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EFFICACY OF TURF SHIELD REPELLENT ON REDUCING DAMAGE BY CANADA GEESE AND MALLARDS

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Abstract: Concentrations of 1/2 to 8 gal of Bird Shield repellent were tested to assess their efficacy on Canada geese and Mallards, determine their potential longevity under natural conditions, and develop strategies to control the bird's use of turf grass areas where they had become physical, aesthetic or health problems to the resource's manager. During the first phase of the trials, each of the concentrations appeared to reduce the birds' use of the treated sites when compared with the untreated control sites. During the second phase of the trial, efficacy was more pronounced when a day use area at a state park was treated than when an adjacent campground was treated, even though the data suggest a pronounced reduction when both were compared with the control. The data also suggest that treating the first 100 feet of turf from the water's edge reduces the birds' activity over the remainder of the area, thus reducing the necessity for treating the entire area. The reduction, however, can be reduced by people feeding the birds while control is being attempted. While not a stated purpose of the research, it was found that a herbicide, 2,4-D, readily mixed with the repellent, did not adversely effect its properties and provided adequate broadleaf weed control where applied on the turf grass.

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Key Words: damage control, birds, ducks, geese, repellent, chemical, turf, methyl anthranilate

Canada geese (*Branta canadensis*), mallards (*Anas platyrhynchos*), American widgeon (*Anas americana*) as well as other waterfowl are commonly found throughout the United States. During the last decade, after several years of decline, their populations have increased until in some areas - particularly urban settings - they have become numerous enough to be classified as pests (Williams and Bishop 1990, Laycock 1982; Conover and Chasko 1985, Mott and Timbrook 1988). As a protected species, traditional entrapment and elimination methods can rarely be used.

Repellent compounds have shown some promise in reducing this problem. Early trials by Mason and Clark (1987) indicated that Canada geese exhibited shorter bouts of grazing when exposed to plots treated with starch encapsulated dimethyl anthranilate (DMA). In a follow-up trial by Bean and Mason (1987) similar results were obtained with Mallards and Ring-necked pheasants. In this study, with 1,100 to 1,200 captive birds per pen, only concentrations greater than 2% eliminated consumption. The following year the work began on the efficacy of a similar, but less expensive compound, methyl anthranilate (MA) on reducing bird damage to fruit crops (Askham 1992). Since that date, a growing body of literature has been developed showing the compound's efficacy on several avian species. The results have been the registration of 2 compounds by the United States Environmental Protection Agency (EPA); Re-JeX-iT, by PMC Specialties Group and Bird Shield by Bird Shield Repellent Corporation. The former has been registered to reduce waterfowl feeding on turfgrass at concentrations of approximately 38 pounds of active ingredient (a.i.) per acre or about 24%. The compound has been

reported to have a rather short efficacy period, three to four days (Cummings et al. 1992; Clark and Cummings 1994) and cause phytotoxicity to broadleaf vegetation (Barkshire 1995). Furthermore, concentrations between 1% and 2% may be required to be an effective repellent (Cummings et al. 1992). With these data it was proposed that the repellent could be effective in reducing goose and duck use of turf grass areas where the birds tend to congregate and pose physical, aesthetic, and/or health concerns.

Bird Shield® repellent has been demonstrated to be effective at rates as low as 0.25% a.i. for up to eight days and has limited phytotoxic properties when applied to cherries and blueberries (Askham 1992)

Research Areas

Two sites were selected for this series of field trials. They were:

1. United States Corps of Engineers, Walla Walla Division, Swallows Park, Clarkston, Washington, and
2. Washington State Parks and Recreation Department's Chief Timothy State Park, Clarkston, Washington.

