STARLING CONTROL IN LIVESTOCK FEEDING AREAS

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The Denver Wildlife Research Center has been investigating methods to combat starling (Sturnus vulgaris) problems at livestock feeding areas since 1960. A variety of chemicals, baits, and methods of bait placement have been tested. This paper summarizes these investigations.

CHEMICALS TESTED

About 500 chemicals have been screened for toxic and stupefacient effects on starlings. Although several chemicals have been found that immobilize starlings in the laboratory, they have been largely ineffective in the field; most starlings regurgitate the treated baits, and seldom have substantial numbers been affected. Of the toxicants screened, four compounds, TEPP, DRC-632, DRC-1327, and DRC-1339, have shown enough activity as control agents for starlings to warrant intensive investigation in the laboratory and the field.

TEPP

The first chemical that possessed sufficient activity on starlings to warrant testing in the field was TEPP (tetraethyl pyrophosphate). The acute oral LD_{50} of TEPP (in an aqueous solution) to starlings is 0.88 mg/kg. Death generally occurs within 5 minutes. The fundamental mechanism of this toxicant is the inhibition of cholinesterase.

TEPP is too toxic to mammals (LD_{50} of 1.2 mg/kg to rats - Spector, 1956), and presumably humans, to recommend its widespread use as a starling control agent. However, it has been useful for evaluating field tests. The rapid deaths it causes have been used to show which baits are well accepted and what species and numbers are affected.

DRC-632

DRC-632 (O,O-Dimethyl O-[4-(methylthio)-m-tolyl]phosphorothioate) was the first compound we found to be far more toxic to birds than mammals (LD_{50} = 7-10 mg/kg for starlings, but 310 mg/kg for male rats). Starlings killed with DRC-632 show typical symptoms of organophosphate poisoning. The primary difference in action between this compound and TEPP is the time lapse between dosage and death. Most starlings dosed orally with 5-10 mg/kg of DRC-632 succumb in 12 to 24 hours, although a small percentage take 48 hours. In laboratory and field tests, the dermal toxicity of DRC-632 to starlings (LD_{50} = 10-15 mg/kg) proved more important than its oral toxicity. However, all of numerous attempts to kill starlings economically by spraying the birds while roosting, or by spraying the roost vegetation shortly before they arrived, were failures. Use of DRC-632 on perches was more effective, but discovery of its higher toxicity to hawks (LD_{50} = 1 mg/kg to sparrow hawk, Falco sparverius) and its extreme secondary hazard to them made it generally unsuitable for use. In one test, a sparrow hawk died after eating a single starling killed with a 6% DRC-632 formulation, and a marsh hawk (Circus cyaneus) died after eating two such starlings. In another test, a sparrow hawk died after eating one sparrow (Passer domesticus) that had been treated with DRC-632. All hawks exhibited typical cholinergic symptoms at death.

DRC-1327

Goodhue and Baumgartner (1965) reported on the use of DRC-1327 (4-aminopyridine) in a new approach toward control of nuisance and depredatory birds. They stated that birds taking baits treated with DRC-1327 emitted distress cries and had violent reactions that were so disturbing that other members of the species in the vicinity abandoned the area. They reported frightening a population of 2,000 - 3,000 starlings from a hog feedlot near Beardstown, Illinois, with two baitings.

DRC-1327 has an LD_{50} of about 14 mg/kg to starlings and 32 mg/kg to rats (Goodhue and Baumgartner, 1965). Most starlings die that display distress. The compound is toxic to most species of birds but does not appear to have any secondary hazards for predators.

In January 1963 near St. George, Utah, about 3,900 starlings were feeding at a 30-acre

turkey feeding area and about 2,300 were using another turkey farm 12 miles distant. Exposure of 4 pounds of 2% DRC-1327-treated poultry pellets at the first farm and 2 pounds at the other resulted in an approximate 95% reduction in starling populations at the two feedlots within 2 days. About 5% of each of the two populations were killed. Many starlings that were frightened from the treated lots congregated at an unbaited lot midway between.

