# The Effects of Different Application Strategies of Nitrogen and Methiozolin on Annual Bluegrass Control on Creeping Bentgrass Golf Greens

C. Fang, J. R. Street, D. S. Gardner, and T. K. Danneberger, D. Bowsher, Ohio State University, Columbus, Ohio 43210

## Introduction

Annual bluegrass (*Poa annua L.*) is considered the most problematic weed on golf greens because of its low heat and disease tolerance in the summer, abundant seed head production, low winter hardiness and light green color. Methiozolin is a newly developed herbicide for *P. annua* control on golf turf, which has shown its effectiveness and safety on multiple turfgrass species. Nitrogen, as one of the essential elements of plants, plays an important role in the lateral growth/recovery, chlorophyll formation and putting surface quality. Two experiments are being conducted at the Ohio State University Golf Club on an 'L-93' bentgrass (*Agrostis stolonifera*) practice green and a third experiment at the Ohio Turfgrass Foundation Research and Education Facility on a 'Pencross' bentgrass green to study the efficiency of different nitrogen and methiozolin application strategies on *P. annua* control, as well as *A. stolonifera* safety and growth/recovery.

## Objective

- Determine the best spring recovery strategy with nitrogen and methiozolin programs after previous fall-applied methiozolin treatments
- Determine the most effective and safe application rate(s) of methiozolin and nitrogen on *P. annua* control in the spring
- Determine the effects of different methiozolin rates and nitrogen rates on the lateral growth/recovery rate of *A. stolonifera*

## Methods

| Project 1<br>Fall/Spring Recovery | Project 2<br>Spring Control | Project 3<br>Lateral Growth |
|---|---|---|
| Methiozolin Fall Treatment (0.2 ml·m$^{-2}$) | Untreated area with 25% of live Poa | Two 0.1m cup-cutter holes refilled with sand in each plot |
| Split-plot design 3 factors, 3 replications | RCBD design 2 factors, 3 replications | RCBD design 2 factors 3 replications |
| Main-plot: methiozolin Sub-plot:N rate x frequency | 4 Methiozolin rates (0, 0.2, 0.3, 0.4 ml·m$^{-2}$) 3 N rates (0.6, 1.2, 2.4 g N·m$^{-2}$) | 5 N rates (0, 0.3, 0.6, 1.2, 2.4 g N·m$^{-2}$) 2 Methiozolin rates (0, 0.2 ml·m$^{-2}$) |
| Grid counting visual assessment for % voids & % live Poa | Grid counting visual assessment for % live Poa | Grid counting for the size of the void |
| NDVI, Green Index visual assessments for CB color | NDVI, Green Index visual assessment for CB color and AB color | NDVI, Green Index visual assessment for CB color |
| Lightbox Photos for DIA | Lightbox Photos for DIA | Lightbox Photos for DIA |


Figure 1. (A) methiozolin application fall, 2013; (B) photography lightbox; (C) core sample of methiozolin treated A. stolonifera; (D) core sample of methiozolin treated P. annua; (E) methiozolin treated area spring, 2014