Site 1 is a swimming beach area known as Swallows Park, situated on the Western bank of the Snake River along a 15 mile green-belt built by the U.S. Corps of Engineers (Corps) (Figure 1). This day-use area was built as part of the requirements for recreation mitigation (sub-section R) for the licensing and construction of the Lower Granite Lock and Dam powerhouse approximately 25 miles west of the confluence of the Snake and Clearwater Rivers. During the year, it is used by thousands of people, particularly those with small children, because of its island-protected sandy swimming beach (Figure 2). The island, approximately 200 feet offshore, is densely covered with small trees and brush - ideal habitat for the 24 Canada goose nest sites that have occupied the location for several years. Feces from these resident birds, and their offspring, have increased until coliform counts in the water, even though it is flushed by the passing river's action several times a day, have risen health concerns by local sanitarians as well as Corps officials.

Immediately north and south of the swimming beach are 2 large day-use areas used primarily for family gatherings, picnics, and other social occasions. Immediately adjacent to the swimming beach, which houses restrooms and showers, is a children's play area as well as a picnic shelter. During the years the location has become a favorite location to view as well as feed wildlife, particularly the Mallards and geese that habituate the site. It is not unusual to see visitors feeding both species throughout the year at the site, even with signs posted along the pathway advising against the activity. Weather conditions were dry and generally warm (65°F to 75°F) during the day and cool (40°F to 50°F) during the night. No data from the U.S. Weather Bureau are available for this time period.

Site 2 is a recreation complex at Chief Timothy State Park consisting of a day-use area with swimming beach, children's playground, toilet, shower, and concession complex, picnic area with shelters, as well as a boat launch, large campground, and open space (Figure 3). The site is situated approximately 15 miles west of Clarkston, Washington along the southern edge of the Snake River. As with the former site, the entire recreation area, an island of approximately 100 acres, receives heavy recreational use throughout the summer. During the last 10 years, Canada geese populations have increased until up to 5,000 birds winter on the island and 3,000 birds become permanent residents for the remainder of the season. Most of the birds, however, leave the island to nest. During 1996, only 21 nests were counted from which 85 successful hatches were recorded on the surrounding islands (Table 1; Butler et al. 1996). Immediately after the young have left the nest, the birds return to the island for the remainder of the year. At the initiation of the first trial, in March, approximately 100 adult geese were counted throughout the developed portion of the park. By the beginning of the second phase of the trials, in May, the number had increased

to approximately 300 geese and 12 ducks. While most of the island is covered with native grasses and shrubs, the swimming beach, day-use areas, campgrounds and boat launch facilities are maintained with fescue (*Festuca* spp), rye (*Secale* spp) and bluegrass (*Poa* spp), turfgrass species where the birds tend to congregate. Temperatures ranged from 21°F to 61°F during the day and cool 40°F to 50°F (Figure 4) with scattered rain and snow showers.

Materials and Methods

The research was divided into two phases; concentration efficacy and field evaluation. The concentration efficacy phase was designed to determine the lowest concentration of repellent required to reduce feeding by the birds on selected areas of turfgrass. The field evaluation phase was designed to evaluate the efficacy of the lowest amounts of repellent identified during the first phase to control the birds' use of areas heavily utilized by their human counterparts.

Phase 1

Site 1 was divided into two equal sections; one treated with 4 concentrations of the repellent while the other was left untreated as the control. Each section was approximately 100 feet (30 m) wide and 250 feet (75 m) long. Both sections bordered on the sand beach of the river. The treated section was further subdivided into 4 subsections of approximately 62.5 feet (18.75 m) by 100 feet (30 m) each. During the first part of the trial, an equivalent of 1.0, 2.0, 4.0, and 8.0 gallons of Bird Shield repellent concentrate, respectively, was applied with a Solo backpack sprayer at an equivalent 60 gallons of tank mix per acre on October 4, 1995. A second treatment of 0.5, 2.0 and 4.0 gallons per acre had been applied to test the efficacy and longevity of 1 reduced rate, repeat the tests for the next two highest rates. The remaining site, where 8.0 gallons per acre had been applied was not retreated, to evaluate its potential long-term efficacy. Sampling plots, measuring 18 inches (45.72 cm X 45.72 cm) were used to count the number of fresh and dried feces within each area; 5 for each treated subsection of the treated area and 7 throughout the untreated (control) area. Samples within each area were collected at 2 to 3 day intervals throughout the trials. The area was mowed on November 30 and October 12. No irrigation was applied during the trials.

