

Animal Damage Management

Department of Entomology

CONTROLLING RODENTS IN COMMERCIAL POULTRY FACILITIES

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The house mouse (*Mus musculus*), Norway rat (*Rattus norvegicus*), and roof rat (*Rattus rattus*) are commonly found in and around livestock and farm facilities. Enclosed and insulated commercial poultry facilities provide ideal rodent habitat because of a nearly unlimited amount of harborage, food, and water. As a result, these facilities may support unusually large rodent populations, which in turn, may pose significant economic problems to a poultry manager. Rodents consume and contaminate feed, gnaw on structural, mechanical, electrical and various utility components, and weaken concrete slabs and walkways via their burrowing activities. Norway rats and large populations of mice are particularly destructive to building insulation. Most common types of insulation including rigid foam and fiberglass are susceptible to damage.

The actual monetary costs of rodent damage to poultry operations are difficult to assess accurately. Operational shutdowns due to electrical or mechanical malfunctions as a result of rodent damage can cost a facility thousands of dollars overnight. The repair and/or replacement of building insulation is expensive in both dollars and time. And, chronic energy losses and the resultant effects on poultry production magnify the expense.

Conducting effective and efficient programs to control rodents in commercial poultry operations are challenging - even for pest control professionals. Rodents may infest the entire length of a facility from the pit to the attic. Rodent baits may not be readily taken by all the rodents because of the copious amounts of food (grain, eggs, chicks, and various insects) and water readily available to the rodents. Finally, if baits are not carefully applied, they quickly become contaminated by dust, feathers, poultry manure, and insects, rendering them unattractive to rodents.

The purpose of this publication is to present a simplified discussion of practical, effective and economical approaches for controlling rodents in commercial poultry facilities.

RODENTS AND POULTRY DISEASES

Rodents and other wildlife can be involved in the transmission of several poultry diseases such as erysipelas, fowl

cholera, salmonellosis, and others (see Table 1). However, the actual occurrence of such diseases in rodents, and the degree to which they contribute to disease problems on poultry farms is poorly documented.

Table 1. Some Common Diseases of Poultry That Rodents May Harbor or Disseminate*

| Disease | Agent | Rodents Implicated |
|---------------|----------|--------------------|
| Bordetellosis | bacteria | rats |
| Leptospirosis | bacteria | rats, mice |
| Erysipelas | bacteria | rats |
| Salmonellosis | bacteria | mice, rats |
| Fowl Pox | virus | rats |
| Fowl Cholera | virus | rats, mice |

* Because rodents are capable of both mechanical and physiological transmission of various bacteria, viruses, and nematodes, the potential exists for rodents to transmit several other pathogens in poultry systems.

Currently, there is widespread concern in the poultry industry regarding salmonellosis. Studies have revealed that salmonella infection in natural wild rodent populations is low in general, but several different species of Salmonella have been carried by rats and mice inhabiting poultry farms from around the United States. These include: *Salmonella enteritidis*, (SE), *S. typhimurium*, *S. dublin* and others. It is difficult however, to determine whether rodents introduce the bacteria into a poultry operation or, if they pick up the bacteria from an already infected house. It is likely that both scenarios occur. The frequency at which rats and mice cause primary salmonellosis infection in poultry operations is not known.

In general, rodents, like other wild animals, insects, and people are capable of carrying diseases directly into a poultry facility. And they can spread or accelerate the spread of established diseases from contaminated areas to uncon-

taminated areas via their droppings, feet, fur, urine, saliva, or blood. As an example, mice may travel through infected poultry manure and then contaminate the food and water of healthy birds several hundred feet away, or introduce a disease to nearby uninfected houses.

Additionally, rodents around farm buildings are a food source that may attract wild predatory animals such as foxes, coyotes, raccoons, skunks, dogs, or cats which in turn may contribute to disease problems.

An effective disease barrier system cannot be assured if rodents inhabit poultry houses.

CONDUCTING RODENT INSPECTIONS

The first, and perhaps most important step in controlling rodents in poultry houses is to conduct a visual inspection of the premises. Rodent sightings, droppings, tracks, burrows, pathways, fresh gnawings, and dead rodents indicate areas where rodents are active.

Rodents living in farm buildings are most active just after dusk and again shortly before dawn. If rodents are seen repeatedly during the day, it indicates an established infestation. To get the most accurate assessment of the problem, premises should be inspected using a good flashlight, with the lights out at either dusk or predawn. If rodents are present, the inspection will reveal the location, distribution, and severity of the infestation. It will prove valuable in determining control procedures - such as the most important areas to bait or place traps. And, after a control program is completed, an inspection will also reveal the program's effectiveness.

Because mice produce between 40-100 droppings in a single evening and rats about 20-50, droppings are one of the more common signs seen by poultry personnel when the rodents themselves are not noticed. Figure 1 presents an illustration to help identify mouse and rat droppings.

The burrow entrances of rodents is another readily seen sign of activity. The insulated walls and ceilings are common nesting locations for rodents and their nest entrances are easily spotted. Rodents also burrow into dry poultry manure, and the ground below slab walkways. If rats are active around the premises, their burrows are often evident along the exterior of the building foundations.

RAT AND MOUSE FACTS

Norway rats and house mice are found in all of the contiguous 50 states, although the Norway rat may be absent from some relatively large geographic areas of the West. The roof rat primarily occupies the coastal areas of Washington, Oregon, and California, as well as a larger area along the Gulf and Atlantic coast states from Texas to Maryland. Roof rats are not established in the mid-western states.

House mice are non-descript, brownish to grayish rodents with relatively large ears and small eyes. They weigh about 1/2 oz. An adult is about 5-1/2 to 7 1/2 inches long including the 3 to 4 inch tail. Norway rats are large, robust animals whose fur color ranges from reddish to grayish brown on the back and sides and grey to yellow-white underneath. They are about 13 to 18 inches long including the 6 to 8-1/2 inch tail. Average weight is about 11 ounces, and few individuals exceed 1 pound. In comparison, the roof rat is a

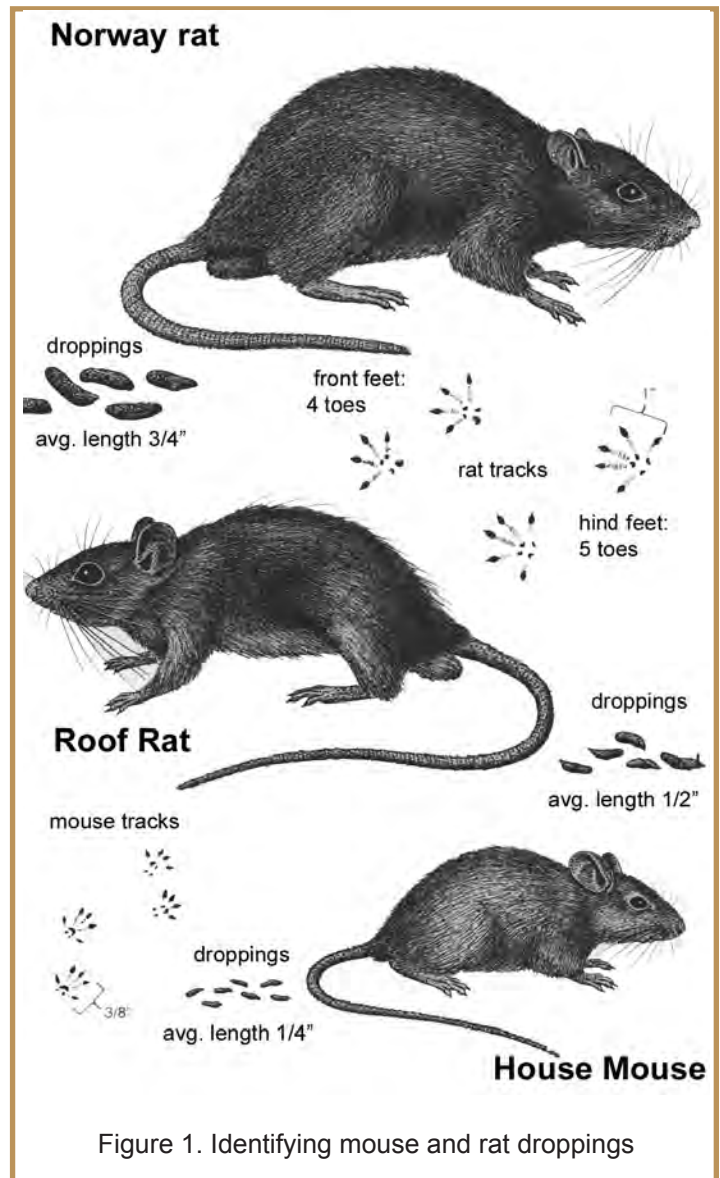


Figure 1. Identifying mouse and rat droppings

smaller, sleeker rat usually colored blackish to grey, with a grey to whitish underside. A roof rat, in contrast to the Norway rat, has a tail longer than its body, larger ears, a more pointed snout, and more prominent eyes.

