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ASSESSMENT OF METHYL ANTHRANILATE (ReJeX-iT AG-36™) FOR REDUCING CANADA GOOSE USE OF TURF GRASS AREAS

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INTRODUCTION

Non-migratory Canada Geese (*Branta canadensis*) populations have been increasing over the past four decades in many parts of the United States. In suburban areas, geese are often found at local parks, on golf courses, and on private and public lawns. At first they were viewed as a pleasant roadside attraction. However as their numbers increased, they became a major nuisance in some situations, primarily as a result of fecal deposits. Feces left by geese lower the aesthetic value of parks, ball fields, and other turfgrass areas, and negatively impact water quality (Conover and Chasko 1985).

Many attempts have been made to alleviate conflicts between geese using turf areas near water sources and people. Specific methods include the use of pyrotechnics, traps, and scare devices (USDA 1986, Heinrich and Craven 1990). However, such methods are often costly, not entirely effective, and may have limited public acceptance. The effectiveness of goose alarm and distress calls has also been evaluated, but results were inconclusive (Aguilera et. al. 1991). The use of dogs, in particular border collies, is currently being investigated as another possible alternative for moving geese from specific locations (A. Herriott, Cornell Cooperative Extension, Rockland County, pers. commun.). In addition, public demand has increased for a bird repellent that is effective, economical, and safe for both target and non-target species (Vogt 1992).

The purpose of this study was to test the repellent properties of methyl anthranilate (MA; ReJeX-iT AG-36™, PMC Specialties, Inc., Cincinnati, OH) on a population of local, urbanized Canada geese. MA is a naturally occurring compound found in plants such as jasmine, concord grapes and orange blossoms (Vogt 1992). It is the raw material used in the production of saccharin, and is contained in some grape-flavored chewing gums at concentrations exceeding 2,200 ppm. While MA tastes sweet to people, it is distasteful to many bird species, and is currently being tested as an oral aversion agent for birds (Avery 1992, Vogt 1992).

The bird-repellent properties of MA were first noted in the 1960s, however, little additional research with this chemical was conducted until the late 1980s. MA is an ester which appears to act primarily through nasal trigeminal irritation (Mason et al. 1989). One difficulty of using MA is that in its pure form, it rapidly photodegrades forming anthranilic acid, which can severely burn plant tissues. Recently, MA has been formulated in a time-release starch matrix (14.4% a.i., Vogt 1992), providing a repellent suitable for spraying on turf and other vegetation. Cummings et. al. (1991) used MA and its corollary, dimethyl anthranilate, in a trial which indicated that Canada goose numbers and fecal deposits on treated areas were less than those for control plots, but few significant differences were observed. In another study, MA and DMA were tested with and without methiocarb on captive Canada geese and mallards (*Anas platyrhynchos*). Concentrations of 2% MA (g/g) and DMA significantly reduced shelled corn consumption by Canada geese and ducks (Cummings et al. 1992).

Experiments involving the direct application of MA to water surfaces are also noteworthy. Avery et al. (1992) determined that coot (*Fulica americana*) use of MA-treated water ceased entirely within two days. Similar tests with mallards and gulls (*Larus delawarensis*) showed significant declines in bird numbers using MA-treated pools (Dolbeer et al. 1992). Experiments in which MA was applied directly to water surfaces are important because this compound appears to be aversive at much lower concentrations (0.10-0.50%) when in liquid suspension.

STUDY AREA AND METHODS

This study was conducted in King's Park, Rockland County, New York (41° 08' N, 74° 02' W). King's Park is used daily for community recreational activities, and is situated in a residential area. The study site was approximately 50 by 120 m, surrounded by a tree line, basketball court, and was bordered on one side by a shallow pond (Fig. 1). The turf consisted primarily of Kentucky bluegrass (>90% *Poa pratensis*), with scattered herbaceous weeds and bare ground (A. Turner, pers. commun.). The test field was partitioned into four 20 m by 30 m plots, which were randomly designated as treatments or controls (2 each). Four randomly-stratified transects were established in each plot within 7.5-m blocks, depending--on distance from the pond.

