Chapter 24

Avian Use of Various Bait Mixtures Offered in Harvested Cornfields during Spring Migration in South Dakota

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The avicide, DRC-1339, is used to cull populations of spring-migrating blackbirds in eastern South Dakota to reduce damage to ripening sunflower in late summer. We investigated nontarget bird hazards associated with using various grain mixtures to attract blackbirds (Icteridae), especially red-winged blackbirds (*Agelaius phoeniceus*), to avicide-treated bait broadcast in harvested cornfields. During spring 1997 and 1998, we recorded the species and numbers of birds attracted to 0.2-ha plots baited with cracked corn and brown rice, fine-chipped sunflower meats and brown rice (1997 only), and unsupplemented brown rice. Unbaited plots were used as reference sites. In 1997 and 1998, nontarget birds showed no preference among bait mixtures (P's > 0.16). In 1997, blackbird preference did not differ among bait mixtures ($P > 0.12$); whereas, in 1998, blackbirds preferred the corn/rice mixture over rice ($P = 0.02$). Our data show that augmenting brown rice with cracked corn or sunflower meats poses little additional risk to nontarget birds and may help attract blackbirds to the baitsite.

In the northern Great Plains, millions of blackbirds (Icteridae) begin feeding on maturing sunflower in mid-August (*1*), causing annual losses of 5 -$10 million before the crop is harvested in October (*2,3*). Sunflower producers began calling for the reduction of blackbird populations in the northern Great Plains shortly after the crop became economically viable in the early 1970s (*4*). DRC-1339 (3-Chloro-*p*-toluidine), an avicide developed by the U.S. Fish and Wildlife Service for controlling European starlings (see tables for scientific names) at feedlots (*5*), was touted as an environmentally safe avicide for reducing spring-migrating blackbird populations responsible for damaging sunflower (*4*). Designated by the U. S.

Environmental Protection Agency (EPA) as a restricted-use pesticide, DRC-1339 can only be applied by trained personnel in the U.S. Department of Agriculture, Animal Plant Health Inspection Service, Wildlife Services program.

In March 1993, we initiated a long-term study to evaluate the use of DRC-1339-treated rice for culling spring-migrating blackbird populations congregating in eastern South Dakota (*6*). The management goal is to cull the breeding population thereby reducing late-summer populations of blackbirds responsible for damaging sunflower (*7*). The treated baits are spread in harvested grain fields raising concerns among wildlife agencies about acute and chronic poisoning of nontarget species (*8*). Currently, DRC-1339 is applied to brown rice and broadcast in harvested cornfields within 50 m of a road (*9*). Although blackbirds eat rice in the southern United States, rice may not be a favored food of spring-migrating blackbirds in South Dakota, and by providing an additional food item along with the treated rice may entice more blackbirds to feed in our baited plots.

Field data comparing preferences of blackbirds and nontarget birds for various bait combinations are not available. Our objective was to assess the preferences of blackbirds and nontarget birds for different bait mixtures.

Study Area and Methods

Study Area

Our study was conducted in Brookings, Miner, and Lake counties in east-central South Dakota. This region of low, rolling hills has been developed for agriculture but still has an abundance of undrained lakes and potholes. Of about 370,000 ha of cropland in these counties, 46% was soybean, 43% corn, and 8% wheat (10). The remaining 156,100 ha of land consisted of hayland (39%), Conservation Reserve Program lands (14%), and wetlands (47%). The long-term average temperature and precipitation during our March-April study period were 2.2° C and 4.2 cm, respectively. In 1997, temperatures averaged 0° C and precipitation totaled 4.1 cm; while in 1998, the average temperature was 2.2°C and precipitation totaled 2.9 cm (10).