Although rodents often feed on cereal grains, they will eat many kinds of food including garbage, insects, meat, fruits and vegetables, and even manure. House mice are sporadic feeders, nibbling bits of food, making as many as 20-30 short visits to food per night eating only tiny amounts during each visit. Rats tend to get their daily food at one or two locations. Rats require 1/2 to 1 fluid ounce of water daily (unless feeding on moist or succulent foods). House mice can survive for long periods without free water.

Rodents have impressive capacities for reproduction - especially in poultry facilities. Thus, it is important to control them diligently and early, before they reach populations that cause significant damage. For example, in a single year a female mouse produces about 6 to 8 litters, each litter averaging 5 to 6 pups. The pups are born 19 to 21 days after mating, and they can reach reproductive maturity in 6 to 10 weeks. The Norway rat produces about 4 to 7 litters, aver-

aging 8 to 12 pups with a similar gestation period as the mouse. Rats reach reproductive maturity between 8 to 12 weeks. Both rats and mice have natural life spans ranging from 5 to 12 months. Where both rats and house mice exist

on the same premises, rats may exclude house mice from the areas where the rats are active. Once the rats are eliminated however, the mice often flourish.

A thorough understanding of the physical abilities of rodents is very useful when designing a control program. For instance, rats are excellent swimmers. They can swim up to 1/2 miles in open water, travel through sewer lines against substantial currents, and tread water for up to 3 days. Roof rats and house mice are excellent climbers. Norway rats, although somewhat less agile, can climb effectively. If they can't climb, they just jump. From a standing position, rats can jump vertically up to 3 feet. And getting down is easy. If necessary, rodents can drop from heights of 50 feet without injury.

If rodents can't get around an object, they go through it. Rodents are capable of gnawing through a variety of materials, including lead sheathing, cinder-block, aluminum siding, glass, and improperly cured concrete. Rodents can also squeeze through very small openings - 1/2 in. for rats, and 1/4 in. for mice.

All of these physical abilities have allowed rats and mice to survive hundreds of years in the human environment. Some of the other sensory abilities that make rodents so remarkable adaptable are presented in Figure 2.

HEARING

Rodents use hearing to locate objects to within a few inches. Rats and mice have a frequency range of 50 kilohertz or more, which is much more than humans, who have a range of about 20 kilohertz. Rodents make high frequency noises in various situations, such as in mating, but the function of these sounds is poorly understood.

TASTE

Rodents have a highly developed sense of taste, which allows them to detect some chemicals at parts-per-million concentrations. This taste sensitivity may lead to bait rejection if the baits are contaminated with insecticide odors or other chemicals. Use of fresh, food quality grain ingredients is the best guarantee of good bait attractability and acceptance.

SMELL

Odor is one of the rodent's most important senses. Rodents mark objects and pathways with urine or glandular secretions. Rodents use their sense of smell to recognize the odors of the pathway to and from food sources and of members of the opposite sex who are ready to mate, to differentiate between members of their own colonies and strangers, and to tell if a stranger is a strong or weak individual.

VISION

Rats and mice have poor vision beyond 3 or 4 feet, but they are very sensitive to motion up to 30-50 feet away. For the most part, rodents are color-blind, but very light-colored or reflective objects may stand out in their environment and cause initial avoidance among sensitive rodents. Rodents are most active at night when light levels are low, at which time they rely less on their eyesight than they do on their other senses, particularly smell, touch, and hearing.

TOUCH

Rodents have a highly developed sense of touch, due to very sensitive body hairs and whiskers (vibrissae), which they use to explore their environment. A rodent in a familiar area relies heavily on the senses of touch and smell to direct it through time-tested movements learned by exploration and knowledge of its home range. Rodents prefer a stationary object on at least one side of them as they travel and thus commonly move along walls, a fact that is very useful when designing a control program. In captivity, rodents will hide quite contentedly in a clear glass jar, since it feels enclosed and secure to them.



Figure 2. Physical abilities and senses of rodents

RODENT CONTROL IN POULTRY OPERATIONS

A FEW BASICS ABOUT EFFECTIVE CONTROL OF RODENTS

Effective control of rodents in and around poultry facilities involves a four step process:

1. sanitation,
2. rodent-proof construction,
3. population reduction, and
4. evaluation.

The first two steps are useful as preventive measures but have only limited practical value for most commercial facilities. When a rodent infestation exists, population reduction is usually necessary. And in most cases, the use of poison baits comprise the majority of practical rodent control programs for poultry facilities, although trapping can be a valuable supplement to baiting programs.

1. Sanitation

Once rodents become established inside poultry houses, it is for the most part impractical to attempt to eliminate their food source. And, because the rodents commonly utilize the walls, ceilings, ground, and poultry manure for nest sites, it is also difficult to eliminate indoor rodent harborage. *But sanitation efforts immediately outside a poultry house will prevent serious infestations.*

Therefore, the following are recommended:

- Keep all outside feed bins in good repair. Any grain spillage which occurs during grain delivery or from a broken bin should be cleaned up quickly.
- Eliminate any outside debris such as old equipment, old boards, etc., that rodents can use for hiding or nesting.

Weeds provide rodents with food, water, nesting material, and cover from predators. Eliminate weeds from the exterior of poultry houses and maintain an uncluttered 3-foot weed-free perimeter around the building. This will also allow for quick detection of any new rodent burrows.

- Rats are discouraged from burrowing near building foundations when a perimeter strip of heavy gravel is present. Gravel should be at least 1 in. in diameter and laid in a band at least 2 ft. wide and 1/2 ft. deep.

2. Rodent-Proof Construction

A lasting form of rodent control is to “build them out” by eliminating all openings through which rodents can enter a poultry building. In most cases, it is often cost prohibitive to make a commercial poultry facility rodent-proof. Nevertheless, rodent proofing should be implemented in all areas where it is possible. *All types of grain storage can, and must be made rodent proof.*

The paired front (incisor) teeth of rats and mice curve slightly inward. This makes it difficult for them to gnaw into flat, hard surfaces. But when given a rough surface or an edge to bite into, they can quickly gnaw through most materials. To close openings or protect other areas subject to gnawing, use materials such as those listed in Table 2. Close openings around augers, pipes and wires where they enter structures with Portland cement mortar, masonry, or metal collars. Plastic sheathing, wood, rubber, green cement, or other gnawable materials are not adequate for sealing openings used by rodents. Stuffing steel wool into openings only provides a temporary plug.

Table 2. Recommended Materials for Rodent-Proofing

| Material | Comments |
|--|--|
| Concrete | Minimum thickness of 2 inches if reinforced, or 3-3/4 inch if not reinforced |
| Galvanized Sheet Metal for Door Flashing | 24 gauge or heavier. Performed sheet metal grills should be 14 gauge. |
| Brick | 3-3/4 inch thick with joints filled with mortar. |
| Hardware Cloth (wire mesh) | 19 gauge 1/2 x 1/2 inch mesh to exclude rats 24 gauge 1/4 x 1/4 inch mesh to exclude rats |

A common entry point for mice into buildings is the unprotected end of corrugated metal siding. If not blocked with metal or mortar, these openings provide access into wall spaces and the building interior. Rubber or vinyl weather stops are quickly gnawed through. Design or modify buildings using metal siding so these openings are not present.

