Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

79 Elm Street • Hartford, CT 06106-5127 www.ct.gov/deep Affirmative Action/Equal Opportunity Employer

BIRD
INFORMATION FOR APPLICANTS FOR COMMERCIAL SUPERVISORY PESTICIDE APPLICATOR CERTIFICATION

There are two classes of commercial certification - Supervisory and Operational.

A supervisory certificate is required for commercial applicators who are responsible for deciding whether or not pesticides are to be employed, how they are to be mixed, where they are to be employed, what pesticides are to be used, the dosage and timing involved in the pesticide use and the methods of application and precautions to be taken in the use of such pesticides. The supervisory certificate allows the licensee to purchase restricted-use pesticides from a registered dealer.

An operational certificate is required for commercial applicators who actively use pesticides in other than a supervisory capacity. This certification allows the holder to use pesticides only under the direction of a certified supervisor. The operational certificate does not allow the holder to purchase restricted pesticides or to go into business for himself.

Separate examinations may be taken in the following categories:

1. Agricultural Pest Control
2. Forest Pest Control
3. Custom Ground Pest Control
   a. Ornamental & Turf
   b. Golf Course Superintendent
   c. Interior Plantscape
   d. Arborist
4. Seed Treatment
5. Aquatic Pest Control
6. Right of Way
7. Industrial, Institutional and Structural Pest Control
   a. General Pest Control
   b. Termite and W.D.O
   c. Fumigation
   d. Rodent Control
   e. Bird Control
   f. Mosquitoes and Biting Flies
   g. Wood Preservation
8. Public Health
9. Regulatory
10. Demonstration and Research

(Over)

REV 11/27/13

In addition to question in the particular category, on the particular specialty, each of the examinations listed contains a number of questions on basic pesticide safety and handling. Study material for these questions can be found in the "Pesticide Applicator Training Manual". The Manual may be obtained from Agricultural Publications, Box U-35, University of Connecticut, Storrs, CT 06268.

Arborist examinations are administered by the Pesticide Management Program, Department of Energy and Environmental Protection. The Practical and Oral parts of the examination are given at the Connecticut Agricultural Experiment Station.

All other examinations are given by the Pesticide Management Program, Department of Energy and Environmental Protection, 79 Elm Street, Fourth Floor, Hartford, CT 06106. Telephone 860-424-3369. All examinations are given by appointment only. **You will need a photo ID to enter the building.**

Each examination requires a fee of $200.00. Following a failing examination grade, an applicant must wait a minimum of 30 days before re-examination. A re-examination appointment requires another $200.00 fee. If more than one test is taken at one time, there is no addition fee

Persons passing any written examination will then have to pass an oral examination before they can receive a license. Applicants who fail their first oral examination will be given a second opportunity to pass. Applicants who fail the second oral examination will be required to retake and pass the written examination before another oral examination is scheduled.

Checks or money orders should be made payable to: "Connecticut Department of Energy and Environmental Protection"(DEEP). **Do not** send cash in the mail.

Look for more pesticide information on the DEP Website:
www.ct.gov/deep/pesticides

Reference Material for
Bird Control Examination

1. **"Pesticide Applicator Training Manual"** - Core Manual
   Available from: University of Connecticut
   Agricultural Publications
   Box U-35, Storrs, CT 06268
   Tel: (860) 486-3336

2. **"Scientific Guide to Pest Control Operations"** - Sixth Edition
   Available from: Continuing Education Business Office
   Stewart Center, Room 110
   Purdue University
   West Lafayette, IN 47907

3. "**Pesticide Applicator Training Manual - Industrial, Institutional, Structural and Health"**
   Subcategory –Structural and Rodent (7a)
   Available from: New York State Pesticide Training Manuals/Cornell University
   Pesticide Manuals
   95 Brown Road, RM 223
   Ithaca, NY 14850
   Phone: 607/225-7282 FAX: 607/225-7311
   website: http://pmep.cce.cornell.edu/CERTIFICATION/MANUAL-PRICES.HTML

4. **"Handbook of Pest Control"** by Arnold Mallis

5. **"Common Sense Pest Control (Least Toxic Solutions for Your Home, Garden, Pets and Community)"** by William and Helga Olkowski and Sheila Daar. The Taunton Press, 1991.
(This book is currently available at Barnes and Noble bookstores or can be ordered for you by other bookstores. Your local library may have a copy.)

6. **'Pertinent Pesticide Statutes and Regulations for Certified Commercial Applicators'.**
   Available from: Department of Environmental Protection
   Pesticide Management Division
   79 Elm Street
   Hartford, CT 06106

INFORMATION FOR APPLICANTS FOR BIRD CONTROL LICENSE

An applicant for a bird control license is expected to possess a working knowledge of the operations performed by a commercial pest control operator and the reasons for performing them. Outlined below are areas in which an applicant should be proficient.

DIAGNOSIS

Diagnosis is of primary importance and an applicant should:

(a) Be able to identify all common nuisance birds found in the region.

(b) Know the biology and habits of the species listed.

(c) Recognize evidence of infestation, such as damage, tracks, droppings.

(d) Be aware of conditions such as availability of food.

(e) Recognize harborages that favor infestations.

TREATMENT

Having determined the needs of a given situation, the applicant should be able to prescribe and apply the proper treatment. This requires knowledge of:

(a) Whether or not pesticides are to be applied.

(b) IPM practices.

(c) The pesticides used, their properties, such as effectiveness against certain pests and their toxicity to man and other warm blooded animals. These should include, but not limited to:

(d) The dosages and timing involved.

(e) How the pesticides are to be mixed.

(f) Methods of application and the various types.

(g) The proper storage and transportation.

(h) State and Federal pesticide laws and regulations.

(i) State nuisance wildlife regulations.

(j) Health concerns associated with birds.

MANAGEMENT OF DOMESTIC BIRD POPULATIONS

Adapted from "Pesticide Training Manual on Bird Control" from Maryland Department of Agriculture.

There are three bird species, all imported, that cause problems in urban areas. These are feral pigeons, house (English) sparrows, and European starling.

PIGEONS

The form, coloration, and habits of pigeons suggest that originally these birds came from the blue rock, or common pigeon, of Europe, Asia and Africa. Grains are one of the sources of food for urban pigeons. The abundance of shelter in most cities assures them ample places to roost and breed. Pigeons give pleasure to some persons, but excessive concentrations of birds are a nuisance and can be a health hazard.

Openings in lofts and towers, behind signs and under viaducts and eaves can be screened with rust-proof wire of 3/4 inch mesh which will also keep out sparrows and starlings. Roosting or nesting on ledges can be discouraged by wire or plastic netting or by wood or metal sheathing installed at a sharp angle. Products such as sticky repellents, wires, or electrical devices can also be used, but applications are usually expensive and not always effective. Most sticky substances discourage roosting. These materials are spread in ribbons along ledges and copings and must be reapplied occasionally to remain effective. Some of these sticky materials may discolor the structure and may require sandblasting for removal. Somewhat more permanent products are those which have metal wires in the form of a bristling fence; they prevent roosting. Buildings can also be fitted with electrical wires which, like electrical fences for livestock, give intermittent shocks when birds contact the wires. Measures to eliminate roosting sites may seem costly, but the long term effectiveness justifies the expense.

Populations of pigeons can be reduced by destroying their nests and eggs at two week intervals during the spring and summer months. Use a hook fastened to the end of a long pole to tear down nests. Noise-making devices have little permanent effect on roosting pigeons that are accustomed to city noises. High-frequency sound vibrations, inaudible to humans, or tape-recorded noises are not usually effective in scaring pigeons. Lights are also of little value. Shooting Roman candles or firecrackers into roosts is temporarily effective in moving birds, but restrictive legislation against fireworks, and the fire hazard involved, makes this method impractical in many areas. Hosing pigeons with water will move them from roosts. If streams or water or similar controls are to be effective, they must be used persistently until the birds have established themselves elsewhere. Trapping can be an effective method of reducing pigeon populations.

A colony of pigeons will usually remain in one general area, which tends to simplify their removal. Set a trap in an inconspicuous spot, where it is not likely to be disturbed, near the place where pigeons feed or roost. Leave a few birds in the trap as decoys, preferably the same individuals, so that they will become fairly tame and thus lure others. Birds with distinctive colors can be easily identified and seem to be better lures.

It is important to bait the trap with the kind of food the birds are eating. Generally, whole corn is excellent. Where they are accustomed to miscellaneous feed, a mixture of one part wheat to five parts of cracked corn makes a good bait. Scatter a small amount outside the trap door to attract the birds. Keep a generous quantity of the bait on the floor inside and near the trap door at all times. Water should be provided except during periods when snow will furnish the necessary moisture. Visit the trap every day or two to remove the pigeons and to add bait as necessary.

There are two pesticides registered for pigeon control. These are Ornitrol and Avitrol.

One of the newer pigeon control chemicals is Ornitrol. Ornitrol is chemosterilant (sex sterilant). When applied at the right time, it inhibits egg laying and those few eggs that are laid are usually infertile. Ornitrol will not kill pigeons when applied according to label directions. Pigeon populations will remain static until death from other causes occurs. Application of Ornitrol should be made in early spring and early fall before mating begins. For each 100 pigeons, scatter 7.5 lbs. of treated bait daily for 10 days. Ornitrol use is an excellent approach to management of pigeon populations where public objection to other toxicants is expected.

Avitrol is registered for pigeon control. Many bird species which consume Avitrol become distressed and utter distress and alarm calls which scare off other members of the flock. Affected pigeons do not appear to alarm other pigeons. Only the pigeons that consume Avitrol are controlled. If Avitrol is to be used, prebait with untreated whole corn for 7 days, then expose the Avitrol treated bait. The bait should be mixed one part treated to 10 - 29 parts untreated. The lower application rate should be used only when other pigeon food is readily available. Be sure to check label directions. As Avitrol will kill pigeons, arrangements must be made to recover and dispose of dead birds.

HOUSE SPARROWS

The house sparrow, also known as the English sparrow, has adapted itself to live throughout the United States and most of Canada. Although their activities are mainly beneficial, they have some habits that are objectionable and may present health hazards to humans. To selectively control house sparrows, it is necessary to understand their behavior and to distinguish them from native sparrows, which are protected.

The male house sparrow has a prominent black throat, white cheeks, dark gray crown, and a chestnut-colored nape. The female and young are dull gray above, light below and generally lack distinctive markings.

House sparrows prefer cavities for nesting. However, they will nest in vines and on buildings where the site is protected. Normally, nest building and egg laying begins in early spring. A clutch consists of four to eight evenly speckled eggs that hatch in 13 to 14 days. House sparrows produce several broods each season and use the same nesting hole for all broods. Generally, the birds are gregarious; they nest, roost and feed together in large flocks.

The house sparrow, like our native sparrows and finches, is primarily a seed eater and supplements his diet with insects. It is one of two birds that will eat the Japanese beetle. (The other is the starling). House sparrow populations can be greatly reduced by destroying nests and eggs at two-week intervals during the spring and summer. A long pole with a hook fastened to the end can be used to tear down nests under eaves, in rafters and in other exposed places.

The elimination of nesting sites may be the best permanent solution to the problem. To prevent recurring infestations, it may be necessary to remove all or part of the vines from certain buildings. Copings and ledges of some buildings may be blocked with wood or with sheet metal strips placed at an angle to eliminate the roosting space.

Steeples, towers, poultry houses, barn lofts, air conditioning units and similar places should be bird-proofed with 3/4 inch or smaller mesh wire (or plastic netting).

Local control of house sparrows can be accomplished by trapping. This presents no danger to protected species, but a permit may be required if non-target species are captured. To lure birds to a trap, use poultry scratch feed, fine cracked corn, grain sorghum, wheat, bread crumbs or combinations. Bait several locations even though only one trap is used. Because some untrapped birds associate unpleasantness with a particular location, move the trap to another baited area when results at the first diminish. The best trap sites are generally near low shrubs or hedges.

