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PRELIMINARY EVALUATION OF A GRANULAR TRIMETHACARB FORMULATION FOR DETERRING GRAZING BY AMERICAN COOTS

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ABSTRACT

In a 0.2 ha flight pen, groups of 4 American coots were tested to determine if their grazing activity could be affected by application of a registered granular-trimethacarb insecticide. In the 3 days following treatment (3 kg/ha, a.i.), grazing activity in the treated portions of the 200 m^2 experimental plots was reduced an average of 47%. Overall use of the treated areas followed a similar pattern but was less consistent among groups. The addition of methylpyrazine, a strong odorant, produced a strong initial suppression of grazing activity in the treated halves of the plots. However, subsequent rain and a change in the coots' grazing behavior prevented a definitive evaluation of the methylpyrazine treatment. Two birds that died during the trimethacarb-only portion of the study did not have abnormally low levels of brain cholinesterase. However, this finding does not preclude the possibility that they were unable to distinguish treated from untreated grass and consumed lethal amounts of trimethacarb. Additional investigation of methylpyrazine appears warranted; such materials may act to decrease the likelihood that birds will ingest lethal quantities of repellent.

INTRODUCTION

American coots (Fulica americana) damage parks, golf courses, and other grassy areas by grazing (Van Way 1986). Also, coot feces present a possible health hazard, and reduce the aesthetic and recreational value of grassy public spaces. The available evidence (Conover 1985) suggests that methyl carbamate insecticides (e.g., methiocarb) may deter grazing by Canada geese (Branta canadensis). Methiocarb may be similarly effective against coots, but the prospects for the registration of methiocarb for turf applications are unknown. Currently, efforts are underway to register another carbamate, trimethacarb, as a turf insecticide (3% granules, Drexel Chemical Co. in collaboration with O.M. Scott Co., L. Haefele, personal communication). Trimethacarb is already registered for use on corn (15% granules, Broot® 15GX). In addition to its insecticidal properties, trimethacarb has bird repellent properties (Schafer et al. 1984) and is generally less toxic to birds than methiocarb (Schafer and Eschen 1984).

In previous experimental trials, Broot® 15GX did not deter birds from unearthing corn seeds (Heisterberg and Twedt 1984). The 3% granular formulation was not available for testing, so in this study, we assessed whether the 15% granular trimethacarb formulation could deter grazing by coots.

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indispensable in that effort. L. Whitehead prepared the manuscript expertly. Use of registered product names does not imply endorsement by the USDA.

METHODS

The flight pen at the Florida Field Station of the Denver Wildlife Research Center was divided into 6 200-m^2 grass-covered plots. Each plot was bisected with a white string suspended at ground level. The halves of each plot were designated "A" and "B" for convenience. A coin flip determined which half was treated. A water pan (30x60x8 cm) was situated centrally in each half of each experimental plot. Plots were separated from one another by 1.5-m high barriers of black plastic sheeting suspended on wire attached to fence posts.

American coots were captured in the vicinity of Gainesville, FL and housed in a 3x10x2 m pen at the Florida Field Station with free access to water and a mixed ration of poultry starter, cracked corn, grit, and grass.

In the first phase of the study, plot treatment was a 2-step process. First, vegetable oil was applied to both halves of each of 4 experimental plot with a Hudson sprayer at the rate of 1 l per 100 m^2. The oil served as an adhesive to stick the granules to the grass blades. The treated half then received trimethacarb granules (Broot® 15GX) applied with a hand operated centrifugal seeder calibrated to deliver the trimethacarb granules to the treated half at the rate of 3 kg (a.i.)/ha. This treatment rate was used successfully by Conover (1985) to deter grazing geese with methiocarb.

Three days of pre-treatment observations started the day after 4 coots were put into each plot. One observer was stationed in a blind at the north end of the flight pen for 90 min during the period 0800-1000. The locations within the plot (A or B) and activities (loafing, feeding, drinking, or walking) of the birds in each plot were recorded at 3-min intervals. On the 4th day, plots were given their assigned treatments, and observations were made for 5 days as during pre-treatment. Throughout the test, no supplementary food was placed within the enclosures.