In Colorado, only 5 pounds of 2% DRC-1327-treated poultry pellets, exposed at strategic places in a 25-acre cattle feedlot, cleared a population estimated at 2,750 starlings. However, small numbers, either the same birds or others from nearby feedlots, returned within an hour and began building toward their original numbers. Populations remained somewhat below pretreatment levels for 3 weeks following baiting. Two more baitings produced similar results.

In areas where bait acceptance by starlings is poor or fair, DRC-1327 is more effective than other known toxicants in reducing damage.

DRC-1339

The most selective bird toxicant presently known is DRC-1339 (3-chloro-p-toluidine hydrochloride). Initial laboratory data (DeCino, Cunningham, and Schafer, 1966) and field testing (Besser, Royall, and De Grazio, 1967) have shown the usefulness of this compound. The acute oral LD_{50} is 3.8 mg/kg for starlings and more than 1,000 mg/kg for rats (DeCino et al., 1966). With normal precautions, it provides a means of starling control that is virtually nonhazardous to other animals. DeCino et al. (1966) state that DRC-1339 never kills starlings in less than 3 hours, even with a dose of 100 mg/kg. At concentrations used in the field, death usually occurs 30 to 36 hours after feeding. Uremic poisoning, along with congestion of the major organs and general circulatory impairment, appears to be the primary cause of death.

BAIT MATERIALS

Water was one of the first baits tried, but competition with nearby water supplies caused poor acceptance in our trials.

Various food items have been used for baits, with preferences often varying with the location. The selectivity of poultry pellets for starlings in Colorado has been shown in many trials and was especially noteworthy in one. In two cattle pens baited with TEPP-treated pellets, starlings made up 98 and 87% of the kill and red-winged blackbirds (Agelaius phoeniceus) 2 and 13%, but in a pen baited with cracked corn (located between the two pens baited with pellets) redwings made up 97% of the kill and starlings only 3%. Poultry pellets have given good results in trials in Nevada, Utah, and Missouri when spread on dry or frozen areas. They dissipate quickly on thaws or when moisture falls.

Rolled barley was a successful starling bait when first tried in Utah. The average starling population at a feedyard near Ogden and the much larger population that came to the feedyard early in the morning decreased about 70%. More than 35,000 starlings were killed, and a general reduction was noted in the starling population that fed at all lots in the vicinity of the test area. Rolled barley proved hazardous to mourning doves (Zenaidura macroura) in Arizona.

Baiting trials in Idaho indicated that poultry pellets were not as effective as potato baits. Elliott (1964) reported that over 1 million starlings were killed with French-fried potato baits in Idaho and Oregon. However, we found that Colorado starlings accepted potato baits poorly.

Siebe (1964) reported killing 13,000 starlings with 250 pounds of raisins with molasses added. Schwab found blue-colored poultry pellets highly successful in other California trials (reported by Fowler, 1966). However, we found that Colorado starlings took eight times as many natural-colored pellets as blue ones in a feeding trial.

Rolled milo proved extremely hazardous to mourning doves in Arizona and did not appear to be a preferred food item of starlings in tests there and in New Mexico.

Cracked corn was fairly well accepted by starlings in two cattle feedlots in New Mexico. In Arizona, it proved very hazardous to mourning doves, even being accepted when

placed atop fence posts.

In many tests conducted in the western United States, poultry pellet, raisin, potato, and rolled barley baits have proved the most effective and selective for starlings.

BAIT DILUTIONS

To reduce the hazard to nontarget species, undiluted bait should be used only in troughs or on elevated structures. Even there, we have usually found it advisable to dilute treated bait with untreated material. Hazards to larger avian species are lessened when baits are adequately diluted. Fifteen poultry pellets, each treated with a minimum lethal dose of DRC-1339 for a starling, would be required to kill a pheasant (Phasianus colchicus). With a bait dilution of 1 part treated to 10 parts untreated, a pheasant must ingest 165 pellets at one feeding to obtain a lethal dose. This may not be impossible, but is much less likely than its ingesting 15. If the diluent includes a grain, e.g., treated poultry pellets diluted with pellets and cracked corn, baiting is less likely to affect granivorous species, which include most upland game birds, doves, and some waterfowl.