The trap should be covered with 3/4 inch mesh wire. Leave one or two birds in a trap as decoys; any more seem to frighten away other birds. Keep the trap compartment well supplied with food and water. Ready-made live traps are also available.

Wooden-base rat snap traps can be used inside buildings where only sparrows are apt to be present. Traps nailed to rafters and baited with pieces of bread will discourage inside roosting.

Certain situations may require the use of pesticides. Decisions as to need and the manner in which a toxicant is to be used should be made only by professionals. Otherwise, serious hazards to humans, pets and wildlife can occur. Toxic baits should be used in locations to which only sparrows or unprotected species have access. This is particularly important because the baits used are attractive to a wide range of bird species. The one toxicant registered for the control of house sparrows is Avitrol.

The procedure for using Avitrol for the control of house sparrows is quite similar to that described for controlling pigeons. The area to be treated should be prebaited, but instead of applying whole kernel corn, corn chops, sorghum, wheat or other mixed grains should be used. When the house sparrows are accustomed to the bait and feeding site, the untreated bait should be removed and Avitrol treated bait substituted. The process should be repeated until the desired population level is obtained. As with pigeons, house sparrows do not become alarmed by the distress caused in affected birds. The sparrows must consume the Avitrol to be controlled. Be sure to check the label directions and be sure to recover and dispose of all dead birds.

STARLINGS

The European starling is a stocky, short-tailed, black bird slightly smaller than a robin. In summer, the adult starling has iridescent black plumage, a long, sharp, yellow bill and dark eyes. As winter approaches, small, buff-colored spots appear in the feathers, and the bill darkens. This coloration is maintained through mid-winter and the spots gradually fade away. The young starlings are plain brownish-gray with a dark bill, but assume the typical adult winter plumage by fall. In flight, the greatly tapered, pointed wings and short tail give the bird a triangular appearance. The flight is swift and straight--not undulating like that of native blackbirds.

Mated pairs of adult starlings begin nesting in cavities such as tree hollows, woodpecker holes, bird houses, or building crevices by mid-April. In cities, several pairs may nest as a small colony in eaves, roofs and other structures. In general, starlings nest earlier than most native birds.

The nest is constructed of stiff, fibrous material lined with fine grass and soft material. The female lays three to eight pale greenish-blue eggs. The eggs hatch in about 12 days and the young remain in the nest for two to three weeks. Once the young can leave the nest, they join together in flocks of gradually increasing size. The adults, however, usually re-nest and produce another brood in late July or August. A third brood may be produced in early November.

With the approach of winter, adults and young gather in large flocks that forage widely and often associate with other blackbirds, especially in the large night roosts. These roosts generally are maintained throughout the winter but gegin to break up with the spring mating season. The late-hatched young remain in flocks longest.

Starlings eat almost anything and are highly adaptive in their food selection. These birds devour large amounts of insects, especially grubs, caterpillars and grasshoppers. (They are especially efficient in probing soil for grubs). The nestlings are fed almost exclusively on insects. Starlings are also found of fruit, especially grapes and cherries, and will eat weed seeds and grain in season. In the winter when the ground is frozen or covered with snow, starlings will eat livestock feeds.

During the nesting season, the starling is an aggressive bird. They will often take over a nesting cavity already occupied, evict the occupants and build their own nest. The population decline of the Eastern bluebird is believed to be due partially to this nesting competition. After nesting, much of this individual agressiveness abates with formation of large flocks. Starling flocks are highly cohesive. Apparently each bird yields part of his individual identity to the large flock identity, thus allowing the flock to bank, turn, and twist without apparent leadership or signal. This same cohesiveness gives the flock the combined experience of its members.

The starling is a constant companion of man because man inadvertently provides most of its requirements. In cities, man's fertilized lawns and parks provide excellent winter roosting places; and in the country, man's mono-cropping provides abundant food in the crops themselves or in the insects they harbor.

The starling has a variety of whistles and rasping, squeaking calls, some of which are quite harsh. It is a clever mimic, however, and can imitate the robin, killdeer, bobwhite, cardinal and other birds.

The starling has a bad reputation. City dwellers generally dislike the bird because of its noisy, messy, winter roosts on city buildings. Not only is the roost obnoxious to ear, eyes and nose, but the birds are known to carry contagious diseases, such as encephalitis, ornithosis and histoplasmosis. Rural residents dislike the birds because they damage fruit and vegetable crops. (In vegetable crops, however, the starling is often only a secondary invader, continuing the damage started by grackles). Feedlots attract starling flocks, too. Starlings not only contaminate and consume large amounts of poultry, hog and cattle feed, but also spread and carry diseases of livestock. Starlings are known to be involved in transmission of hog chlorea and other diseases of swine.

It is important to remember at all times that starlings are highly mobile, very cautious and are capable of learned response. Thus control procedures must be applied at a time when the birds are vulnerable, at a place at which they frequently congregate and by a method they cannot easily recognize. Making building modifications to prevent entrance and roosting of starlings is a long-term solution to the problem. This approach is usually the most satisfactory, even though initially expensive. Hardware cloth or netting as described for English sparrow control can be used to exclude starlings. In specialized roosting situations the use of sticky repellents may be considered, but sandblasting may be required to remove the residue after control has been obtained. Starlings will use two types of roosts during

the year. The first type is the summer roost, which the birds use during July, August and September. (Winter roosts will be discussed under rurual blackbird control). Scare devices are usually very successful in moving birds from summer roosts. The key to success in moving summer starling roosts is to start early in the summer before the roost has become firmly established. Starlings have usually finished the first nesting and have begun to establish roosts by July.

Traps, such as those described for house sparrow control are occasionally successful in controlling small urban starling populations. There are currently no Environmental Protection Agency registered avicides for use on starlings in urban locations.

GULLS

There are four species of gulls. These are the herring gull, the ring-billed gull, the laughing gull and the great black-backed gull. The herring gull is most common and is present year-round. The adult has a pearly gray back and upper wings, white headand belly and black wing tips. The bill is yellow. The ring-billed gull is also common during the winter months. It is similar in appearance to the herring gull but the outer half of the bill has a black ring. The laughing gull is present during the summer. This species nest within the State. These gulls are white beneath, but have a black head. The fourth species, the great black-backed gull is the largest of the gull species. It is present during the summer and winter months. The head, belly and tail are white. The upper wing and back surfaces are black. Wing tips are white. In flight, this gull resembles the bald eagle. The above descriptions are for adult birds. The plumage of immature birds varies considerably.

The principal problems posed by gulls aretheir threat to aircraft. Gulls are general feeders and are attracted to garbage dumps. All too frequently such dumps are located close to airfields. In addition to feeding at the dumps, the gulls will loaf along runways of airfields. The large numbers of gulls that may be found in such locations pose a continuous threat of colliding with aircraft.

All gull species are protected by both State and Federal law. If control by trapping, shooting or toxicants becomes necessary, State and Federal permits must first be obtained. The best control is to get the open garbage dumps converted to sanitary landfills and moved as far as possible from airfields. Gulls can be chased from airfields and dumps through the use of carbide or propane exploders. If exploders are used, it will be necessary to shoot an occasional gull so that the birds will not learn how harmless the exploders are. Distress calls are also effective when used with shellcrackers and live ammunition. Avitrol is an EPA registered avicide. Gulls feeding on bread treated with Avitrol emit distress calls which alarm the rest of the flock. The flock will then depart. If treated bread is distributed each time a flock of gulls lands, the flocks will learn to avoid the area. Gulls do learn to be wary of the vehicle used to distribute the treated bread. It may be necessary to switch vehicle types during the gull moving program. Gulls may also cause an occasional problem on docks and marinas. At such

locations, the use of chemical toxicants or repellents would not be advisable. Under such circumstances, distress calls, exploders, and bird bomb pistols can be used. As previously stated, gulls are protected birds and Federal and State permits are required.

MONK PARAKEET

The monk parakeet is a medium-sized parakeet, about the size of a bluejay. Its color is greenish gray above with a lemon-yellow belly. The forecrown, cheeks, forethroat and breast are bluish gray with darker feather edges. The flight feathers are blue-gray. The long pointed tail is bluish-green. The beak is rosey-flesh colored. These parakeets build large communal nests of sticks that are added to year by year. Each pair of parakeets has its own private compartment within the communal nest. This bird species is native of South America and has been accidentally released in several parts of the United States. It has been able to survive winters as far north as Long Island, NY. The monk parakeet is one of the worst pests of agriculture in Argentia. It destroys corn, sorghum, millet, sunflower, fruit, and a variety of ornamental plants. If populations of this bird species increase, they can become damaging to agriculture. Suggested control measures include shooting and netting. There is currently no Environmental Protection Agency registered avicide for control of the monk parakeet. Information on the location of any of these birds should be given to the Wildlife Administration.

STARLINGS

Ron J. Johnson
Extension Wildlife Specialist
Department of Forestry, Fisheries and Wildlife
University of Nebraska
Lincoln, Nebraska 68583-0819

and

James F. Glahn
Research Biologist
U.S. Fish and Wildlife Service
Kentucky Research Station
Bowling Green, Kentucky 42101

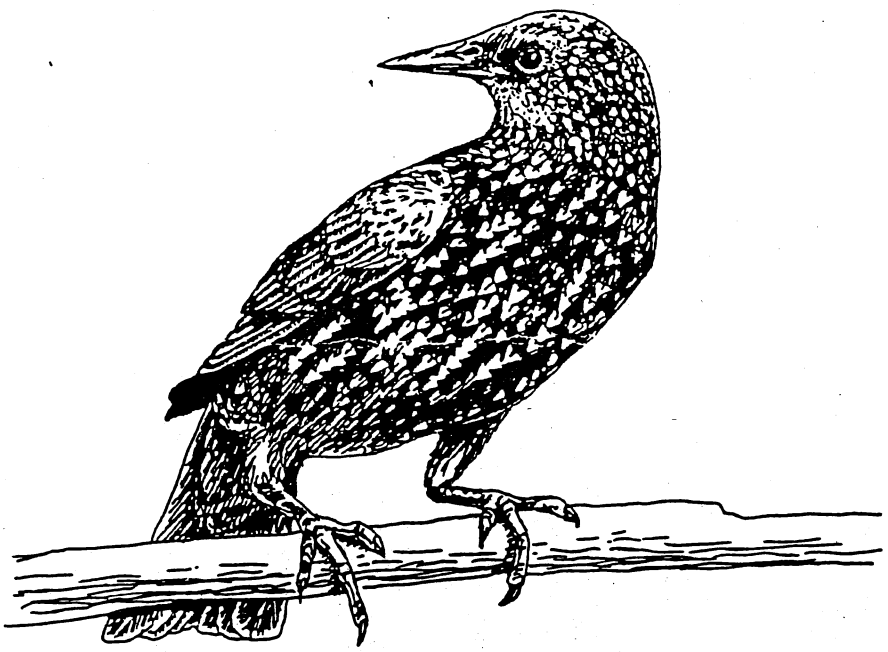


Figure 1. Adult European starling, *Sturnus vulgaris*

Damage Prevention and Control Methods

Exclusion

Close all openings larger than one inch (2.54 cm)
Boards or metal covering at 45° angle on ledges
Metal prongs or sticky repellents on ledges or rafters
Netting to prevent roosting on building rafters or to protect fruit crops
PVC strips to cover door openings

Cultural Methods and Habitat Modification

Reduce availability of food and water at livestock facilities: Remove spilled grain and standing water; use bird-proof feeders and storage facilities; feed livestock in open sheds; where appropriate, feed in late afternoon; lower water level in waterers.
Modify roost sites by closing building roosts or frightening.

