

PEST MANAGEMENT ON POULTRY FARMS

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Poultry pest management is a broad topic covering everything from A to Z and we would be hard pressed to provide an in-depth treatise on the subject in this space. Instead, we will cover the main points as we see it and provide you with some proven management techniques.

WHAT ARE THE POULTRY PESTS?

What is a pest? It is an unwanted organism in your environment. It may be unwanted because it spreads disease, reduces productivity of the birds, wastes feed, destroys the building, is a nuisance to neighbors or any number of other reasons. The major pests associated with poultry facilities are beetles, flies, lice, mites, wild birds and rodents.

Let us first identify the common insect pests. Under the heading *Ectoparasites* there are: The **fowl mites** which include northern fowl mite, chicken (red) mites, scalyleg mite and depluming mite. The chicken **lice** include chicken body louse, chicken head louse, chicken feather louse and turkey lice. We also have bed bugs, chiggers, sticktight flea, and fowl tick to think about.

In confined poultry houses a variety of insects and mites will be found in the manure and litter which come under the heading of **habitat pests**. These include Darkling beetles, Fleas, and of course Flies. There are many types of flies to be controlled, including House flies, the little house fly, soldier flies, the black garbage fly, fruit fly, blow flies, flesh flies and the small dung fly.

There are many species of wild birds that become pests, depending upon where your poultry operation is located. Some of the common bird pests are sparrows, finches, barn swallows, and waterfowl and pigeons.

The last major category of pest is the rodent family. These include rats and mice. Three common species are the Norway rat, Roof rat, and the House mouse.

PEST CONTROL

The goal of pest control is to reduce pests to an acceptable level. Total eradication is an unrealistic goal for most farms.

Integrated Pest Management (IPM) was developed to use all available management tactics or strategies to manage pests so an acceptable level of pest activity is achieved, economically, with

the least disruption to the environment.

IPM uses Cultural, Biological, Chemical and Mechanical methods to control pests. A systematic process of decision making must be followed in order to intelligently and effectively plan and carry out a pest management program. There are five (5) principle elements of this process: 1) Detection; 2) Identification; 3) Economic Significance; 4) Control Method Selection; and 5) Evaluation.

DETECTION

It is hard to overemphasize the importance of detecting pest infestations before they become a problem. Failure to do so will often result in increased cost of control, less effective or ineffective control measures and significant damage or loss. Proper detection requires frequent and careful monitoring, a knowledge of the common pests and an ability to recognize potential problems. The best monitoring methods rely on sampling devices arranged strategically around the facility. Visual appraisals are hard to quantify and can be misleading. However, due to the lack of standardized quantitative methods for all the poultry pests, beneficials and other environmental factors, visual appraisals must be used for many pest control decisions. Regular scouting (visual appraisals) to evaluate current pest problems or to discover new problems should be done daily, weekly or monthly depending upon the magnitude of the problem.

IDENTIFICATION

An organism should not be automatically classified as a pest until positive identification is made. Once identified, information about the pests' behavior and susceptibility to control methods can be obtained. Then an informed decision can be made on how and when to control the pest. There are several publications available through cooperative extension on the identification of common poultry pests. One good example is the publication *Poultry Pest Management* from the North Carolina Cooperative Extension Service.

ECONOMIC SIGNIFICANCE

Control of a particular pest should be considered only when it is believed that economic or social damage (complaining neighbors) will occur. Pests present in low numbers may have very little effect on yield or quality. Two factors that affect the economic decision making process are: 1) the economic injury level and, 2) the economic action threshold.

The *economic injury level* is the level of pest density at which the cost to control the pest is equal to the losses that the pest causes. We do not want to wait until the economic injury level is reached before we attempt to control a pest population, because at this point the damage has been done and you have now increased the cost of control. To prevent reaching the economic injury level the *economic action threshold* was developed. This is the level or density of a pest population where control measures are needed to prevent the pest from causing economic damage and the cost of prevention is less than the cost of potential damage. This, of course, varies with the pest and your particular enterprise.

METHOD SELECTION

Once a pest problem has been detected, identified and the economic and social implications understood, the appropriate method or combination of methods can be selected to achieve

effective, practical, economical and environmentally sound control.

