Does Tall Grass Reduce Bird Numbers On Airports?: Results Of Pen Test With Canada Geese And Field Trials At Two Airports, 1998

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Abstract

A suggested management plan to reduce bird numbers and bird-aircraft collisions at airports is to maintain grass 15-25 cm high. However, 3 studies conducted in the United States in 1998 indicated tall-grass management may not result in fewer birds. First, Canada geese (*Branta canadensis*), in a replicated experiment lasting 9 days in 6 pens in Ohio, showed no preference ($P = 0.53$) for short-grass (4-11 cm) over tall-grass (16-21 cm) plots. Second, we compared bird use of 8 tall- (23.3 ± 0.5 cm high, x ± SE) and 8 short- (14.3 ± 0.2) grass plots totaling 46 ha at Burke Lakefront Airport, Cleveland, Ohio on 15 days from 20 April-9 June. We found no difference ($P = 0.40$) in overall bird use of tall- and short-grass plots. Only 1 species, red-winged blackbirds (*Agelaius phoeniceus*), showed a preference ($P = 0.001$), with more birds (0.4 ± 0.8/ha/3-min observation) found in tall grass compared to short grass (0.1 ± 0.3). Finally, in a similar study at JFK International Airport in New York, bird observations were made on 2 unmowed (max. vegetation height of 48-130 cm) and 2 mowed (max. vegetation height of 15-25 cm) plots totaling 270 ha from 1 July-29 September. The number and species of birds hazardous to aircraft were similar in unmowed and mowed plots. The results of these studies suggest tall grass may not be an effective means of reducing bird numbers on airports. Further research, especially studies that monitor bird use of various grass types and heights over multiple seasons, is necessary to determine habitat management strategies that will reduce the number of bird species of concern on airports in North America.

Aircraft collisions with birds (bird strikes) are not only a serious safety hazard but also result in > $300 million annually in costs to civil and military aviation in the United States (Cleary et al. 1998). Most bird strikes occur within the airport environment (Blokpoel 1976). Sound management techniques that reduce bird numbers in and around airports are therefore critical for safe and economical airport operations.

Large-scale killing of nuisance birds is often undesirable or impractical (Dolbeer 1986); therefore, there is considerable demand for effective nonlethal techniques to deter birds from problem sites. Numerous frightening and exclusion devices have been employed in efforts to reduce bird/human conflicts (e.g., Marsh et al. 1991, Cleary 1994); however, many are ineffective, or are cost-prohibitive (Dolbeer et al. 1995). Chemical repellents to reduce goose grazing on turf have had only short-term effectiveness (Cummings et al. 1991, 1995; Belant et al. 1996, 1997; Dolbeer et al. 1998).

Another approach to reducing flocking bird numbers on airports is the use of tall grass. The general recommendation has been to maintain grass at 15-25 cm (as opposed to standard mowing which keeps grass at 5-10 cm) to interfere with visibility and ground movements for flocking birds such as gulls (*Larus* spp.) and European starlings (*Sturnus vulgaris*) (Blokpoel 1976, U.S. Department of Transportation 1993, Transport Canada 1994, U.S. Department of Agriculture 1998, Dekker and van der Zee 1996). The U.S. Air Force (USAF) implemented a policy (AFI91-202) in 1998 requiring grass on all USAF airfields, where practical, to be maintained at 18-35 cm. The basis for these tall-grass recommendation has come primarily from studies in England (Brough 1971, Mead and Carter 1973, and Brough and Bridgman 1980) in which bird species of concern in the United States were not present. For example, Canada geese

(*Branta canadensis*) and various raptors are a significant problem on many U.S. airports (Dolbeer and Wright 1998), but we do not know how these species react to tall-grass management. Our objective was to determine bird use of tall and short grass plots in a controlled situation and at active airports.