Goose and fecal counts were conducted from 19 May through 24 June (Julian dates: 139-175), during pre-treatment, treatment, and post-treatment phases. The number of geese using each plot were made at tenminute intervals during late morning through early evening each count day. Fecal counts were made every 3 to 5 days by sampling 10, 1-m^2 subplots situated along the transects. After samples were taken, each transect was raked to avoid recounting fecal deposits on the next sampling day. The number of fecal deposits per m^2 were counted and compared between plots throughout the study, and served as an indicator of intensity of goose use.

Experiment 1

On June 2, MA was applied with a model 412 SOLO backpack mistblower on the treatment plots at a rate of 8.4 lbs. of active ingredient (a.i.)/acre (9.4 kg a.i./ha) with a high-volume spray (Table 1). High-volume spraying caused the formulation to be distributed as a fine mist. Each treatment plot received a rate equivalent to 7 gal. of formulated MA per acre mixed 1:3 with water as specified on the experimental label. Control plots remained untreated.

Experiment 2

On 8 June, all four plots were treated with MA. Plots T1 and T2 (prior treatment plots, Fig. 1) were given the same application rate (8.4 lbs. a.i./acre), however, the formulated product was mixed 1:2 with water and applied as a low-volume spray. Plots C1 and C2 (prior controls, Fig. 1) were treated with 16.8 lbs. a.i./acre (18.8 kg a.i./ha) of formulated MA mixed 1:2 with water. This was also applied as a low-volume spray to create larger droplets, thereby providing a more dense coating of MA on individual blades of grass.

ANOVA models (Abacus Concepts, Inc. 1989) were used to test the null hypothesis of equal treatment effects among control and MA-treated plots for the mean number of goose feces deposited/m^2/day. Linear regression models were used to evaluate peak daily goose counts at King's Park over time.

RESULTS

Peak numbers of geese visited King's Park each day during 1200 to 1800 hours. Generally, few geese (<10) were at the park before 0700 hours or after 2000 hours, indicating the flock did not roost on the pond during the night. It was not possible to determine night-roost locations of geese using the park each day.

A few geese using the park each day had been neck-collared previously (B. Swift, NYS Dept. Environ. Conserv., pers. commun.). Observations of these marked geese indicated a portion of the flock visited the site nearly every day (Table 2). However, 4 of the 6 neck-collared geese observed at King's Park visited the site on only one count day. Although peak daily counts of Canada geese were relatively consistent during 4- to 5-day periods, there appeared to be some turnover in flock composition each day.

Experiment 1

Peak daily goose counts did not appear to be affected on the day following the first MA application (3 June, JD 154), however, counts decreased during days 157-159 (Fig. 2). A total of 119 geese were seen on JD 151, prior to treatment, and only 68 birds were observed on JD 157, 4 days post-treatment. After this initial drop, daily counts increased to 90 geese on JD 159, and goose foraging behavior indicated the initial MA application was no longer aversive. The number of goose droppings were not significantly different between control and treatment plots (Fig. 3) except on JD 154 ($F=13.6077$, $P=.0003$), the day following MA application. Consequently, a decision was made to treat all plots with MA using different application rates and methods.

Experiment 2

Peak daily goose numbers declined significantly ($Y = -4.95X + 861.25$, $R^2 = 0.84$) after the second application of MA on 24 June (JD 159), eventually reaching 0 on JD 175 (the last day of observation, Fig. 2). Fecal counts also decreased significantly during days 165 to 175 (Fig. 3). Prior to the second application, about 0.75 goose droppings/m^2/day were counted on all plots. After treatment, 0.40 droppings/m^2/day were tallied.