Site 2 was similarly divided into 2 equal sections; 1 treated with 4 concentrations of the repellent while the other was left untreated as the control. Each section was approximately 100 feet (30 m) wide by 550 feet (165 m) long. Both sections bordered on the river's edge. The treated section was further subdivided into 4 subsections of approximately 100 feet (30 m) by 136 feet (40.8 m) where the equivalent 1.0, 2.0, 4.0 and 8.0 gallons of Bird Shield repellent concentrate was mixed with 59 gal water, respectively, and applied with a tractor mounted sprayer at an equivalent 127 gallons of solution (tank mix) per acre to each of the four test plots. Circular 10.8 square foot (1 m) sampling plots were established in each of the fur quadrants and the center of each treated area as well as the control. Each sampling plot was cleaned at 2 or 3 day intervals when both fresh (1 to 2 days old) and dried feces were counted, dried, and weighed. No mowing or irrigation were conducted in the park during these trials.

Phase 2 Site 1 was abandoned during this phase of the trials because the number of birds using the site could not provide any statistically significant data. Site 2 was originally divided into 2 blocks with a treatment and non-treated (control) zone. The birds block was delineated by the campground area in the park that contained 36 recreation vehicle sites separated by an access road. Because bird use was consistent throughout the area, one-half was designed as the control while the remainder, next to the water, was selected as the treatment site. Each section was approximately 100 feet (30 m) by 1100 feet (330 m) long. Six, 9 square foot (0.81 m) sampling plots were established at approximately 135 foot intervals throughout the center of the treated area. This was later increased to 9 plots to provide better coverage. Seven sample plots were similarly established through the center of the control area. The second block was delineated by the day-use area consisting of a swimming beach, children's playground, picnic shelters, broad lawns, restroom and shower facilities, and a parking lot. As with the first block, bird use was consistent throughout the area and the block was divided into

similar treated and control zones of about equal size. As with the campground area, 6 sample plots were established through the center of the treated area next to the water's edge and 4 throughout the adjacent control. Fourteen days after the trials were initiated, an additional control area was established at the park's boat launch when it became obvious that the original controls were not sufficient to monitor goose activities. Five sample plots were randomly located throughout the site where the greatest number of birds were observed feeding and loafing during the day.

The areas closest to the water were treated with 1 gallon of the repellent concentrate mixed with 59 gallons of water and applied with a tractor-mounted sprayer calibrated to deliver 60 gallons of liquid at 50 psi and 4 miles per hour per acre at 7-10 day intervals, depending on weather conditions. A herbicide, 2,4-D, was added to the tank mix at a rate of 1/2 gallon solution on June 13 and applied with the repellent. On June 20, the treatment rate was increased to 2 gal of Bird Shield concentrate to 59 gallons of water and applied at 60 gallons of solution per acre. All fresh and dried feces were removed, oven dried, weighed and recorded from all sample plots 2 days prior to the first treatment, at the time of the treatment, and at 2 to 3 day intervals thereafter. All of the sites were mowed on Thursdays and irrigated on Monday, Wednesday and Friday of each week. Bird counts were made prior to and after the completion of the trials.