Bait dilution also makes baiting operations more economical by giving more starlings an opportunity to find one of the treated baits. We have observed that if a starling takes one particle of the bait material, it probably will take several, or enough to obtain a treated particle. For feedlots, we recommend a dilution rate of 1:10. For pastures and fields where the risk to nontarget species is greater, 1:200 is advised.

BAITING METHODS

Feedlots

In field tests conducted in 1960-61, little was known about where starlings would take bait, but by using fast-acting toxicants such as TEPP we determined where the best bait sites were. Initially, baits were placed on feedlot fence posts and manure mounds within cattle pens, because birds were most often observed perching there. Although birds were taken on these areas, they afforded too little surface area to accomplish control.

Our initial attempt to remove starlings from a feedlot was with TEPP in water. Watering troughs of 2 and 4-quart capacity were constructed of roof guttering. These were hung at 6 and 8-foot heights on the perimeter of cattle pens in the service alleys. The 0.1 and 0.5% concentrations of TEPP in these partially filled troughs were lethal, but only a few birds used them. With these results and the probable hazard of this procedure, trials with treated water were discontinued. Similarly poor results were obtained when baits were placed in small cups on top of fence posts. Birds appeared frightened by the cups.

Dry and frozen areas of alleys and occupied cattle pens proved better sites, as birds spent much of their feeding time gleaning the manure and taking some of the spillage near bunks. When bait is scattered thinly, cattle have never been observed to take single particles. Successful starling control at cattle feedlots has been obtained in most tests by baiting these areas alone. Baiting the perimeter of pens at poultry farms has been equally successful. A flock of 1,800 starlings at a turkey farm in Washington County, Utah, was reduced by baiting the perimeter of the farm with 20 pounds of treated pellets (Royall, DeCino, and Besser, 1967).

In the laboratory, most starlings exposed to feed containing 1 part treated pellets and 2,000 parts cattle ration picked out a lethal bait in 1 to 3 days, showing that placing bait in cattle rations may be a simpler and more effective means of controlling starlings at feedlots when a starling toxicant is found that is not harmful to cattle.

Preroosting Areas

Although baiting feedlots is successful, a number of them must be baited to reduce a winter roost population contributing birds to dozens of feedlots. Observations of starlings gathering in preroosting areas have indicated that the birds usually feed there before they settle in the roost. During the last 3 years our baiting efforts have been largely restricted to these areas. The first year a feedlot and a pasture were baited, and the starling population was reduced about 80%. The last 2 years only fields and pastures used as preroosting areas were baited, and about 50% control was obtained. During these 3 years the starling population wintering near Denver has decreased more than 90%.

Baiting a feedlot used by preroosting birds required no change in techniques other than scattering bait in early afternoon rather than at dawn, but baiting of pastures and fields required additional precautions. In the following paragraphs the two tests and the procedures employed in baiting these sites are discussed.

A roost of 45,000 starlings, using pastures and fields for preroosting areas, was located near Denver in mid-December 1965. Using TEPP-treated poultry pellets, we determined that these birds would take bait prior to roosting. In mid-January, baiting with DRC-1339 was conducted to reduce the population. Five 25' x 25' exclosures (to exclude ducks, livestock, etc.) of 4-foot-high snow fence similar to those used by Alcorn (1964) were erected under trees near feeding and watering areas used by the birds. Bait used in these exclosures consisted of 20 parts untreated poultry pellets, 4 parts untreated cracked corn, and 1 part 1% DRC-1339-treated poultry pellets. The cracked corn enticed red-winged blackbirds to the exclosures and they, in turn, decoyed starlings to the bait. Ten pounds of untreated pellets were also scattered on the ground inside each exclosure and replenished as needed. The treated bait was placed in 12 troughs in each exclosure, which facilitated covering the bait during snow. Following storms, we cleared and rebaited the area within the exclosures.