DISCUSSION

The geese flocked in small groups converging on the test field in King's Park during mid-day hours in order to forage on the turf grass and rest in the nearby pond. Because a small number of these geese were previously neck-collared (Table 2), we observed that a portion of the flock returned to the park almost every count day. However, daily peak counts were somewhat variable because multiple flocks visited the park, and different groups of geese used the site on different days. The geese we observed at King's Park appeared to be primarily non-breeding subadults, as only one group of 6 goslings was observed on the pond.

During typical foraging activity, the visiting flocks wandered throughout the treatment and control plots spending ample time feeding.

The geese frequently returned to the pond either to rest, drink, or avoid danger (i.e., dogs). Occasionally, the geese spent little time at the test field, choosing instead to forage on the ball field and open grassy area on either side of the research plots. This behavior accounts for much of the variation in both goose and fecal counts.

Following both MA applications, numbers of Canada geese decreased at King's Park. The response was most dramatic during Experiment 2 (Fig. 2), using a high MA concentration with a low-volume spray technique (Table 1). Behavioral observations indicated the MA was extremely aversive to the geese. During the initial feeding bouts following treatment, geese would shake their heads and rapidly pass through treated areas. Sometimes geese that had contacted MA would quickly walk to the pond, where much splashing and preening would follow as the birds attempted to wash the MA from their feathers.

During days 165-175, fecal counts on all plots (0.4 droppings/m^2/day) were significantly lower ($F=23.46$, $P=0.001$) than pre-treatment levels (0.7-1.1 droppings/m^2/day). Also on 24 May (JD 144, Fig. 3) the number of droppings tallied was very low because this count was taken the day after the plots were set up and raked, and the geese spent little time foraging at the study site prior to the count because of this disturbance. Usually plots were sampled and raked every 3-5 days. The greater number ($F=13.6077$, $P=.0003$) of droppings on treatment instead of control plots on JD 154 can be explained by the large number of geese that frequented the park that day (Fig. 2), as well as the tendency of geese to forage on treated plots and an adjacent field following MA application on day 153, rather than feeding in the control area. However, behavioral observations on days 153 and 154 indicated that the geese moved through the treatment plots shaking their heads, and made frequent trips to the pond to wash and preen.

Because this experiment occurred immediately prior to the summer molt (replacement of flight feathers) for geese, it is particularly noteworthy that geese left the study area in King's Park to seek safe haven elsewhere. Another pond was situated approximately 300 m south of the study plots in King's Park. While small numbers of geese foraged at this southern pond during days 144-159, most geese used the King's Park pond for resting and refuge. After the second application of MA on day 159, goose numbers at the southern pond increased and feeding intensified in that area. When disturbed, the geese sought refuge at the southern pond, rather than retreating to the King's Park pond as had been observed previously.

Thus, we conclude that applications of MA on turf grass can effectively repel Canada geese when applied at the proper time of year (i.e., before molting), and with the appropriate rates and techniques. The Environmental Protection Agency registration for MA (ReJeX-iT AG-36™) use as a goose repellent in turf areas was approved in July 1994, and PMC Specialties, Inc. is currently pursuing state agency registrations.

When MA becomes commercially available, it will likely be an expensive method for repelling geese from problem locations, particularly if multiple applications are required. Other longer-term techniques for reducing goose conflicts should be considered and investigated. Designing landscapes that are less attractive to geese may be one option. Conover (1991) noted that geese showed a feeding preference for Kentucky bluegrass, the dominant vegetation at King's Park, over other grass species tested. The geese in that study fed more heavily on grass species with a low ash content and tender leaves. In addition, common periwinkle (*Vinca minor*), Japanese pachysandra (*Pachysandra terminalis*), and English ivy (*Hedera helix*) were found to be unpalatable. Conover and Kania (1991) also noted that planting tall trees or increasing the number of hedges near ponds may make sites less attractive to geese. Landscape management alone will not resolve all goose conflicts, however, there are situations where changes in landscape design, in combination with other methods, could provide a long-term solution.

