegrass turf with selected fungicides and biorational products: Rutgers University, 2011.

Treatment	Rate per 1000 sq ft	Application Schedule (days) ⁴	Color ^{1,2}				Phytotoxicity ³
			30 June	22 July	19 Aug.	16 Sept.	22 June
1 Pillar 00F 0.81G.....	48.0 oz	28 ⁵	3.0 bc	2.9 g-j	3.1 de	2.9 ab	1.0 a
2 Pillar 03F 0.81G.....	48.0 oz	28 ⁵	3.0 bc	3.1 e-i	3.1 de	2.8 ab	1.0 a
3 Pillar 03F 0.81G.....	48.0 oz	14 ⁵	2.8 bc	2.9 g-j	3.0 e	2.5 ab	1.0 a
4 Heritage 0.31G.....	48.0 oz	28 ⁵	3.0 bc	3.1 e-i	3.0 e	3.0 ab	1.0 a
5 Heritage 0.31G.....	48.0 oz	14 ⁵	3.3 b	3.0 f-j	3.0 e	3.0 ab	1.0 a
6 RU 21196-11B.....	0.21 fl oz	28	3.3 b	2.5 ij	3.4 b-e	2.8 ab	1.0 a
7 RU 21196-11B.....	0.262 fl oz	28	3.0 bc	3.1 e-i	3.0 e	2.5 ab	1.0 a
8 RU 21196-11A.....	0.34 fl oz	28	3.5 b	3.0 f-j	3.0 e	2.6 ab	1.0 a
9 RU 21196-11A.....	0.472 fl oz	28	3.3 b	3.0 f-j	3.3 c-e	2.8 ab	1.0 a
10 RU 21196-11E.....	1.1 oz	28	3.0 bc	2.9 g-j	3.1 de	2.8 ab	1.0 a
11 RU 21196-11C.....	2.0 fl oz	28	3.5 b	3.1 e-i	3.3 c-e	2.8 ab	1.0 a
12 Honor 28WG.....	1.1 oz	28	3.5 b	2.8 h-j	3.4 b-e	2.5 ab	1.0 a
13 Insignia 2.1 SC.....	0.54 fl oz	—					
+ Trinity 1.67SC.....	1.0 fl oz	28	3.3 b	3.1 e-i	3.3 c-e	3.0 ab	1.0 a
14 Reserve 4.8SC.....	2.8 fl oz	28	3.3 b	3.6 c-g	3.5 b-d	2.4 b	1.0 a
15 Tartan 2.4SC.....	2.0 fl oz	—					
/Triton Flo 3.1SC.....	0.6 fl oz	28-ALT ⁶	3.3 b	3.6 c-g	3.3 c-e	2.6 ab	1.0 a
16 Triton Flo 3.1SC.....	0.6 fl oz	28	3.5 b	3.8 b-f	3.3 c-e	2.5 ab	1.0 a
17 SP8010-DEC LC.....	1.44 fl oz	—					
+ Banner Maxx 1.3ME.....	2.0 fl oz	14 ⁷	3.0 bc	3.3 e-i	3.4 b-e	2.6 ab	1.0 a
18 SP8010-DEC LC.....	2.88 fl oz	14	2.8 bc	2.8 h-j	3.0 e	2.6 ab	1.0 a
19 SP8010-DEC LC.....	5.76 fl oz	14	2.3 c	2.9 g-j	3.3 c-e	2.5 ab	1.0 a
20 NB37904 20 SC.....	0.75 fl oz	28 ⁸	3.0 bc	2.5 ij	3.3 c-e	2.5 ab	1.0 a
21 NB37904 20 SC.....	1.1 fl oz	28 ⁸	2.8 bc	2.5 ij	3.0 e	2.5 ab	1.0 a
22 Segway 3.3SC.....	0.55 fl oz	28	2.8 bc	2.3 j	3.1 de	2.8 ab	1.0 a
23 Endorse 2.5WP.....	4.0 oz	28	2.8 bc	3.1 e-i	3.0 e	2.6 ab	1.0 a
24 IKF-205 28WP.....	1.1 oz	28	2.8 bc	2.8 h-j	3.1 de	2.5 ab	1.0 a
25 Heritage 50WG.....	0.4 oz	28	3.3 b	2.8 h-j	3.0 e	3.0 ab	1.0 a
26 Velista 50WDG.....	0.3 oz	—					
+ Daconil Ultrex 82.5WDG.....	3.25 oz	14	3.5 b	3.4 d-h	3.8 b	2.8 ab	1.0 a

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(Continued)

Table 1C (continued).

