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The Effect of Human Insect Repellents on Perennial Ryegrass (*Lolium perenne*) Growth and Recovery

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The Effect of Human Insect Repellents on Perennial Ryegrass (*Lolium perenne*) Growth and Recovery

Abstract

Turfgrass damage has been observed from misapplications of human insect repellents. Minimal research has been conducted to determine the cause of the damage. Greenhouse research trials were initiated in November 2016 to survey various human insect repellents on turfgrass growth and recovery. Insect repellents resulted in a wide range of damage. No common trend was observed, although the research trial shows possible repellents to be used around turfgrass that will minimize turfgrass injury.

Keywords

insect repellents, perennial ryegrass, turfgrass injury

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The Effect of Human Insect Repellents on Perennial Ryegrass (*Lolium perenne*) Growth and Recovery

Jared A. Hoyle and Peyton E. South

Summary. Turfgrass damage has been observed from misapplications of human insect repellents. Minimal research has been conducted to determine the cause of the damage. Greenhouse research trials were initiated in November 2016 to survey various human insect repellents on turfgrass growth and recovery. Insect repellents resulted in a wide range of damage. No common trend was observed, although the research trial shows possible repellents to be used around turfgrass that will minimize turfgrass injury.

Rationale. Human insect repellents containing diethyltoluamide (DEET) commonly damage turfgrass due to non-target application. Common visual damage results in two areas of healthy growing turfgrass in the shape of footprints with necrotic and chlorotic turfgrass surrounding. Damage results in unacceptable turfgrass quality and playability. Minimal research has been conducted to explore the influence of human insect repellents on turfgrass injury and recovery.

Objective. Evaluate the influence of human insect repellents on perennial ryegrass (*Lolium perenne*) growth and recovery.

Study Description. Research trials were initiated in November 2016 at the Throckmorton Plant Sciences Center Greenhouses in Manhattan, KS, to determine the influence of human insect repellents on perennial ryegrass (*Lolium perenne*) growth and recovery. Perennial ryegrass was established in 10- by 4-inch pots at 8 lb per 1,000 ft², maintained at 1.75 inches and was irrigated to prevent drought stress. The greenhouse environment was a 12-hr photoperiod at 60°F/ 72°F (night/day).

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Insect repellent treatments were applied to perennial ryegrass plants arranged in a randomized complete block design with 4 replications. Treatments included 9 insect repellents and a non-treated control for comparison (Table 1). Five treatments contained the active ingredient DEET. Other commonly used insect repellents were also included for comparison. Collected data included visual percent injury on a 0 - 100% scale, where 10% represented maximum acceptable injury. Data were subjected to analysis of variance (ANOVA) in SAS 9.4 (SAS Institute Inc., Cary, NC) and means were separated according to Fisher's protected least significant difference (LSD) level at 0.05.

Results. All treatments, except the control, resulted in at least 6% turfgrass injury 1 day after application (DAA). Repel Max (40% DEET) and Off Active (15% DEET) resulted in 68 and 30% injury, respectively 21 DAA. At 21 DAA, all other treatments resulted in turfgrass injury similar to the non-treated (0%). Insect repellents with the same active ingredient percentage resulted in various levels of perennial ryegrass injury and recovery. Even with no percentage difference in DEET, Off Active and Off Family resulted in 30 and 0% injury 21 DAA, respectively. Results also demonstrate that permanent non-target turfgrass injury could occur if Off Active and Repel Max are applied as a human insect repellents. Further greenhouse and field trials are needed to confirm results.

Table 1. Treatments and corresponding active ingredient (%) for human insect repellent influence on perennial ryegrass research trial

Treatment	Active ingredient (AI)	AI %
Repel Natural	Geraniol + soybean oil	5 + 2%
Natrapel	Picaridin	20%
Off Active	DEET	15%
Off Family	DEET	15%
Skin Smart	Propionic acid	20%
Repel Tick Defense	Picaridin	15%
Repel Family	DEET	15%
Repel Sportsmen	DEET	25%
Repel Max	DEET	40%
Non-treated	-	-



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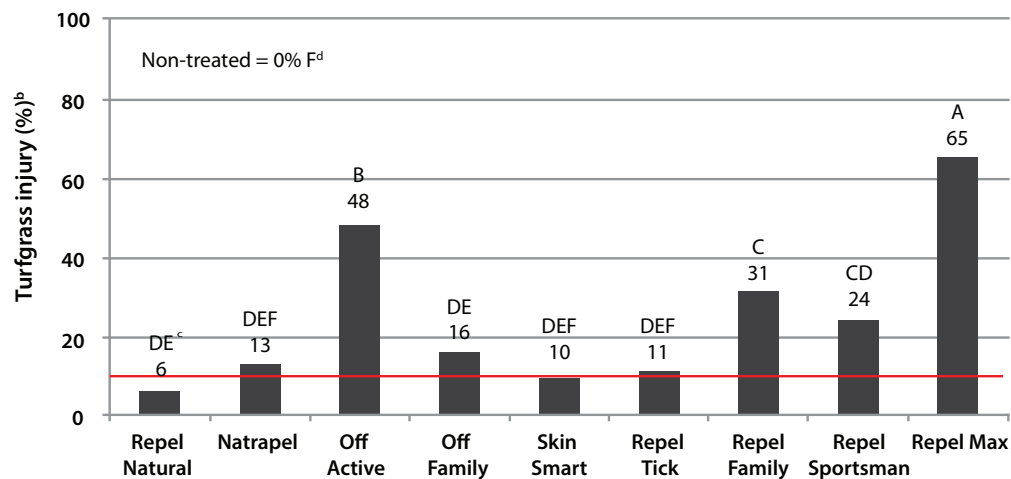


Figure 1. Response of perennial ryegrass (*Lolium perenne*) to common human insect repellents;^{a,e} 1 day after application.