Using trained dogs to displace geese from parks and golf courses also warrants further study. The few anecdotal reports received to date from golf course superintendents are very encouraging (A. Herriott, Rockland Co. CCE, pers. commun.). Larger replicated studies and thorough cost-benefit analyses are needed. This could be another one of several useful methods in our toolbox for dealing with suburban goose conflicts.

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Table 1. Application dates and quantities of methyl anthranilate (ReJeX-iT AG-36™) used as a Canada goose repellent at King's Park, Town of Clarkstown, in Rockland County, New York on 2 and 8 June 1994.

Date	Plot	Area (ac) Treated	Gal. MA. Per Acre	Lbs. A.I. Per Acre	Total Gal.[a] MA Applied
6/2	C1	0	-	-	-
	C2	0	-	-	-
	T1	0.148	7	8.4	1.04
	T2	0.148	7	8.4	1.04
	TOTALS	0.296	-	-	2.08
6/8	C1	0.148	14	16.8	2.08
	C2	0.148	14	16.8	2.08
	T1	0.148	7	8.4	1.04
	T2	0.148	7	8.4	1.04
	TOTALS	0.592	-	-	6.24

[a]On 2 June the methyl anthranilate (MA) was mixed 1:3 with water and applied as a high-volume spray (fine droplet size). On 8 June, the MA was mixed 1:2 with water and applied as a low-volume spray (large droplet size).

Table 2. Observations of neck-collared Canada geese at King's Park (41 08'N, 74 02'W), Town of Clarkstown, in Rockland County, New York during 20 May through 24 June 1994 (X = goose observed; - = goose absent).

	Julian	No. of	White Neck Collars Observed					
Date	Date	Geese	+Z2	+ZX	+ZJ	+ZK	9N5	3F
5/20	140	60	X	X	X	-	-	-
5/24	144	60	X	-	-	X	-	-
5/27	147	65	X	-	-	-	-	-
5/31	151	119	-	X	-	-	X	-
6/1	152	115	X	X	-	-	-	-
6/2	153	85	X	X	-	-	-	-
6/6	157	68	-	-	-	-	-	X
6/7	158	69	-	X	-	-	-	-
6/8	159	90	X	X	-	-	-	-
6/9	160	66	-	X	-	-	-	-
6/13	164	17	-	X	-	-	-	-
6/14	165	60	-	X	-	-	-	-
6/17	168	32	-	X	-	-	-	-
6/24	175	0	-	-	-	-	-	-