Doors, windows, and screens should fit tightly. Mice can be deterred from entering below doors by installing anti-pest tension strips or door sweeps. It might be necessary to cover the edges with metal to prevent gnawing. Where rodent proofing isn't practical, poultry managers should give more attention to the other techniques of rodent control.

3. Population Reduction

Reduction of rodent populations can be achieved via trapping and the use of poison baits.

TRAPPING RODENTS

Trapping is an effective, quick, and economical control approach to supplement baiting programs. Traps can be used in place of baits when there are only a few rodents present, or in situations where baits may pose a hazard.

a. Snap Traps

The simple, inexpensive rat and mouse snap traps are very effective when used properly. In severe or persistent infestations, traps are too time-consuming to be used as the sole method of control. But traps are often the best method of controlling the last few rodents of a baiting campaign or for rodents that don't respond to bait.

TIPS FOR EFFECTIVE TRAPPING:

- Expanded trigger “professional models” traps are more effective than the standard 4-way trap.
- Set traps close to walls, behind objects, in dark corners, and in places where rodent activity is evident such as on ledges or on top of pallets of stored materials.
- Where possible, place snap traps so that rodents will pass directly over the trigger as they follow their natural course of travel, usually close to a wall.
- For rats, a small piece of bacon or hot dog tied securely to the trigger is an effective bait. Peanut butter is an effective bait for mice.
- Set traps so that the trigger is approximately half way between the most upright position and the trap base.
- When trapping rats, leave traps baited but unset until the bait has been taken at least once to reduce the chance of creating trap-shy rats.
- Use enough traps to make the campaign short and decisive.
- Mice do not venture far from their shelter and food supply, so space snap traps 6-8 feet apart for mice and 10-15 feet apart for rats in areas where the rodents are active.

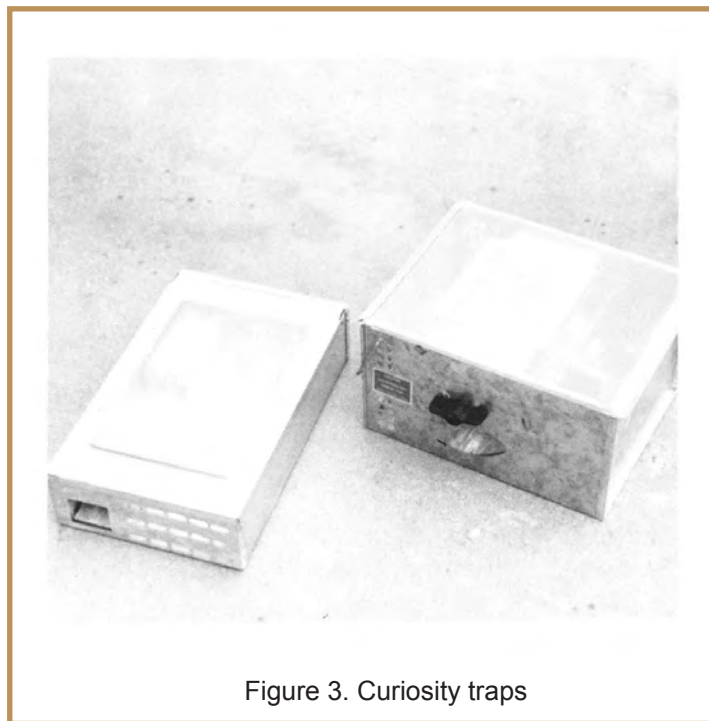


Figure 3. Curiosity traps

b. Multiple-Capture Live Traps

Multiple-Capture Live Traps (also called “curiosity traps”), such as the Ketch-All™, Mouse Master™, Tin Cat™, and Kwik-Katch™ are very effective and useful as a supplemental method for controlling mice in commercial poultry facilities (Figure 3). Some models require winding; others work on a trap door principal. One model has a low profile enabling it to fit easily below pallets, storage items and tables.

Multiple catch traps can capture up to a dozen or more mice each evening. Mice readily enter these traps when placed in their activity areas because they are responding to burrow-shaped openings, and they respond by investigating the potential burrow. These traps do not require bait to be effective.

A dozen (or several dozen in large facilities which have persistent mouse problems) of these traps placed in strategic locations can capture many mice, and thus help prevent mouse infestations from becoming severe.

Place curiosity traps at the following locations:

- Flanking the inside of all doorways,
- At all openings where utility lines enter,
- In areas where it may not be safe or legal to place poison baits (e.g., egg processing areas, feed and drug supply rooms, etc.)
- In any area where mice appear to be especially persistent and numerous. The traps can be placed both inside and outside of the facility in the above areas.

Curiosity traps should be serviced on a weekly basis or more often. For best results, maintain a map and capture log for each trap and location. In this way, the poultry manager can identify the areas of greatest mouse activity. Control efforts (i.e., adding more traps or bait placements) can then be intensified at those specific areas. Curiosity traps are available from suppliers and distributors of pest control supplies.

c. Glue Boards

Glue boards are another type of rodent trap. Glue boards catch and hold rodents attempting to cross them in much the same way flypaper catches flies. Glue boards are most effective when placed along walls where rodents travel. They are more effective for capturing mice than rats.

Glue board traps are an alternative type of rodent trap—not necessarily a more effective trap. Over the long run, they are more expensive to use than the standard snap or curiosity trap. Moreover, unless they are covered, glue boards lose their effectiveness in dusty and damp areas. Extremes of heat or cold also reduce their effectiveness.

Care must be taken when using glue boards, because any animal or object coming in contact with a board will stick tenaciously to it. As a general precaution, do not use glue boards where poultry, pets, children, or desirable wildlife may have accidental contact with them. Should this happen, the best method of removing glue boards for a nontarget animal is by using common cooking oil.

POISON BAITS (RODENTICIDES)

There are many different types of poison baits on the market, and selecting the right bait for the right job can be confusing to the poultry manager. Some persons highly knowledgeable in rodent control prefer to mix their own baits using rodenticide concentrates. But in most situations, ready-to-use use commercial baits are preferred, because they have proven effectiveness and do not require the applicator to handle a concentrated toxicant, which can be hazardous.

Rodenticides are of two broad chemical groups: anticoagulants and non-anticoagulants. These are listed in Table 3.

a. Anticoagulant Baits

Anticoagulant rodenticides cause death as a result of internal bleeding which occurs as the animal's blood loses its clotting ability and capillaries are destroyed. The active ingredients are used at very low levels, and bait shyness does not occur. All anticoagulant rodenticides are relatively slow-acting; death of the rodent usually occurs 3 to 5 days following the ingestion of a lethal amount of bait.