The techniques available for control come under two main categories: Natural and Applied control methods.

Natural controls are those which check or destroy pests without dependence on humans. These include naturally occurring predators, parasites and pathogens; climatic factors (temperature, humidity, sunlight, rain); topographical features (urbanization, rivers, lakes, hills, woods, etc.). and

Applied control includes Cultural, Biological, Chemical, Mechanical, Physical and Legal control.

Cultural control is using good routine management practices to remove the incentive for a pest to choose your poultry facility to make a home for itself. The basic concepts here are cleanliness and sanitation.

OUTSIDE YOUR BUILDING

Remove all trash, and sources of feed and water for the pests from the outside perimeter of your building. Keep grass and weeds mowed to two inches or less, to prevent insect growth and hiding places for rats and mice. Plug all holes in the building (other than air inlets) larger than 1/4 inch to prevent mice and rats from entering. Seal all foundation cracks. Check to see that fan louvers are properly working and close completely when the fan is not running.

INSIDE YOUR BUILDING

Remove feed and water sources for rats and mice by fixing leaking feeders and manage water systems to prevent leaks. Sweep the walkways in cage layer facilities to remove spilled feed, and remove all piles of trash or other possible nesting sites. Basic manure management will prevent many problems. Moisture management, sanitation and manure removal are the keys to reducing pest problems in manure. Dry manure reduces the suitability for fly oviposition (egg laying) and larval development. It also provides a suitable habitat for beneficial predators and parasites.

Legal Control limits the development of pest populations by restricting human activities that may lead to pest problems, such as spreading manure, stockpiling manure, mandating setbacks, etc. This is accomplished by federal, state and local laws and regulations. These are usually a result of farmers not paying attention to the complaints from neighbors due to creeping urbanization and the perception by the public of a pest problem where one might not physically exist.

With the IPM approach in mind, we will now discuss common pest problems found in different types of poultry facilities and the IPM approach to control them.

ECTOPARASITES

The major ectoparasites of concern of chickens are: the northern fowl mite, chicken (red) mites,

chicken body louse, bed bug, chiggers, sticktight flea, scalyleg mite, depluming mite and fowl tick. To monitor ectoparasites, capture at least 20 birds at random and examine the vent areas for northern fowl mites or body louse infections. Mites will usually be seen as small, dark specks moving rapidly over the skin. Northern fowl mite egg masses appear as dirty grey areas at the base of the feathers. Lice are much larger, move more slowly and may be attached to the feathers. An average of more than one mite or louse per five birds is the economic threshold and indicates a need for treatment. If bites or lesions are clearly visible on more than two birds then bed bugs or chicken mites should be suspected. Examine nest box litter, curtain folds, cracks and crevices randomly throughout the house for eggs or other signs of pests. Moving specs indicate a problem and the need for treatment.

Only a few insecticides are available for control of ectoparasites but most of them are available in liquid, dust or wettable powder formulations. Permethrins and carbaryl (Sevin) are effective against northern fowl mites, chicken mites, chicken body lice, bed bugs and fowl ticks. Tetrachlorvinphos (Rabon), RaVap and nicotine sulfate (used as a surface treatment for slats) can also be used in controlling northern fowl mites and chicken body lice. Malathion is good for chiggers, sticktight fleas bed bugs and fowl ticks. Space sprays using DDVP (Vapona) may be used to control bed bugs. Since fowl mites, chicken body lice and other ectoparasites feed at or near the skin surface of the birds, it is essential that the pesticides come into contact with the feathers or skin of the birds. Select only those pesticides which are registered for use in your state. Do not use restricted-use pesticides unless you are licensed. Always read and follow pesticide label instructions. Contact your local extension agent if you have questions concerning pesticide use.

Evaluation of the effectiveness of your control program is just a continuation of your monitoring program.

FLY CONTROL

The fly cycle varies depending upon the species of fly and the temperature under which the pupa and larva develop. The life span of the house fly is 8 to 20 days under average summer conditions. It is therefore to your advantage to prevent optimum breeding conditions from existing on your farm.