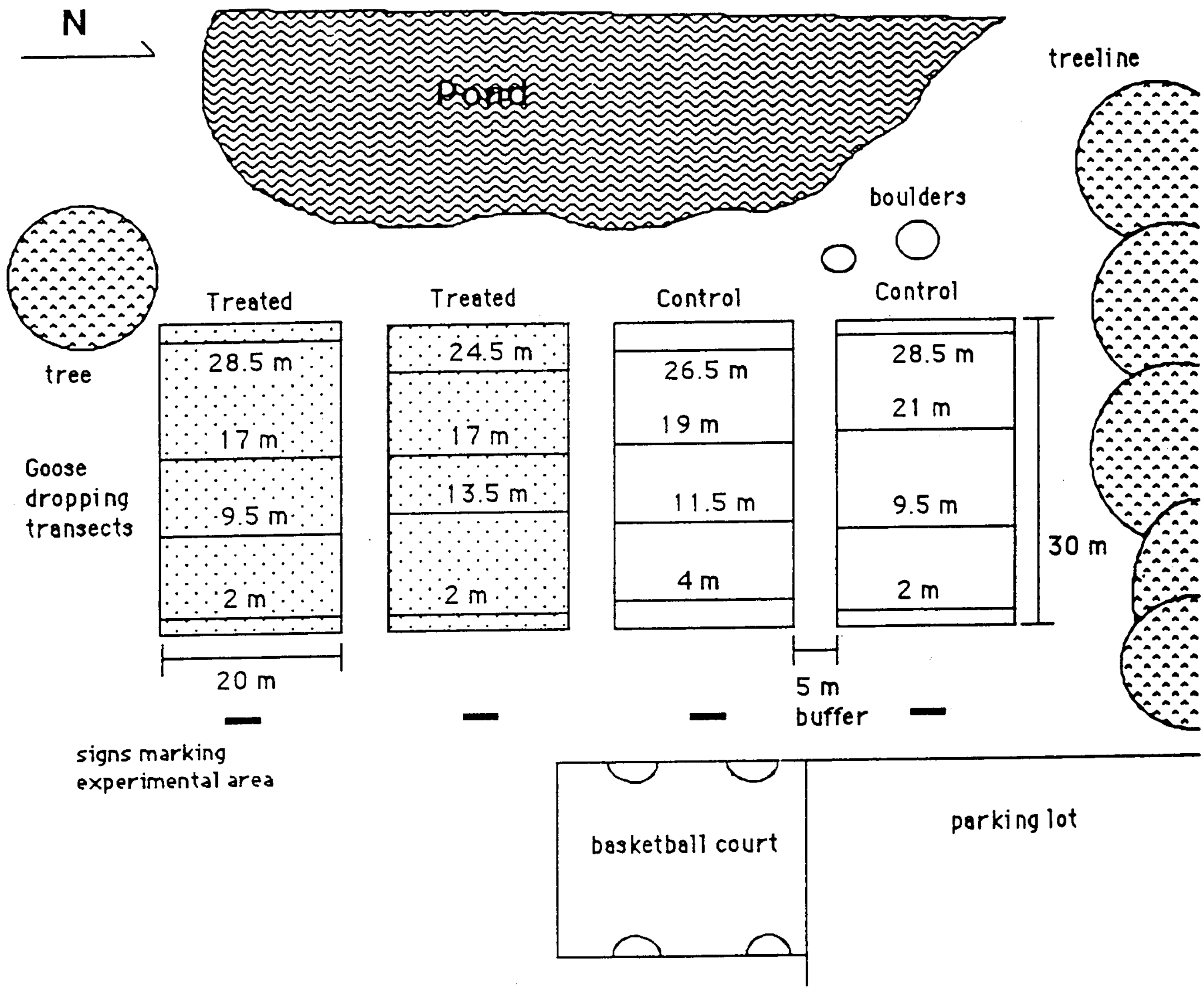

Fig. 1. Description of the King's Park study site, Rockland County, New York for testing the effectiveness of methyl anthranilate (ReJeX-iT AG 36™) for repelling geese from grazing on turf grass.

