BAITING BLACKBIRD AND STARLING CONGREGATING AREAS IN KENTUCKY AND TENNESSEE

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ABSTRACT: Four studies were conducted in January 1977-79 in Kentucky and Tennessee. Two of these studies were to determine the feasibility and effectiveness of selectively reducing starlings from mixed blackbird/starling winter roosts by baiting their congregating areas with Starlicide Complete® pellets. The two remaining studies dealt with determining bait preference of starlings and nontarget birds for two formulations of pelleted baits (Layena and corn). Starlicide baitings were fairly selective for starlings, but nontarget hazards were encountered. Starlings showed no significant preference for either type of pelleted bait, but nontargets preferred corn over Layena pellets. Methods are suggested to minimize nontarget hazards from baiting starling congregating areas.

INTRODUCTION

Large concentrations of wintering blackbirds (Icteridae) and starlings (Sturnus vulgaris) that congregate in feeding roosting areas in the southeastern U.S. reportedly cause serious economic losses to agriculture as well as create health hazards and nuisance problems (USFWS 1976). The major agricultural problems in Kentucky and Tennessee are reported to be in fields of sprouting wheat and in cattle and hog feeding areas. Dolbeer et al. (1978) found that although starlings comprised only 9% of a roosting population near Milan, Tennessee, they appeared to have the greatest negative impact on agriculture in Gibson County, Tennessee. Stickley et al. (1976) found that almost all the damage to sprouting winter wheat in Tennessee was also caused by starlings. Although starlings and blackbirds frequently use cattle feedlots, Besser et al. (1968) showed that starlings cost feedlot owners in the west more than 40 times as much per unit of population as do red-winged blackbirds (Agelaius phoeniceus).

These problems often have been used as a justification for killing large numbers of wintering blackbirds and starlings in the southeastern U.S. (USFWS 1976). However, because the starling appears to be the chief offender in agricultural losses, it is reasonable that most control efforts involving direct local population reduction be directed at this species. Roost sprays (wetting agents) for reducing large populations of blackbirds and starlings (Lefebvre and Seubert 1970) are now in use, but they have inherent problems, i.e., nonselectivity of species, stringent weather requirements for effectiveness, and considerable public controversy (Graham 1976). Therefore, additional methods are needed which are more selective for the starling.

One commercial product, Starlicide®**, which contains 1 pellet treated with 1% DRC-1339 (3-chloro-4-methylbenzenamine hydrochloride) for every 9 untreated pellets, was federally registered in 1967 as a starling toxicant for use in cattle feedlots and poultry-raising operations. DRC-1339 is both selective and slow-acting. It is highly toxic to starlings, generally less toxic to most other birds, and relatively nontoxic to rats, and requires up to 2 days to kill starlings that ingest treated baits (DeCino et al. 1966). This product, produced by Ralston Purina Co., St. Louis, MO., was originally formulated into 70 mg pellets from poultry mash (Layena®) which consisted of several grain products. However, in 1977, for economic reasons, the company changed the basic pellet ingredient to corn, increased the pellet size to 168 mg, and called the product Starlicide Complete® (hereafter called "Starlicide").

Starlicide has been widely and successfully used in feedlots and successfully tested in congregating areas in the western U.S. for reducing wintering starling populations (West et al. 1967, Besser et al. 1967, Royall et al. 1967, and West 1968), but it had not been tested in Kentucky and Tennessee where midwinter blackbird/starling roosts are perennial problems. Therefore, we conducted 4 studies with Starlicide during the winters of 1977-1979 in Kentucky and Tennessee. Two of these studies evaluated the effectiveness of Starlicide baitings on congregating areas to selectively reduce wintering starlings in local mixed roosts containing starlings and blackbirds. The other 2 studies were conducted as a result of nontarget problems encountered in the previous Starlicide baiting studies and dealt with feeding preference by target and nontarget birds for the 2 types of untreated pellets (Layena and corn) used as the carrier for DRC-1339 in the Starlicide product.