Frightening

Use with fruit crops and starling roosts. Also useful at livestock facilities in warm weather and at facilities located near a major roost.
Frightening devices include recorded distress or alarm calls, various sound producing devices, chemical frightening agents (Avitrol®), lights, and bright objects.

Repellents

To protect ripening cherries or blueberries (Mesurol® 75% Wettable Powder)
To discourage roosting on ledges (soft sticky materials)

Toxicants

Starlicide® — poison bait for use around livestock facilities

Toxic Perches

Generally not recommended for starling control

Wetting (Detergent) Agents

Generally not recommended for starling control but may be useful for roost control in some situations; for use only by or under supervision of government agencies trained in bird control.

Fumigants

None registered. Engine exhaust (containing carbon monoxide) may be useful in some farm buildings, but is not registered

Trapping

Nest-box traps, for use during nesting season

Decoy traps may be useful around orchards or livestock facilities. Proper care for trap and decoy birds is necessary.

Shooting

Helpful as a dispersal or frightening technique. Not effective in reducing starling numbers.

Other Methods

The use of starlings as a protein source for livestock or pet food may warrant investigation.

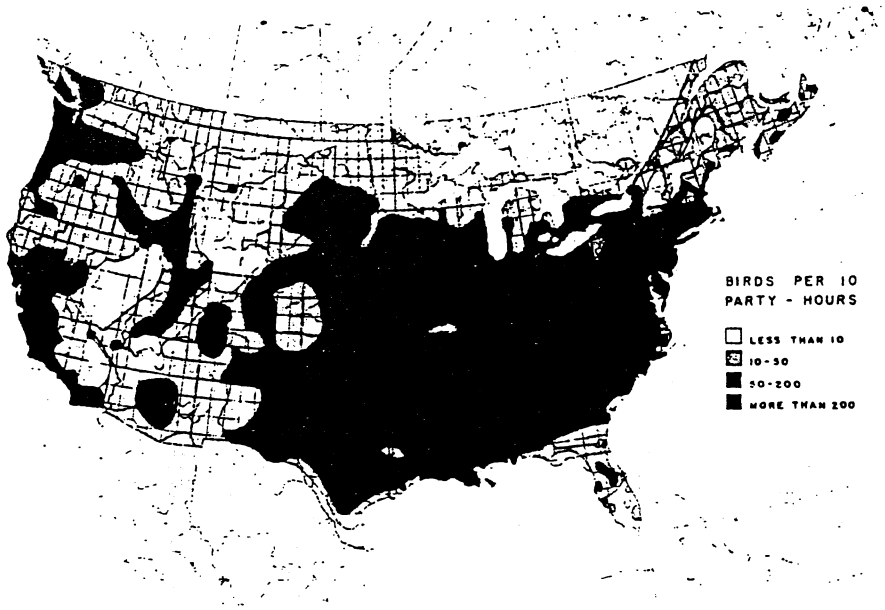


Figure 2. Starling wintering areas, 1972. Map by J.W. Rosahn, based on the National Audubon Society's annual Christmas Bird Count. Map reprinted by permission from "Wintering Areas of Bird Species Potentially Hazardous to Aircraft." D. Bystrak *et al.* 1974. National Audubon Society, Inc.

Identification

Starlings are robin-size birds weighing about 3.2 ounces (90 g). Adults are dark with light speckles on the feathers. The speckles may not show at a distance *(Figure 1)*. The bill of both sexes is yellow during the reproductive cycle (January to June) and dark at other times. Juveniles are greyish.

Starlings generally are chunky and hump-backed in appearance, with a shape similar to that of a meadowlark. The tail is short, and the wings have a triangular shape when outstretched in flight. Starling flight is direct and swift, not rising and falling like many blackbirds.

Range

Since their introduction into New York in the 1890's, starlings have spread across the continental United States, northward to Alaska and the southern half of Canada, and southward into northern Mexico. They are native to Eurasia, but have also been introduced in South Africa, Australia, New Zealand, and elsewhere. *Figure 2* shows starling wintering areas in the United States.

Habitat

Starlings are found in a wide variety of habitats, including cities, towns, farms, ranches, open woodlands, fields, and lawns.

Food Habits

Starlings consume a variety of foods, including fruits and seeds of both wild and cultivated varieties. Insects and other invertebrates total about half the diet overall, and are especially important during the spring breeding season. Other diet items include livestock rations and food in garbage.

General Biology

European starlings were brought into the United States from Europe. They were released in New York City in 1890 and 1891 by an individual who wanted to introduce to the United States all of the birds mentioned in Shakespeare's works. Since that time, they have increased in numbers and spread across the country. They were first observed in Nebraska in 1930 and in Colorado in 1939. The starling population in the United States is estimated at approximately 140 million birds.

Reproduction. Starlings nest in holes or cavities almost anywhere, including tree cavities, birdhouses, and holes in buildings or among rocks. Females lay 4 to 7 eggs which hatch after 11 to 13 days of incubation. Young leave the nest when they are about 21 days old. Both parents help build the nest, incubate the eggs, and feed the young. Usually two clutches of eggs are laid per season, but most of the production is from the first brood fledged.

Movements. Although not always migratory, some starlings will migrate up to several hundred miles, while others may remain in the same general area throughout the year. Hatching-year starlings are more likely than adults to migrate, and they tend to migrate farther.

When not nesting, starlings feed and roost together in flocks. During winter, they prefer to roost in dense vegetation such as coniferous trees, or in towns and other areas protected from wind and adverse weather. Each day they may fly 15 to 30 or more miles (24 to 48 km) from roosting to feeding sites.

Damage and Damage Identification

Starlings are frequently considered pests because of the damage problems they cause, especially to agriculture. At livestock facilities, they consume livestock feed and contaminate the feed and water with their droppings. Where high-protein supplements are added to feeds such as cattle rations, starlings may selectively eat the high-protein portion.

Starlings may also be responsible for transferring disease from one livestock facility to another. This is of particular concern to swine producers. Recent tests show that the TGE (transmissible gastroenteritis, or baby pig disease) virus can pass through the digestive tract of starlings and be infectious in the starling feces. However, researchers also found healthy swine in lots with infected starlings. This indicates that even infected starlings may not always transmit the disease, especially if starling interaction with pigs is minimized. Other ways that TGE may be transmitted include on boots or vehicles, by stray animals, or by infected swine added to the herd. Starlings have been implicated in the spread of other diseases; however, the role of starlings in these diseases is not yet clear and further research is needed.

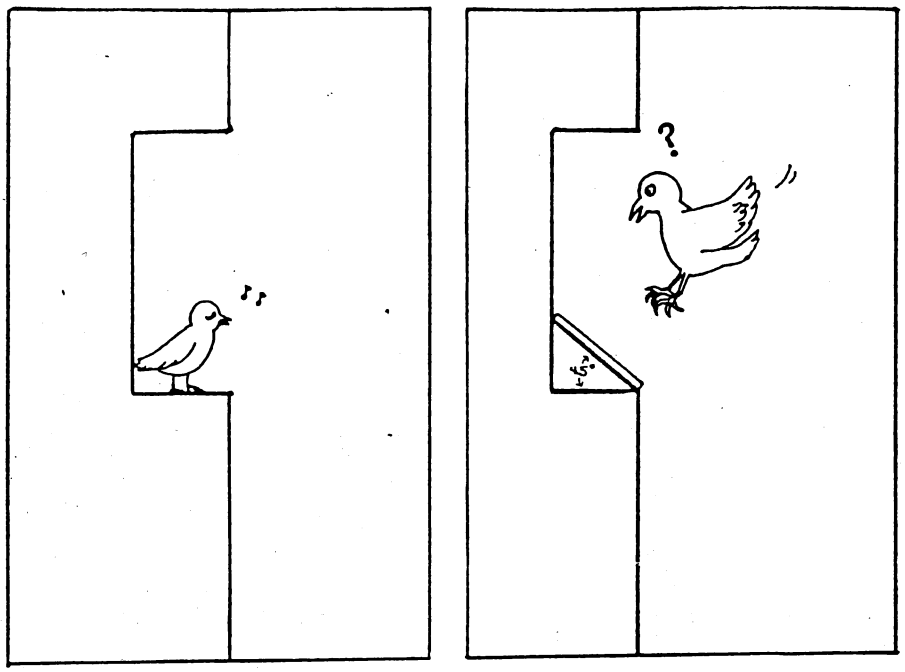


Figure 3. A board or metal covering over a ledge at a 45° angle prevents roosting on the ledge.

Starlings cause other agricultural damage by consuming cultivated fruits such as grapes, peaches, blueberries, strawberries, figs, apples and cherries. In some areas they pull sprouting grains, particularly winter wheat, and eat the planted seed. Starling roosts are also a frequent problem in rural and urban sites. In addition, starlings compete with native hole-nesting birds such as bluebirds, flickers, other woodpeckers, and purple martins for nest sites.

Legal Status

European starlings are not protected by federal law and in most cases not by state law. However, laws vary among states, so check with state wildlife officials before beginning a control program. In addition, state or local laws may regulate or prohibit certain control techniques such as shooting or the use of toxicants.

Damage Prevention and Control Methods

Exclusion

Where starlings are a problem inside buildings or other structures, close all openings larger than one inch (2.54 cm) so they cannot enter. This is a permanent solution to problems inside the structure.

Where starlings are roosting on the ledge of a building, place a board or metal covering over the ledge at a 45° angle to prevent roosting on the ledge *(Figure 3)*. Metal protectors or wire prongs (Nixalite® and Cat Claw®) and sticky repellents (see below) are also available for preventing roosting on ledges or rafters *(Figure 4)*.

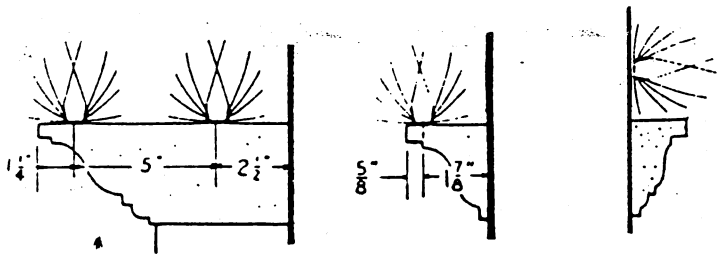


Figure 4. Metal protectors or wire prongs can be used to prevent roosting on ledges or rafters.

Nylon or plastic netting is another option for exclusion *(Figure 5)*. Starlings roosting inside open farm buildings can be excluded from the roost by covering the underside of the rafters with netting. The netting prevents the birds' access to rafters where they perch. Netting is also useful for covering fruit crops such as backyard cherry trees or high-value table grapes.

Heavy plastic (PVC, polyvinyl chloride) strips hung in open doorways of farm buildings have been successful in some areas in excluding birds, while allowing people, machinery, or livestock to enter *(Figure 6)*. These strips might also be useful for protecting feed bunkers. Netting over doorways may also exclude birds from buildings, but would be easily torn by machinery or livestock. While these techniques are promising, they need further testing in farm situations.

Cultural Methods and Habitat Modification

Starlings are attracted to livestock operations by the food or water that is available to them. Feedlots offer an especially attractive food source to starlings during winter when snow cover and frozen ground impede their normal feeding in open fields or other areas. The snow cover and frozen ground increase the likelihood of damage as well as the severity.