## Results

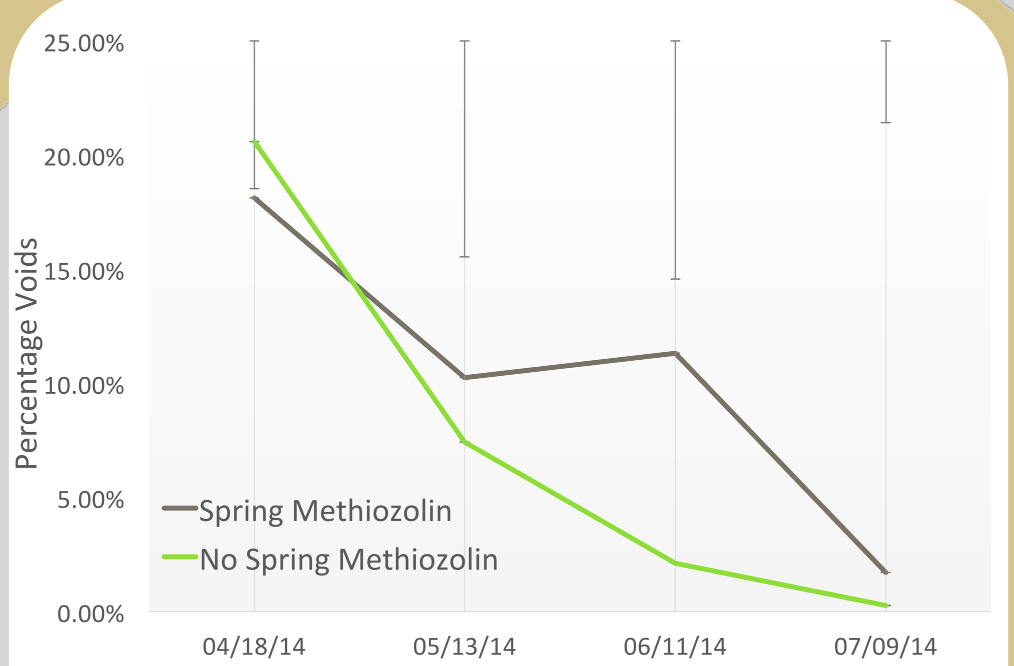



**Figure 2. Effects of Methiozolin on Grid Counting Percentage of Voids**

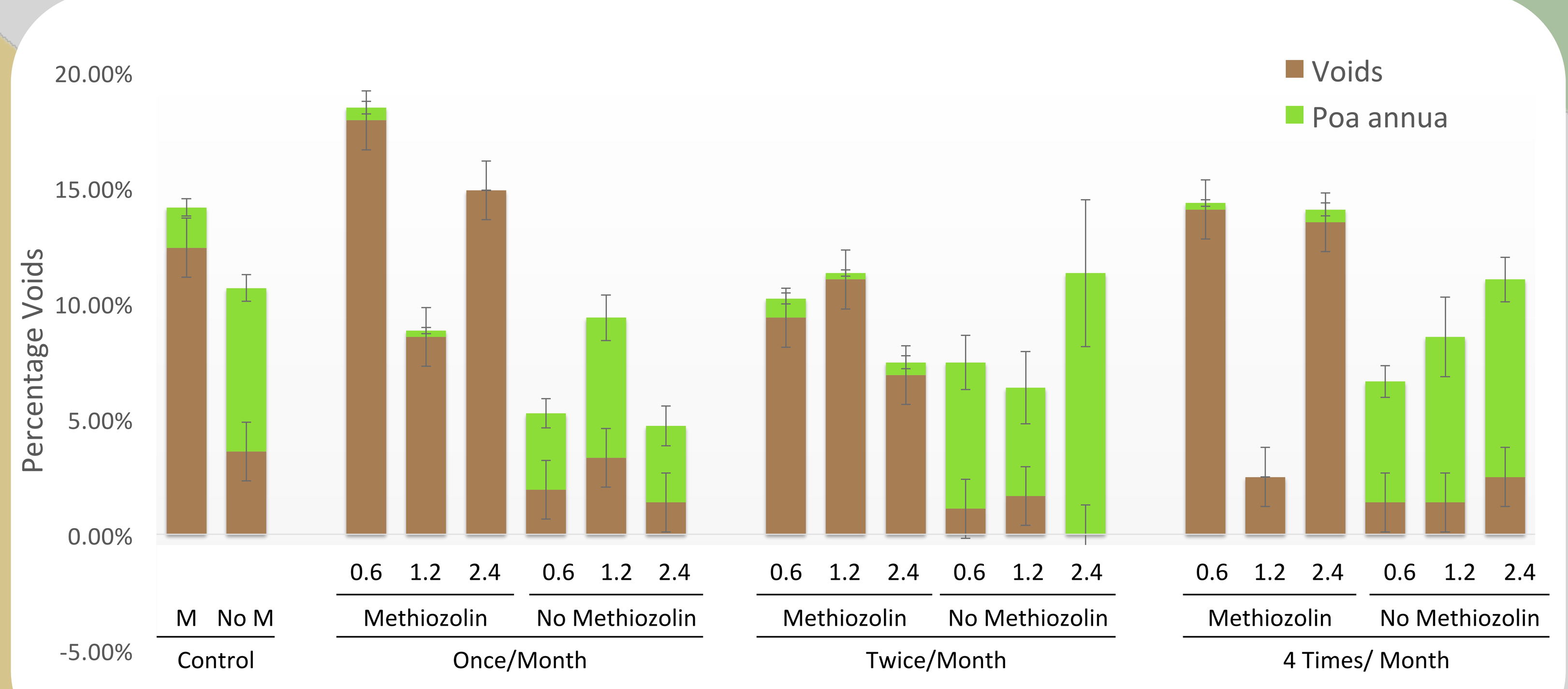



**Figure 3. Grid Counting Percentage of Voids and Poa annua. (06/11/14)**

- There were voids created by dead *P. annua* covering approximately 20% of the plots in the spring after three fall applications of methiozolin (0.2 ml·m$^{-2}$ @ 2 week intervals) (Figure 2).
- Spring methiozolin applications resulted in a slower rate of spring green-up.
- The recovery (*A. stolonifera* lateral growth) of voids caused by dead *P. annua* was only significantly influenced by the spring methiozolin treatments, but by July all methiozolin and no methiozolin treatments resulted in less than 5% *P.annua* (Figure 2).
- Spring-methiozolin treatments had a significantly higher percentage of voids compared to no methiozolin treatments due to a significantly higher percentage (still below 10%) of new *P. annua* germinating in the open voids in the spring prior to *A. stolonifera* lateral growth/recovery.