Baiting Procedure

In 1997, we placed a pair of 0.8-ha (2-acre) plots in each of three harvested corn fields in attractive locations for blackbirds and nontarget birds (e.g., near woodlots and grasslands). The nearest edge of each plot was about 25 m from the road. Each 0.8-ha plot was subdivided into four 0.2 ha (0.5 acre) subplots and randomly assigned one of the following treatments: 2.8 kg rice (6.25 lb) and 2.8 kg fine-chipped sunflower meats, 2.8 kg brown rice and 2.8 kg cracked corn, 2.8 kg rice, and no bait. An all-terrain vehicle, equipped with a seed spreader, was used to apply baits. An unbaited buffer zone of about 3-m was left between subplots.

In 1998, we used a similar design except the rice/sunflower treatment was canceled and sample size was increased to four harvested fields. Plots were subdivided into three 33 x 33 m (0.2 ha) subplots with about a 3-m buffer between them. Each 0.2-ha subplot randomly received either 11.3 kg brown rice and 11.3 kg cracked corn, 11.3 kg rice, or no bait.

In both years, we established four bait stations (30.5 x 30.5 cm) in the reference and baited subplots to monitor bait consumption. The stations contained 10 rice kernels and were checked at least every three days, weather permitting. Subplots were rebaited after 75% of the bait at the stations was eaten or when precipitation exceeded 10 mm (0.4 inches).

Food Characteristics

Percent analyses of dry matter, ash, crude protein, acid detergent fiber, and gross energy (kcal/g) of each food were reported previously (11). Briefly, percent dry matter was essentially equal among the three foods, averaging 92%. Sunflower contained 29% crude protein whereas, rice and corn had about 10% protein. Brown rice had 4% ash and 2% fiber, which was three times more ash and three times less fiber than corn and sunflower. Finally, sunflower contained 7.3 kcal/g; whereas, cracked corn and brown rice contained about 4.5 kcal/g.

Plot Observations

Between 1 April and 25 April 1997, we observed each plot at least every third day beginning at sunrise to three hours after sunrise and from three hours before sunset to sunset. The observer arrived about ½ hr before the start of each one hour observation period and erected a blind on a 3-m high platform affixed to a truck (*5*). The nearest edge of each plot was about 25 m from the truck. After waiting 15 min, the observer began recording all birds that landed in the first randomly selected subplot for 30 sec. The observer then paused 30 sec before recording data in the next plot. After all four subplots had been censused, the observer rested for one minute and repeated the procedure.

In 1998, plots were observed from 27 March to 22 April. Procedures for observing plots were altered so that each 0.2-ha subplot was observed for one minute with a one minute data-recording period between observation periods. Observations were not conducted during steady precipitation or if the wind exceeded 32 km/hr because of poor visibility.

Statistical Analyses

Target birds, as defined under the FIFRA (Federal Insecticide Fungicide and Rodenticide Act) Section 3 Label 'Compound DRC-1339 Concentrate-Staging Areas'

(EPA registration number 56228-30), included red-winged blackbirds, yellow-headed blackbirds, common grackles, Brewer's blackbirds, European starlings, and brown-headed cowbirds (12). All other birds were considered nontargets.

We used Kruskal-Wallis tests to examine the null hypothesis that the number of blackbirds and nontarget birds recorded per hour were similar among the bait treatments and the reference plots and the three bait treatments (13). For the 1998 data, we used the Wilcoxon 2-sample test because we only had two bait treatments (13).

The significance level was set at 0.05 for all statistical tests. Means and standard errors are reported as $\bar{x} \pm$ SE. To illustrate the temporal dynamics of bird migration, we graphed 7-day moving averages of the mean numbers of birds/hour in the plots.

Results

1997

Blackbirds were observed in greater numbers in baited subplots than unbaited reference subplots ($\chi^2 < 9.63$, df = 3, $P > 0.02$); however, we detected no difference in the number of birds using the three bait mixtures ($\chi^2 = 4.22$, df = 2, $P = 0.12$). In comparison, nontarget use of baited and unbaited subplots was similar ($\chi^2 = 1.96$, df = 3, $P = 0.58$). During 86 hours of observations, numbers of blackbirds averaged 84.0 (± 16.6) and nontarget birds 1.5 (± 0.3). Blackbird migration peaked during mid-April (Figure 1), one week later than the peak for nontargets (Figure 1).