Recent research by the U.S. Fish and Wildlife Service shows that some livestock operations are more attractive to starlings than others. Operations that have large quantities of feed always available, especially when located near a starling roost, are the most likely to have damage problems. Results emphasize the importance of farm management practices in long-term starling control. These practices limit the availability of food and water to starlings, thus making the livestock environment less attractive to the birds. The following

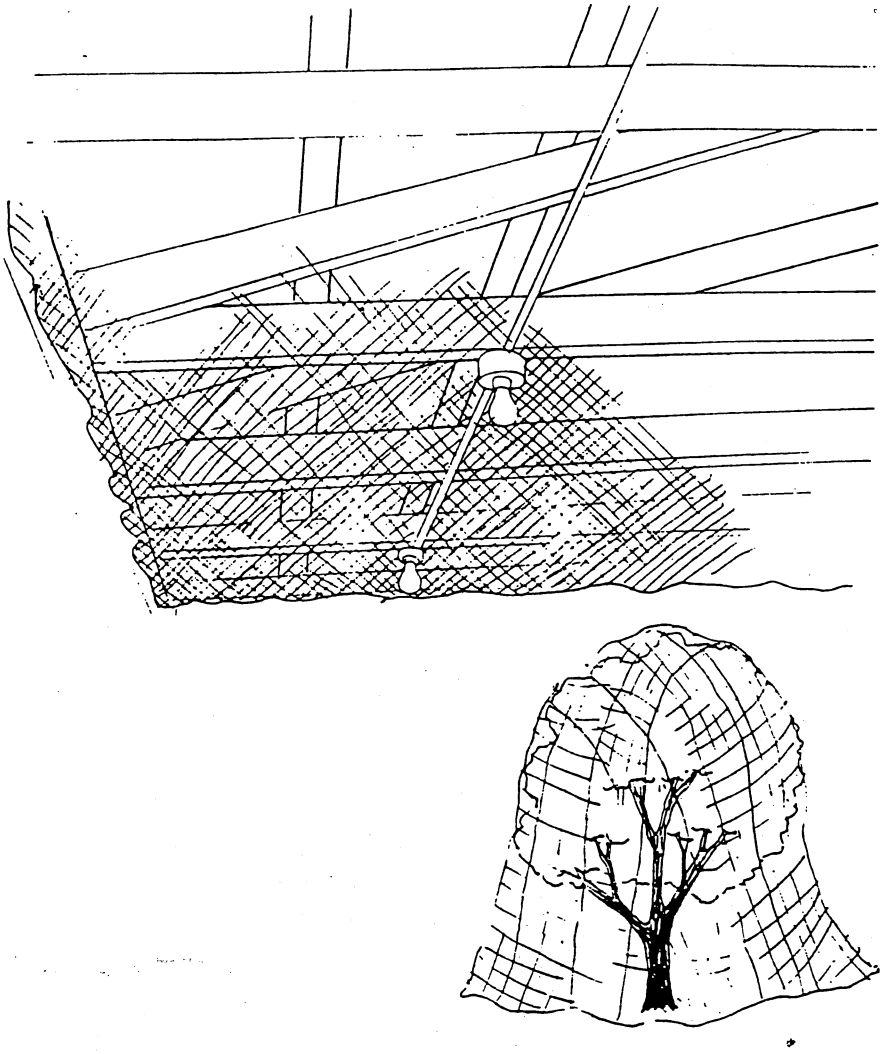


Figure 5. Netting can be useful for excluding birds from building rafters and from fruit trees.

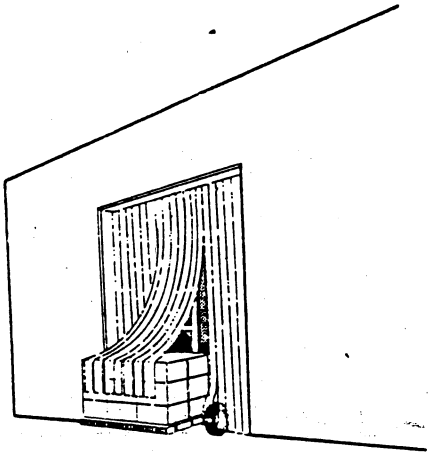
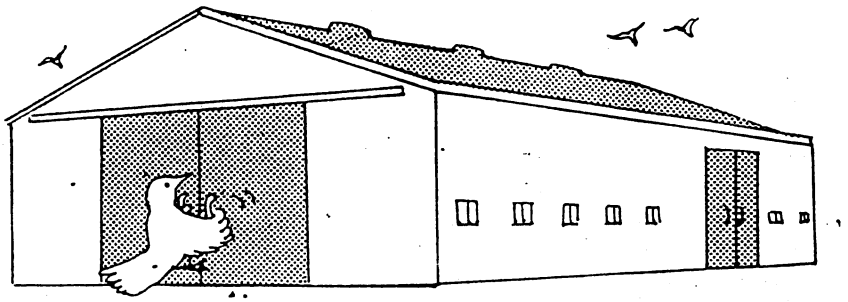


Figure 6. Heavy plastic (PVC) strips can be hung from doorways to exclude birds.



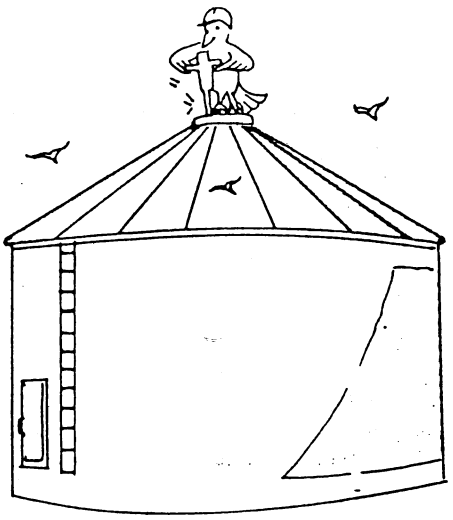


Figure 7. Bird-proof buildings and grain storage facilities permanently eliminate bird problems inside.

practices used singly, or preferably in combination, will reduce feed losses and the chances of disease transmission as well as the cost and labor of conventional control measures.

1. Clean up spilled grain.

2. Store grain in bird-proof facilities *(Figure 7)*.

3. Use bird-proof feeders. These include flip-top pig feeders, lick wheels for liquid cattle supplement, and automatic-release feeders (magnetic or electronic) for costly high-protein rations. Using covered feeders prevents starlings from contaminating the food source with their droppings and also limits their foraging to spillage. In addition, the banging of the lift-top lids as pigs use the feeders may frighten starlings and keep them uneasy. Avoid feeding on the ground, an open invitation to starlings.

4. Where possible, feed livestock in covered areas such as open sheds because these areas are less attractive to starlings.

5. Use feed forms that starlings cannot swallow such as cubes or blocks greater than 1/2 inch (1.3 cm) in diameter. Minimize use of 3/16 inch (0.48 cm) pellets; starlings consume these six times faster than granular meal.

6. Where possible, adjust feeding schedules so that feed exposure to birds is minimized. For example, when feeding once per day, such as in a limited energy feeding program for pigs, delay the feeding until late in the afternoon when foraging by starlings is decreased. Starlings prefer to feed early to mid day and in areas where feed is constantly available. Feeding schedules which take these factors into account minimize problems.

7. When feeding protein supplements with other rations, such as silage, mix them well to limit starling access to the supplements. Use non-protein nitrogen (NPN) sources for cattle to reduce the need for protein supplements.

8. Starlings are especially attracted to water. Drain or fill in unnecessary water pools around livestock operations. Where feasible, livestock waterers can be made unavailable or less attractive to starlings by controlling the water level *(Figure 8)*. Lower the water level so that starlings cannot reach it when perching on the edge of the waterer. At the same time, keep the water level deep enough so they cannot stand in it.

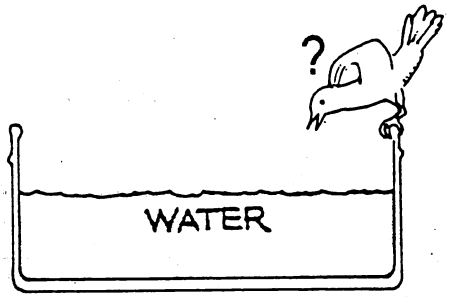


Figure 8. Lower the water level in waterers so starlings cannot reach it when perching on the edge. At the same time, keep the water level deep enough so they cannot stand in it.

Frightening

Frightening is effective in dispersing starlings from roosts, small-scale fruit crops, and some other troublesome situations. Frightening devices include recorded distress or alarm calls, gas-operated exploders, battery-operated alarms, exploding shotgun shells (shell-crackers), chemical frightening agents (see Avitrol®, below), lights, bright objects, and various other noisemakers. Beating on tin sheets or barrels with clubs also works well in scaring birds. A combination of several scare techniques used together works better than a single technique used alone. Varying the location, intensity, and types of scare devices improves their effectiveness. Ultrasonic (high frequency, above 20 kHz) sounds are not effective in frightening birds because birds, like humans, do not hear these sounds. For a more detailed discussion of frightening techniques, see the **Bird Dispersal Techniques** chapter.

In the mid to northern Great Plains states, starlings concentrate at livestock facilities primarily during the cold winter months when snow covers natural food sources. At this time, frightening devices and agents may be less effective because few alternative foods are available. However, frightening can be useful around livestock operations that have warm climates year-round, and where major concentrations of wintering starlings exist. Baiting programs with toxicants generally are less successful during warm weather because starlings have an adequate supply of alternative foods. Toxicants may provide only short-term control where large concentrations of starlings are wintering.

Avitrol®. Avitrol (active ingredient: 4-aminopyridine) is registered in several bait formulations as a chemical frightening agent. The current label indicates that use is restricted to government agencies, pest control operators, or persons under their supervision. It is not for sale to the public. This label is currently undergoing revision, and Avitrol is expected to be classified during 1983 as a Restricted Use Pesticide.

Avitrol baits contain a small number of treated grains or pellets mixed with many others that are untreated. Birds that eat the treated portion of the bait behave erratically and/or give warning cries that frighten other birds from the area. Generally, the small number of birds that eat the treated particles will die. Avitrol baits are available for starling-control use at feedlots and structures. A discussion of field-use of Avitrol for blackbird control is included in the **Blackbirds** chapter.

Around livestock operations, Avitrol could be useful in situations where the goal is to frighten or disperse the birds rather than to kill them. For example, frightening might be more effective than lethal control at a livestock facility located near a major starling roost. The behavior patterns of frightened starlings could help minimize reinfestation following control. However, frightening starlings may disperse them to other livestock facilities, a point that should be considered if disease transfer is a concern.

Four Avitrol formulations are federally registered for starling control at feedlots. The formulation most appropriate for a given situation may vary, particularly if large numbers of blackbirds are mixed with the starlings. However, the Pelletized Feed formulation is generally recommended for starling control because they usually prefer pellets over cracked corn (corn chops). In addition, one treated pellet contains an effective dose, a help in reducing the possibility of bait shyness. Because Avitrol is designed as a frightening agent, birds can develop bait shyness (bait rejection) fairly quickly. Prebaiting for several days with untreated pellets may be helpful for effective bait consumption and control. If the problem persists, changing bait locations and additional prebaiting may be needed. If any Avitrol baits are to be used, we recommend you contact a qualified person trained in bird control work (e.g. from the Cooperative Extension Service; U.S. Fish and Wildlife Service, Division of Animal Damage Control) for technical assistance.

Repellents

Two types of repellents are helpful in controlling starling problems. One type (Mesurol® 75% wettable powder) can be used to protect ripening cherries or blueberries from bird depredation, and the other type (soft, sticky materials) can be used to discourage birds from roosting on ledges, rafters, or other perches.

Mesurol 75% wettable powder (active ingredient methiocarb: 3,5 dimethyl-4-(methylthio)phenol methylcarbamate) is federally registered as a bird repellent for use on cherries and, except for California and Massachusetts, on blueberries. Use on other fruit crops such as grapes is being researched. For one or two backyard cherry trees, we recommend covering them with nylon or plastic netting, or else using frightening devices such as several aluminum pie pans, aluminum strips, and hawk, snake, or human effigies. These frightening devices should be moved occasionally so the birds do not become used to them.