Monitoring of fly populations is easily accomplished with the use of six to ten, 3x5 white index cards placed evenly throughout the facility. As the flies land on the card, they leave a black spec. As the fly population increases so does the number of specs. Depending on farm location an average of 20 to 50 specs per card per week usually indicates you have a fly problem. Inspect and change these cards once each week. Keeping them numbered and dated in a file is a good way to keep a record of the fly activity in your facility should legal reasons require you to substantiate the fly population in your facility. Fly traps may also be used as effective fly monitoring devices.

CAGE LAYER AND BREEDER FACILITIES

In stacked deck systems flies are generally not a problem when manure is removed daily. However, if the manure is improperly stockpiled it can attract flies and become a breeding area. To prevent a fly population from building up stockpiled manure should be covered and kept dry. High-rise, deep-pit and slatted floor systems are common throughout the country and can be a potential source of flies. Manure management is the key to fly control in these facilities. If dry manure conditions - less than 50% moisture - are maintained, manure will form a cone-shaped mound as it accumulates and only the fresh additions of manure at the peak of the cone will be suitable for fly breeding. Proper ventilation will help keep the manure dry. Although manure removal is often used as a fly-control method, the fly life-cycle must be broken for control efforts to be successful. Removal of manure full of fly larvae only moves the problem from inside the house to outside the building. Proper manure management reduces fly buildup and maximizes the development of beneficial parasite and predator populations. Fresh manure that accumulates within two days of clean-out is ideal for fly breeding and a severe fly outbreak may occur as soon as 5 - 6 days after cleaning during the fly season.

BIOLOGICAL CONTROL

Biological control can be an important aspect of fly control in production systems having prolonged accumulations of manure. A diverse population of fly predators and parasites should be developed in the manure. Beetle predators in the families Staphylinidae and Histeridae may be quite abundant in manure. The most common and abundant are histerids in the genus *Carcinops*, especially *C. pumilio*. These feed on fly eggs and first instar pupae and may consume 13 -24 house fly eggs per day, while the beetle larvae consume 2-3 eggs per day.

Mite predators of fly eggs and first-instar larvae are mostly species of the families Macrochelidae, Uropodidae and Parasitidae. Usually as the manure accumulates and ages the order of invasion by these mites is Parasitidae, Macrochelidae and lastly Uropodidae. The macrochelid mites are better known and are frequently very abundant in poultry manure. Most commonly found are *Macrocheles muscaedomesticae* and *Glyphtholaspis confusa* Foa. The mites are found on the outermost layer of manure, particularly at the peak.

Some hymenopterous parasites of the genera *Muscidifurax*, *Spalangia* and *Pachycrepoideus* of the family Pteromalidae are also found in poultry facilities. These parasitic wasps lay their eggs on the fly pupa within the puparium and the developing parasite larva consume the fly pupa. However, low numbers of these parasites are normally found and one must rely on the mass release of laboratory-reared parasites at specified intervals to become an effective control measure. Laboratory parasites must be released before a fly problem arises and have proper manure conditions to be effective.

Most producers should concentrate on conserving and building their native predator and parasite populations by using proper management techniques and by minimizing the use of insecticides, especially in manure storage areas.

CHEMICAL CONTROL

Chemical controls can be quite effective if used properly. However, improper timing and indiscriminate insecticide use may result in increased populations and resistance. Insecticide applications may be classified as adulticides and larvicides and by method of application such as sprays, baits and feed additives. There are six families of insecticides for use against flies and external parasites (Table 1.). The key to the use of insecticides is *rotation between families* on a regular basis to avoid resistance. To control adult flies residual surface sprays are usually the most effective and economical. For best results spray only where flies regularly rest. DO NOT indiscriminately treat all wall and ceiling surfaces. Check for fly specks on walls, ceilings, rafters, wires, etc. They indicate where flies rest and areas that should be treated. Residual spray materials include permethrin, fenvalerate, tetrachlorvinphos (Rabon) and Tetrachlorvinphos + dichlorvos (RaVap).