Treatment	Rate per 1000 sq ft	Application Schedule (days) ⁴	Color ^{1,2}				Phytotoxicity ³
			30 June	22 July	19 Aug.	16 Sept.	22 June
27 Velista 50WDG.....	0.3 oz	—					
+ Heritage 50WG	0.2 oz	14	3.5 b	2.9 g-j	3.1 de	2.6 ab	1.0 a
28 Velista 50WDG.....	0.3 oz	14	3.0 bc	2.6 h-j	3.0 e	2.6 ab	1.0 a
29 Velista 50WDG.....	0.5 oz	14	3.5 b	3.0 f-j	3.0 e	2.9 ab	1.0 a
30 FPS-2011 5A LC	3.1 fl oz	—					
+ FPS-2011 5B LC	6 oz	14	3.0 bc	3.1 e-i	3.1 de	2.6 ab	1.0 a
31 FPS-2011 5A LC	6.2 fl oz	—					
+ FPS-2011 5B LC	4.0 oz	14	3.0 bc	3.1 e-i	3.1 de	2.5 ab	1.0 a
32 FPS-2011 5A LC	6.2 fl oz	—					
+ FPS-2011 5B LC	6.0 oz	14	3.3 b	3.0 f-j	3.1 de	2.8 ab	1.0 a
33 CX-42 1.73SC.....	0.50 fl oz	14	3.0 bc	2.8 h-j	3.1 de	2.5 ab	1.0 a
34 Torque 3.6SC	0.6 fl oz	14 ⁹	3.3 b	3.1 e-i	3.0 e	2.5 ab	1.0 a
35 Torque 3.6SC	0.9 fl oz	14 ⁹	3.3 b	3.1 e-i	3.3 c-e	2.8 ab	1.0 a
36 Torque 3.6SC	0.6 fl oz	—					
+ 3336 4F.....	3.0 fl oz	14 ⁹	3.0 bc	2.9 g-j	3.1 de	2.5 ab	1.0 a
37 RU 192514-11ZE SC	4.5 fl oz	—					
+ RU 192514-11ZB	0.6 fl oz	28	4.8 a	4.1 a-d	4.5 a	3.3 a	1.0 a
38 RU 192514-11L	1.6 fl oz	—					
+ RU 192514-11ZB	0.3 fl oz	14	4.8 a	3.9 b-d	4.8 a	3.0 ab	2.0 b
39 16-2-7 25% SRN LC	12 fl oz	—					
+ Manganese 5% LC	6 fl oz	—					
+ Flo Thru 2403 LC.....	3 fl oz	14	3.0 bc	3.1 e-i	3.0 e	2.8 ab	1.0 a
40 16-2-7 25% SRN LC	9 fl oz	—					
+ Manganese 5% LC	3 fl oz	—					
+ Flo Thru 2403 LC.....	3 fl oz	14	3.3 b	2.8 h-j	3.6 bc	2.8 ab	1.0 a
41 QP Tebuconazole 3.6F.....	0.6 fl oz	—					
+ Foursome 100 SL	0.4 fl oz	28	3.3 b	4.3 a-c	3.3 c-e	3.0 ab	1.0 a
42 2011 SP Program #1.....	Quali-Pro	14-ALT ¹⁰	4.5 a	4.5 ab	4.5 a	3.3 a	1.0 a
43 2011 SP Program #2.....	Quali-Pro	14-ALT ¹¹	4.8 a	4.8 a	4.5 a	2.8 ab	1.0 a
44 2011 SP Program #3.....	Quali-Pro	14-ALT ¹²	4.5 a	4.5 ab	4.4 a	3.0 ab	1.0 a

(Continued)

Table 1C (continued).