We acknowledge the contributions of our coworkers in the conduct of these studies: Roger L. Hothem, David L. Otis, W.C. Royall, Jr., and Edward W. Schafer, Jr.

METHODS

Starlicide Tests

The first test was conducted near Campbellsville, Kentucky, in January, 1977 where initially an estimated 61,000 birds (30% starlings, 70% blackbirds) roosted in 2.8 ha of mixed hardwoods and eastern red cedars (Juniperus virginiana). Bait sites were established in 3 fields adjacent to the roost,

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**Registered trademark of the Ralston Purina Co., St. Louis, MO. Use of trade names does not imply government endorsement of commercial products.

and in 5 selected cattle and/or hog feedlots situated along major flightlines of birds emanating from the roost. Large numbers of birds passed through or congregated daily at these sites, especially when departing from or returning to the roost.

The 5 feedlots were 3 to 10 km from the roost and from 0.2 to 0.8 ha in size. Lot owners usually fed hay to their cattle and eared corn to their hogs. Some owners also fed hogs supplemental rations of protein pellets which were similar to untreated pellets we used as prebait. The pasture sites were adjacent to or within 0.8 km of the roost. One site consisted of four 8 m x 50 m swaths spaced about 50 m apart, created by plowing snow to expose the ground. The second site consisted of three 3 m x 12 m swaths spaced about 20 m apart, created by spreading hay on top of snow cover, and the third was a single 15 m x 100 m swath created by spreading pulverized livestock manure on top of the snow.

The commercially available corn base Starlicide used in this study was further diluted 1:1 with similar untreated Purina Hog Finisher WM® pellets giving a test mixture of 1:19 treated to untreated pellets to minimize the possibility of an individual starling ingesting more than one treated pellet during one feeding. One treated pellet contained a dose of 21.3 mg/kg which is about 5.1 times the starling (avg. wt. 75 g) LD_{50} of 4.2 mg/kg as reported by DeCino et al. (1966). One treated pellet could conceivably account for more than one dead bird if pellets were broken into smaller parts by a feeding bird.

As soon as selected, V-shaped troughs (20 cm wide x 2.5 m long) were placed at each site and prebaited with untreated pellets and cracked corn for up to 7 days before treated baits were offered. Lids were used to cover the troughs at night and during periods of inclement weather. Up to 24 troughs were used at the largest field baiting site and as few as 4 at the smallest feedlot. Troughs were usually placed in clusters of 4 to 8 about 1.5 m apart.

At each site, untreated cracked corn was offered along with the pellets in an attempt to attract blackbirds which in turn acted as decoys to attract starlings (West 1968). The corn, exposed in separate troughs (about 1 out of every 4 troughs) and occasionally spread on the ground or snow cover around troughs at field bait sites, was used also in an attempt to draw blackbirds and other nontarget species away from the pellet troughs.

A total of 2.3 kg of bait per trough was exposed at each site and bait was replenished to this level as necessary (usually once a day, weather permitting). Before replenishing and when more than half the bait in a trough was consumed, the remainder was weighed and consumption recorded at each site.

Our second Starlicide test was conducted in January, 1978, near Madison, Tennessee, where initially an estimated 600,000 birds (74% starlings and 26% blackbirds) were roosting in 6 ha of a 16 ha mixed hardwood-cedar woods. Two congregating areas, a 5 ha pasture and a 3 ha ballpark-recreation complex, closed for the season, that were adjacent to and on opposite sides of the roost were selected for baiting trials. At least 25,000 to 50,000 starlings were observed feeding on these areas on more than one occasion before baiting began. Fencing excluded livestock from each area, and "Poison" signs were posted at all access points. Within each area bait sites were established by plowing snow and exposing the ground.

Under the conditions of Experimental Use Permit No. 6704-EUP-16 granted by the Environmental Protection Agency, Starlicide was applied on the ground by an electric Cyclone® spreader mounted on a pickup truck tailgate. The rate was 56 kg per ha (5.6 kg toxic pellets per ha) broadcast on two 15 m x 150 m strips in the pasture and one 15 m x 110 m strip at the ballpark.