Some of the anticoagulant baits such as *warfarin*, *diphacinone*, and *chlorophacinone* are "multiple-dose" poisons; that is, they cause death **only** after they are eaten for several days in succession by the rodent. Thus, these baits must be available continuously until the rodent ingests

Table 3. Common Rodenticide Baits Used in Poultry Facilities

| Active Ingredients | Examples of Trade Name | Formulation Available | Dose Required to Kill/Comments |
|----------------------------|--|--|---|
| ANTICOAGULANTS | | | |
| Brodifacoum | Jaguar, D-Con, Final, Ropax, Bar-Bait, Havoc, Others | Loose Pellets (bulk), Bait blocks, Place packs | Single dose; kills warfarin resistant rodents |
| Bromadiolone | Confrac, Boothill, Hawk, Trax-one, Just One Bite, Maki, Others | Loose Pellets (bulk), Bait blocks, Place packs | Single dose; kills warfarin resistant rodents |
| Diphacinone | Ramik, Green, Confrac-D, Di-trac, Trap-n-a-Sak, Others | Pellets, Bait packs, Bait blocks | Diphacinone may cause death in rats occasionally after only one feeding, but 2-4 multiple feedings is usually required |
| Difethialone | Generation | Pellets, Bait packs | Single dose; kills warfarin resistant rodents |
| Pival | Confrac-P, Parakakes | Bait packs, Bulk packages, Bait blocks | |
| Warfarin | Ferret, Confrac | Bulk pails, Place packs, 50 lb. bulk | Warfarin and pival must be ingested in repeated doses over 4-10 days for rats, sometimes longer for mice. Genetic resistance developed in some locations. |
| NON-ANTICOAGULANTS* | | | |
| Bromethalin | Assault, Fastrac, Trounce, Vengeance, Others | Loose pellets (bulk), Place-packs, Bait blocks | Single dose; Stop-feed action; kills warfarin resistant rodents. |
| Cholecalciferol | Rampage, Quintex | Place packs (meal, pellets and canary seed) | One-three feedings are lethal. Kills warfarin resistant rodents. |
| Zinc Phosphide | Many brands | Pellets and mixed grains | Single dose (acute) bait Quick kill results; some rodents may become bait shy to zinc phosphide. |

* Rodenticides such as strychnine, ANTU, and phosphorus are registered and available in some states, although they are rarely used today because of limited availability and high toxicity. To simplify information, trade names of some products have been used. No endorsement of named products is intended, nor is criticism implied to similar products not mentioned.

enough doses (with warfarin baits, it may require as many as ten feedings) for death to occur.

Some of the newer anticoagulants such as brodifacoum, bromadiolon, and difetnalone, however, are exceptions, as these rodenticides can cause death following only one feeding (although the rodent may continue to live and feed for 3-5 more days). Thus, these anticoagulants are often referred to as “single-dose” anticoagulants. Single-dose anticoagulants are especially useful in poultry and other livestock facilities because rodents have plenty of food alternatives. Often times, mice may not visit a poison bait placement more than once or twice before returning to feed on the available poultry feed. Moreover, some populations of rodents have become resistant to some of the multiple-dose anticoagulants. Resistant rodents can be controlled by using one of the single-dose anticoagulants or one of the non-anticoagulant baits.

b. Non-Anticoagulant Baits

The two most common non-anticoagulant baits are: 1) bromethalin and 2) cholecalciferol.

Bromethalin kills rodents by disrupting the energy production within the cells of the body. Eventually, this results in a decrease in nerve impulses, paralysis and death. A single dose of bait is usually lethal within 1 to 3 days. Rodents stop feeding on bromethalin after they have consumed a lethal dose. Thus, only relatively small amounts of this bait need to be available.

Cholecalciferol is actually vitamin D3. In massive doses this compound is toxic—especially to rodents. And because of their small size, rodents succumb to relatively small amounts. Cholecalciferol will act as a single-dose poison if a sufficient amount is consumed by a rodent in one feeding,

but it will act as a multiple-dose poison if consumed in lesser amounts over several days. Because both bromethalin's and cholecalciferol's modes of action are completely different from that of the anticoagulants, they are effective against anticoagulant-resistant rodents.

Zinc phosphide is a rat and mouse poison which has been used for many years. It is a blackish powder with a distinctive garlic-like odor that is said to be attractive to rats and mice but generally unattractive to people and pets. It is available as ready-made commercial baits. Zinc phosphide is used to a much lesser extent due to the increased effectiveness of the new anticoagulants and non-anticoagulant baits, but it is still an effective bait, and can provide quick knock down of rodent populations. Some rodents may become bait shy to zinc phosphide, however, should they receive a sub-lethal dose.

BAIT FORMULATIONS

Most brands of bait are available in several formulations. Formulations used for livestock baiting programs include *pellets*, *cereal meal*, *seeds*, *wax blocks*, and *packet-style*. Common examples are illustrated in Figure 4. (Other formulations such as liquid baits and poisonous tracking powders are occasionally used by professional exterminators.)

When purchasing baits, it is wise to buy some of each type of formulation because some are better suited for certain areas of the poultry facility than others. For example, the wax blocks and packet baits offer a convenient and quick method for direct baiting of burrows in the ground, walls, or for baiting in hard-to-reach areas such as attics. The wax blocks are also useful in damp locations where the meal or pellet baits would spoil quickly.



Figure 4. Three useful bait formulations for poultry facilities. From l-r: bulk pellets, wax blocks, and packet-style. Each formulation has specific applications in a facility.

The pelletized and meal formulations of baits are more appropriate for areas of the facility that require many bait placements, or when using container baiting methods as described below. Furthermore, bulk quantities of loose pellet baits or meal baits are a more economical formulation (providing they are not overused) for large scale baiting compared to using hundreds of the packet baits (although bulk baits do not provide the convenience of packet baits or bait blocks). Although pelletized and meal baits are about equally attractive to rodents, meal formulations tend to spoil more rapidly than pellet baits.

BAIT CONTAINERS

There are several different types of rodenticide bait containers (also called bait boxes or bait stations). Some are more effective and/or appropriate for use in one type of poultry operation than another or within certain areas of a poultry facility (e.g., indoor baiting vs. outdoor baiting). See Table 4.

Placing baits in containers offers several advantages over placing baits out in the open:

- Containers keep baits fresh by protecting them from dirt, dust, poultry manure, rain or snow. This is important, as rodents are less likely to feed on dirty, moldy, or contaminated bait.
- Containers allow you to monitor bait consumption.
- Containers reduce the chances of accidental poisoning of livestock, pets, and non-target wildlife.

| Table 4. Examples of Commercial Rodent Bait Containers Available for Use in Poultry Facilities | | | |
|---|---|--|------------------------|
| Container Material | Example | Distributor and/or Manufacturer | Areas for Use |
| NON-TAMPER PROOF CONTAINERS | | | |
| Cardboard | Victor™ Professional (rat and mouse size) | Woodstream Corp. | Indoors only, Pit area |
| Plastic | Rodent baiters, Safe-Tee Plastic Bait Station | Motomco Co., J. T. Eaton Co. | Indoors |
| TAMPER-PROOF CONTAINERS | | | |
| Heavy Duty Molded Plastic | T. P. 906 (mouse size) | J. T. Eaton Co. | Indoors, Outdoors |
| | T. P. 903 (rat size) | J. T. Eaton Co. | Indoors, Outdoors |
| | Protecta | Motomco Co. | Indoors, Outdoors |
| | Tube baiter | Nitragen Co. | Indoors, Outdoors |
| Heavy Duty Galvanized Metal | 910 TPR Metal Bait Station | J. T. Eaton Co. | Indoors, Outdoors |