RESULTS Phase 1 Site l. The number of fresh feces and dried feces scraps changed from an average of 3.1 per 2.25 square feet (0.2 m) at the beginning of the trials throughout the area to 1.3 in the controls to 0, 0, 0.2 and 0.2 respectively for each of the 1, 2, 4 and 8 gallon per acre treatment rates 9 days after the trials began (Figure 5). This represented a decrease in fecal counts of 38.8% in the controls to 100%, 99.5%, 93.6% and 97.0% for each of the respective treatment sites. The following 2 days after the site was mowed the numbers increased to 1.8, 1.7, 0.7, 1.6 and 1.7 respectively for each area or an average of 48%. Thirteen days after the second treatment, the counts were again reduced from an average of 2.3 per sample plot in the controls to 1.3, 0.2, 0.2 and 0.8, a reduction of 20.4%, 94.6%, 93.6% and 85.4% on each of the treated sites. By the end of the trials, 33 days after they began, the control sample plots contained an average of 3.6 feces in the controls and the treated areas an average of 3.3, 1.2, 0.7 and 2.0. Site 2 The number of fresh and dried feces changed from an average of 25.35/m^2 at the time the trials were initiated to 1.4 in the control and 1 gallon acre treated areas to 0.2 and 1.0 in the 2 gallon per acre and 4 gallon per acre treated areas (Figure 6). Dried feces weights decreased from an average of 6.56 g/plot to 1.21 g, 0.46 g, 0.06 g and 0.00 g respectively 6 days later after which they increased to 0.19 g, 0.28 g, 0.25 g and 0.15 g. None of the sites were mowed. The number of birds began to decline as the geese began to mate and disperse from this land to more suitable nesting sites when the trial was terminated 12 days after they began.

Phase 2 Site 1 was abandoned because of the lack of birds consistently using the site.

Site 2. Campground. Initial dried feces weights in the campground ranged from an average

of 7.55 g per 9 square foot sample plot in the control area to 3.48 g in the treated area 2 days prior to the trials (Figure 7). At the time of the first treatment, three days after the initial sampling, an average of 1.52 g and 1.42 g per plot were collected. By the end of the first 11 days these numbers had changed to 2.70 g in the former and 0.56 g in the latter. Two days later, when the areas were retreated, the sample weights in the control rose to 3.49% while the weights in the treated areas remained the same. By the end of the next thirteen days the weights in the control did not fluctuate significantly while the weights in the treated section remained stable between 1.53 g and 2.48 g per plot after 2 treatments of 1 gallon repellent per acre. By the last 7 days, plot feces weights had dropped to 0.18 to 0.58 g. Temperatures ranged from 21°F to 6°F (Figure 8). Mowing appeared to have a slight impact on the repellent's efficacy. Two days after the treatment rate had been increased to 2 gallon per acre, dry weights decreased to 0.62 g and 0.30 g before increasing to 0.97 g and 1.09 g/plot. Forty birds were counted in the area during the last day samples were collected. No adverse effects from the herbicide with the tank mix were noted after the application. Effective control of broad leafed vegetation was noted.

Day use. Prior to the first treatment an average of 7.35 g of dried feces were collected in the control plots and 3.20 g in the treated area plots next to the water. At the time the area next to the water was treated, 3 days after the initial sampling, an average of 0.16 g and 0.49 g were collected from the controls and treated plots. As with the control in the campground, dried feces weights declined to 0 but had decreased to the same amount in the treated area. Two days later, when the area was retreated, the controls remained at 0 while the treated area increased to 0.69 g/plot. By the 31st day, all goose activity had ceased in both the controls and treated areas. Only 48 geese were seen loafing in the water along the shore next to the swimming beach. As in the campground, no adverse effects from the herbicide with the tank mix were noted during the application. Effective control of broad-leafed vegetation was also noted.

Boat launch. The initial sample weight for the 5 plots averaged 8.69 g. Two days later, after the initial cleaning, the dry weights averaged 3.49 g/plot. Throughout the remainder of the trial these weights fluctuated from a low of 1.23g to a high of 10.56 g with a median weight of 2.75g.

DISCUSSION

Phase 1 Site 1. The data indicate that all 4 concentrations of 1 gallon, 4 gallons, and 8 gallons of Bird Shield repellent, applied at 60 gallons of solution per acre, appear to be effective in reducing goose activity for up to 9 days for a single application and 28 days with 2 applications with the 1 gallon, 2 gallon, and 4 gallon rates during the times of year the trials were conducted. Effective reduction appears to be possible with a second application of 1/2 gallon per acre for an additional 12 days and up to 28 days with the 8 gallon per acre rate. Mowing, which removes the repellent from the grass, appears to be more detrimental to the longevity of the repellent than weather conditions during this time of year.