Untreated pellets (similar to Starlicide pellets) were offered on 5 occasions within 8 days. (No cracked corn was used as it was in the Kentucky study.) When observations showed that all or most of the prebait was being consumed, Starlicide baiting began. We used the commercial 1:9 dilution because results from the 1977 Kentucky study showed that the average consumption rate for individual starlings was about 6.5 pellets (0.94 g) per feeding.

Visual estimates (percent) of the amount of bait consumed were made by walking the entire baited area immediately after each evening feeding period. We used visual estimates out of necessity because it was almost dark when birds finished feeding, and by the next morning precipitation and/or excessive ground moisture had usually rendered any remaining bait totally indistinguishable.

Efficacy in both studies was based on bait consumption. Laboratory data (Schafer, pers. comm.) had shown that caged starlings offered the 1:19 diluted Starlicide bait, as used in Kentucky, consumed 2.5 g ($S_{\bar{x}}$ = 0.38) per mortality, resulting in an estimated 400 ($S_{\bar{x}}$ = 61) (1000 g ÷ 2.5 =) dead birds per kg of bait while those offered the 1:9 bait, as used in Tennessee, consumed 2.33 g ($S_{\bar{x}}$ = 0.29) per mortality, or 429 ($S_{\bar{x}}$ = 53) dead birds per kg.

In both studies, additional data were also collected to help evaluate the kill. Roost population estimates including species composition were determined at least 3 times a week by observing departing or arriving flightlines. Observations of individual feeding target and nontarget birds were made to determine consumption capabilities. Daily estimates were made to determine numbers and species of birds utilizing bait sites. And finally, the number and species composition of birds that died in the roosts were estimated from systematically located transects which sampled 1.24% of the roost area in Kentucky and 6.1% in Tennessee. Peripheral habitat was also searched at all sites for dead birds.

Bait Preference Studies

The two remaining studies, conducted in January and February 1979, near Bowling Green, Kentucky, dealt with the feeding preferences of target and nontarget birds for untreated Layena pellets and corn pellets, both materials having been used by the manufacturer as carriers of DRC-1339. The first study utilized birds from a congregation of 750,000 blackbirds and starlings roosting in pines (Pinus spp.) Two pasture feeding sites were located within 0.4 km of the roost while a third was about 12 km away where we had observed considerable numbers of nontarget birds other than blackbirds. At each feeding site we established 4 pairs of parallel baited strips with each pair separated from another by about 3 m. Strips within each pair were 3 m long, 0.5 m wide, and 1.5 m apart. Each strip in each pair randomly received 23 kg of one of two types of untreated pellets (corn or Layena) before each evening roost flight.

At each site, evening species composition counts were started when birds first landed on either strip in a pair and continued until at least one count of up to 50 birds per strip had been made on all occupied bait strips. In addition, randomly selected individual birds were observed on each occupied strip to determine their consumption rate (pellets or parts of pellets consumed per feeding).

The last study was conducted in the laboratory. Six groups each of from 5 to 50 starlings, brown-headed cowbirds (Molothrus ater), common grackles (Quiscalus quiscula), redwings, and cardinals (Cardinalis cardinalis) were segregated by species into 3 m x 1.5 m x 9 m screened enclosures for up to 14 days. Equal weights of corn and Layena pellets were exposed daily in troughs to each group. Feeds were weighed back at the end of each day and consumption recorded to determine preference.

RESULTS AND DISCUSSION

Starlicide Baiting

Of the evaluation procedures used in these studies, calculating mortalities from bait consumption perhaps provided the most reliable data on total kill. Consumption of corn base Starlicide bait totaled 126 kg in Kentucky and 149 kg in Tennessee, resulting in a calculated mortality of 50,400 (95% C.I. = 33,602 - 67,198) and 63,900 blackbirds and starlings in the two states, respectively (Table 1). (Confidence intervals were not determined for the Tennessee mortality figure because of the

Table 1. Starlicide baitings at blackbird/starling congregating areas in Kentucky, 1977, and Tennessee, 1978.