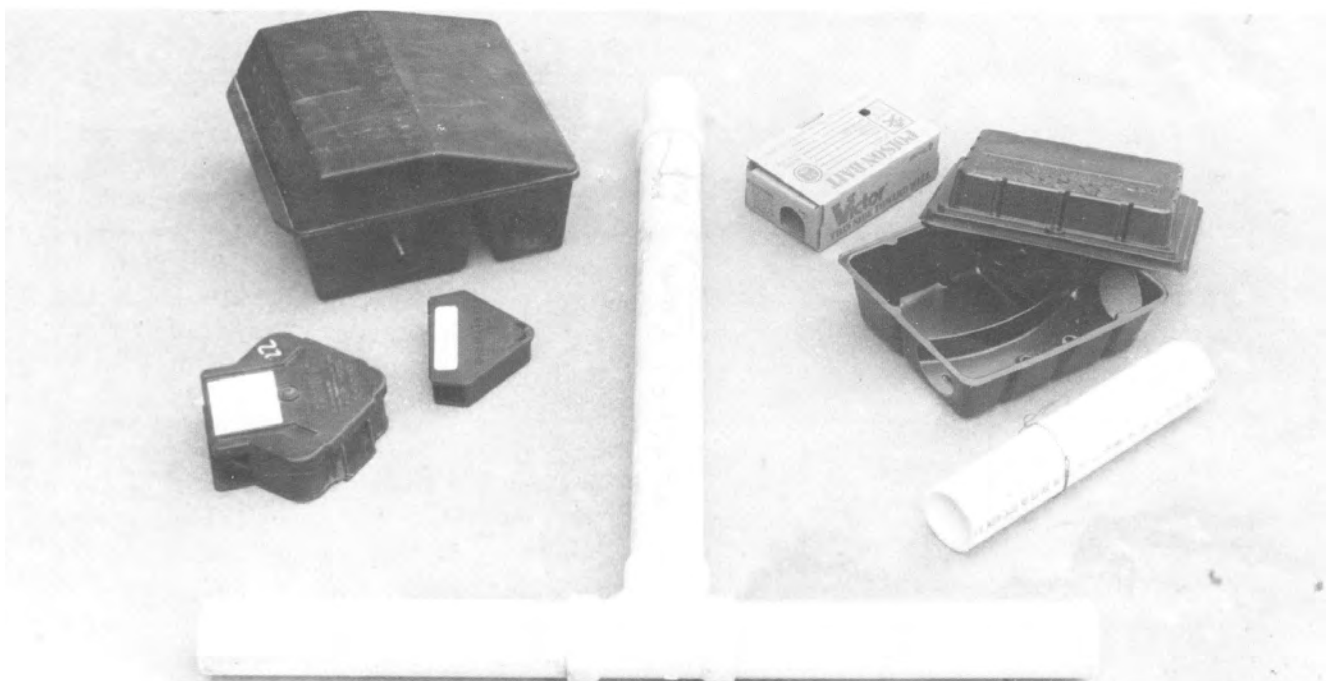


Figure 5. Examples of bait containers for poultry facilities. The smaller stations are designed for mice. The larger stations for both rats and mice. PVC plumbing pipes can be used to make homemade stations. The small cardboard station (top right) is an economical station for baiting in pits.

Bait containers can be homemade or purchased from pest control supply distributors. Some commercial containers are made of very durable materials (e.g., metal, or molded plastics) and are designed for long term and repeated uses either indoors or outdoors (Figure 5). Other, non-durable commercial bait stations are made of cardboard or thin plastic and are designed for short term use and only indoor baiting efforts.

Homemade containers can be constructed from lengths of metal or plastic PVC pipes (12-24 inch length), wooden boxes, or large cans. Even nailing a board on a slant up against a wall and placing baits behind the board will provide an effective bait station for certain situations. Containers should be large enough to accommodate several rodents at one time and should have at least two rodent-size openings (1.5 inches for mice; 2.5 inches for rats).

If bait containers are to be placed among or near free-roaming poultry, they should not allow poultry any access to the bait and be sturdy enough to withstand any occasional poultry contact. They should also be heavy enough not to be easily knocked over or blown over by the wind. Some commercial bait boxes offer such features, and they are classified as “tamper-resistant” bait boxes.

In situations where baits may attract children, pets, wildlife and other non-target animals, rodenticide bait must be placed within tamper-resistant boxes and be secured to walls or the ground.

A "HOW-TO" GUIDE FOR USING BAITS AND BAIT CONTAINERS IN POULTRY FACILITIES

It first must be stressed that rodents will not travel far from their normal activity areas to locate baits. The key to success in controlling rodents with baits is placing the baits where the rodents will repeatedly encounter the bait. *In other words, you must bring the bait to the rodents!*

Such areas include:

- 1) in or close to rodent burrows;
- 2) at or near the rodent's regular feeding sites; and/or
- 3) in pathways between the rodent's nests and their food source.

A good baiting program for poultry facilities involves placing bait *directly* into rodent burrows and harborage where possible, and *using bait containers* to place baits in various rodent pathways inside and outside the facility.

If the rodent problem is minor, such as a few rats living in ground burrows, then the direct placement of baits into the burrows will usually solve the problem. However, when the problem is more serious, rodents (especially mice) tend to distribute their populations throughout poultry facilities. For example, some rodents may live outside in burrows, some inside in dry poultry manure, and others within the insulation of the walls and attics. In cases of moderate or severe infestation, a combination of direct placement of baits and the use of bait containers is usually the best approach to achieve quick, effective, and economical control.

The inspection of the premises at dusk or very early morning will help to determine the severity and extent of the rodent infestation and provide an estimate of the amount of bait and labor needed to control the rodents.

Some baiting principals and procedures are essentially the same for all poultry facilities. However, due to differences in building construction and operations among the different types of poultry facilities, some procedures differ significantly from one type of poultry facility to another. The use and type of bait containers appropriate for turkey operations, for example, may be different from that used in egg-layer facilities.

Part I of the following discussion presents a step-by-step approach for using baits and bait containers in all poultry facilities. Part II provides tips for controlling rodents in each type of poultry facility.

PART I. GENERAL BAITING PROCEDURES FOR ALL POULTRY FACILITIES

1. Inspect and Bait Outdoor Rat Burrows

Inspect the exterior of the building and grounds for rat burrows. (If rats have not been observed around the facility, proceed to step 3).

If rat burrows are found they can be baited by placing bait containers near the burrows, or by placing bait blocks or packet style baits directly into the burrows. Before baiting, however, a quick survey should first be conducted to determine which rat burrows are active (in this way, you will not waste time and bait by baiting old and inactive burrows). To do this, close all burrows by filling the burrow opening with dirt or crumpled newspaper. Inspect all burrows the following day for re-opened (i.e., active) burrows.

- Bait all active burrows with one or more bait blocks or bait packets (or use the quantity per label instructions) per opening. A few ounces of loose pellet bait

can also be placed down into the burrow using a ladle or a long handle spoon. Do not cave in the burrows after baiting!

- Repeat the baiting procedure daily in those burrows where the bait is consumed, but do not rebait any burrows where bait has not been taken or some bait remains.
- After ten days, fill in all burrows as described above. Inspect for re-opened burrows the following day, and bait any remaining active burrows.
- Continue to monitor and bait ground burrows as needed for three weeks or until all burrowing activity stops.
- When baiting burrows, never place baits directly out on the ground where they will be exposed to children, pets, poultry, other livestock or wildlife. To more accurately monitor bait consumption, and save on bait usage, it may be easier to use outdoor bait containers placed next to or near active burrows. Containers will also reduce the hazard of placing baits outdoors where dogs, livestock or other non-target animals may have access to them. Use bait containers which are classified as “tamper proof” (Table 3) or homemade stations that are heavy enough to prevent damage by dogs or wildlife.

2. Inspect and Bait Indoor Rat Burrows

Indoors, inspect all wall, floor and manure areas for rat burrows. Rats in these areas can be controlled by placing bait blocks and/or packet style baits directly into their nests in walls, ceilings, and manure.

- Place blocks or packet per label instructions, check daily and replace any bait which is entirely consumed.
- If baits cannot be directly placed into rat burrows, or if direct placement of baits may pose a hazard to non-target animals, baits can be placed inside rat-size bait containers and placed near the rat activity area. Follow label directions for the amount of bait to place inside the bait container and replace as needed.

3. Bait Ceiling Voids and Attics For Rats or Mice

Rodents often utilize insulated ceiling for harborage during the cooler months (October – April). Therefore, insulated ceiling/attic areas must also be baited – especially in severe infestations. If they are not baited, the rodents living in these areas will continually replace those rodents killed by your baiting program at floor level.

- Ceilings can be baited by using packet style baits or block formulations as these provide the convenience needed for distributing baits in hard-to-reach areas.

