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Controlling Invasive Crane Flies and White Grubs: Two for One?

Damaging infestations of invasive crane flies are building in home lawn, golf course and other turf settings across western NYS. As a short-term management approach, insecticides can be a reliable and efficacious control tactic. We have demonstrated or validated the efficacy of a wide range of control products available to pest management practitioners in New York State. Even though invasive crane flies were not detected until 2004 in the Northeast U.S., there are >200 products labeled for the control of larvae, including viable alternatives for preventive and curative control windows. Among them are several classes of active ingredients: anthranilic diamide (chlorantraniliprole), biologicals (*Beauveria bassiana*), carbamate (carbaryl), insect growth regulators (azadirachtin), neonicotinoids (imidacloprid), organophosphate (chlorpyrifos, trichlorfon), oxadiazine (indoxacarb), pyrethroids (e.g., bifenthrin), and dual compounds (bifenthrin+carbaryl, bifenthrin+imidacloprid, cyfluthrin +imidacloprid).

Nevertheless, it is the need for an additional insecticide application that may be one of the most serious consequences of invasive crane fly establishment. As we understand them currently, the best control windows are in spring (April to May) or autumn (September to October), essentially too early or too late to overlap with the traditional periods of preventive (June to early August) and curative (late August to early September) white grub control. Like white grubs, invasive crane flies are bound to become widespread locally. Our previous studies showed, for instance, that within 1 or 2 seasons after initial detection, 22-98% of golf course greens and tees are already infested. Prevention or suppression of crane flies may thereby entail broad applications across whole lawns and fairways. The result is that turf managers are forced to contemplate an additional insecticide application, implying a costly new economic and environmental burden to the turfgrass industry.

Certain long-residual insecticides, when applied as early as April to target other turf pests (e.g. bluegrass billbugs and annual bluegrass weevil), can persist long enough to prevent white grub outbreaks

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Feature Story

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in the summer. Indeed, several products carry "guarantees" for the season long control of one or more kinds of insect pests. Turf managers may not necessarily be "condemned" to an additional widespread application to protect susceptible turfgrass when they suffer infestations of both pest complexes. We therefore examined this approach as a management strategy for tandem control. Forced to intervene against invasive crane flies in the spring, will turf managers enjoy protection over the same area from white grubs in the summer? Likewise, will those forced to intervene against white grubs in the summer, enjoy protection from invasive crane flies in the fall?

Methods

The field study was conducted on a low maintenance nonplay area of a golf course located near Lockport, NY. The site was chosen based on well-established populations of the European crane fly *Tipula paludosa*. Turf composition was a mix of perennial ryegrass and other unidentified grasses (approximately 80%), as well as broadleaf perennial weeds such as chickweed and dandelion (approximately 20%). Grass was maintained at a cutting height of 2.5 inches over the course of the study. The study was conducted as a randomized complete block design with 6 repetitions of 4 treatments. Each treatment plot was 1 x 1 meter.

Liquid and granular formulations were applied with a pressurized CO2 sprayer system and a drop spreader, respectively. Products, formulations and rates are summarized in Table 1. All three insecticides are registered and labeled for use on invasive crane fly larvae in New York State: Acelepryn 1.67SC (chlorantraniliprole), Merit 0.5G (neonicotinoid) and Provaunt 30 SG (indoxacarb). For each product, both the lowest and highest recommended application rates were included as treatments. The insecticide treatments were applied to separate plots at each of three seasonal windows for targeting white grubs such as Japanese beetle (JB) larvae. The first application was made 21 May 2009 to simulate an early preventive window prior to JB egg laying. The second application was made 6 July to simulate a late preventive window to target JB eggs and first instars. The third application was made 28 July 2009 to simulate an early curative window to target first and second instars.

The effect of treatments on the abundance of crane fly larvae was measured on 2 November, or 165, 120 and 100 days after application. This species of crane fly completes larval development in early June, aestivates all summer, pupates in September and emerges as an adult in September/October. Rating the plots in November thereby measured residual protection against new crane fly larvae of the fall population. Each plot was rated by collecting five 2-inch diameter soil cores, from which larvae were separated through a heat extraction technique in the laboratory. Soil samples were discarded after 24 hours of extraction. The number of larvae from each plot was tallied using a dissecting microscope. Percent control was calculated with respect to the untreated check plots.

