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Effective Plot Sizes for Testing Red-Winged Blackbird Repellents in a Large Flight Pen

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ABSTRACT: Three plot sizes (36, 78, and 108 m^2) were evaluated for testing blackbird seed repellents within a 0.2-ha flight pen. Groups of 12 to 20 red-winged blackbirds were observed as they foraged on pairs of plots within each size category. One plot from each pair was sown with 134 kg/ha of rice seed treated with 1.25-g methiocarb/kg of seed. Plot selection, avoidance, discrimination, and latency to discrimination were determined for each plot size. With the 36-m^2 plots, there were long delays in selecting untreated plots, treated plots were not avoided, the birds had difficulty discriminating between the plots, and results were inconsistent among replicates. The 78-m^2 plots were adequate for most purposes, but the clearest and most consistent results were from the 108-m^2 plots. These plots were readily found by the birds, were accurately discriminated, and had bird pressure similar to that observed in Louisiana rice fields.

KEY WORDS: methiocarb, bird repellent, plot size, repellent testing, *Agelaius phoeniceus*, blackbird, simulated field study, flight pen

Field studies are essential for demonstrating the efficacy of bird damage control techniques. However, before conducting a field test, preliminary development under controlled conditions is necessary [*1,2*]. Historically, initial tests have been performed in cages [*3*], and encouraging results have been followed with field tests. However, there are vast differences between the test cage environment and field conditions. The suite of variables that influences the results of cage tests is often replaced by an entirely different set of variables in the field. An intermediate stage that incorporates the experimental control of cage tests with conditions more closely resembling field situations would permit researchers to refine techniques and evaluate hypotheses prior to conducting a major field test. Savings in time and money will result as field tests become more definitive and the likelihood of conducting a successful field test increases.

Suitable plot size has been a recurrent concern for experimental treatments in the field because plots that are small relative to the foraging area of free-ranging birds may not be discovered by the birds or may receive inadequate bird pressure for an effective test. West et al. [*4*] demonstrated repellency of pheasants from corn fields treated with methiocarb only after switching from small plots to an entire field experimental design. Dolbeer et al. [*1*] and Stickley and Ingram [*2*] also suggested more discernible effects would result from

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The behavior of birds within the pen was not overtly affected by other redwings, common grackles *(Quiscalus quiscula),* or northern mockingbirds *(Mimus polyglottos)* that sometimes perched on the pen wire. Hawks occasionally swooped unsuccessfully at the pen, but the effects of raptorial harassment rarely persisted more than a few minutes.

Methods

Experimental Array

Both of the 500-m^2 arable areas were rototilled and smoothed. While one area was left barren, the other was subdivided into six plots: two plots of 108 m^2 (9 by 12 m), two of 78 m^2 (6 by 13 m), and two of 36 m^2 (6 by 6 m). The plot boundaries were marked with red and blue vinyl flags, 0.3 m high and spaced at 1-m intervals. A 0.3-m-wide walkway separated each plot. The juxtaposition of each plot size and treatment was arbitrarily altered for each replication. The 108-m^2 paired plots were offered first during replicate I, but the 36-m^2 plots were offered first during the other two replicates.

For each test, the plots were paired by size and the treated (TRT) plot was sown with 134 kg/ha of rice seed treated with 1.25 g of methiocarb/kg of seed. Methiocarb was in the form of Mesurol® 75% (active ingredient [a.i.]) seed treater supplied by Mobay Chemical Corp., Kansas City, Mo. The appropriate amount of repellent was added to rice seed in a rotating tumbler and mixed for 5 min. The matching untreated (UNT) plot was similarly sown with untreated seed. The birds were released one day after planting.

Following a four-day test for a particular plot size, the birds were removed from the pen until the rice in those plots was seven to ten cm tall (seven to ten days after planting). The plot was then rototilled to return it to a barren state. The main advantage in tilling between tests was that the following test could be started almost immediately. However, used plots containing rice seedlings did not appear more or less attractive to the birds than tilled plots.

Bird Preconditioning, Release, and Recapture

Twenty experimentally naive, cage-acclimated, male redwings were selected for each test. Test birds were placed in the decoy trap at the southwest corner of the pen at least two days before release. In the trap, they received unhulled rice and water. Following preconditioning, the birds were released into the pen in the early morning, and the trap was reset. After foraging in the test plots, the birds readily returned to the trap (2 to 3 h for total recapture).

Seed Counts

Quadrats were randomly established within each experimental plot at a rate of one quadrat per 18 m^2, except for the 36-m^2 plots, which had three quadrats each. Additionally, two bird-proof exclosures were placed within each plot. Quadrats and exclosures each circumscribed 0.09 m^2. Seeds were counted at the beginning and end of each four-day trial.

Behavior Observations

The birds were observed continuously each morning of the four-day tests beginning with the morning release from the decoy trap and continuing until $\geq$70% of the birds had returned to roost. Observations ended then because it was discovered that when more than half of the birds were in the trap, foraging activity by the remaining birds was negligible.