Soft, sticky repellents such as Roost-No-More®, Bird Tanglefoot®, and others, are non-toxic materials that can be useful in discouraging starlings from roosting on sites such as ledges, rafters, or shopping-center signs. It is often helpful to put masking tape on the surface needing protection first, then apply the repellent onto the tape; this makes removal, if desired, easier. Netting and metal protectors or wire prongs, as described above under "Exclusion", are possible alternatives to consider.

Toxicants

When using toxicants or other pesticides, always refer to the current pesticide label and follow its instructions as the final authority on pesticide use.

Starlicide. A chemical compound developed for starling control during the 1960's by the U.S. Fish and Wildlife Service is now commercially available as a pelletized bait. It is sold under the trade name Starlicide Complete® (0.1% 3-chloro p-toluidine hydrochloride) and in some other formulations.

Starlicide is a slow-acting poison for controlling starlings and blackbirds around livestock and poultry operations. It is toxic to other types of birds in differing amounts, but will not kill house (English) sparrows. Mammals are generally resistant to its toxic effects.

Poisoned birds experience a slow, non-violent death. They usually die from one to three days after feeding, often at their roost. Generally, few dead starlings will be found at the baiting site.

Poisoned starlings are not dangerous to scavengers or predators. However, to provide good sanitation and to prevent the spread of diseases which the birds may carry, pick up and bury or incinerate any dead starlings found.

How to Use. Field tests in Nebraska, Kansas and other states have established guidelines for using Starlicide. For the best success in a control program, we recommend the following steps:

1. ***Observe*** birds feeding in and around the livestock operation. Note the number of starlings and when and where they prefer to feed. The best time for observing is usually during the first few hours following sunrise when birds will be seeking their morning meal.

2. ***Determine*** what kinds of birds are feeding. If any protected birds such as doves, quail, pheasants, or songbirds are present, contact your county Extension office or the state wildlife agency. ***Do not apply toxic bait if protected bird species are present.***

3. ***Time of Application*** — Use of bait is more effective on very cold days when snow covers the ground. At this time, starlings become stressed for food and concentrate in livestock feeding areas. In the mid to northern Great Plains states, these conditions usually occur in late December or January.

In warm-weather climates, such as the southernmost Great Plains states, good bait acceptance may be more difficult to obtain. If this occurs, and the Starlicide Complete bait is not eaten, an alternative may be to use Starlicide Technical® (98% active ingredient) applied to baits such as French-fried potatoes, small fruits, or livestock feed. The French fries and fruits may be more attractive to starlings, but they can spoil rapidly. Generally, livestock feed makes an acceptable bait because starlings are accustomed to feeding on it.

Starlicide Technical can be used only by or under supervision of U.S. Fish and Wildlife Service employees. Contact the USFWS, Division of Animal Damage Control for help. Extra precautions should be employed to ensure that desirable non-target birds are not present in the baiting area. Procedures for using baits prepared using Starlicide Technical are generally the same as for Starlicide Complete.

4. ***Prebaiting*** is usually desirable. Use a prebait (non-poisonous bait) to accustom starlings to feeding on bait at particular locations. Place the prebait in areas where the starlings concentrate to feed, but where it will not be accessible to livestock or other non-target animals. The best prebait is a high quality food that resembles the toxic bait in color, size and texture. If such prebait is unavailble, use a good quality feed such as that normally fed to livestock.

Prebait for 1 to 4 days until the birds readily feed on the prebait. If good consumption is not obtained, move the prebait to another location where starlings are concentrating to feed.

5. ***Bait Placement*** — Bait containers permit easier handling of the prebait and toxic bait and protect it from the weather *(Figure 9)*. Black rubber calf feeder pans work well for this. They do not tip easily, their dark color does not frighten the birds, and the bait is openly exposed. Empty farm wagons, feeder lids turned upside down, wooden troughs or other containers may also work. Avoid brightly colored or shiny containers or ones which might tip and spill bait. At night, the containers can be covered to protect the bait from the weather. However, they must be uncovered at dawn so that the starlings can feed as soon as they arrive. At large feedlots where large numbers of starlings (more than 100,000) are involved, and where large quantities of feed are available on the ground, broadcast baiting as per label directions is recommended.

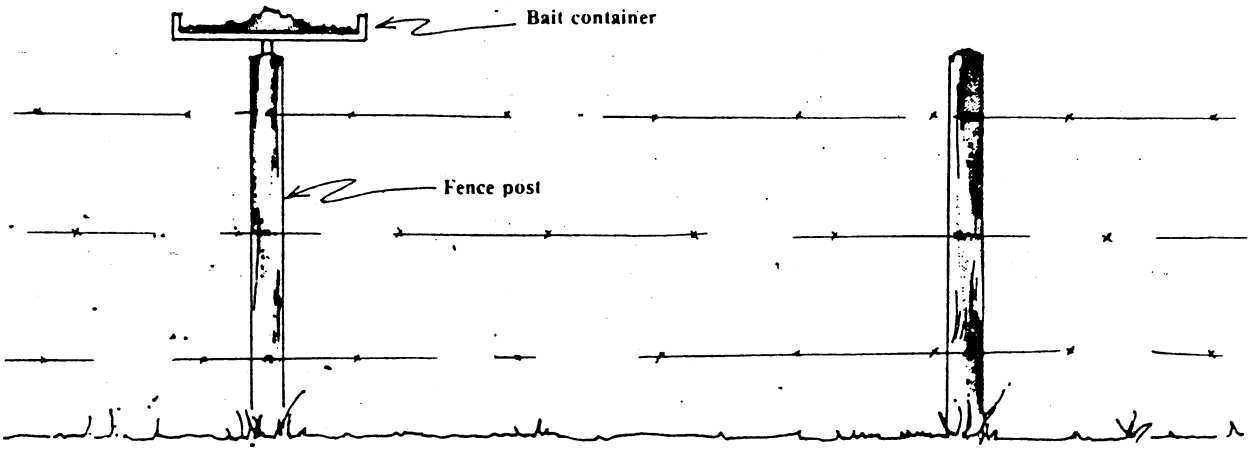


Figure 9 Use bait containers when baiting starlings. One example is shown here.

6. ***Toxic Bait*** — After the starlings feed readily on the prebait, remove all prebait and replace it with the toxic (poison) bait. Consult the label directions for the amount to use [one pound (0.45 kg) of Starlicide Complete used properly will kill about 100 to 200 starlings]. The total number of starlings using a farm over a long period of time may greatly exceed the numbers observed on a given day, so continue baiting for at least two or three days or until bait consumption diminishes. Bait should be available to the starlings at all times when they are present.

7. ***Remove Bait*** — At the end of three days, remove any remaining bait. Observe any birds arriving at the feedlot the next two to three mornings after baiting. Reduced bird numbers at this time indicate bird control, as most birds will die at the roost. If starlings continue to be present, or if they gradually return in increasing numbers, wait until a number of birds are regularly returning to feed at the area. Then apply prebait and toxic bait (Steps 4 to 6) as before. Do not leave Starlicide baits exposed for prolonged periods because this may cause bait shyness (bait rejection), and may also increase hazards to protected bird species.

8. ***Group Baiting*** — For most effective control, consider coordinating control efforts with your neighbors. Because starlings may forage over a large geographic area and may change feeding sites from day to day, several persons baiting at the same time will produce better control. Notify local wildlife officials of your plans so that if large numbers of starlings are removed, the officials will be able to explain the die-off.

9. ***Cautions*** — Starlicide is poisonous to chickens, turkeys, ducks, and some other birds. Never expose bait where poultry, livestock, or nontarget wildlife can feed on it.

Do not re-package pesticides into anything other than their original containers. Read and follow all label directions.

Toxic Perches. Generally, toxic perches are not recommended for starling control because of the considerations mentioned below and because there is limited usefulness of these perches for removing starlings. Toxic perches are perforated metal tubes several feet long that contain a wick saturated with a contact poison that enters the birds' feet as they perch on the tube. Two chemicals, endrin (Rid-A-Bird Control Liquid®) and fenthion (Rid-A-Bird 1100®) are federally registered for use in these perches. Endrin is a Restricted Use Pesticide. Labels of both chemicals indicate that they are restricted to persons trained in bird control work. Both chemicals are rapidly absorbed through the skin and should be used with caution to avoid spillage and exposure to the handler. Both chemicals are highly toxic to birds; however, fenthion has a much lower toxicity to mammals, a safety consideration for handlers. For additional information on the chemicals, see the section **Pesticides**.

One potential use of these perches is for starling control inside some farm buildings where other controls are not feasible. Complications arising from use outside buildings include a generally greater potential for exposure of non-target birds and hazards to hawks that feed on affected birds. All killed birds should be picked up and buried or burned. In addition, studies with dyes at livestock feeding areas have shown that starlings landing on the perches carry the perch liquid on their feet into the feed bunks. This may create a hazard to livestock.

Wetting (Detergent) Agents. Compound PA-14 (Tergitol®) is a wetting agent that can be sprayed from aircraft onto blackbirds or starlings at night while they roost. The detergent solution removes the protective oils on the birds' feathers and they die of exposure. It is registered for use only by or under the supervision of government agencies trained in bird control work and is effective only during cold wet conditions. Temperatures must be between 33 and 45°F and one-half inch (1.3 cm) or more rain is needed during or immediately after the spraying. Some data indicate that starlings are more resistant to this treatment than are blackbirds. In areas where starlings are the birds causing problems, spraying a starling/blackbird roost may kill mostly blackbirds, leaving more resources and better roost sites for the remaining starlings. This could potentially increase starling problems rather than reduce them. In spite of these difficulties; wetting agents may have application in starling control in some situations. However, the problem situation and control alternatives should be carefully considered before deciding to use a wetting agent. For further discussion of PA-14, see the **Blackbirds** chapter.

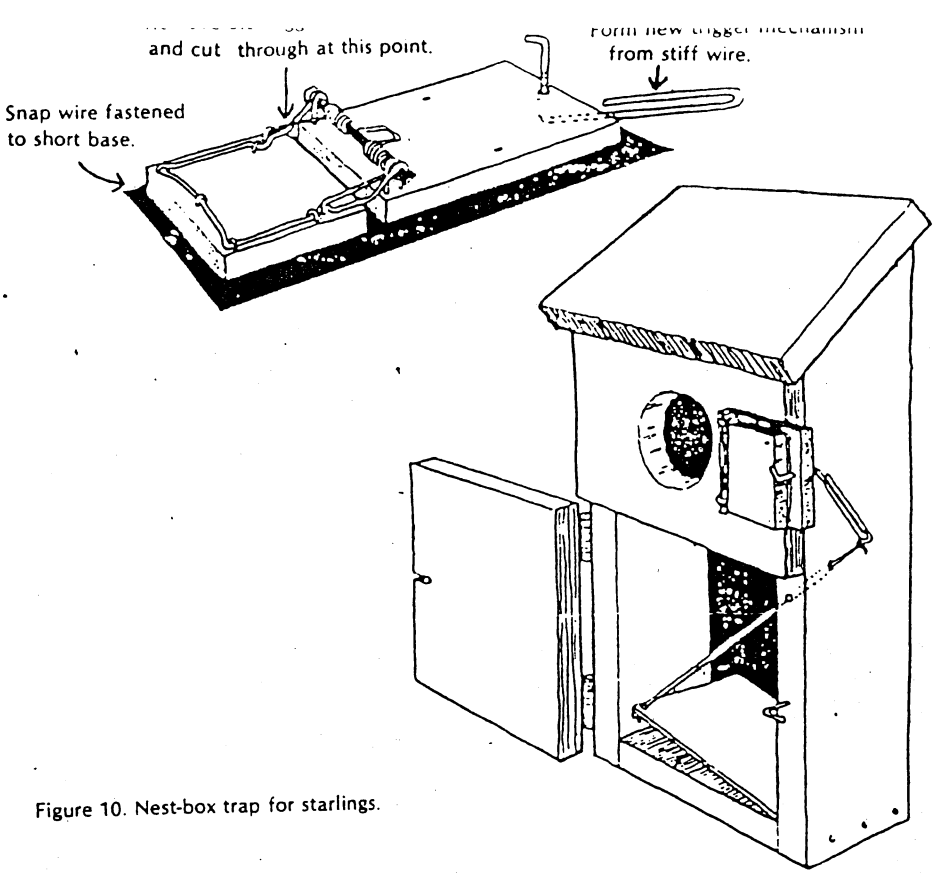


Figure 10. Nest-box trap for starlings.

