Interaction of Nitrogen, Plant Growth Regulators and Fungicides on the Control of Anthracnose

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Can the control of anthracnose basal rot and foliar blight, caused by *Colletotrichum graminicola*, be improved by mixing fungicides with nitrogen and/or plant growth regulators? In order to develop realistic and effective management strategies for turf management professionals, this is an important question to be addressed. We already talked about the effect of contact and systemic fungicides and the timing of initial application for the control of anthracnose in last issues of the *Grass Roots* (Jung, 2004). In summary, as preventive applications, Daconil Ultrex® (contact fungicide) performed very well as did Banner MAXX® and Endorse®. The effect of the initial application on the anthracnose control was not detected due to the fact of delayed occurrence of the disease by one month in 2003 compared to 2002. Basically, the application of treatments started too early before initial disease occurrence. Experiments were run on creeping bentgrass fairways at the Blackhawk Country Club (BCC) in Madison and annual bluegrass at the Plum Lake Golf Course (PLGC) in Sayner, WI but no disease developed at the PLGC. This project was funded by WTA and NGLGCSA. Three original objectives at both sites were 1) to reaffirm research results of what we found in the 2002 experiments, 2) to determine if timing of initial fungicide applications has an effect on disease control, and 3) to evaluate interactions between fungicides, plant growth regulators, and fertilizers for the disease control. In this article, the final objective #3 will be discussed which is based on one year's data. This summer the same experiments will be repeated at both locations.

Materials and Methods

Fungicides, fertilizers, and PGRs tested for this study are listed in Tables 2 and 3 (page 37). The experimental plot at Blackhawk Country Club in Madison, WI was set up on an annual bluegrass/creeping bentgrass fairway where more than 60% of the turfgrass population was estimated to be *Poa annua* species. Over the years, high disease pressure has been consistently observed at this location. The experiment was arranged in a split block, randomized complete block design with the fungicides being the main plot and plant growth regulators/urea treatments as the sub-plot (3 ft x 3 ft). Preventive chemical applications (14 day interval) from the initial application were continued on June 16, June 30, July 14, and July 28, and August 11 at the BCC, 2003. Liquid treatments were applied with a CO_2-powered boom sprayer using XR Teejet 8005 VS nozzles at 30 psi in water equivalent to 2 gal per M. The site is maintained at 0.5" mowing height, and the plot did not receive additional fertility or plant protection treatments during the studies.

Disease ratings (percentage of plot area with symptoms) of the plots were visually recorded on September 2nd and 13th, 2003 at the BCC. The first disease symptoms at the BCC were noticed around the first week of August which was almost one month later than the previous year. In addition, the total percentage of *P. annua* populations per plot was visually estimated on June 6, 2003. Since the anthracnose occurred only on *P. annua* species, the percentage of

the diseased areas of *Poa* was recalculated by estimating the percentage of the entire plot that was diseased and then dividing that amount by the proportion of *P. annua* present in the plot. The final data analysis using the recalculated damage percentage was carried out and presented in Tables 1, 2, and 3.

Results and Discussion

No significant interactions ($P > 0.993$ and $P > 0.875$, on ratings of Sept. 2 and 13, respectively) between fungicides and urea and/or PGRs on the control of anthracnose were detected in our first year's experiment (Table 1). In other words, the control efficacy of fungicides was not significantly influenced by either nitrogen and PGRs or both. These results were a surprising outcome because at least nitrogen is expected to have a positive effect on the control of anthracnose. On the other hand, highly significant treatment differences in the control efficacy among fungicides and nitrogen/PGRs, respectively were detected (Table 1).

Daconil Ultrex® (contact fungicide) performed very well as observed in previous experiments. In addition, Banner MAXX®, Chipco Signature®, Medallion®, and Lynx® controlled the anthracnose as well as Daconil Ultrex® (Table 2). However, in a statistical point of view, these fungicides differ in efficacy from Compass®, Eagle®, and Cleary's 3336® on both Sept. ratings and additionally Bayleton® on Sept. 13 rating, but not from the other fungicides despite a difference in the mean percentage of the diseased area (Table 2). The huge variation was probably caused by visual estimations of disease damage as well as the fact that the field experiment was uninoculated. In addition, anthracnose severity is highly correlated with factors such as drought, traffic, and other stresses, so the unequal level of stresses may have also contributed to the variation. The overall trend of fungicide efficacy for controlling the disease was observed this year as in the 2002 study.