Location	Starlicide consumed/offered (kg)	Treatment Period (days)	Estimated kill[1] (all species)	Percent Starlings[2]
Kentucky[3]	126/193	15	50,400	92
Tennessee[4]	149/194	11	63,900	52
TOTALS	275/433	26	114,300	

[1] Based on bait consumption.

[2] Based on roost transects.

[3] Troughs used to expose bait.

[4] Ground baiting.

inaccuracy of using visual estimates to determine bait consumption.) About 60% of the total bait consumption occurred in the first 24 hrs. of baiting in Kentucky and 58% in the first 73 hrs. in Tennessee.

In Kentucky, slightly more than 28,000 birds were killed by consuming bait at the feedlot sites and about 22,000 at field bait sites; however, more birds were killed per site-day at field sites (1,145) than feedlots (718). Although there were fewer treatment site-days at field sites (20) than feedlots (39), and field sites were active for only about 2 hrs. per day, congregations of birds were much larger at the field sites and the greatest amount of treated bait was consumed there. This indicates that baiting field sites near roosts is more effective and requires less effort and time compared to baiting several widely scattered feedlots.

Numbers of birds using bait sites daily in Kentucky ranged from 20 to 3,600 at feedlots and up to 5,000 at field sites during prebaiting. After treatment began, these numbers ranged from 0 to 1,400 up to 5,600, respectively. Blackbirds outnumbered starlings at all sites except one feedlot where only starlings were observed. At this site, a pretreatment population of 3500 starlings was reduced to 0 after 3 days of Starlicide baiting. About 600 dead starlings were collected in a barn at this site the first morning after bait exposure. In Tennessee, numbers of birds using bait sites ranged from 4,000 to 25,000 daily during both prebaiting and treatment periods with no noticeable decline due to treatment.

Estimates of the numbers (and species) of roosting birds were of little value for evaluating baiting efficacy because both roosts were unstable. Onset of the most severe weather in January in the last 100 years (NOAA 1977, 1978) in both states caused considerable changes and fluctuations in roost populations and species compositions. Robins (Turdus migratorius), common to both roosts in mid to late December (as many as 100,000 used the Kentucky roost), left the area completely, blackbirds arrived, and starlings no longer fed in frozen fields where previously observed. The Kentucky roost population varied from 48,000 to 77,000 birds whereas Tennessee populations varied from a peak of 874,000 birds to 232,000 toward the end of January. Most of this decline and/or variation in both studies was primarily caused by starlings responding to drastic weather changes by deserting the roost (and moving to barns as roost sites) rather than from the baiting effort.

Other than for determining species composition, collecting dead birds in roosts and projecting these figures to determine total kill of a Starlicide baiting program is totally unreliable. Because it may take up to 2 days for a bird, particularly a starling, to die after ingesting a DRC-1339 treated bait (DeCino et al. 1966), an unknown number of birds die away from the roost. Therefore, to use roost mortality to estimate the overall kill from the baiting would be purely speculative.

Species composition of dead birds found on roost transects (Table 2) closely coincided with the composition observed on bait sites. In Kentucky, 92% of the dead birds collected were starlings, while 91% of all birds observed on bait troughs containing Starlicide were starlings. In contrast, of all birds observed on troughs containing only cracked corn, 92% were blackbirds. In Tennessee, where bait was broadcast on the ground and no cracked corn was used to attract nontargets, 52% of dead birds on transects in the roost were starlings, 34% cowbirds, and 14% other blackbirds (redwings, grackles, and rusty blackbirds Euphagus carolinus; Table 2). Bait site observations of feeding birds showed relatively similar percentages; 44% starlings, 40% cowbirds, and 16% other blackbirds.