Methods

Canada Geese Pen Test

Canada geese of undetermined sex were captured during molt in northern Ohio on 30 June 1998 and transported to a 2-ha fenced pond in Erie County, Ohio. Grass and shade were available along the perimeter of the pond. Geese had primary feathers from 1 wing cut before being released into the pond. Whole-kernel corn and poultry pellets were provided as food supplements. A 0.4-ha fenced holding area adjacent to the pond was used to separate experimental from non-experimental geese. This holding area contained grass, shade, and included about 20 m^2 of the pond. Geese maintained in this area also were provided corn and poultry pellets.

A fenced chute connected the holding area to the test site which consisted of six 18.3- x 30.5-m pens constructed of 1.5-m high fence in a grass area. The area was oversown with perennial rye and fertilized 7 weeks before testing. Pens were spaced 5-12 m apart. A 1.5-m high heavy plastic fence was placed between adjacent pens to serve as a visual barrier for the enclosed geese. Each pen consisted of two 15.2- x 18.3-m plots (short grass and tall grass) delineated by a spray-painted line on the grass. A 0.5-m diameter pan of water was positioned in the center of each plot. A rain gauge was placed at the test site to monitor precipitation.

Grass was mowed to a height of 5 cm in all pens on 7 July. On 7 July, 24 geese were herded from the pond to the holding area and each was assigned randomly to 1 of 6 groups of 4 geese. We attached color-coded neck collars (1 color/group) to individuals in each group. For 6 days (8-13 July) prior to testing, the 24 neck-collared geese were herded from the holding area to the test site and the same 4 geese were placed in each of the 6 pens at 0830. The geese were herded back to the holding area at 1200. This grazing schedule allowed geese to adjust to pen conditions and establish social hierarchies prior to testing.

Three 4.9-m high towers were positioned 15-30 m from the pens. Following the conditioning period we randomly selected 1 side of each pen as tall grass and on 14 July mowed the grass in the other side to 5-cm.. Grass was not cut again until the experiment ended on 23 July. On 6 of the 9 days following 14 July (15-17, 20, 22-23 July), geese were herded into the pens at 0830 and a person conducted observations of geese from each tower starting at 0900. Each person observed geese in each of 2 adjacent pens from 0900-1000 and from1100-1200 hrs, alternating observations between pens every 60 sec (daily total of 60 min/pen). During each 60-sec interval, observers recorded the number of geese observed initially in each plot, and the total number of bill contacts with grass in each plot. The experiment was terminated on 23 July at which time test geese had collars removed and all cut primary feathers pulled before being placed back in the holding pond. These geese were able to fly from the pond within 40 days.

We measured grass height in each tall-grass plot on 15, 17 and 23 July at 4 randomly selected locations. We measured one short grass plot on 15 July and then each short plot on 17 and 23 July. At each sample point grass height was measured by vertically placing 2 1-meter sticks 1.5 m apart with a string running between the meter sticks. The height of the string was adjusted to be level with the dominate grass tops and the mean height was determined by averaging the distance from the ground to the string on the 2 meter sticks.

Mean numbers of geese observed, and mean numbers of bill contacts were analyzed using randomized block ANOVA with repeated measures (SAS 1988). If main effects or interactions were significant ($P \leq 0.05$), we used Tukey tests to determine which means differed.

Burke Lakefront Airport

Burke Lakefront Airport, in Cleveland, Cuyahoga County, Ohio is a 193-ha public-use airport adjacent to Lake Erie. The airport has 2 parallel runways that handle about 81,000 movements per year. Gulls, waterfowl, shorebirds and grassland bird species are found on the airport (A. J. Montoney, U. S. Department of Agriculture, personal communication).

Sixteen plots were established adjacent to and at either end of the runways. Eight plots (1.3-5.0 ha, total area 21.3 ha) were designated as tall-grass with a target height of 25-35 cm and 8 (1.0-6.2 ha, total area 24.9 ha) were short grass with a target height of 5-10 cm. Plots alternated so that tall and short plots were adjacent or there was a roadway between plots.