1998

More blackbirds ($\chi^2 = 21.8$, df = 2, $P < 0.01$) and nontarget birds ($\chi^2 = 8.64$, df = 2, $P = 0.01$) were recorded using subplots baited with corn/rice or unsupplemented rice than unbaited plots. We counted more blackbirds in subplots baited with corn/rice than brown rice ($Z = 2.26$, df = 1, $P = 0.02$). However, abundance of nontargets did not differ between these two baits ($Z = 1.40$, df = 1, $P = 0.16$). During 66 hours of observation, mean numbers of blackbirds and nontargets observed per hour in all subplots were 29.4 ± 8.1 and 3.2 ± 0.6, respectively. Migration peaks for blackbirds and nontarget birds were similar, occurring in early April. (Figure 1).

Years Combined

We observed 21 nontarget birds species during 152 hours of observations. After pooling the data across years, we found that the numbers of blackbirds differed ($\chi^2 = 6.49$, df = 2, $P = 0.04$) among the baited subplots (Table I), with the blackbirds preferring sunflower/rice over corn/rice and rice alone. In comparison, over-all

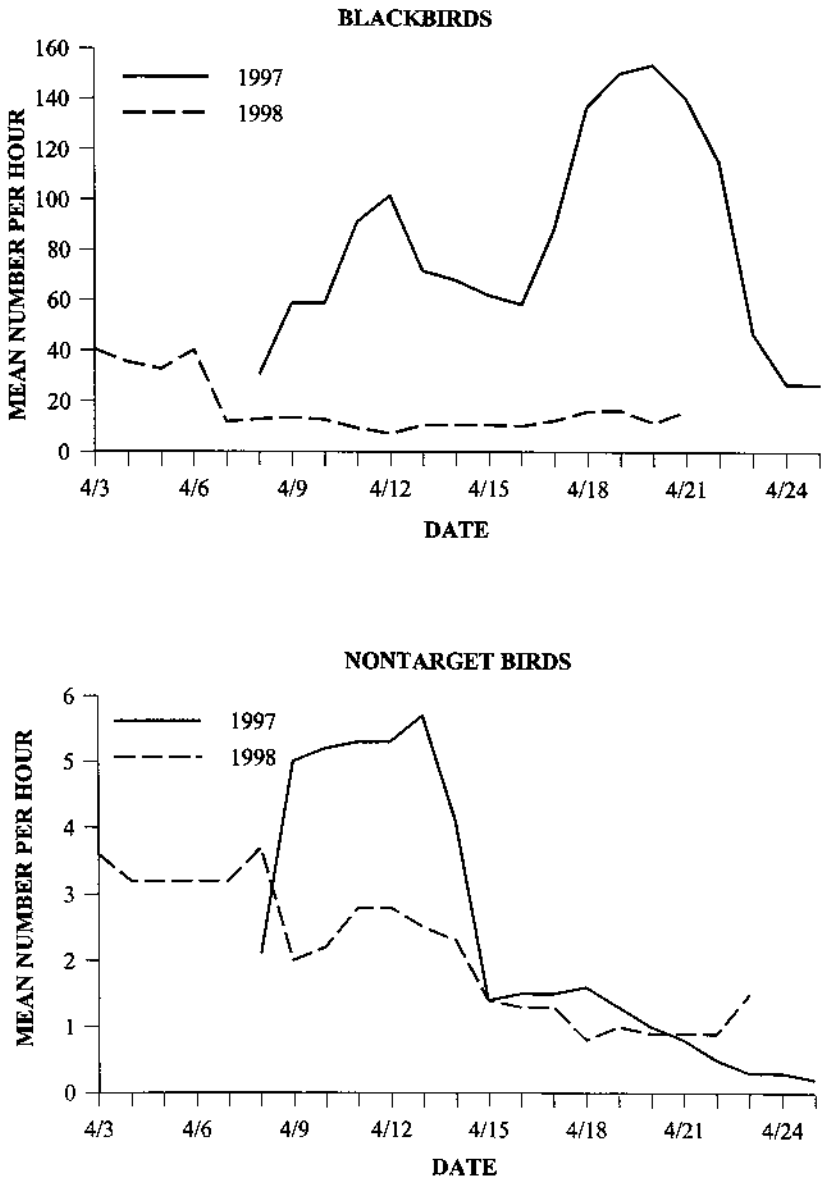

Figure 1. Seven-day moving average of the mean number of blackbirds and nontarget birds using 6-0.2 ha subplots in harvested cornfields in east-central South Dakota during April 1997 and 1998.

Table I. Target birds observed in east-central South Dakota cornfields containing 0.2 ha areas of bait mixture combinations of fine-chipped sunflower and brown rice, cracked corn and brown rice, and brown rice during March and April 1997 and 1998.

		Bait Type			
		Sunflower[a]	*Corn*[b]	*Rice*[b]	*Reference*[b]
Common Name	*Scientific Name*	Mean Number Per Hour (Percent Frequency of Occurrence)			
European starling	*Sturnus vulgaris*	0.00(0)	0.09(2)	0.01(<1)	0.00(0)
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	4.58(31)	4.35(24)	3.01(16)	1.64(15)
Brewer's blackbird	*Euphagus cyanocephalus*	0.80(5)	0.20(1)	0.05(1)	0.20(<1)
Brown-headed cowbird	*Molothrus ater*	0.15(8)	0.31(11)	0.13(8)	0.03(1)
Red-winged blackbird	*Agelaius phoeniceus*	70.01(64)	48.65(53)	42.65(47)	27.06(35)
Common grackle	*Quiscalus quiscula*	22.15(24)	13.66(20)	13.95(14)	17.06(10)