Table 2. Species composition of dead birds collected on roost transects during Starlicide baiting studies in Kentucky, 1977, and Tennessee, 1978.

Species	KY (%)	TN (%)
Starling	92.0	52.2
Brown-headed cowbird	1.3	34.1
Red-winged blackbird	1.3	8.1
Common grackle	2.6	4.7
Rusty blackbird	2.6	0.9
TOTAL	100.0	100.0
N	76	1582

Nontarget birds other than blackbirds were frequently observed on bait sites. While their relative abundance in the area was low and difficult to determine, several individuals of 29 species were observed; 13 species were common to both studies (Table 3). Twelve species were observed on corn troughs

Table 3. Nonblackbird nontarget birds observed on or within 20 meters of bait sites in Kentucky and Tennessee, 1977-79.

Species

Cooper's hawk (Accipiter cooperii)
Red-tailed hawk (Buteo jamaicensis)
American kestrel (Falco sparverius)
Bobwhite (Colinus virginianus)
Killdeer (Charadrius vociferus)
Mourning dove (Zenaida macroura)[1]
Common flicker[1]
Red-bellied woodpecker (Centurus carolinus)
Downy woodpecker (Dendrocopos pubescens)
Horned lark[1]
Blue jay[1]
Common crow (Corvus brachyrhynchos)
Black-capped chickadee (Parus atricapillas)
Winter wren (Troglodytes troglodytes)
Mockingbird (Mimas polyglottos)
Brown thrasher (Toxostoma rufum)
American robin[1]
Water pipit (Anthus spinoletta)
Cedar waxwing (Bombycilla cedrorum)
House sparrow (Passer domesticus)[1]
Eastern meadowlark[1]
Cardinal[1]
Purple finch (Carpodacus purpureus)
Rufous-sided towhee (Pipilo erythrophthalmas)[1]
Dark-eyed junco[1]
Tree sparrow[1]
White-crowned sparrow
White-throated sparrow[1]
Song sparrow[1]

[1] Common to bait sites in both states.

in Kentucky and 11 of these were also seen on Starlicide troughs, but only 2--a cardinal and blue jay (Cyanocitta cristata)--were seen to actually ingest a pellet. One flock of 16 meadowlarks (Sturnella magna) was routinely observed on one field bait site during pretreatment. All disappeared after treatment began, but only 1 was found dead during searches of peripheral habitat near this site. Other

dead bird searches around bait sites near the roost and at feedlots produced 1 dark-eyed junco (Junco hyemalis), 1 common flicker (Colaptes auratus), and 1 cardinal.

Nonblackbird nontarget birds, particularly cardinals, were more abundant at bait sites in the Tennessee study. In one instance, during an evening observation period, 19 cardinals, 5 dark-eyed juncos, 2 tree sparrows (Spizella arborea), and 3 white-throated sparrows (Zontrichia albicollis) were observed foraging on one of the baited areas. During almost 6 minutes of individual bird feeding observations on this evening, 6 cardinals, 1 white-throated sparrow, and 1 tree sparrow consumed 22 pellets or large parts of pellets. Cardinals averaged 2.8 pellets per bird per feeding while the sparrows averaged 2.5. Before the treatment period, searches for dead birds on transects in the roost as well as at random in peripheral habitat around bait sites produced no dead nontargets other than a few blackbirds. However, three searches conducted after treatment began and extending over a 10-day period revealed 11 cardinals, 1 blue jay, and 2 white-throated sparrows, all victims of Starlicide baiting.

Nonblackbird nontarget bird exposure to Starlicide pellets during ground baiting in Tennessee was not surprising considering the method of bait exposure and location of bait sites. When areas are located close to woodlots or wooded streams and fencerows as in this study, many different granivorous species would have easy access to baited areas and could be extremely vulnerable to poisoning. Snow cover may increase this hazard. Conversely, in Kentucky, nontarget birds were not as abundant as in Tennessee, but the potential exposure for those present on or near bait sites was still relatively high. The major difference between the two studies besides the use of troughs was the use of cracked corn as an attractant to lure nontargets including blackbirds away from the Starlicide baits. This procedure was very effective, judging from the species composition of dead birds and from the polarization of birds observed on the troughs containing the 2 types of baits.