The second phase of the study was conducted differently. First, there was no pre-treatment period. In addition, only the treated half of each plot was sprayed with vegetable oil prior to application of trimethacarb. Finally, the vegetable oil contained 0.01% (volume/volume) pyrazine (2-methoxy-3-methylpyrazine, CAS No. 2847-30-5). This odorant markedly enhances the effectiveness of methiocarb against blackbirds (Avery and Nelms 1989).

Immediately following treatment applications, 2 groups of 4 birds were released onto the two treated plots. Observations identical to those described above (phase 1) were made on each of 4 consecutive post-treatment days.

Because of a heavy rainfall (1.8 cm) on the night following treatment, the pyrazine and trimethacarb treatment was replicated (phase 3) approximately 4 weeks after the end of phase 2. The same groups of birds served in both phase 2 and phase 3, but in phase 3 we reused two of the plots from phase 1.

On a daily basis, mean numbers of coots present and mean number grazing in treated and control areas were calculated and standard errors were estimated. Two-way repeated measures analyses of variance (ANOVA) were conducted on the grazing activity and overall use of the treated and untreated areas by the groups in the pre- and post-treatment periods of the the first phase of the study. Phases 2 and 3 were not statistically assessed because of insufficient replication. However, descriptive statistics and a qualitative assessment of the

pyrazine-trimethacarb treatments are provided below.

RESULTS AND DISCUSSION

Phase 1

Throughout this phase of the study there was significantly less total use ($F_{1,3}$ = 25.8, p = 0.013) and grazing ($F_{1,3}$ = 10.1, p = 0.043) in treated areas of the experimental plots than in control halves. During the 3-day pre-treatment period, and average of 35% (S.D. = 10%) of the coots' grazing activity occurred in the portions of the plots designated for trimethacarb treatment. Partially because grazing activity favored the untreated half of most plots before the treatment was applied, the interaction between treatment and period (pre-treatment and post-treatment) was not statistically significant ($F_{1,3}$ = 1.4, p = 0.32). As indicated by this lack of significant treatment-period interaction, the trimethacarb treatment that we applied was not sufficiently strong to overcome the pre-treatment bias displayed by the birds. In future studies of this kind, treatments should be assigned on the basis of pre-treatment patterns of use rather than preassigned. Overall, there was significantly less grazing during the post-treatment ($F_{1,3}$ = 11.1, p = 0.05), suggesting that trimethacarb applications did affect the feeding behavior of the coots, although other, unknown factors could have been involved.

While trends over days were not evaluated in the ANOVA, the results suggest that, with the exception of plot 1, grazing in all units declined immediately after treatment (Fig. 1). These declines persisted for 3-4 days. Grazing in plot 1 also declined on post-treatment days 2-3, after showing a slight increase on post-treatment day 1. Overall, for the 3 days following application of the trimethacarb granules, coot grazing in the treated portions of the plots declined an average of 47% relative to pretreatment levels (Table 1). Grazing activity in the control areas declined an average of 8% during the same period. By the fifth day post-treatment, grazing activity in the treated areas had increased so that the mean reduction from pre-treatment levels was just 14%. The birds in group 2 loafed in the treated half of their plot (Fig. 1) even though they tended to feed in the untreated portion, and on day 2 post-treatment, group 4 also used the treated area for loafing while grazing elsewhere. Otherwise, the overall pattern of use of the treated and untreated portions of the plots was similar to that of the grazing activity. By post-treatment day 5, groups 3 and 4 no longer avoided treated areas, and the effect of treatment on groups 1 and 2 appeared to be extinguishing as well.

Phases 2 and 3

Immediately following the first application of methylpyrazine-trimethacarb, overall use and grazing activity in the 2 treated areas was very low (Table 2). However, by the second day post-treatment, total use as well as grazing in the treated areas increased substantially and remained high for the duration of the trial. We believe that a heavy rain on the evening of the first day washed the sprayed material off the grass, or at least reduced its' effectiveness. When the pyrazine treatment was repeated 4 weeks later, one of the groups seldom used the treated area at all, and the other group used the treated half more than the untreated half. Each group showed a marked overall reduction in grazing activity relative to that displayed by groups in earlier trials (Table 3).