Results

In the untreated check plots, the mean density of crane fly larvae was 74/sq ft. There was a significant effect of treatment on larval densities for all three application

Table 1. Insecticidal treatments (low and high rates are based on label recommendations)

Product method	Product/1000 sq ft	Pounds AI/acre	Application
Acelepryn 1.67SC, low	5.43 ml	0.104	liquid
Acelepryn 1.67SC, high	10.86 ml	0.209	liquid
Merit 0.5G, low	1.4 lb	0.3	granular
Merit 0.5G, high	1.8 lb	0.4	granular
Provaunt 30SG, low	0.138 oz	0.1125	liquid
Provaunt 30SG, high	0.275 oz	0.225	liquid

dates (P<0.05, ANOVA).

For the first application date (21 May), a significant reduction in fall crane fly populations was attributed to the following treatments: chlorantraniliprole (low 66%, high 93%) and imidacloprid (low 50%). No carry-over residual effect was detected for either rate of indoxacarb or the high rate of imidacloprid for the suppression of fall populations after spring application.

For the second application date (6 July), a significant reduction in fall populations was attributed to the following treatments: chlorantraniliprole (low 98%, high 100%), imidacloprid (high 45%) and indoxacarb (low 45%). No carry-over residual effect was detected for the low rate of imidacloprid or the high rate of indoxacarb for the suppression of fall populations after early July application.

For the third application date (28 July), a significant reduction in fall populations was attributed to the following treatments: chlorantraniliprole (low 88%, high 94%), imidacloprid (high 53%) and indoxacarb (low 58%, high 72%) (Table 2, Fig. 3, Fig. 4). No carry-over residual effect was detected for the low rate of imidacloprid for the suppression of fall populations after late July application.

Discussion:

Are turf managers necessarily condemned to an additional application when they suffer infestations of invasive crane flies on top of white grubs? Probably not. Certain long-residual insecticides do hold potential for the tandem control of ECF and other susceptible turf-infesting insect pests such as white grubs. Our study reveals that applications of chlorantraniliprole made in May and July can persist long enough to protect turf from fall populations of invasive crane flies. Applied in late May, we recorded a residual effect of 66-100% reduction in the fall. Applied in early or late July, we recorded 89-100% control in the fall. While both imidacloprid and indoxacarb showed some residual activity, their promise for season long control is still ambiguous. More studies are required to define the length of season long control opportunities.

In practical terms, these results mean that pest management practitioners forced to intervene against white grubs in the summer may also experience protection against the fall generation of invasive crane flies if they use chlorantraniliprole. Moreover, those forced to intervene in May against invasive crane flies, may enjoy protection against them for the rest of the season, as well as against any other co-occurring insect pests for which those products have proven efficacy (e.g., white grubs).

In addition to long-residual control, chlorantraniliprole offers relatively good efficacy in spring when applied for the curative control of late instar crane flies. In our previous studies with this insecticide, the mean efficacy against late instars in spring was 43% (range 5.2-53.1%, n=7). Consistent with the idea that insecticide efficacy declines with increasing size of the immature target stage, mean efficacy was 63% (n=2) in late April, 47% (n=3) in early May and 16% (n=2) in late May. In our previous studies with imidacloprid and indoxacarb, the mean efficacy against late instar crane flies in spring was 62% (range 57-67%, n=4) and 42% (range 0-94%, n=11), respectively, for applications made between 2 May and 30 May. In order to fully validate a spring window for curative control opportunities with these insecticides, more data should be gathered on the efficacy of applications made from early April to late May. Moreover, the season-long efficacy of those timings should be confirmed against the fall populations of ECF.

The study will be repeated in 2010 to validate results. If proven successful, this new approach will mean that areas targeted for preventive white grub control will be protected from crane flies for the rest of the season. Conversely, areas targeted for curative crane fly control in the spring will be protected from white grubs for the rest of the growing season and even from crane flies through late fall. Benefits of this "two-for-one" should ultimately be experienced across the entire industry through one less insecticide application: one less visit for lawn care service providers, one less fairway application for golf course superintendents, and one new tactic to ensure a high quality (uninfested) product for sod producers. The overall impact will be to mitigate the impact and curb the spread of invasive crane flies across New York and the broader Northeast.

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