Mean		97.8(65)	67.3(55)	59.8(49)	46.0(36)

[a] *n = 86 observation hours*
[b] *n = 152 observation hours*

numbers of nontarget birds recorded were similar among bait mixtures ($\chi^2 = 2.13$, df = 2, $P = 0.34$) (Table II).

Discussion

Bait Selection

In both years, blackbirds consistently selected against unbaited subplots and tended to select the highest energy food mixture available, suggesting that blackbirds choose feeding sites based on food quantity and probably food quality. An assessment of food preference is confounded by several factors, including food characteristics such as color, size, taste, and caloric content (13, 14, 15), and the morphology of the bird. For example, in a cage study, female red-winged blackbirds, which are 30% smaller than males, clearly chose brown rice over cracked-corn (*11*). On the other hand, males showed no consistent food preference. It probably was easier for the smaller-billed females to handle rice than cracked corn.

Migration and feeding ecology

In 1997 and 1998, we observed 21 nontarget bird species in our study plots. In comparison, Kenyon (*16*) recorded 12 species in 1995, and Knutsen (*9*) detected 13 species in 1996 and 1997 (Table III). Across all four years, 24 nontarget species were recorded in cornfields in east-central South Dakota. We believe that nearly all nontarget birds that commonly use harvested corn in east-central South Dakota from mid-March to late April were recorded during these three studies.

In 1997, Lapland longspurs, which normally migrate north from east-central South Dakota by mid- to late March, were abundant in the study area until mid-April because of harsh weather. In comparison, large numbers of blackbirds and other early migrant species such as western meadowlarks, mallards, snow geese, and American robins were not observed in appreciable numbers in South Dakota until late March 1997. Differences in migrational timing between study years were probably related to the mild, late-winter weather that created open agricultural land two weeks earlier in 1998 than in 1997, allowing for an earlier arrival of migrant birds (17, 18).