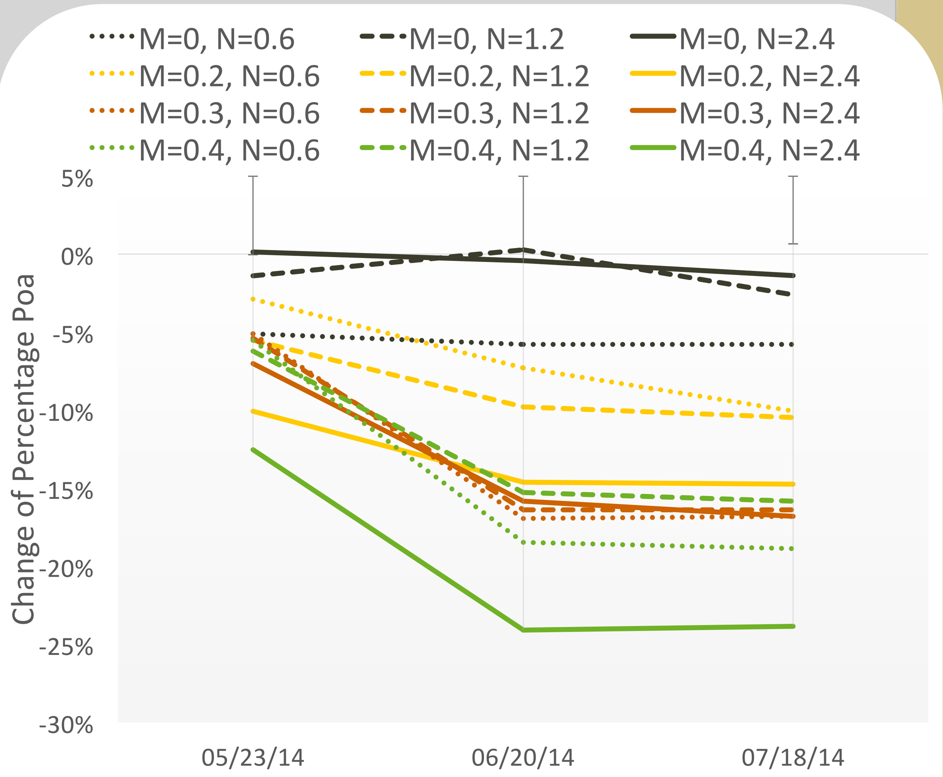



**Figure 4. Change of Percentage Coverage of Poa annua with Different Methiozolin and