The nitrogen treatments performed better than the PGRs for anthracnose control on August 11 rating, but the trend was reversed by September ratings (Table 3). Primo Maxx did seem to decrease susceptibility more than urea and Proxy treatments which could not be biologically deciphered at this moment. Since the results were based on one year's data, at least another year's experiment is required before making any conclusion.

Conclusion

Despite of the huge variation in the disease severity which was contributed by environmental variation and other factors such as the mixed growth of two grass species in the same area, natural inoculation, and other abiotic stresses, significant and consistent treatment effect of fungicides were observed in studies of WI and other states. I still have a big question on how much of the pathogen's virulence or *Poa annua* physiological condition or both play a role of causing the actual symptoms. I can't resist stating once more how intriguing the whole question of anthracnose really is. Hopefully, a more in-depth experiment will be designed to understand the biology of the disease step by step in coming years.

Literature Cited

Jung G. Effect of first application timing on the control of anthracnose. 2004. The *Grass Roots* XXXIII No.2 pages 47-49.

Table 1. Analysis of variance of two disease ratings on September 2 and 13, 2003 for interactions of fungicides and nitrogen/plant growth regulators (PGRs) for the control of anthracnose.

		September 2, 03		September 13, 2003	
Source	DF	F ratio	Prob > F	F ratio	Prob > F
Replication	3	2.3581	0.0718	1.4502	0.2284
Chemical	13	9.8472	<.0001	6.8971	<.0001
PGRs/Nitrogen	6	5.0267	<.0001	4.3632	0.0003
Chemical x PGRs/Nitrogen	78	0.6240	0.9930	0.8036	0.8750

Table 2. Systemic and contact fungicides evaluated for the control of anthracnose disease of *Poa annua* and creeping bentgrass fairway at 14 days spray schedule at the Blackhawk Country Club in Madison, WI.

Treatment	Rate (oz a.i./M sq ft)	Mean (%) of diseased area[a]	
		Sept. 2, 2004	Sept. 13, 2004
Eagle (Myclobutanil: 40WP)	0.6	29.5 a	29.1 a
Compass (Trifloxystrobin: 50WG)	0.15	32.0 a	27.5 a
Cleary's 3336 (Thiophanate-methyl: 4F)	4 FL	29.2 a	26.9 a
Check		26.4 ab	23.3 ab
Bayleton (Triadimefon: 50WDG)	0.5	24.1 ab	21.2 ab
Chipco 26GT (Iprodione: 2SC)	3 FL	18.8 abcd	18.3 abc
Heritage (Azoxystrobin: 50WDG)	0.2	19.2 abc	16.5 abc
Insignia (Pyraclostrobin: 20WG)	0.5	14.0 abcde	14.0 abc
Endorse (Polyoxin D: 2.5WP)	4	9.2 bcde	10.2 abc
Banner Maxx (Propiconazole: 1.24MC)	1 FL	5.4 cde	7.7 bc
Chipco Signature (Fosetyl-al: 80WG)	4 FL	1.0 de	2.9 c
Medallion (Fludioxonil: 50WG)	0.25	1.2 cde	2.8 c
Lynx (Tebuconazole: 45WP)	0.6	1.4 cde	2.7 c
Daconil Ultrex (Chlorothalonil: 82.5WDG)	2.75	0.4 e	2.3 c

[a]Values followed by the same letter do not significantly differ ($\alpha = 0.05$).

Table 3. Plant growth regulators and nitrogen evaluated for the control of anthracnose disease of *Poa annua* and creeping bentgrass fairway at the Blackhawk Country Club in Madison, WI.

Treatment: spray schedule	Rate (oz a.i./M sq ft)	Mean (%) of diseased area[a]		
		Aug. 11, 2004	Sept. 2, 2004	Sept. 13, 2004
Primo Maxx (1ME): 28 days Urea 46-0-0 (46WG): 14 days	0.25 FL 2	2.2 abc	7.4 b	7.4 b
Primo Maxx (1ME): 28 days	0.25 FL	3.1 a	10.3 b	8.7 b
Proxy (2EW): 28 days Urea 46-0-0 (46WG): 14 days	5 FL 2	2.4 ab	11.9 ab	11.7 ab
Proxy (2EW): 28 days	5 FL	1.2 bc	13.0 ab	11.7 ab
Urea 46-0-0 (46WG): 14 days	4	0.6 c	18.1 ab	17.8 ab
Urea 46-0-0 (46WG): 14 days	2	1.6 abc	22.2 a	21.7 a
Control		2.4 abc	23.0 a	21.2 a

[a]Values followed by the same letter do not significantly differ ($\alpha = 0.05$).