We consider these 2 studies to be qualified successes in showing that with a concentrated effort at baiting congregating areas with Starlicide, large numbers of starlings from a winter roosting population can be fairly selectively killed in a rather short time. There were a number of limiting factors, however, that may have reduced the potential kill. Snow cover caused many problems with respect to access to bait sites and reduced the number of potential sites that could have been used. In Tennessee, continuous snow cover limited the size (0.6 ha) and number of areas that could be effectively cleared with a tractor-scraper to allow ground baiting. Constant problems with ground moisture and precipitation caused the dissolution of baits which might otherwise have been consumed by feeding birds. The EPA-imposed limitation of 2.3 kg of toxic pellets per ha restricted the amount of bait that could be applied to the small bait sites, and in Kentucky the limited use of bait troughs reduced the amount of bait that was exposed to feeding birds on a daily basis.

On the other hand, the unusually severe weather and persistent snow may have been a benefit. Subfreezing temperatures, frozen ground, and snow cover which blanketed natural food supplies in pastures and stubble fields may have created ideal conditions for baiting birds. Once we began removing snow from parts of former congregating areas in fields, birds began to use bait sites more readily and consistently than they had during no-snow conditions present during preliminary observations in December. Further studies using this same baiting technique under more normal (no-snow) weather conditions typical of these areas should be carried out to determine if the same degree of success could be achieved.

Bait Preference Studies

Analysis of variance of the data showed no particular evidence ($p=0.413$) of starling preference for Layena pellets over corn-base pellets in the field study. Of 5,037 starlings counted on bait strips, 52% chose Layena pellets and 48% corn pellets (Table 4). In contrast, there was a highly significant

Table 4. Bait preference of bird species using untreated pellet bait sites near Bowling Green, Kentucky, January, 1979.

	Total number birds observed	Layena[1] %	Corn[1] %
Species:			
Starling	5037	52	48
Brown-headed cowbird	1231	13	87
Common grackle	13	15	85
Red-winged blackbird	11	27	73
Rusty blackbird	6	50	50
Eastern meadowlark	9	56	44
House sparrow	125	26	74
White-crowned sparrow	24	58	42
White-throated sparrow	9	44	56
Song sparrow	5	60	40
Cardinal	39	33	67
Dark-eyed junco	92	33	67
Blue jay	2	0	100

[1] Average pellet size = 100 mg and 4.0 mm in diameter.

difference ($P < 0.001$, $F_{1,6} = 123.46$) in cowbird preference for the corn pellets. Of 1,231 cowbirds counted on bait strips, 87% chose corn pellets vs. 13% Layena (Table 4). For 11 other nontarget species, an average of 67% (range 40 to 100%) of 335 individuals chose corn pellets.

Starlings consumed an average of 10.6 ($S_{\bar{x}} = 1.22$) Layena and 7.9 ($S_{\bar{x}} = 0.78$) corn pellets or parts per feeding (Table 5) compared to an average of 6.5 (Kentucky) and 5.2 (Tennessee) during the Starlicide studies. These increases in consumption rates can be explained in part by the fact that the pellets

Table 5. Average feeding rates of bird species consuming untreated pelleted baits on sites near Bowling Green, Kentucky, January 1979.