A scan sample [*9*] of bird locations was made immediately following the morning release and was repeated at 4- to 6-min intervals throughout the observation period. Locations were classified as TRT, UNT, periphery (PER), or TRAP. Those data were used for site selection [*10*], group size, density, frequency of use, and probability of use analyses. Rep-

TABLE 1—*Daily selection and avoidance of TRT and UNT plots by red-winged blackbird flocks.*

Plot Size, m^2	Treatment[a]	Replicate	Days Avoided	Days Selected
36	TRT	I	none	none
		II	1, 2	none
		III	1	3
	UNT	I	1, 3	none
		II	1, 2, 3	none
		III	1	3, 4
78	TRT	I	4	none
		II	2, 3, 4	none
		III	none	4
	UNT	I	none	1, 2, 3
		II	2	1, 3, 4
		III	none	1, 2, 3, 4
108	TRT	I	1, 2, 4	none
		II	2, 3, 4	none
		III	1, 3, 4	none
	UNT	I	1, 2	3, 4
		II	1	2, 3, 4
		III	1	3, 4

[a] TRT: plots sown with seed treated with 1.25-g a.i. methiocarb/kg seed. UNT: plots sown with untreated rice.

from incidental trespass by birds that actually selected the UNT plot. When replicates were combined, the results indicated that the birds selected the UNT plots in preference to TRT plots, but generally failed to avoid the treated area.

The clearest results were demonstrated in the 108-m^2 plots (Table 1). The birds successfully avoided the TRT plots three out of four days in each replicate. Treated plots were never selected. All 108-m^2 UNT plots were avoided on Day 1 of each trial—a tendency not shown in the 78-m^2 plots. Although the birds selected 78-m^2 plots more often than 108-m^2 plots, selection and avoidance were stronger during the 108-m^2 trials.

Discrimination

Although some level of plot discrimination was required to produce the results described above, the birds could have selected a general region without recognizing the specific plot per se. The pattern of use in the plots could have been generated as the birds moved indiscriminantly across plot boundaries. The smaller the plot, the more difficult it would be for the birds to avoid the TRT. To evaluate that possibility, the movement patterns of birds using each plot type were evaluated. The expected frequency of movement types for birds that recognized the contents and boundaries of TRT and UNT plots would include a relatively high percentage of movements within the UNT and out of the TRT.

The expected pattern was clearly shown in the 108-m^2 plots where 50 of 69 (73%) birds in the UNT plots that encountered a boundary reversed their path and remained within the plot, whereas 39 of 45 (87%) in the TRT plots left the plot upon reaching the boundary (Table 2). Among the smaller plot sizes, birds consistently demonstrated the appropriate reaction to the plot boundary only in the 36-m^2 TRT plots.

A possible source of error in this analysis is the assumption that the birds used both TRT and UNT plots for feeding on rice seed. Conceivably, the birds could have used the 36- and 78-m^2 TRT plots for purposes other than feeding on rice, thereby discriminating between plots without showing avoidance of the TRT or reacting to the plot boundaries as

TABLE 4—*Latency (in hours from start of trial) to first visit and first observed persistent use.*

		36 m²		78 m²		108 m²	
	Replicate	TRT[a]	UNT	TRT	UNT	TRT	UNT
Time to first use	I	0.1	0.9	0.3	0.2	0.3	1.1
	II	4.8	4.6	0.3	0.3	0.4	2.6
	III	2.6	2.3	0.4	0.2	1.6	1.7
	Mean	2.5	2.6	0.3	0.2	0.8	1.8
Time to first persistent use	I	NO[b]	NO	3.4	0.2	8.4	7.0
	II	NO	4.6	NO	0.3	4.1	2.6
	III	NO	NO	2.8	0.2	NO	2.8
	Mean	NO	NA	NA	0.2	NA	4.1

[a] As in Table 1.
[b] NO = not observed; NA = not applicable.

TABLE 5—*Use of various size plots by red-winged blackbird flocks in 0.2-ha (2000-m²) flight pen. Values given are means (SE) of three replicates/treatment.*

Plot Size, m²	Scan Samples	Treatment[a]	Birds Observed	Flock Size	Probability of Use
36	81 (6)	TRT	15 (3)	1.7 (0.4)	0.12 (0.01)
		UNT	38 (31)	2.3 (0.7)	0.14 (0.08)
78	107 (23)	TRT	45 (5)	2.2 (0.5)	0.23 (0.06)
		UNT	124 (9)	3.2 (1.0)	0.43 (0.07)
108	105 (17)	TRT	30 (8)	2.3 (0.5)	0.14 (0.04)
		UNT	184 (49)	5.8 (1.3)	0.32 (0.06)

[a] As in Table 1.

flock size between treatments. Probability of use was significantly ($P < 0.10$) greater in the UNT 78- and 108-m² plots than in the corresponding TRT plots or in the UNT 36-m plots.

Bird pressure (bird-seconds of use per square meter) is a function of flock size and the flock's pattern of use in a given area. A daily bird pressure index (BPI) was derived by combining replicates for each treatment and plot size (Table 6). For each plot size, the BPI was substantially greater for UNT than TRT plots. The 78-m² UNT plots had fairly constant BPI, whereas bird pressure tended to increase with time in the other plots. A rough estimate of the average bird pressure observed in Louisiana during 1986 [*12*] was 28 500 bird-minutes per hectare for eight rice fields (3-ha [30 000-m²] average). This was similar to that observed during the flight pen trials in the 78- and 108-m² plots (Table 6).

Discussion

The results of this study indicate that 36-m² plots are too small for reliable tests of seed repellents within the flight pen. The birds did not differentiate between treated and untreated plots, which suggests that they viewed both as a single food patch. Furthermore, there was inconsistency among replications in the birds' behavioral responses.

Each of the two large plot sizes has advantages. The prime advantage to 78-m² plots is the ability to fit more plots into the pen and consequently create more powerful experi-

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