For quick knockdown of adult flies, fogs, mists and space sprays are effective. Houses should be sealed during treatment to ensure that the material effectively fills the house for the short time required to knock down adult flies. In warm weather, treat at night or early morning when closing houses would cause undue heat stress on the birds. Pesticides used for knockdown are not residual and must be used every few days to control fly outbreaks. This can become expensive if used for extended periods. Pesticides used for this include pyrethrins, dichlorvos, and naled.

Fly baits can be used to control adult flies when numbers are low and can be used in conjunction with residual sprays. It is best to place baits in some type of a container, such as a plastic one-gallon milk jug, with four 3" holes cut into the sides. An attractant plus bait works well. No less than one bait station per 1,000 square feet should be used. These bait stations may also be used as fly number monitoring devices. Some of the common baits are tetrachlorvinphos, methomyl and naled.

The last area of chemical control is larvicides. Most larvicides are broad-spectrum insecticides and may kill beneficial insects along with fly larvae, so care must be taken when using these insecticides to preserve the populations of beneficial insects. For best results spray only areas where large numbers of larvae are visible, especially in wet or fresh manure. The commonly used larvicides include tetrachlorvinphos, dimethoate and tetrachlorvinphos + dichlorvos.

Cyromazine (Larvadex) can be administered through the feed or as a liquid spray (2SL). Cyromazine is not harmful to the beneficial arthropods and parasites but resistance by the flies may develop when using larvadex continuously, as with all other insecticides.

MECHANICAL DEVICES

Electrocution devices are also available to kill flies. New technology has improved the efficiency of these devices and improved designs have made them more durable and able to withstand the poultry house environment.

Other mechanical devices include traps, sticky tapes and the old stand by - the fly swatter. These devices are of limited value if used alone when large infestations occur but baited traps using pheromone (muscamone) attractants are gaining popularity in areas where other insect control methods are undesirable. Traps must be placed both inside and outside of the facility to be effective. (See USDA ARS AIB # 673, *How to Control House and Stable Flies Without Using Pesticides* for plans and information on using traps.)

Some recent studies have shown the combination of electrocution devices along with traps have been effective in controlling fly populations.

MANURE MANAGEMENT

Proper manure management is the key to most fly control programs. Manure below 25% moisture and above 80% moisture will not support housefly breeding. So one method is to keep the manure dry to prevent fly breeding. Managing your water system is the first step to dry manure. Monitor water presser and keep it set to manufacturer specs. Replace worn valves, stems, nipples, gaskets and hoses to prevent leaks. Clean out the system by flushing regularly during clean out and during production. Removal of the manure every one to two days and stored in a lagoon or spread thinly on fields to dry will also prevent fly build up. Manure stored for longer periods, such as from high-rise or deep-pit facilities should be removed from the poultry house during cold weather, usually between November and March. Stockpiled manure should be covered with 6 ml plastic. Composting of manure will also kill the flies and larvae. Manure with infestations of pupae or larvae should be treated with pesticides prior to removal and spreading on fields or stockpiling. This will reduce the potential for moving the problem from inside the house to outside and then to neighbors. Recent research indicates that spreading manure containing fly larvae or pupae, even thinly on fields, or incorporating it into the soil immediately, may not kill all the larvae and pupae and will result in emergence of adult flies from the soil. Further research is required to verify these findings, but this may alter our previous thinking on manure management.

BEETLES ASSOCIATED WITH LITTER AND MANURE

Two species of beetles associated with poultry manure and litter accumulations are the lesser mealworm, or darkling beetle, *Alphitobius diaperinus*, a pest of stored grain products, and the hide beetle, *Dermestes maculatus*, long recognized as a pest of hides, skins and furs. Adults and larvae of both species can become extremely abundant in poultry manure and litter.

Both beetles can cause extensive damage as the mature larvae bore into structural materials, apparently seeking a safe pupation site. The lesser mealworm is also a vector (transmitter) and serves as a reservoir for several poultry disease pathogens such as acute leukosis (Marek's disease), fowl pox, numerous pathogenic *Escherichia coli* serotypes, several *Salmonella* species, and tapeworms. Large beetle populations may become a public nuisance at clean-out time because of adult migration from fields where the manure is spread into nearby residential areas.