	Bait-Type							
	Layena[1/]				Corn[1/]			
Species	n	Total eaten	Mean No./ Bird/ Feeding	Mean feeding time/bird (min.)	n	Total eaten	Mean No./ Bird/ Feeding	Mean feeding time/bird (min.)
Starling	24	253	10.6	0.5	24	189	7.9	0.4
Brown-headed cowbird	5	45	9.0	0.5	17	189	11.1	0.6
Common grackle	1	5	5.0	0.5	6	69	11.5	1.0
Red-winged blackbird	0	0	0	0	2	5	2.5	0.1
Rusty blackbird	1	4	4.0	0.6	2	21	10.5	1.0
Eastern meadowlark	3	30	10.0	1.3	3	14	4.7	0.5
House sparrow	0	0	0	0	4	22	5.5	0.3
White-crowned sparrow	4	41	10.2	1.2	4	14	3.5	0.2
White-throated sparrow	1	12	12.0	2.0	0	0	0	0
Song sparrow	1	14	14.0	2.2	0	0	0	0
Cardinal	12	28	2.3	0.3	9	70	7.8	1.0
Dark-eyed junco	2	9	4.5	0.3	7	40	5.7	0.4
Blue jay	0	0	0	0	4	19	4.7	0.1

[1/] Whole pellets or large parts. Average pellet size 100 mg and 4.0 mm in diameter.

in the preference study were smaller, i.e. they averaged 59% of the weight and 83% of the diameter of those in the Starlicide studies (168 mg and 4.75 mm, respectively). The feeding rate data generated during the Kentucky Starlicide study strongly justified the use of the standard 1:9 treated to untreated dilution rate of Starlicide used in Tennessee. This dilution was more than adequate to minimize the probability of feeding birds consuming more than 1 lethal pellet per feeding. However, with the reduced pellet size now in use for Starlicide baits the probability of a starling consuming 1 or more lethal pellets is increased but not enough, we feel, to change the 1:9 dilution rate solely for this reason.

The laboratory feeding study showed starlings preferred Layena 2.6 to 1 (mean of 2 groups - 72% vs. 28%), whereas blackbirds (cowbirds, grackles, and redwings) preferred corn pellets 6.1 to 1 (mean of 3 groups = 86% vs. 14%). Cardinals preferred corn 2.3 to 1 (70% vs. 30%) which was almost the same preference obtained in the field where 26 of 39 cardinals (67%) also chose corn over Layena (Table 4). These data suggest that under field use conditions the potential nontarget hazard would be reduced, but not eliminated using Layena pellets as the DRC-1339 carrier.

Based partially on our results, the state of Kentucky purchased 30,000 lbs. of Starlicide in 1978 and 40,000 lbs. in 1979 to dispense to livestock raisers in 10-lb. packages, free of charge, to combat their reported starling problems in livestock feeding areas. In 1979, Tennessee also purchased an unknown quantity, and made it available to livestock raisers for a small fee.

In 1979, also based primarily on our information, Ralston Purina agreed to change Starlicide from the corn-base pellet back to the Layena poultry pellet used prior to 1977. We feel this was an honest effort by the company to minimize potential nontarget problems associated with the use of Starlicide.

CONCLUSIONS AND RECOMMENDATIONS

1. Baiting blackbird/starling congregating areas with Starlicide pellets with minimal, but concentrated effort appears to offer considerable potential for selectively reducing numbers of starlings using large winter roosts in Kentucky and Tennessee.

2. Of the evaluation methods tried, bait consumption, supported by laboratory and field bird consumption capability data, appears to offer the most reliable method for determining total effectiveness of Starlicide baitings.

3. Snow cover may enhance the effectiveness of baiting congregating areas as well as increase the nontarget hazard. Further studies of the feasibility and effectiveness of congregating area baiting under no-snow conditions should be conducted.

4. A nontarget hazard exists in baiting congregating areas, particularly open-field ground baiting. The addition of cracked corn as an alternate food source had a significant effect in reducing this hazard in trough baiting. This procedure may have a similar effect in ground baiting and should be thoroughly investigated.

5. Hazards to nontarget birds apparently can also be reduced by using Layena pellets rather than corn pellets as a carrier for DRC-1339 in Starlicide baits.

6. Ultimately, an amended federal registration of Starlicide should be sought to allow the use of this baiting technique, if additional data support it.

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