Nitrogen rates**

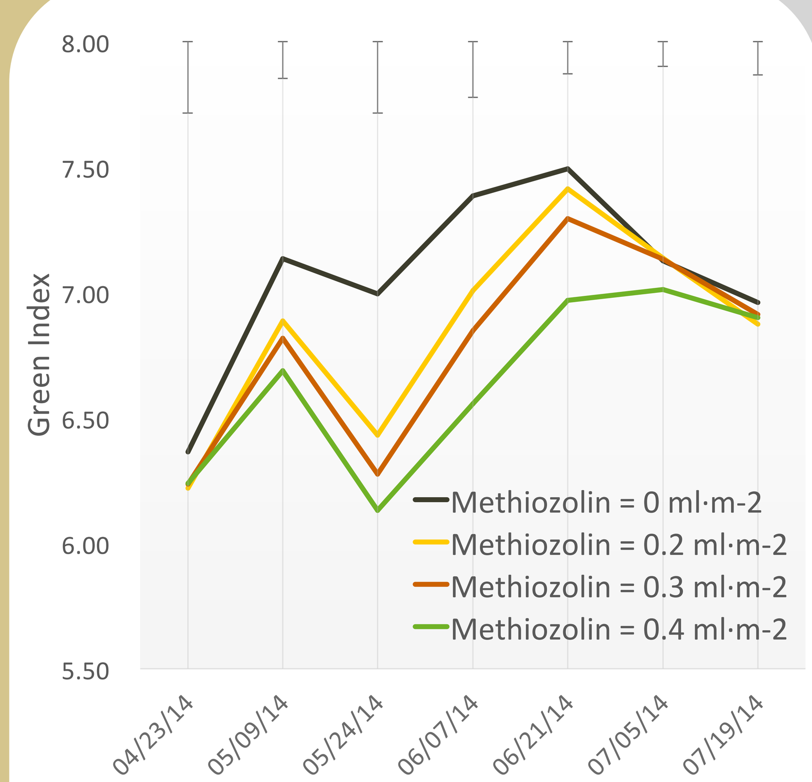



**Figure 5. Effects of Methiozolin Rates on the Green Index of Poa annua.