Fumigants

Fumigation is generally not practical for starling control, and no fumigants are specifically registered for this purpose. However, starlings roosting inside farm buildings have been successfully controlled by closing building exits at night, then fumigating the building with carbon monoxide from the exhaust of an older model engine (without catalytic converter). Such exhaust fumes may affect straw, hay, feeds, or other materials in the building, and their use would require proper precautions to ensure safety from exhaust fumes for the operator and other non-targets. In addition, engine exhaust gases are not registered for starling control.

Trapping

Trapping and removing starlings can be a successful method of control at locations where a resident population is causing damage or where other techniques cannot be used. An example is trapping starlings in a fruit orchard. Often, however, the wide ranging movements of starlings and the time necessary to maintain and manage traps make this an impractical control.

Two types of traps, nest-box and decoy traps, are commonly used. Nest-box traps *(Figure 10)* are successful only during the nesting season, whereas decoy traps *(Figure 11)* are most effective during other times when the birds are flocking. Non-target birds captured in traps should be immediately released unharmed.

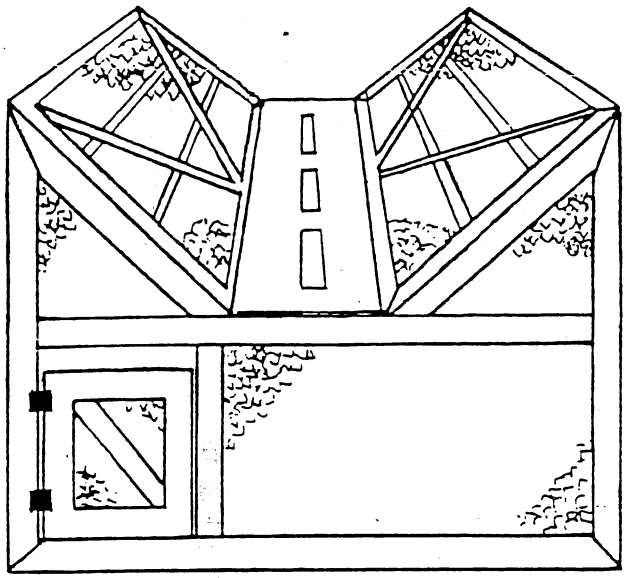
Decoy traps for starlings can be made in nearly any size but should be at least 8 to 10 feet (2.4 to 3 m) square and 5 feet (1.5 m) high. If desired, the sides and top can be constructed in panels to facilitate transportation and storage. In addition, decoy traps can be set up on a farm wagon and thereby moved to the best places to catch starlings. To be successful, the trap should be placed where starlings are likely to congregate. Always leave 10 to 20 starlings in the trap as decoys; their feeding behavior and calls attract other starlings that are nearby. Decoy birds in the trap must be well watered (including a bird bath) and fed. A well-maintained decoy trap can capture 10 to 100 or more starlings per day depending on its size and location, the time of year, and how well the trap is maintained. However, as mentioned above, the time necessary to maintain the trap and the number of starlings that can be captured compared to the total number in the area, often makes this technique less attractive than others for starling control.

Figure 11. Starling decoy trap.

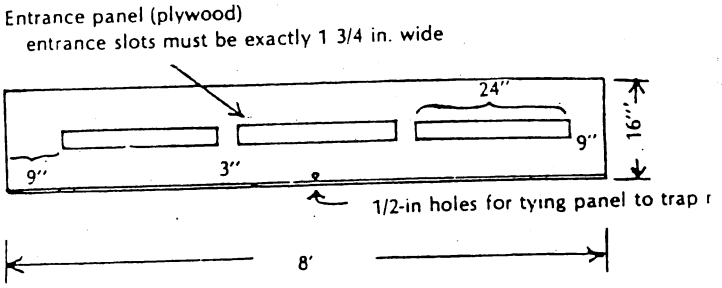
Materials Needed for Trap

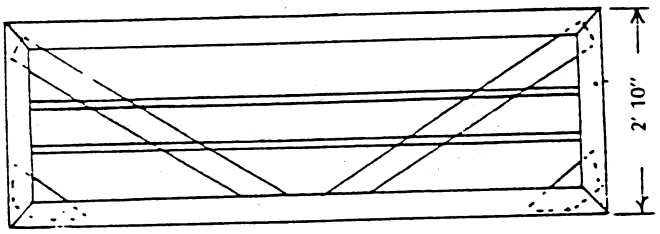
15 pieces 1 x 4s 8 feet long
25 pieces 1 x 4s 6 feet long
4 pieces 1 x 1s 8 feet long

1 piece 1/2 x 16-in exterior plywood, 8 feet long
2 hinges
2 lbs. staples
40-ft. length of 6-ft. chicken wire, 1-inch mesh

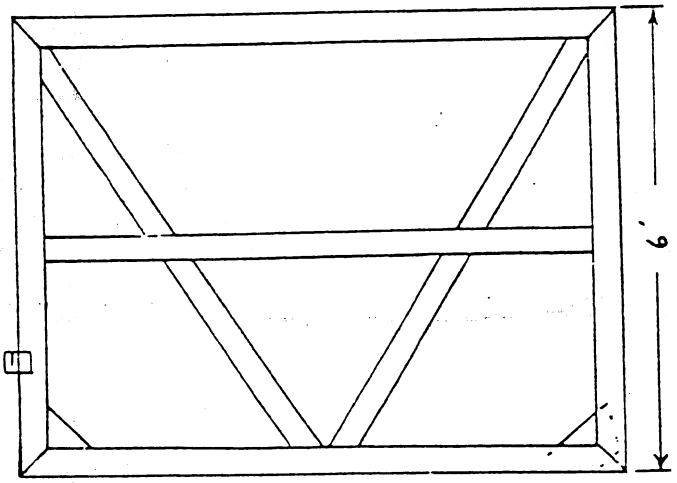


Assembled starling trap



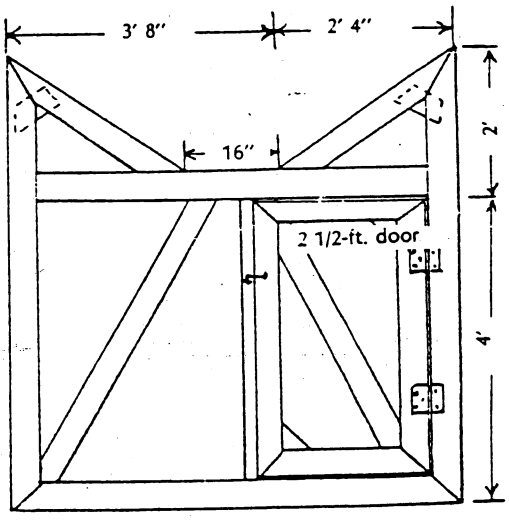


Top panel (make two)



Notched brackets may be used for quick assembly

Side panel (make two)



Front panel
Rear panel (omit door)

Shooting

Shooting is more effective as a dispersal technique than as a way to reduce starling numbers. The number of starlings that can be killed by shooting is very small in relation to the numbers of starlings usually involved in pest situations. However, where shooting is used as part of a dispersal program, it can be a helpful technique to supplement and reinforce others. For more detail on dispersal, see the **Bird Dispersal Techniques** chapter.

Other Methods

A possibility that may warrant further investigation is using starlings as a protein source, particularly for livestock or pet food.

Economics of Damage and Control

At livestock facilities, starlings consume livestock feeds, contaminate feed and water with their droppings, and in some situations, may transmit disease. The costs associated with these problems are often difficult to determine but some data are available.

Data reported in 1968 from Colorado feedlots estimate the costs of cattle rations consumed during winter by starlings to be $84 per 1,000 starlings. Current feed costs and the associated losses would certainly be much higher. A 1967 report indicated that one million starlings at a California feedlot resulted in losses of $1,000 per day because of food consumption and contamination, and starling interference with cattle feeding activity. Another report estimated that starlings in Idaho consumed a ton of cattle feed per hour, or 15 to 20 tons (13.5 to 18 mt) per day. A 1978 study in England estimated that the food eaten by starlings in a calf-rearing unit over three winters was 6 to 12 percent of the food presented to the calves. Two other studies in England since then found 4 percent losses and negligible damage, respectively. These examples demonstrate that starling consumption of livestock feeds can at times be a substantial economic consideration.

Producers who wish to estimate feed losses to starlings at their facilities can do so using one of two methods developed for this purpose. The following equation, which is appropriate for problems in the Northern Great Plains because it was developed from data in Colorado, estimates the cost of feed consumed per day:

> Cost of feed ration consumed/day = estimated starlings (to nearest thousand) x fraction of birds using trough x cost of feed ration per pound x 0.0625 pound (0.02813 kg) consumed per starling per day.

A second method recently developed may be applicable to most geographic areas and precludes the need of estimating starling populations. This requires that the operator observe the feed troughs several times during the day and estimate from these samples the number of starlings entering the troughs per day. From this estimate the cost of the feed ration consumed per day can be estimated with the following equation:

> Cost of feed ration consumed per day = estimated starling entries into troughs x 0.0033 pounds (0.001485 kg) consumed per starling entry x cost of feed ration per pound (0.45 kg).

These losses projected over a 3- to 4-month damage season can assist in evaluating the cost-benefits of proposed control measures.

Feed contamination from starling excreta may not be an economic loss for cattle or pig operations. In two years of testing by the U.S. Fish and Wildlife Service, neither pigs nor cattle were adversely affected by long-term exposure to feed heavily contaminated with starling excreta. As compared to controls, no significant differences were observed in weight gain or feed efficiency (ratio of weight gain to weight of feed offered). In addition, there were no observed differences in feed rejection or disease incidence. These results indicate that there is no economic justification for starling control based solely on feed contamination. The effects of livestock water contamination from starling excreta have not been well studied, but this area warrants investigation.

Starling interference with livestock feeding patterns may have economic importance. A study in England reported that calves in pens protected from starlings showed higher growth rates and better feed conversion than those in unprotected pens. This led to an increased profit margin. However, the difference observed might have been caused by starlings consuming the calf food, especially the high protein portion, rather than by actual interference with the calf feeding.

The costs associated with starlings in the spread of disease are difficult to quantify and can only be estimated. However, for TGE, the costs may be substantial. For example, during the severe 1978-1979 winter, a TGE outbreak occurred in southeast Nebraska with over 10,000 pigs lost in one month in Gage County alone. Because this TGE outbreak was concurrent with large flocks of starlings feeding at the same facilities, starlings were implicated in this outbreak. More recent data show that starlings are capable of carrying this disease in their feces. The role of starlings in disease transfer, however, needs further study.

Bird damage to grapes in the United States was estimated to be at least $4.4 million in 1972; starlings were one of the most damaging species. Starlings, as well as many other species of birds, also damage ripening cherry crops. A 1972 study in Michigan found 17.4 percent of the total crop lost to birds. A 1975 study in England estimated damage to be 14 percent (lower branches) to 21 percent (tree canopy) of the crop; similar 1976 data showed less damage. The Great Plains has very little grape or cherry production; however, it appears that bird damage control would be cost-effective for small-scale growers.