Treatment	Rate per 1000 sq ft	Application Schedule (days) ⁴	Color ^{1,2}				Phytotoxicity ³
			30 June	22 July	19 Aug.	16 Sept.	22 June
45 2011 SP Program #4.....	Quali-Pro	14-ALT ¹³	4.5 a	4.1 a-d	4.8 a	3.0 ab	1.0 a
46 Banner MAXX 1.3ME.....	2.0 fl oz	14	3.3 b	2.6 h-j	3.1 de	2.8 ab	1.0 a
47 Untreated check.....	–	–	2.8 bc	2.9 g-j	3.0 e	2.4 b	1.0 a
		INT ¹⁴	DAT ¹⁵	DAT	DAT	DAT	DAT
		14	6	14	14	42	12
		28	6	28	28	56	26

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). All fungicides were applied in 4.0 gal H₂O per 1000 sq ft with a CO₂ compressed air sprayer, T-Jet nozzle 8003E, at 30 psi.

² Color of foliage, where 1 = very chlorotic, 2 = slightly chlorotic, 3 = normal green color, 4 = slightly dark green color, and 5 = very dark green color.

³ Phytotoxicity on a 1 to 5 scale, where 1 = no discoloration, 2 = slight foliar chlorosis or necrosis, 3 = moderate chlorosis or necrosis, 4 = severe chlorosis or necrosis, and 5 = all turf dead. No phytotoxicity was observed when phytotoxicity was assessed on 22 July or 18 August.

⁴ Fungicides were applied on 27 May (all treatments), 10 June (14-day treatment), 24 June (14- and 28-day treatments), 8 July (14-day treatment), 22 July (14- and 28-day treatments), and 5 August (14-day treatment).

⁵ Treatments 1 to 5 were applied to dry foliage and then immediately irrigated with 1.0 gal of water per plot.

⁶ ALT= Alternation treatment, where treatment 15 consisted of Tartan 2.4SC (2.0 fl oz) applied on 27 May and Triton Flo 3.1SC (0.6 fl oz) applied on 24 June and 22 July.

⁷ Treatment 17 consisted of SP8010-DEC LC (1.44 fl oz) applied on 27 May and then SP8010-DEC LC (1.44 fl oz) + Banner MAXX 1.3ME (2.0 fl oz) every 14 days thereafter.

⁸ Treatment 20 was applied on 27 May (0.41 fl oz), 24 June (0.75 fl oz), and 22 July (0.75 fl oz); Treatment 21 was only applied on 27 May (0.82 fl oz) and 24 June (1.1 fl oz).

⁹ Treatments 34 to 36 were irrigated with 1 gal water per 1000 sq ft immediately after application.

¹⁰ ALT = Alternation treatment, where treatment 42 (Quali-Pro 2011 SP Program #1) consisted of QP Tebuconazole 3.6F (0.6 fl oz) + Foursome 100SL (0.4 fl oz) applied on 27 May, 24 June, and 22 July, and QP Ipro 2SE (4 fl oz) + Foursome 100SL (0.4 fl oz) on 10 June, 8 July, and 5 August.

¹¹ ALT = Alternation treatment, where treatment 43 (Quali-Pro 2011 SP Program #2) consisted of QP Tebuconazole 3.6F (0.6 fl oz) + Foursome 100SL (0.4 fl oz) applied on 27 May, 24 June, and 22 July, and QP Chlorothalonil 82.5DF (3.2 oz) + Foursome 100SL (0.4 fl oz) on 10 June, 8 July, and 5 August.

(Continued)

Table 1C (continued).

¹² ALT = Alternation treatment, where treatment 44 (Quali-Pro 2011 SP Program #3) consisted of QP Tebuconazole 3.6F (0.6 fl oz) + Foursome 100SL (0.4 fl oz) applied on 27 May, 24 June, and 22 July, and QP TM/C 66.7 WG (4 oz) + Foursome 100SL (0.4 fl oz) on 10 June, 8 July, and 5 August.

¹³ ALT = Alternation treatment, where treatment 45 (Quali-Pro 2011 SP Program #4) consisted of QP Tebuconazole 3.6F (0.6 fl oz) + Foursome 100SL (0.4 fl oz) applied on 27 May, 24 June, and 22 July, and QP TM Flo 4.5F (2 fl oz) + Foursome 100SL (0.4 fl oz) on 10 June, 8 July, and 5 August.

¹⁴ Spray interval in days.

¹⁵ Days after the last treatment.