Grass height was measured once a week from 20 April-9 June 1998. Five sample points (10 points in 1 tall grass plot due to variations in grass height resulting from topography and species of grass) were systematically laid out across each plot. At each sample point grass height was measured by vertically placing 2 1-meter sticks 1.5 m apart with a string running between the meter sticks. The height of the string was adjusted to be level with the dominate grass tops and the mean height was determined by averaging the distance from the ground to the string on the 2 sticks. Plots were mowed by maintenance personnel at Burke Lakefront Airport using tractor-drawn mowers adjusted to the target grass heights (5 cm and 25 cm).

Bird observations were conducted 2 days per week at random hours of the day from 20 April-9 June 1998. Observers parked a vehicle 5-15 m from the edge of each plot. Each plot was observed for 3 minutes, during which time the numbers of birds on the ground in the plot, adjacent to the plot, or flying over the plot were recorded by species. Birds were considered adjacent to a plot when they were on the ground immediately next to the plot but not in an adjacent plot or if they were perched on some structure within the plot.

Numbers of birds observed per plot each day were converted to birds/ha since plot size varied. We used 2-way analysis of variance (days and grass-height treatment) to compare mean number of birds in tall and short grass plots (Statistix 1994). We compared mean numbers per ha for all birds and for selected species by use category in tall and short grass plots.

John F. Kennedy International Airport (JFK)

In 1985, a 2-month study was conducted at JFK to examine laughing gull (*L. atricilla*) use of 36 0.4-ha plots that had vegetation maintained at either 5 or 46 cm (Buckley and McCarthy 1994). The study indicated that fewer laughing gulls landed in tall-vegetation than in short-vegetation plots. However, the small plots size, short duration of the study and single-species focus limited the usefulness of the study as a general plan for an integrated, multi-species bird management program for the entire airport. Nevertheless, since 1986 mowing at the airport has been limited to 1 mowing in the fall or winter every 1-2 years.

On 30 June 1998 2 study areas were selected at JFK in which 1 plot was maintained at 15-25 cm and an adjacent plot was unmowed. The 2 mowed plots were 40 ha and 89 ha and the 2 unmowed plots were 61 ha and 70 ha in size.

Vegetation height, percent bare ground and visibility at 4 randomly selected points were measured in each plot on 7 dates from 30 June-24 September 1998. The percent bare ground and visibility measurements provided indices of vegetation density. At each sample point, vegetation height was measured by vertically placing 2 1.3 m measuring sticks 1.5 m apart with a string running between the sticks. The height of the string on the pole was adjusted to be level with the tallest vegetation touching the string. An observer then visually estimated the percent of ground that was bare (i.e., devoid of living vegetation) beneath the string. Finally, the observer stood 3 m from each stick and noted the minimum cm marker visible (i.e., the number of cm from the ground where the cm markers became visible). The mean of the 2 measurements was recorded as a visibility index.

Bird observations were conducted on 16 days (2-4 per day) from 1 July-29 September 1998 for a total of 47 counts. Counts were made throughout daylight hours; typically 1-2 counts were made in each plot in the morning and 1-2 in the afternoon. A count in each plot consisted of 2 5-minute observations in adjacent 305-m sections parallel to the runway during which time the numbers of birds were recorded by species on the ground in the plot, on the runway within the plot, perched on structures in the plot, flying over the runway in the plot, or flying over the plot but not the runway. A bird could only be assigned to 1 category during an observation period.

Results

Canada Geese Pen Trial

Grass stands in the 6 pens were in excellent condition during the test. Tall-grass plots had a mean grass height of 17.4 ± 3.3 cm on 15 July (Day 1) which increased to 20.9 ± 4.0 cm on 23 July (Day 9). Mean grass height in short-grass plots ranged from 4.2 ± 0.7 cm on Day 1 to 11.0 ± 3.2 cm on Day 9. Rainfall measured 81 mm from 15-23 July.

There was no difference (F = 0.43, 1, 10 df; P = 0.52) in number of geese/30 observations in tall- (52 ± 14) compared to short-grass (68 ± 14) plots (Fig. 1). There was no difference (F = 0.31; 1,10 df; P = 0.59) in bill contacts/30 min between tall- (377 ± 370) and short-grass (334 ± 428) plots (Fig. 1). There was an interaction of day and plot treatment for both goose presence (F = 3.32; 5,50 df; P = 0.01) and feeding rate (F = 7.22; 5,50 df; P < 0.01).