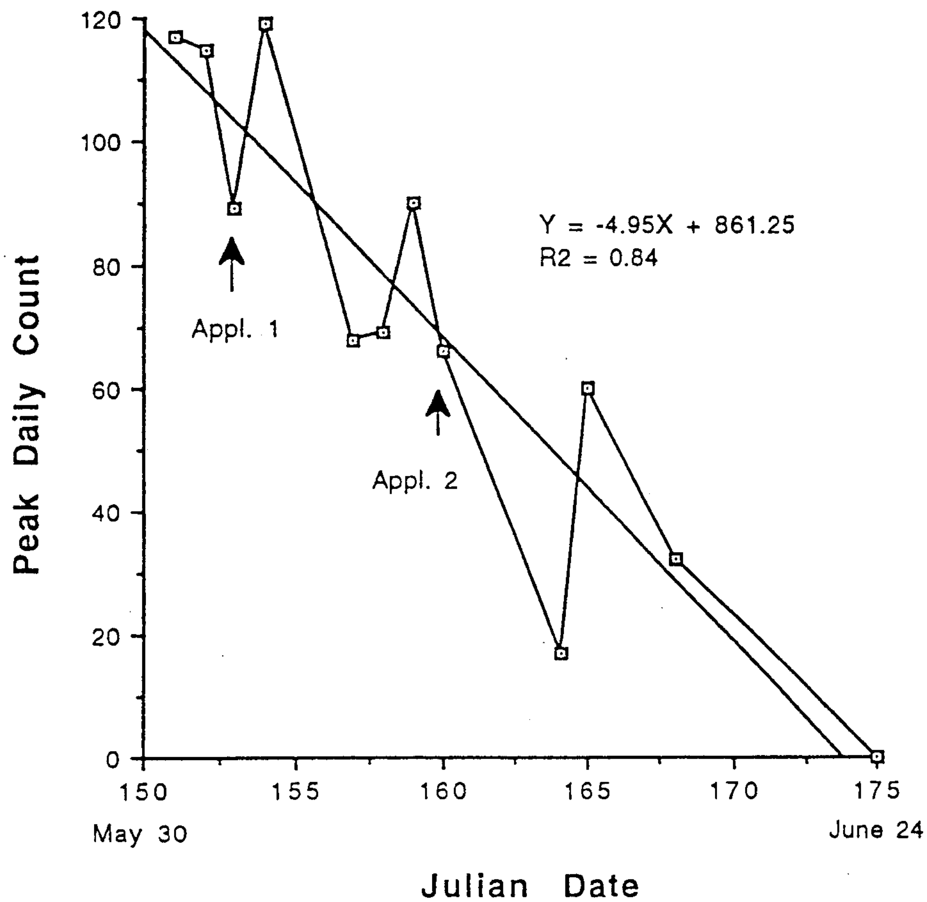

Fig. 2. Peak daily counts of Canada geese at King's Park, Rockland County, New York during 30 May through 24 June, 1994.

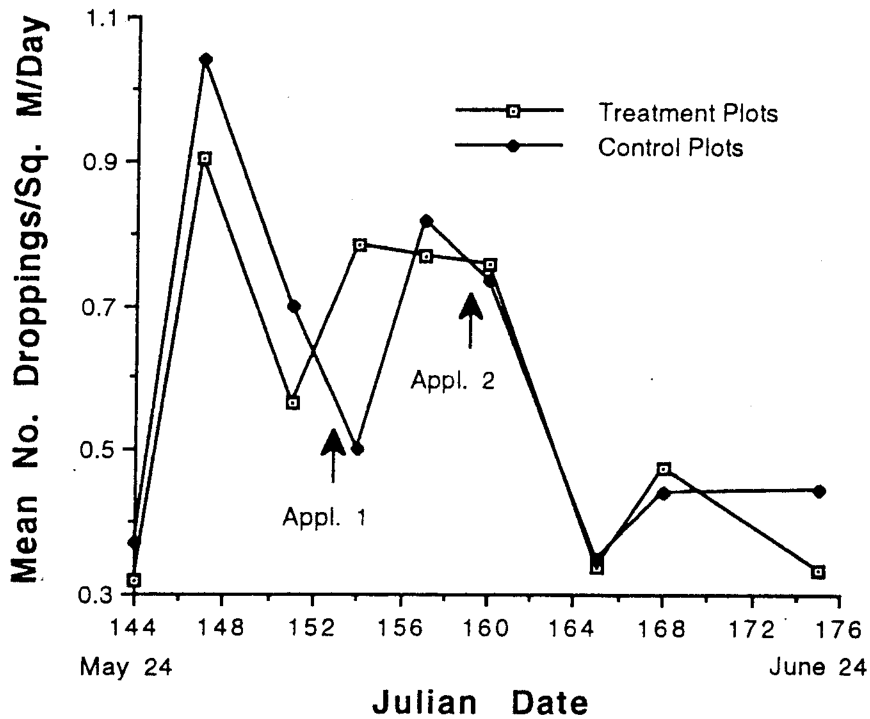

Fig. 3. Mean number of Canada goose fecal droppings/m^2/day counted on control and treatment plots at King's Park, Rockland County, New York during 24 May through 24 June, 1994.