^a Trial was initiated in the Throckmorton Plant Sciences Center Greenhouses in Manhattan, KS, on November 26, 2017. Day:night conditions; 60°F:72°F with a 12-hr photoperiod.

^b Turfgrass injury was rated on a 0 to 100% scale, where: 0 = no injury and 100 = complete chlorosis/necrosis.

^c Means for percent turfgrass injury followed by different letters are significantly different according to Fisher's Protected LSD at $\alpha = 0.05$.

^d A non-treated control was included for comparisons. Non-treated resulted in 0% injury throughout the research project.

^e Red line indicates maximum acceptable turfgrass injury according to the National Turfgrass Evaluation Program (NTEP) regulations.

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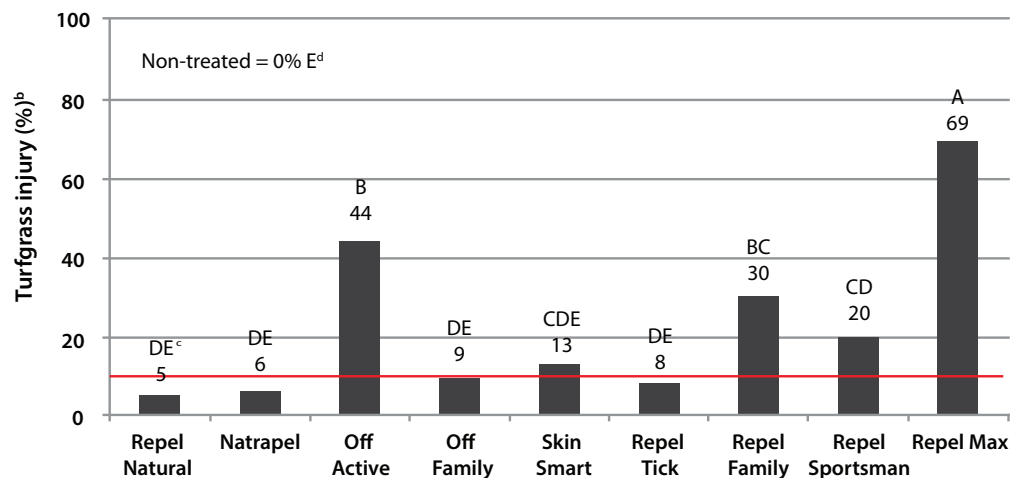


Figure 2. Response of perennial ryegrass (*Lolium perenne*) to common human insect repellents; ^{a,e} 7 days after application.

^a Trial was initiated in the Throckmorton Plant Sciences Center Greenhouses in Manhattan, KS, on November 26, 2017. Day:night conditions; 60°F:72°F with a 12-hr photoperiod.

^b Turfgrass injury was rated on a 0 to 100% scale, where: 0 = no injury and 100 = complete chlorosis/necrosis.

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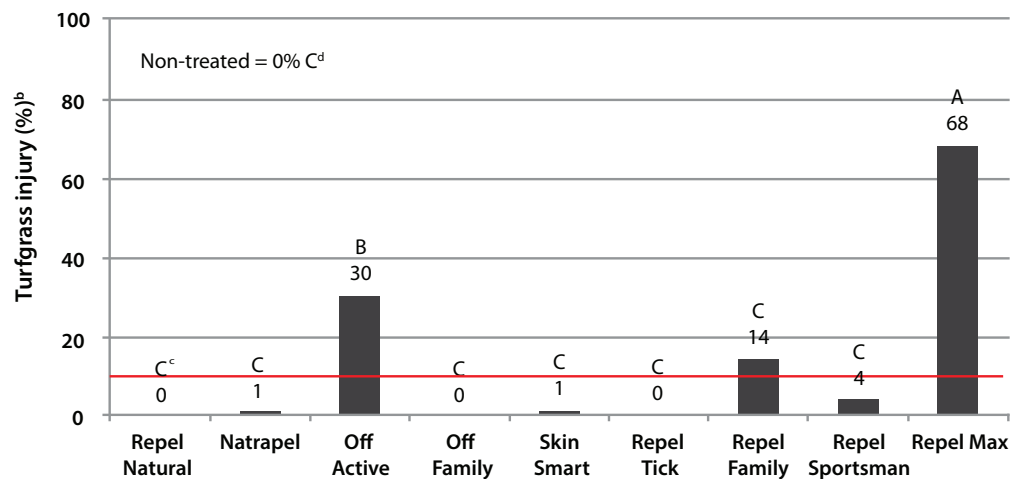


Figure 3. Response of perennial ryegrass (*Lolium perenne*) to common human insect repellents; ^{a,e} 21 days after application.

^a Trial was initiated in the Throckmorton Plant Sciences Center Greenhouses in Manhattan, KS, on November 26, 2017. Day:night conditions; 60°F:72°F with a 12-hr photoperiod.

^b Turfgrass injury was rated on a 0 to 100% scale, where: 0 = no injury and 100 = complete chlorosis/necrosis.

^c Means for percent turfgrass injury followed by different letters are significantly different according to Fisher's Protected LSD at $\alpha = 0.05$.

^d A non-treated control was included for comparisons. Non-treated resulted in 0% injury throughout the research project.

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