Burke Lakefront

Grass Height

Tall grass plots had a mean (± SE) height of 23.3 (± 0.5) cm and a range of 8.9-72.7 cm. Short grass plots had a mean height of 14.3 (± 0.2) cm and a range of 6.3-48.2 cm.

<u>Bird Presence</u>

Twenty-two and 23 bird species were observed associated with tall and short grass plots, respectively (Table 1). A total of 1,575 and 1,553 birds was observed in, over or adjacent to the tall and short grass plots, respectively. The mean (± SD) number of birds/ha/3 min observed in all use categories associated with tall (5.6 ± 7.3) and short (6.3 ± 9.5) grass plots did not differ (F = 0.76; 1, 14 df; P = 0.40, Fig. 2). The mean number of birds/ha/3 min observed on the ground in tall (2.9 ± 6.5) and short (3.4 ± 7.3) grass plots did not differ (F = 0.68; 1, 14 df; P = 0.42). The mean number of birds/ha/3 min observed adjacent to tall (1.1 ± 2.7) and short (0.5 ± 1.5) grass plots did not differ (F = 3.62; 1, 14 df; P = 0.08). Finally, the mean number of birds/ha/3 min observed flying over tall (1.6 ± 2.1) and short (2.4 ± 4.5) grass plots also did not differ (F = 3.97; 1, 14 df; P = 0.07).

Starlings comprised 61% of all birds observed in all categories and 81% of all birds observed on the ground in plots (Table 1). Red-winged blackbirds (*Agelaius phoeniceus*), Canada geese, and savannah sparrows (*Passerculus sandwichensis*) were the next 3 most commonly observed birds on the ground in plots. The mean number of starlings observed/ha/3 min in tall (2.1 ± 6.6) and short (2.7 ± 6.9) grass plots did not differ (F = 0.64; 1, 14 df; P = 0.44, Fig. 3). The mean number of Canada geese observed/ha/3 min in tall (0.1 ± 0.3) and short (0.2 ± 1.4) grass plots did not differ (F = 0.84; 1, 14 df; P = 0.37). The mean number of herring (*L. argentatus*) and ring-billed (*L. delawarensis*) gulls observed/ha/3 min in tall (0.1 ± 0.4) and short (0.1 ± 0.5) grass plots did not differ (F = 0.40; 1, 14 df; P = 0.54). However, more red-winged-blackbirds were observed/ha/3 min in tall (0.4 ± 0.8) than in short (0.1 ± 0.3) grass plots (F = 15.73; 1, 14 df; P = 0.001).

JFK

Vegetation Measurements

Mean vegetation height in unmowed plots ranged from about 48-69 cm in Study Area 1 and from about 43-130 cm in Study Area 2. Vegetation in the mowed plots was generally maintained at the target level of 15-25 cm.

Vegetation was generally sparse in both unmowed and mowed plots, especially in Study Area 1 where >50% of the surface area was often bare ground. This sparseness is a consequence of the poor, sandy soils on much of the airport. As expected, visibility close to ground was better in mowed than in unmowed plots. Only the bottom 5-10 cm of the pole was generally obscured by vegetation at a distance of 3 m in mowed plots compared to the bottom 13-28 cm (Study Area 1) or 36-81 cm (Study Area 2) being obscured in unmowed plots.

We did not determine species composition of vegetation but noted that the plots were dominated by forbs. In Study Area 1, spotted knapweed (*Centaurea maculosa*) was common. In Study Area 2, *Phragmites communis* was found in several wet areas.