**

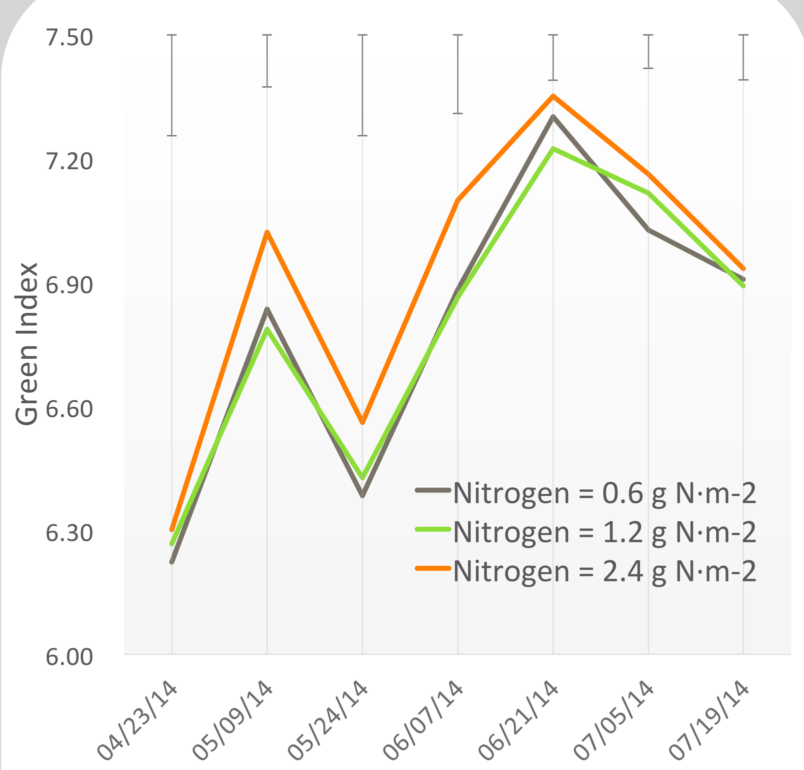
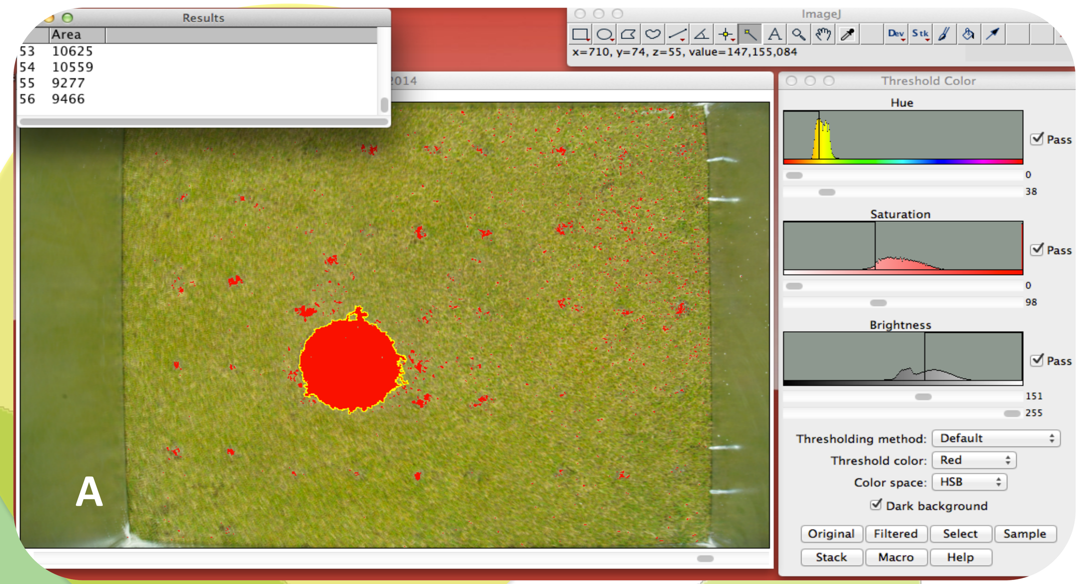
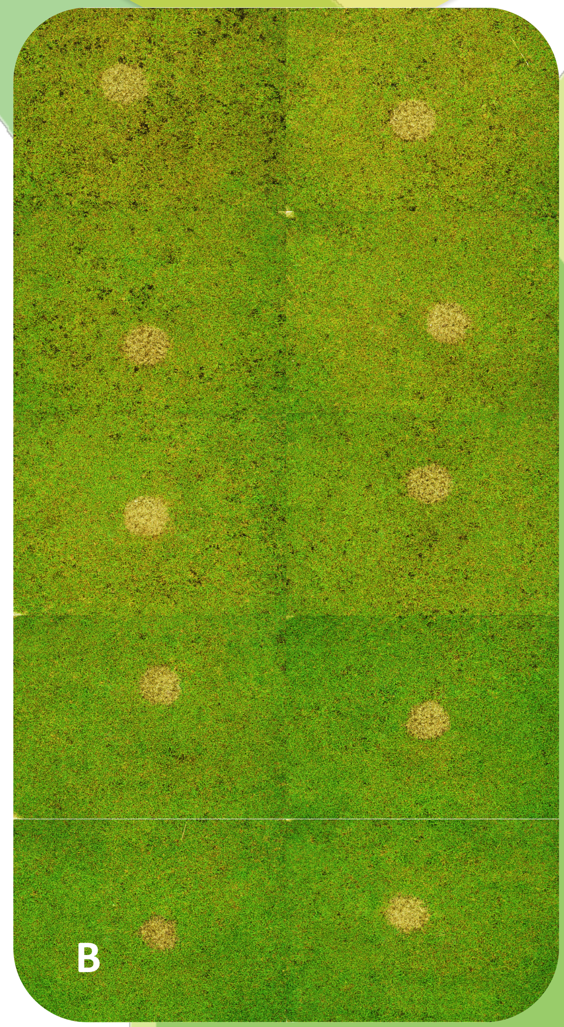