On the beneficial side, starlings eat large quantities of insects, especially during the spring breeding season. Many of these insects are considered pests. However this benefit is partially offset by the fact that starlings often take over nest cavities of native insect-eating birds.

Although starlings are frequently associated with damage problems, some of which clearly cause substantial economic losses, the economics of damage in relation to the cost and effectiveness of controls are not well understood. Several factors contribute to this: (1) Starlings are difficult to monitor because they often move long distances daily from roost to feeding areas, and many migrate. (2) Effectiveness of controls, particularly in relation to the total population in an area, is difficult to document. For example, does population reduction in a particular situation reduce the problem or merely allow an influx of starlings from other areas, and how does this vary seasonally or annually? In addition, does lethal control just substitute for natural mortality or is it additive? (3) The economics of interactions with other species are difficult to measure. For example, how much is a bluebird or flicker worth, and what net benefits occur from starlings eating pest insects when their interference with native hole nesting birds is considered? (4) Other factors such as weather and variation among problem situations complicates accurate evaluation of damage and the overall or long-term effectiveness of controls. These points, as well as others mentioned in this chapter, are examples of factors that must be considered in assessing the total economic impact of starlings. Clearly, the goal of minimizing starling/agriculture conflicts needs a better understanding of the interactions among starlings, agricultural systems, and control measures.

Acknowledgments

The references listed under "For Additional Information" and many others were used in preparing this chapter. Gratitude is extended to the authors and the many researchers and observers who contributed to this body of knowledge. We also thank M. Beck, J. Besser, R. Fritschen, D. Mott, A. Stickley, and R. Timm for comments on the manuscript, and J. Andelt for typing and technical assistance.

Figure 1 by Emily Oseas Routman, University of Nebraska-Lincoln.

Figure 2 from Bystrak *et al.* (1974), used with permission. Figure copyrighted by the National Audubon Society, Inc. Adapted by Jill Sack Johnson.

Figures 3, 4, and 5 by Jill Sack Johnson.

Figure 6 from Salmon and Gorenzel's chapter Cliff Swallows in this publication.

Figures 7, 8, and 9 from Johnson and Timm (1981), drawn by John Eggers, Cooperative Extension Service, University of Nebraska-Lincoln.

Figure 10 from DeHaven and Guarino (1969), adapted by Jill Sack Johnson.

Figure 11 from U.S. Fish and Wildlife Service (no date), "Trapping Starlings," Bulletin AC 210, Purdue University, West Lafayette, Indiana.

For Additional Information

Besser, J.F., J.W. DeGrazio, and J.L. Guarino. 1968. Costs of wintering starlings and red-winged blackbirds at feedlots. *Journal of Wildlife Management* 32:179-180.

Besser, J.F., W.C. Royall, Jr., and J.W. DeGrazio. 1967. Baiting starlings with DRC-1339 at a cattle feedlot. *Journal of Wildlife Management* 31:45-51.

Boudreau, G.W. 1975. *How to win the war with pest birds.* Wildlife Technology, Hollister, California. 174 pp.

Bray, O.E., K.H. Larsen, and D.F. Mott. 1975. Winter movements and activities of radio-equipped starlings. *Journal of Wildlife Management* 39:795-801.

Burtt, H.E. and M.L. Giltz. 1977. Seasonal directional patterns of movements and migrations of starlings and blackbirds in North America. *Bird-Banding* 48:259-271.

Bystrak, D., C.S. Robbins, S.R. Drennan, and R. Arbib, Editors. 1974. Wintering Areas of Bird Species Potentially Hazardous to Aircraft. A special report jointly prepared by the National Audubon Society and the U.S. Fish and Wildlife Service. National Audubon Society, Inc., New York, New York. 156 pp.

Crase, F.T., C.P. Stone, R.W. DeHaven, and D.F. Mott. 1976. Bird damage to grapes in the United States with emphasis on California. USDI, Fish and Wildlife Service, Special Scientific Report — Wildlife No. 197. Washington, D.C. 18 pp.

DeCino, T.J., D.J. Cunningham, and E.W. Schafer, Jr. 1966. Toxicity of DRC-1339 to starlings. *Journal of Wildlife Management* 30:249-253.

DeHaven, R.W. and J.L. Guarino. 1969. A nest-box trap for starlings. *Bird Banding* 40:49-50.

Dolbeer, R.A. 1982. Migration patterns for age and sex classes of blackbirds and starlings. *Journal of Field Ornithology* 53:28-46.

Dolbeer, R.A., P.P. Woronecki, A.R. Stickley, Jr., and S.B. White. 1978. Agricultural impacts of a winter population of blackbirds and starlings. *Wilson Bulletin* 90:31-44.

Feare, C.J. 1980. The economics of starling damage. Pp. 39-55 in *Bird Problems in Agriculture* (E.N. Wright, I.R. Inglis, and C.J. Feare, Eds.), British Crop Protection Council, Croydon, UK. 210 pp.

Feare, C.J. and K.P. Swannack. 1978. Starling damage and its prevention at an open-fronted calf yard. *Animal Production* 26:259-265.

Glahn, J.F. 1981. No production loss associated with starling contamination of livestock feed. USDI, Fish and Wildlife Service, Kentucky Research Station, Research Information Bulletin No. 81-5, Bowling Green, Kentucky. 1 p.

Glahn, J.F. 1982. Factors influencing the distribution of bird damage at Tennessee feedlots identified. USDI, Fish and Wildlife Service, Kentucky Research Station, Research Information Bulletin No. 82-47, Bowling Green, Kentucky. 2 pp.

Glahn, J.F. 1982. Use of starlicide to reduce starling damage at livestock feeding operations. *Proceedings Fifth Great Plains Wildlife Damage Control Workshop* (R.M. Timm and R.J. Johnson, Eds.), University of Nebraska-Lincoln, pp. 273-277.

Glahn, J.F., D.J. Twedt, and D.L. Otis. 1983. Estimating feed losses from starling use of feed troughs. *Wildlife Society Bulletin* 11:(In press).

Gough, P.M. and J.W. Beyer. 1982. Bird-vectored diseases. *Proceedings Fifth Great Plains Wildlife Damage Control Workshop* (R.M. Timm and R.J. Johnson, Eds.), University of Nebraska-Lincoln, pp. 260-272.

Hamilton, W.J., III, and W.M. Gilbert. 1969. Starling dispersal from a winter roost. *Ecology* 50:886-898.

Johnson, R.J. 1979. Program planning for extension wildlife damage control—bird damage. *Proceedings Fourth Great Plains Wildlife Damage Control Workshop* (F.R. Henderson, Ed.), Kansas State University, Manhattan, pp. 224-237.

Johnson, R.J. 1982. Stopping starlings. Nebraska Swine Report, E.C. 82-219, Cooperative Extension Service, University of Nebraska, Lincoln, p. 14.

Johnson, R.J. and R.M. Timm. 1981. Starlings and their control. NebGuide G81-580, Cooperative Extension Service, University of Nebraska, Lincoln. 4 pp.

Kessel, B. 1953. Distribution and migration of the European starling in North America. *The Condor* 55:49-67.

Kessel, B. 1957. A study of the breeding biology of the European starling *(Sturnus vulgaris* L.) in North America. *American Midland Naturalist* 58:257-331.

Levingston, P.E. 1967. Winter starling control with DRC-1339. *Proceedings Third Vertebrate Pest Conference*. University of California-Davis, pp. 100-103.

Lustick, S. 1976. Wetting as a means of bird control. *Proceedings Seventh Bird Control Seminar* (W.B. Jackson, Ed.), Bowling Green State University, Bowling Green, Ohio, pp. 41-47.

Meanley, B. and W.C. Royall, Jr. 1976. Nationwide estimates of blackbirds and starlings. *Proceedings Seventh Bird Control Seminar* (W.B. Jackson, Ed.), Bowling Green State University, Bowling Green, Ohio, pp. 39-40.

Palmer, T.K. 1976. Pest bird damage in cattle feedlots: the integrated systems approach. *Proceedings Seventh Vertebrate Pest Conference* (C.C. Siebe, Ed.), University of California-Davis, pp. 17-21.

Royall, W.C., Jr., T.C. DeCino, and J.F. Besser. 1967. Reduction of a starling population at a turkey farm. *Poultry Science* 46:1494-1495.

Royall, W.C., Jr., J.L. Guarino, A. Zajanc, and C.C. Siebe. 1972. Movements of starlings banded in California. *Bird-Banding* 43(1):26-37.

Stewart, P.A. 1978. Foraging behavior and length of dispersal flights of communally roosting starlings. *Bird-Banding* 49:113-115.

Stickley, A.R., Jr. 1979. Extended use of starlicide in reducing bird damage in southeastern feedlots. *Proceedings Eighth Bird Control Seminar* (W.B. Jackson, Ed.), Bowling Green State University, Bowling Green, Ohio, pp. 79-81.

Stickley, A.R., Jr., R.A. Dolbeer, and S.B. White. 1976. Starling damage to sprouting wheat in Tennessee. *Proceedings Seventh Bird Control Seminar* (W.B. Jackson, Ed.), Bowling Green State University, Bowling Green, Ohio, pp. 30-38.

Stone, C.P. 1973. Bird damage to tart cherries in Michigan, 1972. *Proceedings Sixth Bird Control Seminar* (H.N. Cones, Jr. and W.B. Jackson, Eds.), Bowling Green State University, Bowling Green, Ohio, pp. 19-23.

Tahon, J. 1980. Attempts to control starlings at roosts using explosives. Pp. 56-58 in *Bird Problems in Agriculture* (E.N. Wright, I.R. Inglis, and C.J. Feare, Eds.), British Crop Protection Council, Croydon, England. 210 pp.

Twedt, D.J. and J.F. Glahn. 1982. Reducing starling depredations at livestock feed operations through changes in management practices. *Proceedings Tenth Vertebrate Pest Conference* (R.E. Marsh, Ed.), University of California-Davis, pp. 159-163.

West, R.R. 1968. Reduction of a winter starling population by baiting its preroosting areas. *Journal of Wildlife Management* 32:637-640.

West, R.R., J.F. Besser, and J.W. DeGrazio. 1967. Starling control in livestock feeding areas. *Proceedings Third Vertebrate Pest Conference*, University of California-Davis, pp. 89-93.

Williams, R.E. 1979. An experimental design for investigating winter bird depredation at south Texas feedlots. *Proceedings Eighth Bird Control Seminar* (W.B. Jackson, Ed.), Bowling Green State University, Bowling Green, Ohio, pp. 302-305.

Wright, E.N. 1973. Experiments to control starling damage at intensive animal husbandry units. *European Plant Protection Organization Bulletin* 9:85-89.

Wright, E.N., I.R. Inglis, and C.J. Feare, Eds. 1979. *Bird Problems in Agriculture*. BCPC Publications, 144-150 London Road, Croydon, England. 210 pp.

Wright, E.N. 1982. Bird problems and their solutions in Britain. *Proceedings Tenth Vertebrate Pest Conference* (R.E. Marsh, Ed.), University of California-Davis, pp. 186-189.

THE UNIVERSITY OF CONNECTICUT COOPERATIVE EXTENSION SERVICE

PESTICIDE FACTS

Fact Sheet No. 1

Laundering Pesticide Contaminated Clothing

By Candace L. Bartholomew Extension Agent, Pesticides*

The problem of how to launder pesticide contaminated clothing has puzzled many as pesticide use has become widespread. What is the best method? What water temperature should be used? Is there a difference in detergent performance? Must you be careful about washing contaminated clothes with other clothing?