<u>Bird observations</u>

Bird numbers on the airport were generally low and similar in unmowed and mowed plots during July-September 1998. During the 188 5-minute observation periods in the 2 unmowed plots, we recorded a total of 421 birds of 28 species in all activity codes, an average of only 2.2 birds per 5-minute observation. The 2 mowed plots had even lower numbers: 376 birds of 20 species for an average of only 2.0 birds per 5-minute observation. We recorded 36 birds on the ground in unmowed plots compared to 29 in mowed plots.

Gull numbers were similar in unmowed and mowed plots; 87 (including 50 laughing gulls [*L. atricilla*]) in unmowed plots and 86 (including 54 laughing gulls) in mowed plots. We also noted similar numbers of European starlings (19 and 23) and raptors (15 and 18) in unmowed and mowed plots, respectively. No Canada geese were noted on the ground during observations; the only geese recorded were 6 flying over an unmowed plot.

Discussion

At both Burke and JFK the short- or mowed vegetation was taller than some tall-grass regimes. However, in each case these "short-grass" plots did provide a contrast with the taller plots. At Burke these short-grass plots were the normal "short-grass" height maintained at the airport. At JFK the mowed plots were markedly different than the unmowed plots. For example, visibility measures on mowed plots showed that above 10 cm a bird could see the surrounding area compared to above 13-81 cm in the unmowed plots.

Contrary to our expectations, birds did not exhibit a preference for short-grass plots in any of the studies. Accurate counts of birds were difficult in both tall and short grass plots. In tall grass, birds were often not visible unless they flew into or out of the grass. Even observations of larger birds, such as Canada geese, in tall grass were sometimes hindered by grass height due to the ability of geese to feed or loaf in a manner that made them difficult to observe. In short grass plots, smaller birds sometimes were difficult to see unless they walked into view or the observer's attention was drawn to them by moving grass or their calls.

Burke Lakefront Airport frequently had European starlings, Canada geese, and herring and ring-billed gulls in the air and on the ground near runways. Based on studies by Brough (1971), Mead and Carter (1973), and Brough and Bridgman (1980), the conventional habitat management technique would be to allow the grass to grow to heights of at least 15 cm. However, our pen trial with Canada geese does not support that recommendation. Our observations at Burke Lakefront Airport with free-ranging birds also indicated that Canada geese were not deterred by grass ≥20 cm tall, and we saw no difference in numbers of starlings in tall and short grass plots. Furthermore, red-winged blackbirds responded positively to tall grass plots, indicating that tall grass management on airports may increase numbers of certain species of birds.

It has been hypothesized (Dekker and Buurma 1997, Transport Canada 1994, U. S. Department of Agriculture 1998) that flocking birds avoid tall grass because the reduced field of vision prevents them from seeing predators. Previous grass height studies (e. g., Brough and Bridgman 1980) focused on species of concern in Europe. The lack of long-term grass preference studies in North America on species of concern (e.g., Canada geese and gulls) makes recommendations for tall grass for North American airports difficult to support.

It is imperative that bird management programs use an integrated approach of efficacious management practices implemented by personnel dedicated to keeping birds off airports. Tall grass is one management strategy that may be useful in an integrated program to minimize numbers of some species. However, the use of tall grass needs to be determined on a species- and site-specific basis. In some areas, maintaining tall grass may provide a limited resource that attracts birds. Likewise, short grass habitat may be limiting and airports that provide short grass may attract birds. Mixing tall and short grass habitat types on airports provides a habitat edge that may also be attractive to birds. Grass species may also influence bird use of an area. In summary, further research is necessary to determine which species of birds are influenced by tall grass throughout the year as well as which species of grass are repellent to the species of concern in North America.

References

Belant, J. L., T. W. Seamans, L. A. Tyson, and S. K. Ickes. 1996. Repellency of methyl anthranilate to pre-exposed and naïve Canada geese. Journal of Wildlife Management 60:923-928.

Belant, J.L., L. A. Tyson, T. W. Seamans, and S. K. Ickes. 1997. Evaluation of lime as an avian feeding repellent. Journal of Wildlife Management 61:917-924.

Brough, T. E. 1971. Experimental use of long-grass in the U.K. Bird Strike Committee Europe 6: unpaged.