From dilution rate (1:24) and bait consumption, we sought to calculate the kill. Starlings consumed 146 pounds of bait in 15 days. If only one lethal pellet had been taken by each starling, then an estimated 29,000 starlings would have been killed. However, a roost search on January 27 indicated that no more than 10,000 starlings had been killed. Following this, only treated pellets were scattered on the ground in the exclosures and untreated cracked corn placed in troughs. A substantial kill resulted in the next 5 days, but few starlings were killed thereafter, indicating the prebaited starlings had been removed. The final search of the roost showed that a total of about 18,000 had been killed. Numbers of birds seen at the roost indicated a higher kill of about 25,000 as an estimated 20,500 starlings were still using the roost after baiting studies ended. This trial showed that starlings can be baited in pastures and fields used for preroosting during mid and late winter. Presumably, if baiting had started earlier, better control would have resulted.

In November-December 1966, exclosures were not used, and baited areas used by preroosting starlings were enlarged. The primary areas baited were a railroad roadbed and an alfalfa field. These were baited with 1% DRC-1339-treated poultry pellets diluted with 200 parts untreated pellets. (This dilution rate was chosen because cage tests showed that mallards (Anas platyrhynchos) fed for 2 weeks at a 1:100 dilution suffered some mortality, but those fed at 1:150 did not.)

During these 2 months, 4,600 pounds of bait (23 pounds of treated pellets) were exposed. From collections of dead birds on transects established in the roost, 12,000 starlings were calculated to have been killed. Migration was taking place and the actual number of birds that used the roost during this period was unknown, but the population peaked in December at an estimated 40,000 starlings. This roost was abandoned early in January 1967. Had it not dispersed, we feel that a more substantial reduction would have resulted.

Baiting preroosting areas appears to be an effective and economical means of reducing wintering starling populations. Feedlots used by preroosting birds are the most successful sites. Preroosting areas containing trees and open water throughout the winter are also excellent, particularly for baiting within exclosures.

OTHER METHODS

The fact that this paper has dealt only with chemicals is not meant to imply that these are the only effective methods of controlling starling damage. Scaring devices, such as shell crackers, and carbide and acetylene gas exploders, have often proved valuable, especially in small feedlots or those with sporadic problems.

SUMMARY

More than 500 chemicals have been screened for toxic and stupefacient activity on starlings at the Denver Wildlife Research Center the last 7 years, and four have proved effective enough to warrant field testing. TEPP is too toxic to mammals, and presumably humans, for widespread use in controlling starlings at feedlots but has utility in learning bait and site preferences. DRC-632, although somewhat less hazardous to mammals, possesses a high secondary hazard to hawks. When bait acceptance is good, DRC-1339 has proven very

effective for controlling starlings; when it is poor, DRC-1327 is more useful.

Acceptance of different food items varies with location. Poultry pellets are selective and advantageous for baiting starlings in many states. Raisins in California, potatoes in Idaho, and rolled barley in Utah have been used successfully to reduce starling numbers at feedlots. Grain baits are usually hazardous if beneficial birds are present.

The use of undiluted bait is unwise unless it is exposed in elevated containers that reduce the hazard to nontarget species. Diluting treated bait with 10 parts untreated is more economical and reduces the hazard of exposing excessive toxic materials. It appears that treated bait should be diluted with 200 parts untreated when baiting areas that may be visited by ducks, pheasants, or other beneficial nontarget species. The use of exclosures made of snow fence in such areas makes it possible to use less dilute bait.

Best acceptance has been obtained at both feedlots and preroosting areas by broadcasting baits thinly in the birds' natural feeding sites. Starlings feeding in preroosting areas often accept bait readily, making such sites excellent places to control a large population troubling many feedlot owners.

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