From 1995 to 1998, six members of the sparrow family *(Emberizidae)* were observed in our study plots; none, however, have been tested for susceptibility to DRC-1339. We recommend LD_{50s} for some or all of these birds because their granivorous food habits, small size, and flock feeding behavior may make them vulnerable to DRC-1339 poisoning.

Other birds frequently observed in the plots included American robins, killdeers, and American coots. The foraging habits and diets of these species make it unlikely that they will be adversely affected by DRC-1339-treated rice baits (*8, 19*). On the other hand, western meadowlarks, as members of the highly vulnerable blackbird

Table II. Nontarget birds observed in east-central South Dakota cornfields containing 0.2 ha areas of bait mixture combinations of fine-chipped sunflower and brown rice, cracked corn and brown rice, and brown rice during March and April 1997 and 1998.

		Bait Type			
		Sunflower[a]	*Corn*[b]	*Rice*[b]	*Reference*[b]
Common Name	*Scientific Name*	Mean Number Per Hour (Percent Frequency of Occurrence)			
Canada goose	*Branta canadensis*	0.01(1)	0.00(0)	0.00(0)	0.00(0)
Wood duck	*Aix sponsa*	0.12(1)	0.06(1)	0.00(0)	0.00(0)
Northern pintail	*Anas acuta*	0.00(0)	0.01(<1)	0.00(0)	0.00(0)
Blue-winged teal	*Anas discors*	0.00(0)	0.01(<1)	0.00(0)	0.00(0)
Northern shoveler	*Anas clypeata*	0.06(1)	0.00(0)	0.00(0)	0.00(0)
Ring-necked pheasant	*Phasianus colchicus*	0.00(0)	0.01(<1)	0.00 (0)	0.03(1)
Killdeer	*Charadrius vociferus*	0.04(4)	0.07(5)	0.11(6)	0.11(5)
Common snipe	*Gallinago gallinago*	0.00(0)	0.03(<1)	0.01(1)	0.01(1)
Mourning dove	*Zenaida macroura*	0.02(1)	0.09(4)	0.10(3)	0.01(<1)
Downy woodpecker	*Picoides pubescens*	0.00(0)	0.01(1)	0.01(<1)	0.01(<1)
Northern flicker	*Colaptes auratus*	0.01(1)	0.20(<1)	0.02(1)	0.01(<1)
Horned lark	*Eremophila alpestris*	0.05(1)	0.16(4)	0.12(4)	0.05(2)
American robin	*Turdus migratorius*	0.00(0)	0.07(2)	0.10(4)	0.17(4)
Water pipit	*Anthus spinoletta*	0.00(0)	0.00(0)	0.03(2)	0.00(0)

Table II. Continued

Common Name	*Scientific Name*	Bait Type: *Sunflower*[a] Mean Number Per Hour (Percent Frequency of Occurrence)	*Corn*[b]	*Rice*[b]	*Reference*[b]
American tree sparrow	*Spizella arborea*	2.23(14)	1.61(9)	0.70(7)	0.62(10)
Vesper sparrow	*Pooecetes gramineus*	0.01(1)	0.01(<1)	0.01(<1)	0.00(0)
Savannah sparrow	*Passerculus sandwichensis*	0.00(0)	0.24(7)	0.26(7)	0.01(<1)
Song sparrow	*Melospiza melodia*	0.00(0)	0.25(3)	0.33(2)	0.03(2)
Dark-eyed junco	*Junco hyemalis*	0.07(2)	0.13(5)	0.05(3)	0.03(2)
Lapland longspur	*Calcarius lapponicus*	0.05(2)	0.07(<1)	0.01(1)	0.01(<1)
Western meadowlark	*Sturnella neglecta*	0.12(8)	0.15(9)	0.09(5)	1.70(6)
Unknown species		0.00(0)	0.01(<1)	0.20(3)	0.00(0)
Mean		2.80(29)	2.98(38)	1.85(34)	1.85(26)

[a] *n = 86 observation hours*
[b] *n = 152 observation hours*

Table III. Nontarget birds observed in cornfields in east-central South Dakota from 1995 through 1998.