Brough, T. E. and C. J. Bridgman. 1980. An evaluation of long-grass as a bird deterrent on British airfields. Journal of Applied Ecology 17:243-253.

Blokpoel, H. 1976. Bird hazards to aircraft. Clarke, Irwin and Co. and Canadian Wildlife Service, Ottawa, Canada. 236 pp.

Buckley, P. A. and M. G. McCarthy. 1994. Insects, vegetation, and the control of laughing gulls at John F. Kennedy International Airport, New York City. Journal of Applied Ecology 31:291-302.

Cleary, E. C. 1994. Waterfowl. Pages E139-E155 in S. E. Hyngstrom, R. M. Timm, and G. E. Larson, editors. Prevention and control of wildlife damage. University of Nebraska Cooperative Extension. Service, Lincoln, Nebraska.

Cleary, E. C., S. E. Wright, and R. A. Dolbeer. 1998. Wildlife strikes to civilian aircraft in the United States, 1991-1997. Federal Aviation Administration, Wildlife Aircraft Strike Database Serial Report 4, Washington, DC. 33pp.

Cummings, J. L., J. R. Mason, D. L. Otis, and J. F. Heisterberg. 1991. Evaluation of dimethyl and methyl anthranilate as a Canada goose repellent on grass. Wildlife Society Bulletin 19:184-190.

Cummings, J. L., P. A. Pochop, J. E. Davis, Jr., and H. W. Krupa. 1995. Evaluation of ReJeX-iT AG-36 as a Canada goose grazing repellent. Journal of Wildlife Management 59:47-50.

Dekker, A. and F. F. van der Zee. 1996. Birds and grassland on airports. Bird Strike Committee Europe 23:291-305.

Dolbeer, R. A. 1986. Current status and potential of lethal means of reducing bird damage in agriculture. International Ornithological Congress 19:474-483.

Dolbeer, R. A., N. R. Holler, and D. W. Hawthorne. 1995. Identification and control of wildlife damage. Pages 474-506 *in* T. A. Bookhout, editor. Research and management techniques for wildlife and habitats. The Wildlife Society, Bethesda, Maryland, USA.

Dolbeer, R. A., T. W. Seamans, B. F. Blackwell, and J. L. Belant. 1998. Anthraquinone formulation (Flight Control™) shows promise as avian feeding repellent. Journal of Wildlife Management 62:1558-1564.

Dolbeer, R. A. and S. E. Wright. 1998. Ranking the hazard level of wildlife species to aviation. Wildlife Habitat Management (Task 2, Part 2) Interim Report DTFA01-91-Z-02004. U. S. Department of Agriculture, Animal Plant Health Inspection Service, Wildlife Services, National Wildlife Research Center, Sandusky, Ohio, USA.

Kahl, R. B., and F. B. Samson. 1984. Factors affecting yield of winter wheat grazed by geese. Wildlife Society Bulletin 12:256-262.

Marsh, R. E., W. A. Erickson, and T. P. Salmon. 1991. Bird hazing and frightening methods and techniques. California Department of Water Resources, Contract No. B-57211. 233pp.

Mead, H. and A. W. Carter. 1973. The management of long grass as a bird repellent on airfields. Journal of the British Grassland Society 28:219-221.

SAS Institute Inc. 1988. SAS/STAT user's guide. Version 6. SAS Institute Incorporated, Cary, North Carolina, USA.

Statistix. 1994. User's manual, version 4.1. Analytical Software, Tallahassee, Florida, USA. 329 pp.

Transport Canada. 1994. Wildlife control procedures manual. Environment and Support Services, Safety and Technical Services, Airports Group. TP11500E. Ottawa, Canada.

U.S. Department of Agriculture. 1998. Managing wildlife hazards at airports. Animal Plant Health Inspection Service, Wildlife Services, Washington, D.C., USA.

U.S. Department of Transportation. 1993. Airport wildlife hazard management. AC 150/5200-32. Federal Aviation Administration, Office of Airport Safety and Standards, Washington, D.C., USA.