Coot Mortality

Two coots died during the initial trimethacarb trial, one on day 2 post-treatment and the other

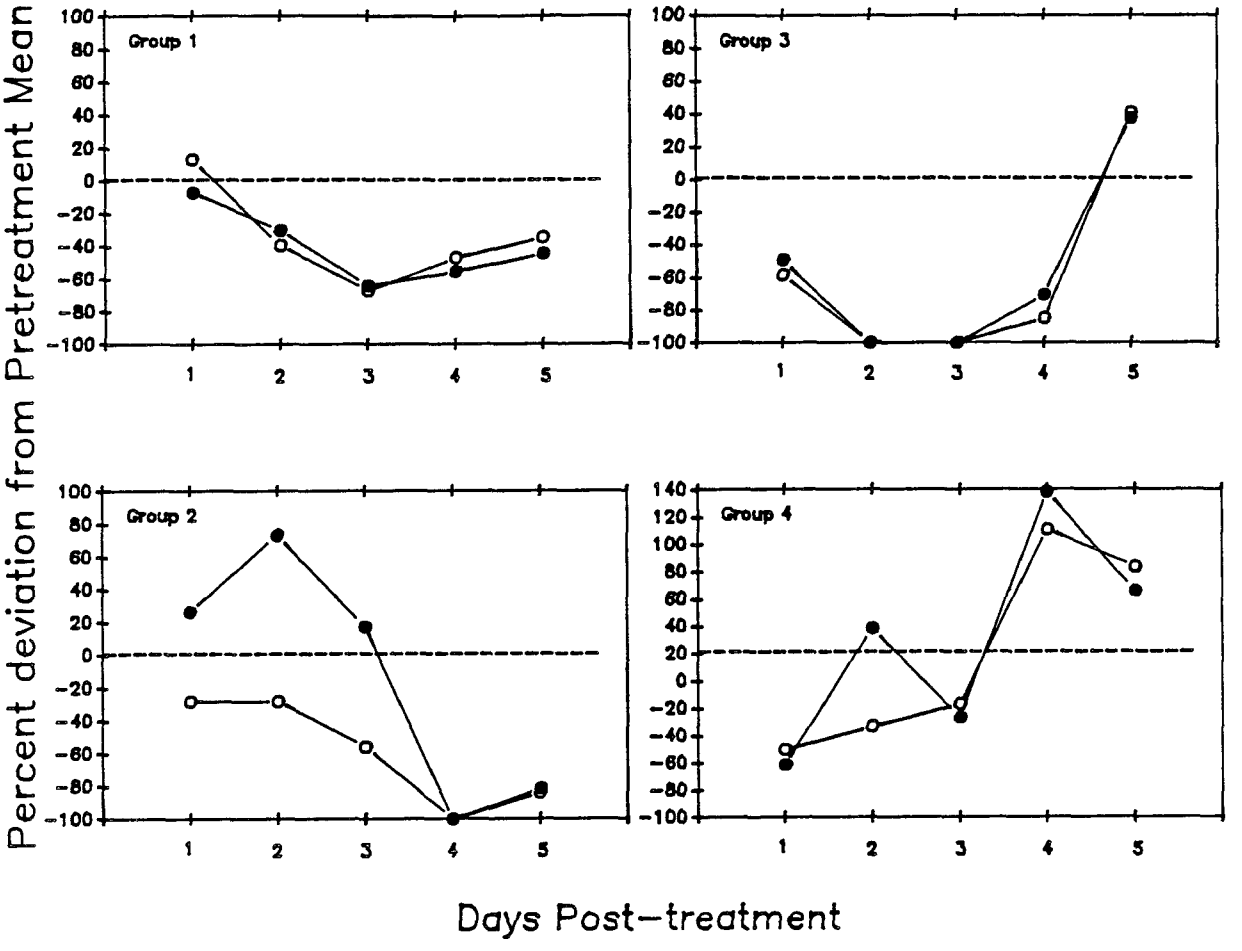

Figure 1. Grazing (o) and total time (●), expressed as percentages of their respective pretreatment mean, spent by 4-bird groups of American coots on the trimethacarb-treated portion of their experimental plots.

Table 1. Mean daily number of observations of coots grazing in the designated treated portion of experimental plots during the pre- and post-treatment phases of the study.

	Number of observations		
	Pre-treatment	Post-treatment	
Plot	Days 1-3	Days 4-6	Days 7-8
Northeast	40	27	24
Southeast	25	16	2
Southwest	26	4	21
Northwest	18	12	36
Mean	27	15	21
S.D.	9	10	14
Mean reduction from pre-treatment		47%	14%

Table 2. Observations of 2 groups of coots using grass areas 1 to 4 days after treatment with trimethacarb plus methylpyrazine.