- In accessible attic spaces, baits should be placed on both sides of the center beam every 8-10 feet for mouse infestations, and every 25-50 feet for rat infestations, in those areas showing activity (e.g., burrows within the insulation, droppings, etc.).
- Use the closer spacing for severe infestations and bait the entire attic.
- If the packet formulation is used, punch a small hole or two into the packet prior to placement to increase acceptance.
- Check ceiling baits weekly by inspecting with a flashlight. Replace those baits which are entirely consumed.
- In many parts of the United States there is less need to bait attics during the months of June-September as attic areas are usually excessively warm and unattractive to rodents.
- If rats are active along rafters, or in shrubbery or tree canopies (i.e., roof rats), bait blocks can be placed using wire to secure the baits to ceiling rafters, ledges, on shelves, or in trees (follow label directions).

4. Use Traps to Control Rodents in Coolers, Storage Areas, Poultry and Egg Processing Areas

To control rodents in these areas, baits can be used, but affected rodents may die inside an egg carton or other items scheduled for delivery, or used for processing of poultry. It is also possible rodenticide baits may inadvertently be spilled into a food produce or carton, or the rodents themselves may carry and drop the bait in areas or items which may pose a contamination hazard. Thus, rodents in these areas can be controlled using traps such as the multiple catch traps for mice, or snap traps for rats or mice (refer to trapping discussion).

PART II. RODENT BAITING FOR SPECIFIC POULTRY FACILITIES

1. High Rise Egg Layer and Pullet Facilities

Rodents can be controlled in high rise facilities by: 1) hand baiting wall areas and cage support beams; and, 2) using bait containers to supplement hand baiting. Much of the discussion below is also represented in Figures 6-8.

When baiting for mice, it is important to recall that mice are sporadic and nervous feeders. They feed at many locations each evening nibbling tiny bits of food here and there. For baits to be most effective, mice should have the opportunity to find baits at several different places within their territories. Therefore, the key to controlling mice is to provide many bait placements, each containing small amounts of bait.

- In houses which have wall girts supporting insulation batting, mice often used the wall girts as runways from their nests in the walls to travel to the

feed troughs and walkways. Often they hide, rest, and feed behind the support poles. Pelletized baits (use the bulk formulation for ease of use and economy) can be placed every eight feet at each wall girt support pole intersection from the pit area up to the girting nearest the ceiling. With the single-dose baits (e.g., brodifacoum, bromadiolone, bromethalin) only small amounts (1-2 tsp.) of baits need be placed. Multiple dose baits will require considerably more bait (refer to label directions of the bait you are using).

- The use of packet baits or block baits is not recommended for ledge and wall baiting as the rodents often knock the entire packet or block off the wall resulting in waste of bait as well as a contamination of crop fields or other areas with rodenticide packets when the manure is removed.
- Mice in high-rise facilities commonly nest in the dry manure which accumulates on the support beams underneath the cages. They travel from their nests along the beams to the troughs and walkways for

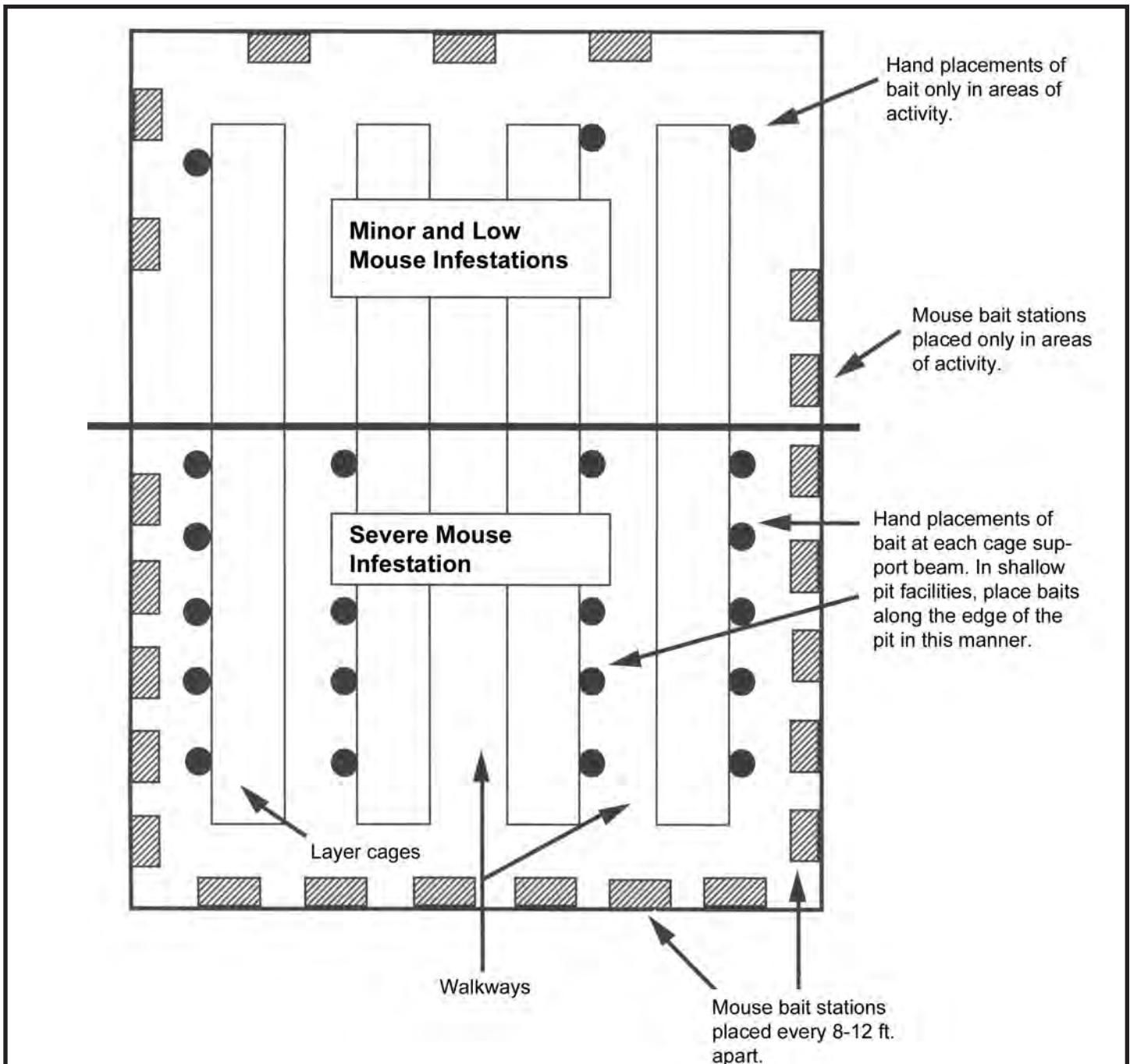


Figure 6. Aerial view of a floor-level baiting program for mice in an imaginary egg layer facility. For maintenance baiting the rotation baiting method can also be used as shown in Figure 8. Refer to Figure 7 for bait placement involving the walls, pit, and attic areas.

food. Thus, small quantities of baits can be placed on each cage support beam at the base of the walkway. (In severe infestations, the entire length of the house may need to be baited in this fashion.)

- Walkway areas at the front and rear of the house must also be baited with permanent bait containers at 8-12 ft. intervals for mice and 25-50 ft. intervals for rats.
- Checked bait placements weekly at the beginning of the control program. Replace bait in only those areas and/or containers in which bait has been entirely consumed.

- Always replace bait which becomes damp, dusty, spoiled, or stale as rodents will not accept foul-tasting baits.
- Once control is achieved, check and replenish baits on a bi-weekly basis. For minor infestations, an entire poultry house need not be baited. Baits can be placed out in only those areas where rodents are active, persistent, or likely to enter. An inspection of wall girts, cage supports, and walkways on a weekly basis for fresh mouse droppings will identify where baits should be placed (be sure to sweep away all old rodent droppings). Also, place several additional bait containers on all sides beyond the infested area.