As with flies, a combination of monitoring, cultural practices and insecticides is required to properly manage beetle infestations. The larvae are very active and burrow into litter when disturbed. They may also be found in cracks and crevices or feeding on the underside of bird carcasses. The pupae are often found in the lower, compressed layer of litter, dry manure or in the soil. The adults are very active and burrow into litter when disturbed. They are also found crawling on walls, in cracks and crevices and feeding on the underside of carcasses.

Less than 100 beetles or larvae scattered throughout the facility usually pose little threat, but continuous monitoring from the first week of the flock cycle until the birds are removed is required to limit infestations while the birds are in the house. Look for concentrations in the litter, on carcasses, on walls and in the insulation for signs of infestation. You can trap the beetles for counting with 2-inch-diameter PVC pipe. Use a 10-12" length with a roll of corrugated cardboard inside. Evenly distribute six traps between wall, feeder and brooder locations from one end of the house to the other. Remove the cardboard from the traps and count once a week. A rapid increase in numbers indicates the need to treat.

Cultural practices include cold weather (less than 30°F) and proper litter and manure handling. Remove litter and cake from the house as soon as possible after removing the birds. If applied to land, incorporate immediately and if composted, turn the compost several times to encourage multiple heatings to kill off adults and larvae.

Chemical control is effective only when used properly. No one chemical consistently controls beetles for more than one flock. Therefore, control is largely a matter of treatment timing and application method. Treatment should be year round. The most commonly used products include Sevin 80WP or SL, Rabon 50WP and RaVap for use as residual sprays and Sevin 5D and Rabon 3D as litter treatments. Sevin 10B can be used as a bait broadcast over the litter while the birds are housed. Vapona 1 OS and permethrin are registered for use as dusts, sprays or both. Since only one pesticide (Sevin bait) is registered for use while birds are present, timing of application is extremely important. The pesticides must be applied to the litter within 24-48 hours of bird removal, with a second treatment just prior to placement of birds. Insecticides applied to the walls and litter at this time will retain activity long enough to suppress beetles that escaped earlier treatments.

In high-rise and deep-pit layer houses the pesticides can be applied directly to the manure piles as needed and residual sprays should be applied to the walls and rafters to prevent the beetles from infesting the insulation.

RODENT CONTROL

Rodents, rats and mice, are not only a nuisance but spread disease and therefore must be controlled. The Norway Rat is the most common rat found around poultry farms. They usually live in burrows in the ground or under the foundation, in litter and under slats of a breeder house, under equipment, and in wood piles and other debris inside and outside the poultry house. They require water daily, and although they will eat most any food, they prefer fresh food. They are normally nocturnal and search for food just after sundown.

The house mouse will also eat most any type of food, but tend to feed throughout the day, sampling many items during the feeding period, but feeding the heaviest at sunset and dawn. House mice can live without free water, obtaining what they require from the moisture in their feed.

Both rats and mice can enter a hole large enough to pass their head through, as small as 1/4 inch, for mice.

In general rodents have three basic requirements: food, water and harborage. If one or more is missing, rodent populations will remain small.

Monitoring of the rodent population is important and is best done with cage type traps where you can count the number of rats or mice caught over a 24 hour period.

Three elements are essential for a good rodent control program: sanitation, rodent proofing and rodent killing. The first lines of defense are sanitation and rodent proofing. Sanitation is removing the food, water and shelter from the rats and mice. In reality all food and water cannot be removed while birds are in the house, but availability to the rodents can be reduced by controlling feed and water spillage and properly disposing of waste eggs, dead birds and garbage. Rodent proofing is making it more difficult for rodents to enter the building by sealing or covering with wire mesh, all holes and cracks in the walls and foundations, around water pipes and drain spouts.

Rodent killing is the third element of the program and a variety of methods can be used. Glue boards and traps can be used in small areas, but in larger areas (over 12,000 sq ft) baits are more practical.

Rodenticides are available in a large variety of compounds and formulations (Table 2.). Single-dose and multiple-dose rodenticides are available and it is important to select the proper material for your situation.