Site 2. The data suggest that each of the three concentrations, 1%, 2%, and 4%, appear to have had some efficacy when applied at 127 gallons of solution per acre, in reducing goose activity on each of the treatment sites. These data are inconclusive as most of the resident birds had left the island to seek suitable nesting sites during the last few days of the trial. **Phase 2** Site 1. It is unknown if the repellent trials affected the return of the birds to the site, however the number of birds counted prior to the second phase of the research (25), by the author and the Corps biologist, indicated that too few birds habituated the site to warrant any further work.

Site 2. Campground. The data indicate that 1 and 2 gallons of Bird Shield repellent is effective in reducing goose use of turf grass areas in a campground when combined with 59 gallons of water and applied at 60 gallons of solution (tank mix) per acre. During the first part of the trial, activity remained consistent at about 2.24 g/plot (range 2.48 to 1.53). When application rates were doubled, fecal weights decreased to an average of about 0.74 (range – 0.30 to 1.09) or approximately 67%. When compared with the average feces weights of 3.08 g/plot at the boat landing, the treated area had about a 27% reduction in the use during the first part of the trial. During the second part of the trial, the dried feces weights increased at the boat landing to about 4.3 g/plot while the weights in the treated section decreased to 0.74 g/plot or a difference of about 83%. These numbers support the park manager's observation that the birds were moved from the treated area to the untreated area during the trials.

The data also indicate that the repellent is most effective when applied in the first 100 feet from the water's edge. After the first 10 days, no feces were collected from the second 100 foot strip adjacent and parallel to the treated area. Irrigation did not wash the repellent off the grass, but mowing significantly reduced the amount available to the geese. Mixing the repellent with a 2,4-D herbicide did not affect the application solution or repellency but did removed broad-leafed weeds from the turf grass.

One of the factors that appears to have significantly affected the results was the campground users' propensity to feed the birds even though discouraged by the manager. On several occasions, campers were observed feeding geese good scraps, loaves of bread and scattering dog food in front of their recreation vehicles, which drew the birds from the water onto the treated lawns.

Day-use. The dried feces weights in the day- use area indicate that 1 treatment of 1 gallon of Bird Shield repellent concentrate, mixed with 59 gallons of water and applied at 60 gallons of solution per acre, effectively reduced the activity of geese from an average of 0.59 g/plot in 11 days. Repeated applications of the same rate, a 7 to 10 day intervals after mowing, maintained an effective repellency.

