Control of Japanese Beetle Larvae in Turfgrass with Preventive and Curative Insecticide Applications

Adam Van Dyke, M.S., Professional Turfgrass Solutions LLC
Author email: adam@proturfgrasssolutions.com

Objective

1. Compare select insecticides applied preventively or curatively for controlling Japanese beetle larvae.

Materials and Methods

This RMEGI-supported research was conducted in 2023 at Meadow Hills Golf Course in Aurora, CO where Japanese beetle (*Popillia japonica*) is an established pest (Figure 1) and insecticides are rarely used for control. Turf was a cool-season mix of Kentucky bluegrass (*Poa pratensis*) and perennial ryegrass (*Lolium perenne*) maintained as golf rough and grown on native soil. Mowing was performed at 2 inches twice each week, and 1 pound of nitrogen/1000ft^2 was applied between June and October. Irrigation replaced 80% of evapotranspiration (ET) each night, as needed to prevent wilt and no cultivation was performed during the study.

Plots were 5-feet by 5-feet arranged in a randomized complete block design with five replications, and laid out in an area of the course that historically has high adult activity and heavy pressure from larvae (also called white grubs). Treatments were applied at two separate timings for targeting the turf-damaging larvae, either preventively on June 25 (when adult beetles were ovipositing [laying eggs]), or curatively on September 6 (to first- and second-instar larvae). Insecticide treatments included Acelepryn 1.67 SC (a.i. chlorantraniliprole, Syngenta) applied at 8 fl. oz./ac; Arena 50 WDG (a.i. clothianidin, NuFarm) applied at 12.8 wt. oz./ac; and Suprado Insecticide (a.i. novaluron, Quali-Pro) applied at 3 fl. oz./1000ft^2. A non-treated check (hereafter, untreated) was also included for comparison. Treatments were applied in water using a CO_2-pressurized backpack sprayer at 40 psi fitted with TeeJet AI11002VS air-induction nozzles calibrated to deliver 2 gal. per 1000ft^2 (87 GPA), and watered-in with 0.2 inches of post-application irrigation. Other pesticides were excluded from the experimental area during the year.

Despite being guided by the superintendent's past experience and historical insect activity, grub pressure was low in the experimental area after sampling through several cup-cutter plugs for larvae before making the curative applications on Sept 6. It was decided to not apply the curative treatments in the original area, and instead lay out a separate curative experiment in a nearby area where larvae were more abundant. This new design and plot size were the same as mentioned previously, except there were six replications used in the curative experiment.

White grub control was determined by counting larvae on October 9. Turf was destructively sampled by cutting strips down the center of each replicate with a sod cutter (Figure 2). Turf was pealed back in the center of each plot and the number of larvae found in the central one square foot were counted for standardization (Figure 3). The percent reduction of larvae was determined with the Abbott calculation; X= (1- T/NT) x 100, where *X* is the corrected control (%), *T* is the number of insects in a treated plot and *NT* is the number of insects in an untreated plot. If the calculated control was negative, zero was used for analysis. Larval data from each experiment were analyzed separately for differences using ARM 2023 (GDM Solutions, Inc., Brookings, SD) with means compared using Fishers' protected least significant difference (LSD) at a 95% confidence interval. In the preventive trial, no larvae were found in the untreated plot in Rep 4, so plots in this replication was excluded from the analyses and the means reported are from four replicates.

Results

White grub pressure was low in the preventive trial and moderate in the curative trial, with untreated turf averaging ~ 3 and 8 larvae/ft^2, respectively (Table 1). Suprado did not reduce larvae compared to the untreated in either study, indicating it had poor efficacy as both a preventive and curative treatment under these conditions. Acelepryn did not reduce larvae applied as a curative treatment, but provided complete control (100% control) of larvae as a preventive treatment. This highlights the importance of knowing the water solubility of an active ingredient, as higher water-soluble molecules are required as a curative strategy because they must be moved through verdure and thatch to reach the larvae where they feed in the soil. The water solubility of chlorantraniliprole (the active ingredient in Acelepryn) is low, and one reason it is such an effective preventive treatment on white grub pests. However, this data suggests it may not be the best curative chemical option for Japanese beetle. Arena had excellent efficacy on larvae when applied at both timings, providing complete preventive control (100% control) and 97% curative control of larvae. Clothianidin (the active ingredient in Arena) is more water-soluble than the active ingredients in Acelepryn or Suprado (https://pubchem.ncbi.nlm.nih.gov/) and likely contributed to it performing better as a curative treatment. More research should be done in the region to validate these results across different years and under heavier pest pressure. Phytotoxicity was not observed with any treatment indicating they offer excellent turf safety (data not shown).

Acknowledgements

Thank you RMEGI Board of Trustees for funding this project. Special thanks to John Magnuson for running the sod cutter – and for hosting the research, providing me with the tools needed to complete the work, and for the help. Thanks to Steve Sarro and Jack Robbins for their continued support, and Kyle Kramer for the technical assistance, also to Matt Giese, Jason Fausey and Justin Ruiz for providing the insecticides.

Table 1. Effect of treatments applied at preventive or curative timings for controlling Japanese beetle larvae in cool-season rough at Meadow Hills Golf Course in Aurora, CO. 2023.

Treatment[Z] and rate	Application Date	Larvae[Y] Oct. 9	Control[X]
		(#)	(%)
Preventive trial			
Untreated	---	2.8 a[W]	0 c
Acelepryn 8 fl oz/ac	June 25	0.0 a	100 a
Arena 12.8 oz/ac	June 25	0.0 a	100 a
Suprado 3 fl oz/1000ft^2	June 25	1.8 a	60 b
Curative trial			
Untreated	---	8.3 a	0 c
Acelepryn 8 fl oz/ac	Sept. 6	8.7 a	40 b
Arena 12.8 oz/ac	Sept. 6	0.3 b	97 a
Suprado 3 fl oz/1000ft^2	Sept. 6	7.7 a	29 b

[Z]Active ingredients are chlorantraniliprole in Acelepryn 1.67SC (Syngenta), clothianidin in Arena 50WDG (NuFarm), and novaluron in Suprado Insecticide (Quali-Pro).
[Y]Average number of larvae found in plots standardized to a #/ft^2 (see text).
[X]Corrected control of larvae using Abbott's calculation (see text).
[W]Treatment means in a column within each trial with a different letter are significantly different (P=0.05; LSD).

Figure 1. Japanese beetle (*Popillia japonica*) is and established insect pest in the greater-Denver area whose larvae (also grubs, pictured) cause damage to turfgrasses.

Figure 2. Turf was destructively sampled for the turf-damaging larvae by cutting strips down the center of each plot with a sod-cutter, and pealing back sod in the center of each plot to count larvae.

Figure 3. Sod strips were pealed back in the center of each plot and larvae counted in one square foot for standardization. Larval activity was greater in the curative trial averaging nearly 10/sq.ft.