Use the pesticide label as a guide for knowing which chemicals are more toxic. Key words on all pesticide labels identify the toxicity of the product *(Figure 1).*

Key Word	Toxicity	Examples*
DANGER POISON	Highly toxic/ concentrated	Counter Disyston Parathion Furadan Dyfonate Lasso
WARNING	Moderately toxic	Diazinon Glyphosate Phosmet Dicamba
CAUTION	Slightly toxic	Ammate Sevin Atrazine Malathion

*Toxicity of the pesticide may vary depending upon the formulated product. Use the key word as an indication of the toxicity level.

Figure 1

Clothing contaminated with highly toxic and concentrated pesticides must be handled most carefully, as these pesticides are easily absorbed through the skin. If the clothes have been completely saturated with concentrated pesticides, discard them. Clothing contaminated by moderately toxic pesticides do not warrant such drastic measures. Hazards are less pronounced in handling clothing exposed to low toxicity pesticides. But...the ease of pesticide removal through laundering does *not* depend on toxicity level—it depends on the formulation of the pesticide. For example, 2,4-D amine is easily removed through laundering because it is soluble in water; 2,4-D ester is much more difficult to remove through laundering.

Disposable clothing helps limit contamination of clothes because the disposable garments add an extra layer of protection. This is especially important when you are in direct contact with pesticides, such as when mixing and loading pesticides for application.

Laundering Recommendations

Wash contaminated clothing separately from the family wash. Research has shown that pesticide residues are transferred from contaminated clothing to other clothing when they are laundered together. Know when pesticides have been used so all clothing can be properly laundered.

Prerinsing contaminated clothing before washing will help remove pesticide particles from the fabric. Prerinsing can be done by:

1. presoaking in a suitable container prior to washing;
2. prerinsing with agitation in an automatic washing machine;
3. spraying/hosing garment(s) outdoors.

Prerinsing is especially effective in dislodging the particles from clothing when a wettable powder pesticide formulation has been used.

Clothing worn while using slightly toxic pesticides may be effectively laundered in one to three machine washings. It is strongly recommended that *multiple* washings be used on clothing contaminated with more toxic or more concentrated pesticides to draw out excess residues. Burn or bury clothing contaminated with concentrated, highly toxic pesticides. Always wear rubber gloves when handling highly contaminated clothing to prevent pesticide absorption into the body.

Washing in hot water removes more pesticide from the clothing than washing in other water temperatures. Remember...the hotter, the better. Avoid cold water washing! Although cold water washing might save energy, cold water temperatures are relatively ineffective in removing pesticides from clothing.

Laundry detergents, whether phosphate, carbonate, or heavy duty liquids, are similarly effective in removing pesticides from fabric. However, research has shown that

*Reviewed by Anita Malone, home economist for New Haven County, and slightly revised by Candace Bartholomew, Agricultural Agent for Tolland County, with permission from The University of Nebraska at Lincoln. The original authors of this fact sheet are: Carol Bryan Easley, Instructor: Textiles, Clothing and Design, John Laughlin, Professor of Textiles, Clothing and Design; Roger Gold, Extension Specialist: Environmental Programs; University of Nebraska at Lincoln.

CONNECTICUT COOPERATIVE EXTENSION SERVICE
COLLEGE OF AGRICULTURE AND NATURAL RESOURCES THE UNIVERSITY OF CONNECTICUT

heavy duty liquid detergents are more effective than other detergents in removing emulsifiable concentrate pesticide formulations. Emulsifiable concentrate formulations are oil-based and heavy duty liquid detergents are known for oil-removing ability.

Laundry additives, such as bleach or ammonia, do not contribute to removing pesticide residues. Either of these additives may be used, if desired, but caution must be used. *Bleach should never be added to or mixed with ammonia,* because they react together to form a fatal chlorine gas. Be careful—*don't mix ammonia and bleach!*

If several garments have become contaminated, wash only one or two garments in a single load. Wash garments contaminated by the same pesticide(s) together. Launder, using a full water level to allow the water to thoroughly flush the fabric.

During seasons when pesticides are being used daily, clothing exposed to pesticides should be laundered daily. This is especially true with highly toxic or concentrated pesticides. It is much easier to remove pesticides from clothing by daily laundering than attempting to remove residues that have accumulated over a period of time.

Pesticide carry-over to subsequent laundry loads is possible because the washing machine is likely to retain residues which are then released in following laundry loads. It is important to rinse the washing machine with an *empty load*, using hot water and the same detergent, machine settings and cycles used for laundering the contaminated clothing.

Line drying is recommended for these items. Although heat from an automatic dryer might create additional chemical breakdown of pesticide residues, many pesticides break down when exposed to sunlight. This also eliminates the possibility of residues collecting in the dryer.

When Laundering Pesticide Contaminated Clothing...REMEMBER

READ the pesticide *LABEL* for information.

DISPOSABLE PESTICIDE CLOTHING provides extra protection.

PRERINSE clothing by:
- *presoaking in a suitable container;
- *agitating in an atuomatic washing machine;
- *spraying/hosing the garment(s) outdoors.

WASHING machine settings: **Hot** water temperature (140o F/60° C), **Full** water level, **Normal** (12 minutes) wash cycle.

REWASH the contaminated clothing two or three times, if necessary.

Wash *A FEW* contaminated garments at a time using lots of water.

Wash *SEPARATELY* from *FAMILY* laundry.

DISCARD (bum or bury) clothing if thoroughly saturated or contaminated with highly toxic pesticides.

LAUNDER CLOTHING DAILY when applying pesticide daily.

RINSE MACHINE thoroughly after laundering contaminated clothing.

LINE DRY to avoid contaminating the automatic dryer.

BE AWARE of when pesticides are being used so that clothing can be appropriately laundered.

THE UNIVERSITY OF CONNECTICUT COOPERATIVE EXTENSION SERVICE

PESTICIDE FACTS

Fact Sheet No. 2

Protecting Groundwater From Pesticide Contamination

By Candace L. Bartholomew Extension Agent, Pesticides*

Groundwater is the source of water for wells and springs. It is widely used for household and other water supplies. About half the people in the United States depend on groundwater as a source of drinking water. Ninety percent of them are rural residents.

Groundwater forms when water moves below the earth's surface and fills in empty spaces in and around rocks and soil. In the past few years contamination of groundwater with pesticides has featured prominently in the news media. As a pesticide user it is your responsibility to take any and all precautions necessary to protect groundwater from contamination by pesticides.

Pesticides are usually applied to or near the surface of the ground. Five major factors determine whether they will reach groundwater:

— the practices followed by the pesticide applicator,
— the presence (or absence) of surface water from rain or irrigation,
— the characteristics of the pesticide being used,
— the type of soil in the area of application,
— the location of the groundwater
— the distance from the surface and the type of geological formations above it.

Good application practices include careful attention to the pesticide label. Pesticide labels have been developed to provide instruction on how to use the material for the best control of pests with the least risk of environmental contamination. The proper timing and placement of pesticides are very important.

Mix and calibrate accurately. Avoid the temptation to use more product than the label directs. Overdosing will not do a better job of controlling the pests, it will only increase both the cost of pest control and the chance that the material may reach groundwater. Calibrate equipment carefully and recheck it often. Measure chemical concentrates and diluents accurately.

Avoid spills when mixing and loading. Use a backflow preventer or back-siphoning preventer when drawing mix water directly from a well or a pond.

Dispose of wastes properly. Improper disposal of empty containers, equipment rinse water, or unused chemical can cause localized groundwater problems. Triple-rinse or pressure-rinse containers and pour the rinse water into the spray tank. Leftover product in your spray tank must be disposed of in a manner consistent with the product label. Avoid having leftover tankmix in the first place by mixing only the quantities you need. Do not drain rinse water from equipment into ditches, streams, ponds, lakes or other water sources.

Prolonged heavy rain or excessive irrigation will produce excess surface water. If there is more water on the soil than the soil can hold, the water with pesticides in it is likely to move downward to the groundwater. Use weather forecasts, personal observations and irrigation scheduling to predict when excess surface water may be a problem.

Consider using Integrated Pest Management practices to reduce the amount of pesticides necessary to achieve pest contol.

Agricultural chemicals vary in the potential for moving to groundwater. Three properties of pesticides which may influence such movement are:

Solubility. Chemicals vary greatly in water solubility; the greater the water solubility, the more potential for movement of the product to groundwater.

Soil adsorption. Some chemicals become tightly bound to soil particles and do not move in the soil, some are not so strongly adsorbed, and are more likely to move.

Persistence. Some chemicals break down quickly; other, persistent materials take a long time to break down. The more persistent ones are more likely to reach groundwater over time.

Three major soil characteristics affect chemical movement:

Soil Texture. This is an indication of the proportions of sand, silt, and clay in the soil. Pest control products tend to be adsorbed mostly on clay and organic matter. Coarse, sandy soils generally allow water to move rapidly downward and offer few opportunities for adsorption. Finer textured soils generally allow water to move at much slower rates, and they contain more silt and organic matter to which pesticides and other chemicals may be adsorbed.

Soil Permeability. This is a general measure of how fast water can move downward in a particular soil. The more permeable soils must be carefully managed to prevent any form of chemical from reaching groundwater.

Soil Organic Matter. This influences how much water the soil can hold before movement occurs. Increasing organic matter will increase the water-holding capacity of the soil. Some pesticides may also be adsorbed into organic matter.

The distance of groundwater from the surface and permeability of

CONNECTICUT COOPERATIVE EXTENSION SERVICE
COLLEGE OF AGRICULTURE AND NATURAL RESOURCES THE UNIVERSITY OF CONNECTICUT

Kirvin L. Knox, Acting Director. Issued in furtherance of the Acts of Congress of May 8 and June 14, 1914. The University of Connecticut, Storrs, CT. 06268. The Connecticut Cooperative Extension Service programs and policies are consistent with pertinent Federal and State laws and regulations on nondiscrimination regarding race, color, national origin, religion, sex, age, or handicap.

geologic layers is another important factor. If the groundwater is within a few feet of the soil surface, and geologic layers are highly permeable, groundwater contamination is more likely to occur than if groundwater occurs at greater depths and below impervious geologic layers.

For more information on Integrated Pest Management Practices contact your local Extension Service. For information on soil types contact your local Soil Conservation Service.

*This information adapted from *Protecting Our Groundwater A Growers Guide*. 1987. American Farm Bureau Federation, National Agricultural Aviation Association. National Agricultural Chemicals Association, U.S. Department of Agriculture, Extension Service.

Write, phone or visit the office nearest you for information, programming and printed material.

Fairfield Extension Office
67 Stony Hill Road
Bethel, CT 06801
(203) 797-4176

Hartford Extension Office*
1800 Asylum Avenue
West Hartford, CT 06117
(203) 241-4940

Litchfield Extension Office
Agricultural Center,
Box 607, West Street
Litchfield, CT 06759
(203) 567-9447

Middlesex Extension Office
1066 Saybrook Road, Box 70
Haddam, CT 06438
(203) 345-4511

New Haven Extension Office
670 Wintergreen Avenue
Hamden, CT 06514
(203) 789-7865

New London Extension Office*
562 New London Turnpike
Norwich, CT 06360
(203) 887-1608

Tolland Extension Office
24 Hyde Avenue
Vernon, CT 06066
(203) 875-3331

Windham Extension Office
139 Wolf Den Road
Brooklyn, CT 06234
(203) 774-9600

Sea Grant Marine Advisory Service
S.E. Branch Building
Avery Point, Bldg. 24
Groton, CT 06340
(203) 445-8664

Bridgeport EFNEP Office
1374 Barnum Avenue
Bridgeport, CT 06610
(203) 579-6307

Waterbury EFNEP Office
32 Hillside Avenue
Waterbury, CT 06710
(203) 755-4840

*also EFNEP office

2M987 87-47