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Figure 1

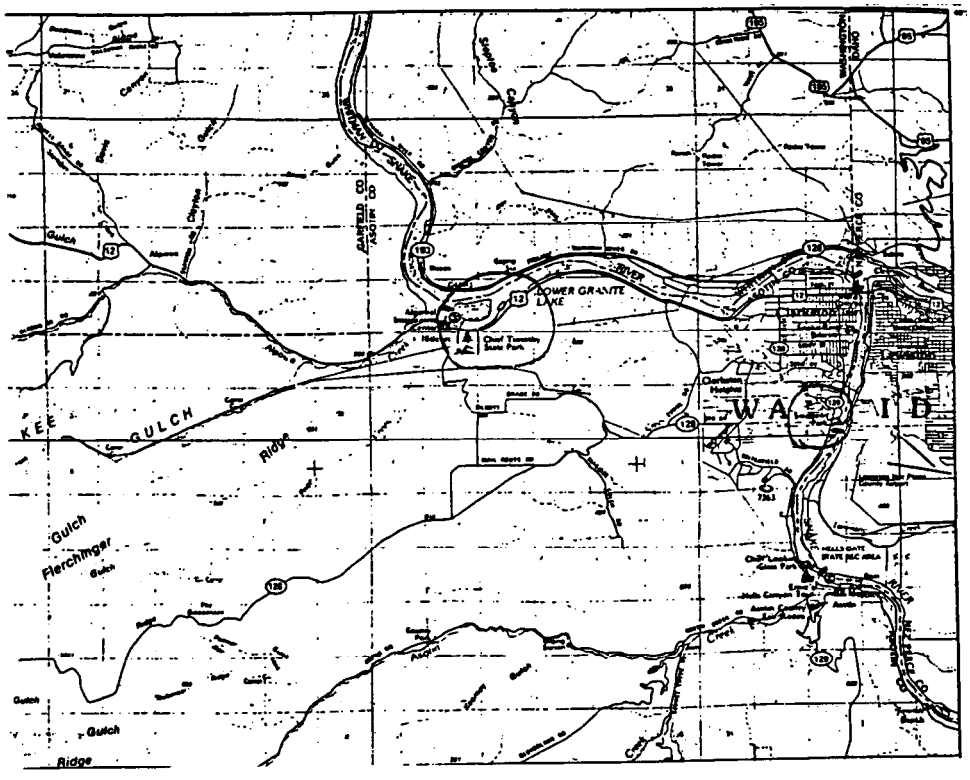

Figure 2

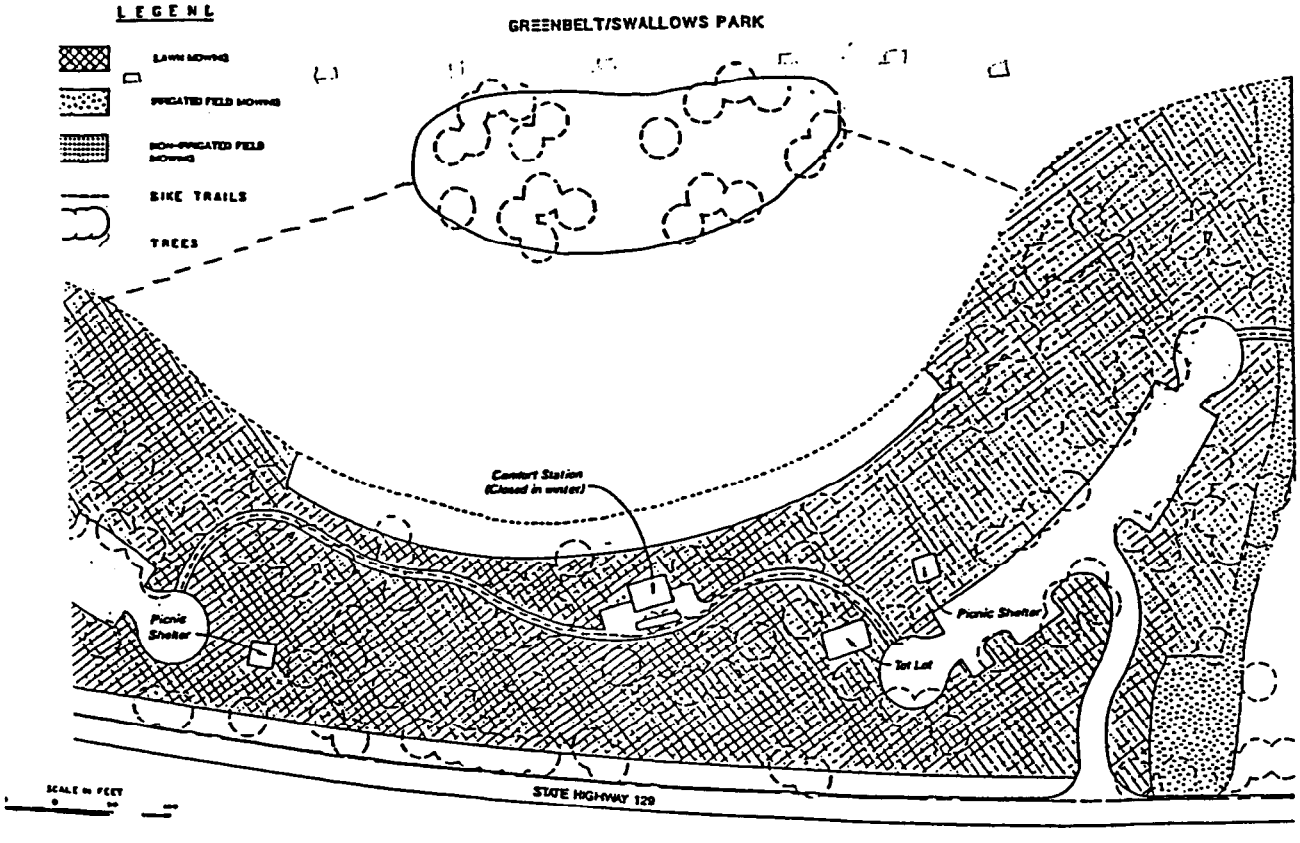