Common Name	Year						
	1995[a]	*1996*[b]	*1997*[c]	*1997*[d]	*1998*[e]	*Mean*	*Rank*
	(Percent Frequency of Occurrence)						
American tree sparrow	1	28	5	36	10	16	1
Western meadowlark	3	23	9	13	17	13	2
Canada goose	11	22	12	1	0	9	3
Ring-necked pheasant	35	7	3	0	2	9	3
American robin	10	1	12	6	6	7	4
Killdeer	4	4	8	8	12	7	4
American coot	0	0	35	0	0	7	4
Dark-eyed junco	5	3	0	8	6	4	5
Song sparrow	0	9	3	0	7	4	5
Unknown species	12	1	1	1	3	4	5
Mourning dove	1	0	5	4	5	3	6
Downy woodpecker	6	0	1	4	2	3	6
Horned lark	0	0	0	7	6	3	6
Savannah sparrow	0	0	0	0	15	3	6
Northern flicker	7	1	0	1	3	2	7
Water pipit	0	0	0	0	2	2	7
Mallard	5	2	3	0	0	2	7
Lapland longspur	0	0	0	6	0	1	8
Wood duck	0	0	0	2	1	<1	9
Green-winged teal	1	0	0	0	0	<1	9

Table III. Continued

Common Name	Year					Mean	Rank
	1995[a]	*1996*[b]	*1997*[c]	*1997*[d]	*1998*[e]		
	(Percent Frequency of Occurrence)						
Northern shoveler	0	0	0	1	0	<1	9
Common snipe	0	0	0	0	3	<1	9
Vesper sparrow	0	0	1	2	1	<1	9
Number of Identified Species	12	10	12	16	16		
Total Individuals	177	111	147	101	150		

[a] *n = 72 observation hours, 4 fields with 2-0.8 ha plots in each field; Kenyon 1996*
[b] *n = 58 observation hours, 3 fields with 2-0.8 ha plots in each field; Knutsen 1998*
[c] *n = 77 observation hours, 4 fields with 2-0.8 ha plots in each field; Knutsen 1998*
[d] *n = 86 observation hours, 3 fields with 2-0.8 ha plots in each field; This study*
[e] *n = 66 observation hours, 4 fields with 2-0.8 ha plots in each field; This study*

family, may be susceptible to DRC-1339 because they feed in open fields and eat rice grains (20).

The number of ring-necked pheasants, mourning doves, and waterfowl recorded in the plots were too small for valid statistical analyses. Ring-necked pheasants and waterfowl are both wary, particularly during the early spring, and thus probably avoided our study plots because of their proximity to traveled roads. Mourning doves are not susceptible to spring baiting with DRC-1339 because they do not arrive in east-central South Dakota in significant numbers until late April, after the baiting has been completed.

Conclusions

The purpose of our study was to evaluate bird use of three bait offerings placed within harvested cornfields. Of the 10 most commonly observed nontarget birds, the western meadowlark was probably the most susceptible to poisoning due to its abundance, feeding habits, size, and possible chemical susceptibility to DRC-1339. Even so, this bird is very common (*21*), and DRC-1339-treated brown rice is unlikely to significantly affect the population. The ring-necked pheasant may also be vulnerable to acute and chronic DRC-1339 poisoning (22). The other eight species of nontargets are not susceptible to a spring-baiting program because of their size, food habits, behavior, or high tolerance to DRC-1339.

Future Research

We recommend two studies to further clarify the hazards of DRC-1339 to spring-migrating nontarget birds: 1. A food habits study of bird species that frequent rice-baited plots to determine which species eat rice and how much they eat. 2. Determine the LD_{50} values for rice-eating species observed in the baited plots.

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