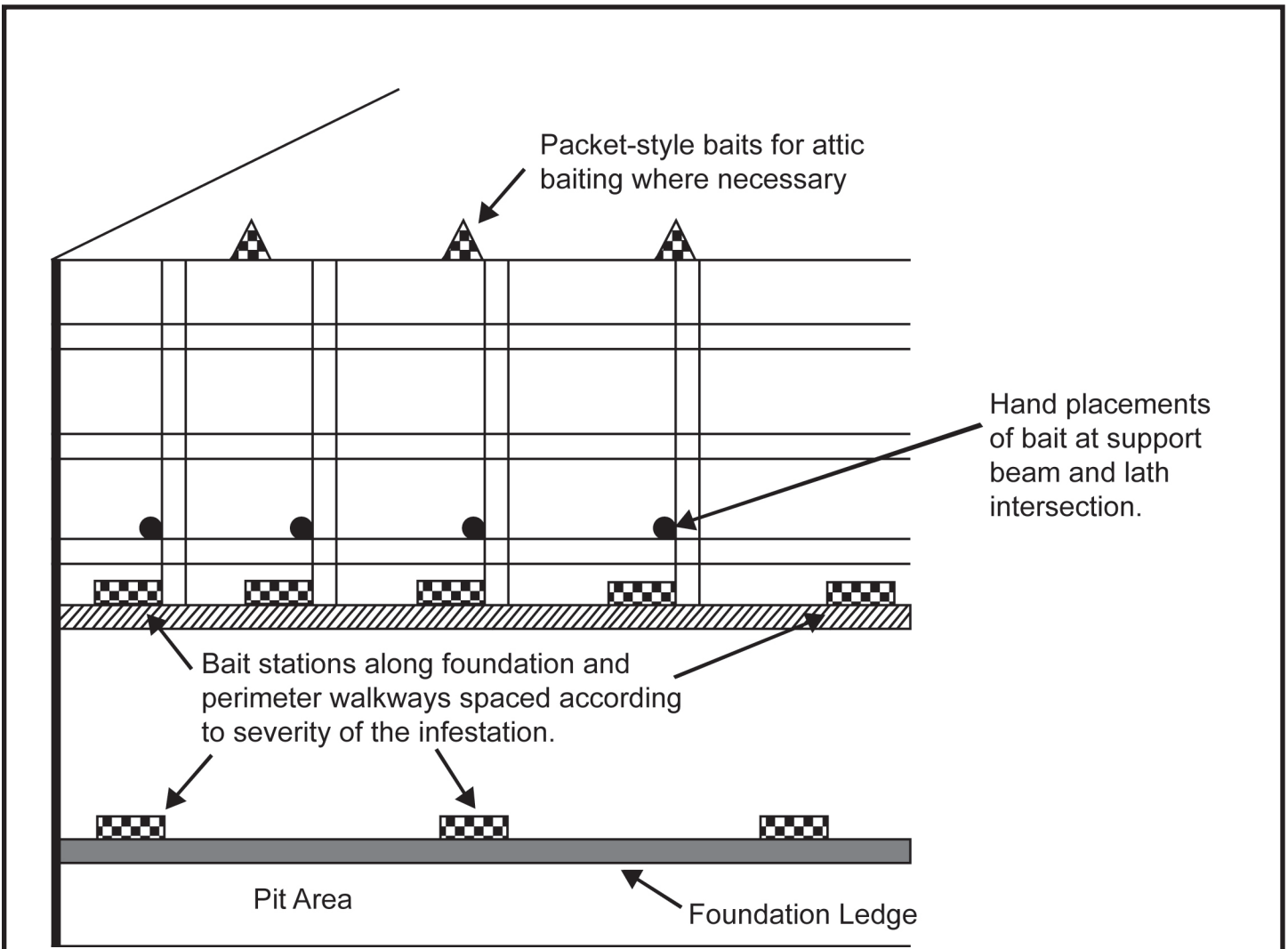


Figure 7. Sideview of a baiting program for mice inside a high rise egg layer facility. For severe mouse infestations, stations need to be placed every 8-12 feet until control is achieved. In minor and low infestations, baiting can be concentrated at only those areas of mouse activity or the rotational baiting method can be used as shown in Figure 8.

BAITING THE PIT AREA

Rodents often nest in the dry manure in pits of high rise facilities and travel up wooden support beams to gain access to the feed troughs and walkways. But unless the infestation is severe, the entire pit need not be baited.

- Walk the pit on a regular basis, inspect for rodent burrows, and place baits in plastic containers (homemade or available in bulk quantities from pest control supplies distributors) directly next to active burrows.
- Some poultry managers use Styrofoam egg cartons for bait containers for the pit area. However, rodents tend to gnaw into these cartons to use the Styrofoam as nesting materials. Thus, the bait usually gets spilled and wasted. Thin plastic bait containers are more suitable.
- Inspect the containers weekly and replace consumed baits. Remove those containers which become wet or do not show any activity, and cave in the associated inactive rodent burrow.
- If the facility has a foundation ledge, then bait containers should be permanently maintained on the foundation wall ledge at 8-12 ft. intervals for mice and 25-50 ft. intervals for rats in areas showing rodent activity (use the closer spacing for severe infestations).

ROTATIONAL BAITING

A practical technique for maintenance baiting of rodents in high-rise and other poultry facilities involves the use of a rotating bait container method (Figure 8).

This method eliminates the need for many bait containers and the labor required to place out, pick up, and bait each container.

Rotation baiting involves placing eight to ten bait containers (either the pvc tubes or the rat-size bait containers)

containing 1-2 lbs. If baiting (use only the single-dose baits) spaced 100 ft. apart along the building perimeter walkways. These containers are then rotated around the house perimeter every third day in 8' increments (e.g., placed at each support pole).

The rotation baiting method is most effective in controlling minor and low infestations of mice, or as a maintenance program. It should not be used for the initial knockdown of the rodent population.

1. Single-Story and Shallow-Pit Egg-layer Operations

- Baiting single-story and shallow-pit egg-layer operations is similar in principle to high rise facilities. In these facilities, however, rodents often extensively use the manure and the ground below the manure and walkways for harborage.
- In severe infestations, rodents may become established in the manure pit throughout the entire length of the house. Bait placements often have to be made on walkways (or within all dry pits which are harboring rodents) in addition to all perimeter wall and ceiling baiting as described for high rise facilities.
- For severe infestations, the entire length of the house should be baited. Plastic bait stations containing 1/4 to 2 ounces of bait (or per label directions) can be placed every 8' to 12' for mice and every 15'-25' for rats, (use the shorter distances for severe infestations) at the edge of the slab walkway directly in the pit (if the pit is dry), or if the pit is a wet/slurry pit, the baits can be placed on the edge of the walkway. Baits should be left in place for several days.
- It is helpful to mark in some manner (e.g., color marker pen) those bait stations which receive the greatest activity. In this way, the most heavily infested areas can receive the most attention. Likewise,