Figure 3

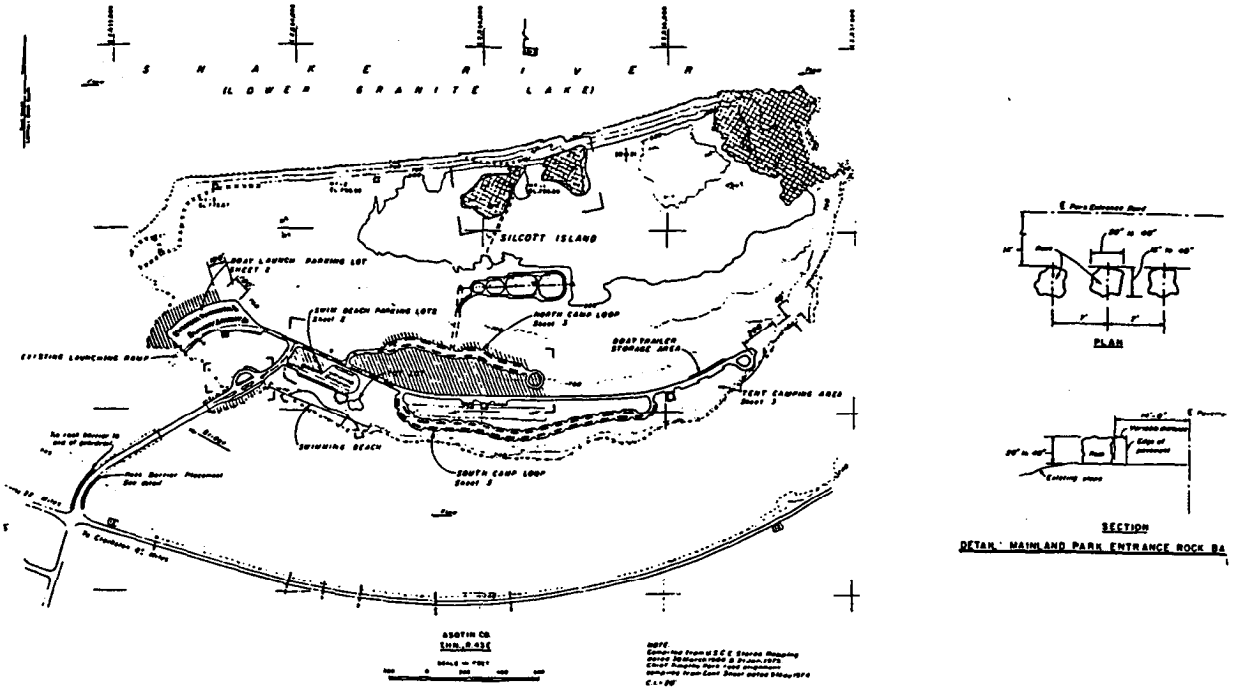

Figure 4. Maximum and Minimum Temperatures at the Lewiston Airport Between March 14 and March 26, 1996