Rodenticides are formulated as pellets, bar baits, tracking powders and concentrates. The important thing to understand about rodenticides is the active ingredient it contains, which

determines how it is used. All of the multiple-dose and two of the single-dose compounds are anticoagulants that kill the rodent by causing internal bleeding. The other products affect the nervous system or other body systems, resulting in death.

Multiple-dose poisons must be eaten by the rodent every day for 7 to 21 days if the rodent is to accumulate enough poison to kill it. Any break in feeding will break the cycle and they will not die. The active ingredients in multiple-dose rodenticides are: warfarin, coumafuryl, chlorophacinone and diaphacinone.

Single-dose poisons will kill rats and mice in only one or two feedings and contain: brodifacoum, bromadiolone, bromethalin, or zinc phosphide as active ingredients. Cholecalciferol, if consumed in sufficient quantity over a single day, or consumed in small doses over a few days time will be lethal. The rodents usually die within 2-4 days after eating a lethal dose.

Placement of the rodenticide is critical to its effectiveness. Remember that rodents will not go out of their way to eat poison bait if other food is available. Baiting methods are different for rats and mice and will be discussed separately.

Baiting rats is easier than mice. Their burrows are easier to spot and can be baited by placing the rodenticide directly into the burrow. Bait stations along the walls of the house near burrows is also effective. There are many types of bait stations on the market which work well.

An inexpensive bait station can be made from 1 1/2-inch diameter PVC for mice and 2-3-inch diameter for rats. Cut 12-15" sections of pipe and make a "T" from three sections. Place the stem of the "T" up against the wall and the cross section along the wall, tight to the wall. Add about 1 oz of fresh bait as needed. Place these about 20-25' apart down the wall.

Mouse baiting requires placing bait on sill plates, horizontal wall braces, ceiling rafters and any other place mice are crawling. Bar baits are particularly useful in these places. Use bait stations along the walls and alleyways.

WILD BIRDS

Wild birds can be vectors of disease and parasites such as Avian influenza, newcastle disease, fowl cholera, mycoplasma and chicken mites and must not be allowed to mingle with your poultry flocks. The most effective control for wild birds is screening poultry house air inlets and open windows with 3/4 x 3/4 inch wire mesh. Cleaning up feed spills and water accumulations outside the building and cut grass and weeds to prevent nesting. Look for nests and roosting areas and remove them. Some mechanical frightening methods are available but are of limited value. Trapping birds may require permits, and again, is not a long term solution. Shooting and use of chemical controls, such as Avitrol, are also effective for decreasing bird populations.

EVALUATION

The last part of any good IPM program is evaluation. You must continually evaluate the results of your pest control programs. This can be done in several ways, such as counts of pests before and after treatment, comparative damage ratings, yearly comparisons of costs of pest control, records of pesticides used and evaluation of their effectiveness. Once you have your pests under control, it's just a matter of maintaining that level and continue your monitoring program. Remember, you will never eradicate your pest problems, you will just control them to a manageable level.

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Table 1. Insecticides: Classification and Use

Family	<u>NAME</u>	<u>USE</u>		
	Generic Name	Ext. Parasites	Litter Beetles	Flies
Organophosphate	coumaphos		x	
	dichlorovos			x
	dimethoate			x
	naled		x	x
	tetrachlorvinphos		x	x
Synthetic Pyrethroid	permethrin		x	x
	cyromazine			x
Botanical	pyrethrins			x
Carbamate	methomyl			x
	carbaryl		x	x
Sodium Borate	disodium octaborate tetrahydrate			x

Table 2. Rodenticide Classification of Families and Use

<u>NAME</u>		<u>USE</u>		
Family	Generic	Multiple Dose	Single dose	Acute Single Dose
Anticoagulant	brodifacoum			x
	bromadiolone			x
	chlorophacinone		x	
	coumafuryl		x	
	diaphacinone	x		
	isovaleryl indandione	x		
	pindone		x	
	warfarin		x	
Vitamin D Complex	Colecalciferol	x		
Di-Phosphides	zinc phosphide			x
Diphenylamine	bromethalin			x

Acknowledgements

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