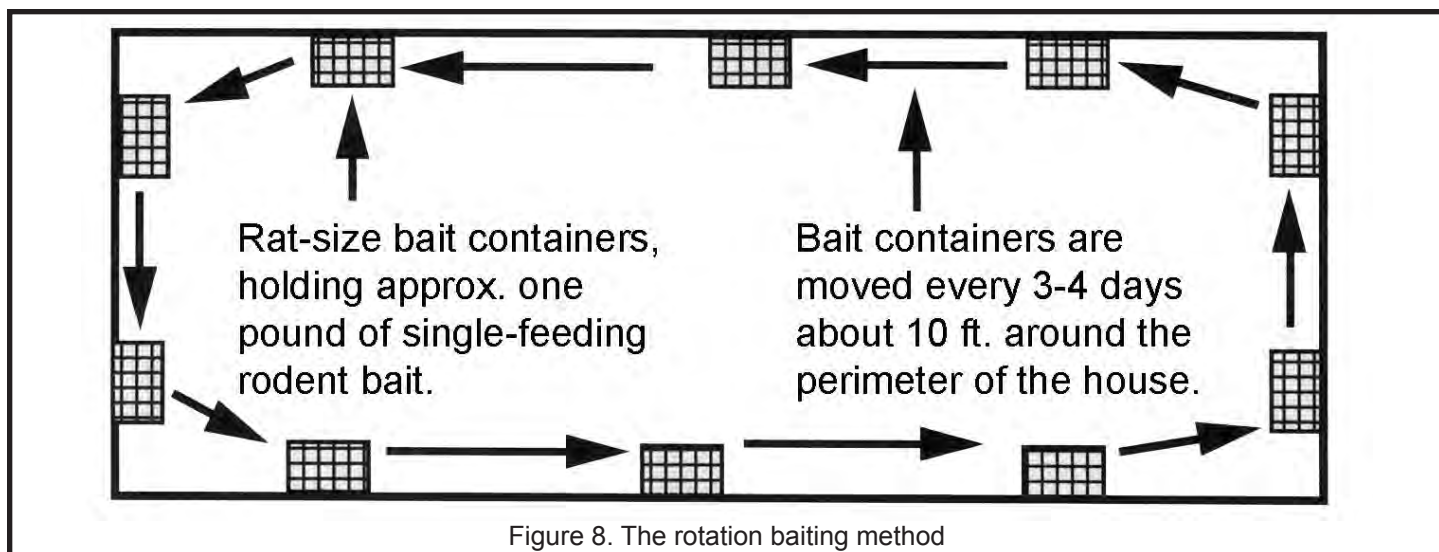


Figure 8. The rotation baiting method

those bait containers receiving little attention may be picked up or moved. Nighttime (dusk) or early morning inspections will also aid in revealing the areas of the facility with the greatest activity and serve as a guide as to where to concentrate the placements of bait.

- The rotation baiting method as described for high rise facilities can also be useful in shallow pit facilities. The bait containers can be placed along the edges of each walkway or in the dry pit below the cages, started at both ends of the house and moved 10' every three days towards the opposite end of the house (see Figure 8).

2. Turkey and Broiler Operations

The general principles of baiting as described for egg layer facilities are similar for turkey and broiler operations. For example, the amounts of bait to be used, the number of bait placements, and the distance between each placement are critical to success. Thus, the turkey and broiler manager should also review the previous discussion.

There are, however, some minor differences in rodent control procedures for turkey and broiler facilities due to the birds roaming free.

RODENT CONTROL DURING FLOCK TURNOVER

- Rodent control programs in turkey/broiler facilities are best accomplished during flock turnover. At this time, rodent baits can be administered without using any special precautions (other than those listed on the rodenticide label). Moreover, because the poultry feed has been removed during flock turnover, bait acceptance by the rodents will be enhanced.
- Because poultry will not be at risk during flock turnover, there is less need to use special enclosed bait containers.
- Various boxes can be improvised to make baiting trays or bait boxes. For example, iced broiler shipment boxes can be converted into temporary bait boxes by cutting a 1 1/2 inch hold at each end of the box, turning the box over, and placing the bait on the floor in the center of the box.
- Packet-style baits and/or wax block baits can be placed directly on ledges and/or nearby any indoor rodent burrows providing they are retrieved before installing the next flock, and non-target animals will not have access to bait.

RODENT CONTROL DURING NORMAL FLOCK OPERATIONS

Maintenance rodent control programs should also be constructed during normal flock operations because it is unlikely you will exterminate all the rodents during even the most thorough control program during flock turnovers – and any remaining rodents from the turnover program must be kept in check to prevent population rebounds.

- Rodent activity in confined turkey/broiler operations usually occurs along perimeter wall areas. Thus place baits out in these areas at distances and quantities already discussed and as recommended by product label directions.
- Because poultry are present, baits must be placed within tamper-resistant bait boxes (Table 3). Secure all bait containers to the ground using stakes or heavy weights to prevent any accidental spillage of bait.
- Homemade bait stations can be substituted for tamper-resistant bait boxes. For example, boards slanted on an angle can be temporarily nailed or affixed to the wall area, and long, narrow cardboard trays, boxes, or old poultry feed troughs (or sections of inexpensive rain guttering) containing bait can be slid behind the boards to create a long dark feeding area and runway along the wall/floor junction for rodents. The angle of the board should be sharp enough, and the bait placed deeply enough within the tunnel to deny poultry or other animals any access to the baits.

PART III. MAINTAINING CONTROL: ALL POULTRY FACILITIES

Once rodent control is achieved, it is important not to let your guard down and neglect the rodent control for a couple of months. This will ultimately result in “undoing” all the work it took to control the rodents initially.

Keep in mind that a few rodents are likely to survive even the most thorough control program. And, rodents from nearby fields or structures will immigrate to the poultry facility on a regular basis. New rodents will multiply quickly if not kept in check with an ongoing control program. For example, one scientific study showed a population of mice living around a farm, to increase from less than 50 to over 2000 mice in only 6 months! **Therefore, it is important to establish permanent bait stations around the outside perimeter and multiple catch traps in problem areas within the buildings. Exterior bait stations should flank any doors or utility openings which would allow rodents from field areas to enter the facility. Replace exterior baits at least every 4-6 weeks, or sooner if the baits become wet or rancid.** Fresh bait in the bait containers will control invading rodents before breeding populations become established.

Rodent control inspections and maintenance baiting/trapping programs must be a regular and continual part of a commercial poultry operation. After control has been achieved, make it a point to put aside an hour every other week to inspect the interior and exterior of the facility for fresh rodent signs. Check and empty all mouse traps, and refill all bait stations as needed with fresh bait. Mark it on the calendar.

PART IV. OTHER CONTROL APPROACHES

SOUND AND ELECTRONIC DEVICES

Although rodents are easily frightened by strange or unfamiliar noises, they quickly grow accustomed to regularly repeated sounds (and thus they are commonly found living in grain mills and factories with high sound levels). Ultra-sonic sounds – those above the range of human hearing – have not proven effective for controlling rodents around most structures.

CATS AND DOGS

Although cats, dogs, and other predators may kill a few rodents, they will not provide effective control of rodents in commercial poultry facilities. Moreover, cats and dogs around poultry facilities may pose an additional potential for disease transmission into the facility. It is also common to find flea infestations inside poultry houses which house one or more cats. Fleas from cats can multiply rapidly and will readily feed on poultry personnel, who may, in turn, transport fleas to their companion animals and homes.

PART V. SAFETY PRECAUTIONS

Certain general safety precautions should be followed in addition to those appearing on the labels of products. Most rodenticides present some degree of hazard to animals other than rodents. The anticoagulants and some non-anticoagulant rodenticides may present some hazard to predators or scavengers which feed on the carcasses of poisoned rodents. Therefore, keep baits out of the reach of poultry, dogs, cats, and wildlife. Handle rodent carcasses with rubber gloves, long tongs, or newspaper, and bury or incinerate all dead rodents. As an added safety precaution, keep any dogs or cats which have access to the poultry facility confined during any intensive baiting operations.

Label all outdoor bait containers clearly with appropriate warnings, and keep unused baits in their original containers. Store baits in a locked cabinet and post appropriate warnings on the outside of cabinet doors. Do not store baits with other chemicals, as they will absorb chemical odors, which will reduce the bait's effectiveness. Carefully follow label directions on all rodenticides. Remove and properly dispose of all uneaten bait at the end of the poisoning program.

READ AND FOLLOW ALL LABEL INSTRUCTIONS. THIS INCLUDES DIRECTIONS FOR USE, PRECAUTIONARY STATEMENTS (HAZARDS TO HUMANS, DOMESTIC ANIMALS, AND ENDANGERED SPECIES), ENVIRONMENTAL HAZARDS, RATES OF APPLICATION, NUMBER OF APPLICATIONS, REENTRY INTERVALS, HARVEST RESTRICTIONS, STORAGE AND DISPOSAL, AND ANY SPECIFIC WARNINGS AND/OR PRECAUTIONS FOR SAFE HANDLING OF THE PESTICIDES.

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