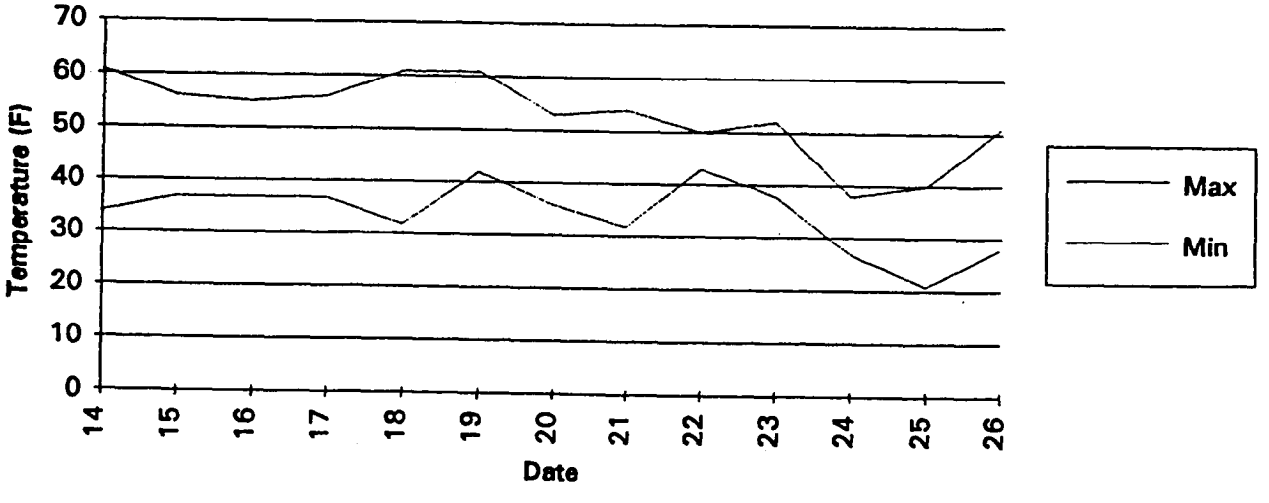

Figure 5. Efficacy of 5 Concentrations of Turf Shield Repellent to Turf Reduce Feeding by Geese at Swallows Park, Clarkston Washington Between October 4 and November 6, 1995

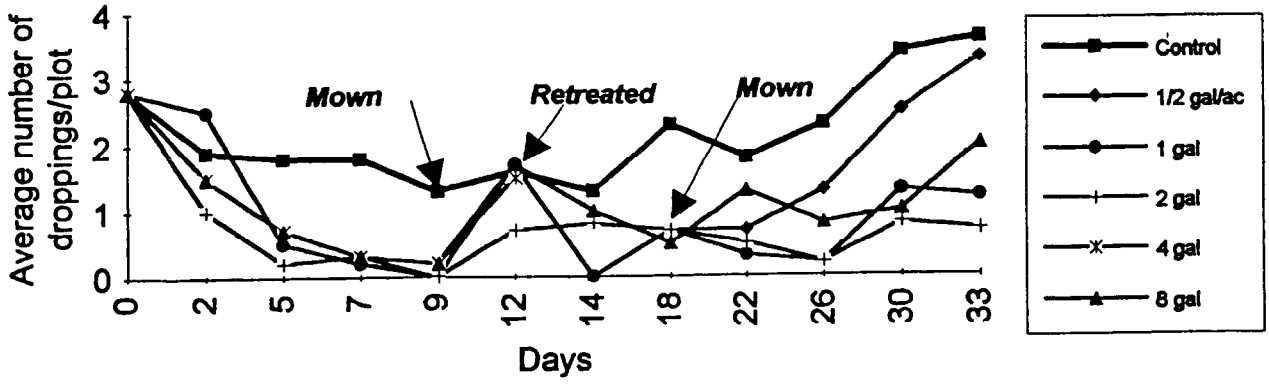

Figure 6. Efficacy of Three Concentrations of Turf Shield Repellent to Reduce Goose Populations at Chief Timothy State Park, Clarkston, Washington, Between March 14 and March 26, 1995