Group	Percent of total observations			
	Day 1	Day 2	Day 3	Days 4
North	0	40	73	33
South	7	44	40	23

Table 3. Overall grazing activity (min/bird) by coots during 90-min observation periods in trimethacarb grazing repellency study.

Treatment	Test group			
	1	2	3	4
Trimethacarb (17-21 March)	16.9	14.2	17.2	14.2
Trimethacarb plus pyrazine				
(22-25 March)	13.4	8.9	--	--
(17-20 April)	2.3	3.9	--	--

on day 3. Each bird was found moribund prior to the start of the morning's observations and was removed from the experimental area and replaced with a new bird. The moribund coots were placed in a shaded, protected area, and each died within 2 h. The dead birds were immediately frozen for later examination.

Heads of the dead birds were later shipped under dry ice to the USEPA Environmental Research Laboratory in Corvallis, Oregon for analysis of brain cholinesterase levels. The assays showed cholinesterase levels (27 and 28 μmoles hydrolyzed/min/g of tissue) in excess of those previously reported from apparently normal coots (mean = 18, S.D. = 1.5, n = 5) by Hill (1988). Thus, it is not possible to conclude that the birds died because of overexposure to trimethacarb and subsequent cholinesterase depression.

However, this possibility cannot be ruled out either, as cholinesterase assays are sensitive to many variables, and comparisons with previously published data must be made with caution (Fairbrother and Bennett 1988).

MANAGEMENT IMPLICATIONS

In controlling nuisance waterfowl on golf courses, parks, and similar sites, reduction in bird use of space is the main objective. Birds that loaf extensively on a site will be a considerable problem even if they graze elsewhere. The trimethacarb treatment was marginally effective in reducing overall use. The application of methylpyrazine provided an additional stimulus to help the coots discriminate the treated from the untreated half of their plots. Despite a promising initial response, this approach remains untested because of the adverse weather conditions and because of a

subsequent change in the birds' behavior that markedly reduced their grazing activity.

We felt that 100 m^2 treated and untreated halves would provide the 4-coot groups with sufficient plot area to allow discrimination. On the basis of their grazing activity, the coots in the first four groups did discriminate well. Their overall use pattern was less reliable, however, and this may indicate that certain portions of the plots were preferred loafing areas because of proximity to shade or because of other (unknown) features attractive to coots. If an area is being used by birds for feeding, then a feeding deterrent such as trimethacarb is likely to reduce their use of the area. If the area in question is being used for loafing or for some other nonfeeding activity, then the application of a material that depends on ingestion for effectiveness will likely be less successful. Moreover, if the presence of a small pond or lake is the main attraction for birds at a given site, then treatment of the water with a repellent material may be more effective than treatment of the grass. The feasibility of this approach has yet to be evaluated.

Trimethacarb is considered to be a less effective bird repellent than methiocarb (Schafer and Eschen 1984). The rate of application used in this study was the same as Conover (1985) used with methiocarb. Thus, it is perhaps not surprising that our results did not show dramatic repellent effects. A higher application rate may have produced a more definitive response in the test birds. Furthermore, the granular formulation we used is likely to be less effective than a wettable powder (the form in which methiocarb was tested) that can be sprayed more uniformly on the treated area, that will adhere more strongly to the grass, and as a result, be more weather resistant.

The laboratory assays found no evidence of depressed brain cholinesterase levels in the 2 dead coots. However, this type of assay can produce "false positive" results (J. Bennett, personal communication), so that overexposure to treated grass cannot be ruled out completely as a possible cause of death. Usually, postingestional effects that accompany carbamate intoxication induce an aversive reaction before a lethal dose is acquired. In some instances, these effects may not be sufficiently strong to enable the birds to associate them with the treated food or the treated area. For the 2 dead birds, repeated exposure to treated grass coupled with an inability to distinguish between the treated and untreated areas of the plots may have inhibited feeding to the point where they became debilitated and could not recover. In Phases 2 and 3 of this study, the addition of methylpyrazine to the trimethacarb treatment provided additional information to the test birds as to which part of their plot was treated. While the results were not conclusive, the addition of the methylpyrazine may have prevented overgrazing in the treated grass so that, unlike Phase 1, no deaths occurred in the later trials.

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