**Figure 6. Effects of Nitrogen Rates on the Green Index of Poa annua.**

- The change of percentage coverage of *P. annua* was significantly influenced by different spring methiozolin rates in Project 2. There are also significant correlation effects between methiozolin rates and nitrogen rates, so all methiozolin rates and nitrogen rates were combined together as different treatment groups and shown in Figure 4. There was a significant difference between treatment groups 4 weeks after initial treatment (WAIT), 8 WAIT and 12 WAIT on the change of percentage coverage of *P. annua*.
- There was no significant correlation between methiozolin rates and nitrogen rates on the green index of *P. annua*, so the data was separated into two graphs (Figures 5 and 6)
- Methiozolin rates start to show a significant difference in *P. annua* color at 2 WAIT. There was no difference between the 0.2 ml·m$^{-2}$ and 0.3 ml·m$^{-2}$ methiozolin rates
- Nitrogen rates also started to show significant differences in *P. annua* color at 2 WAIT. The highest N rate, 2.4 g N·m$^{-2}$ resulted in the highest color ratings




Digital Image Analysis (DIA) was utilized for color and coverage analysis. (Project 3)

Figure 7. (A) ImageJ was used for specific area selection and measurement after parameter correction. ; (B) The Images taken with the light box have shown color differences among different treatments: methiozolin treated (left column), methiozolin untreated (right column), nitrogen rates (top to bottom: 0, 0.3, 0.6, 1.2, 2.4 g N·m$^{-2}$)

## Conclusion

- There was no statistical difference of nitrogen rates and frequencies on the lateral recovery rate of creeping bentgrass into dead *P. annua* voids caused by fall-applied methiozolin based on grid counts (Project 1). Both the percentage coverage of voids and newly germinated *P. annua* was significantly influenced by methiozolin spring treatments.
- There was a significant difference among different methiozolin and nitrogen rate combinations on changes of percentage coverage of *P. annua*. Color measurements reflected in *P. annua* discoloration also showed significant effects on *P. annua* decline over time with different methiozolin rates and nitrogen rates.
- Digital Image Analysis is a convenient tool for data collection and visualization in turfgrass research area.

## References

Vargas, J. M., & Turgeon, A. J. (2004). Poa annua: Physiology, culture, and control of annual bluegrass. Hoboken, NJ: Wiley.

Koo, S., Hwang, K., Jeon, M., Kim, S., Lim, J., Lee, D., & Cho, N. (2014). Methiozolin [5-(2,6-difluorobenzyl)oxymethyl-5-methyl-3,3(3-methylthiophen-2-yl)-1,2-isoxazoline], a new annual bluegrass (L.) herbicide for turfgrasses. *Pest Management Science*, 70(1), 156-162. doi: 10.1002/ps.3541

Ghali, I. E. (2011). Comparing digital image analysis and other turf quality measurements in the evaluation of smart irrigation technologies (unpublished master's thesis of North Carolina State University).

American Society of Agronomy · Crop Science Society of America · 목우연구소 Moghu Research Center · Ohio State Golf Club · The Ohio State University