fertilizer cost. Follow these steps to take credits from manure:

1. **Test soils**: Know what nutrients the soil already contains, including residual N, plant available phosphorus (P) and potassium (K), as well as soil pH.

2. **Analyze poultry litter**: Take samples before applying. Results should include dry matter content, N, P and K contents.

3. **Determine when to apply**: Apply litter as close to crop needs as possible to improve nutrient use efficiency and reduce nutrient loss to the environment.

4. **Determine how much to apply**: To best calculate application rates, balance the nutrient levels in the soil and manure with the needs of the crop.

5. **Calibrate manure spreader**: By calibrating the equipment, one can deliver the right amount to the field.

6. **Use supplemental fertilizer as needed**: Extra N may be needed if application rates are based on P. Phosphorus and K can build up in the soil if manure is used to meet the N needs of a crop.

7. **Consider conservation measures**: Maintain grass waterways, buffer strips and other best management practices to prevent nutrients from reaching nearby water supplies.

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**Related Extension Publications**

- PSS-2207 - How to Get a Good Soil Sample
- PSS-2246 - Using Poultry Litter as Fertilizer
- PSS-2248 - Sampling Animal Manure
- PSS-2249 - Managing Phosphorus From Animal Manure

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Protecting poultry flocks—continued

Producers should divide their pest control efforts into two key areas— the facility and environment:

- **Facility:** Where poultry eat, sleep and lay eggs are prime locations for pests and the diseases they can pass from one animal to another. Treating litter, cages and flooring of the broiler and/or egg-laying operation can aid in stopping the spread of pests.
- **Environment:** Pests may use the areas beyond the immediate housing facilities to breed and replenish their numbers. Treating these areas can play a significant role in reducing the pest population.

Focusing on protecting the facility and environment can help minimize issues from these pests, while on-animal sprays and dusts also can help protect birds from mites.

**Using documentation, sensitivity training and science**

Proper documentation of the beetle population is important. Producers should consider using a scoring system to document the level of beetle population in each flock. Monitor changes in the beetle population can help get a clear idea of the infestation levels.

Good records or documentation of the beetle population will help guide producers in the effectiveness of control measures which is equally important.

Producers should also look at testing for beetle sensitivity and susceptibility. This gives producers an idea of the insect’s tendency to be killed by an insecticide. The more susceptible the beetles are to an insecticide, the more efficiently it works against them. The test will use insecticides belonging to different classes based on mode of action (MOA), and the results will tell you to which class of insecticides the darkling beetles are most susceptible. This helps producers determine an appropriate rotation strategy.

**Rotating active ingredients to maintain effectiveness**

The development of resistance to insecticides due to the repeated use of compounds belonging to the same MOA is another concern for producers. Proper documentation of the products used in between each flock in each poultry house is needed for insecticide resistance management. Producers who have proper documentation and a rotation of insecticides will have a lesser chance of seeing severe problems.

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**Fertilizer Nutrient Contents in Poultry Litter**

Hailin Zhang, Ph.D
Director, Soil, Water and Forage Analytical Lab
Oklahoma State University

Poultry litter contains many plant nutrients so it can be a valuable asset rather than a liability for poultry producers when effectively managed and properly used on field crops and pasture. Besides providing valuable macro- and micro-nutrients to the soil, poultry litter supplies organic matter to improve the soil’s physical, chemical and biological properties. It also increases infiltration and storage of water and enhances retention of nutrients and promotes growth of beneficial organisms. Therefore, poultry litter application can improve soil health.

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Overall, trade is supposed to allow those who are willing to pay for certain products the ability to do so regardless of location. Exports are one example of a way to relieve some of the supply pressure. Proposed and implemented changes to trade agreements and tariffs are something that growers should stay aware of. As long as production increases are expected and feed prices stay low, finding outlets for the end product domestically and internationally will be key.

An effective rotation strategy alternates between products from completely different MOA groups, not just between active ingredients from the same MOA group. Modes of action available include:

- Pyrethroids: sodium channel modulators that disrupt the normal flow of sodium ions
- Organophosphates: cholinesterase inhibitors that prevent the breakdown of acetylcholine
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Keeping flocks healthy
At the end of the day, reducing beetle populations that spread disease not only means a cleaner operation, but also potentially a healthier flock. Recent studies on the economic impact of darkling beetles determined that a good beetle control program can save producers as much as $4,262 per 100,000 birds. Effective rotation strategies are needed to thwart resistance to insecticides. An effective rotation strategy alternates between products from completely different MOA groups, not just between active ingredients from the same MOA group. Modes of action available include:

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Protecting poultry flocks

Keys to Successful Beetle Control Using Insecticides

- Rotate between the different MOA groups at least every two flocks. If one product is used for an extended period of time, resistance to it will build in the beetle population and that chemical will no longer be effective.
- Don’t be too hasty in judging any particular chemical to be ineffective. The number of beetles killed in the first 24 hours is not the best indication of effectiveness. Some insecticides will kill the beetles in just a few hours and others may take a few days to begin killing the beetles, but then continue killing the beetles for the entire grow out. When the birds are 4-5 weeks old look under the feed pans and see how many adults and larvae you find. If you only find a few adults and larvae you have good control.
- Apply the label recommended amount of each insecticide. Using less than the recommended amount will lead to increased resistance to the insecticide.
- If you are seeing large populations of beetles, apply your insecticide before placement of each flock. This will keep the beetle populations under control in every flock.
- Apply insecticides using as little water as possible. It is best not to exceed 12 gallons of water in a 500-ft house. Change your nozzle tips to a flat fan, 04-08 nozzle tip to get a fine mist, instead of a coarse spray application.
- Apply insecticide in a 3 ft wide band under the feed lines and a 3 ft band along the walls, including the footing and 2 ft up onto the wood above the footing, instead of the entire house. Focusing the insecticide applications to the areas where the beetles are living will offer much better control.
- Add 1 packet of Citric Acid or PWT to each Organophosphate or Pyrethroid insecticide tank mix before applying the product. These insecticides kill more beetles when they have an acid added to the tank mix.
- Add 2 ounces of clear household ammonia/gallon of tank mix when using Elector.
- Apply insecticides on top of the litter after caking out, or on top of fresh shavings after clean out. The beetles crawl on top of the litter as they are making their way to the feed line areas after bird placement. You will not get as good of results if you apply the insecticide on the bare floor.
- After caking out or clean out apply insecticide to any litter stored in the stacking shed. This will prevent the beetles from migrating right back into your houses.

Virulent Newcastle Disease

Barry Whitworth, DVM
Area Food/Animal Quality & Health Specialist
Oklahoma State University

On May 18, 2018, the United States Department of Agriculture (USDA) confirmed the presence of virulent Newcastle disease (vND) which was formerly known as Exotic Newcastle disease in a backyard poultry flock in California. This is the first case of vND in the United States (US) since 2002. Several additional cases have been reported since the initial case. All the cases have been in California. As of September 7, 2018, no cases of vND have been reported in commercial poultry operations. The USDA has spent over $8 million to contain this outbreak. Oklahoma poultry producers should continue to strictly adhere to their disease prevention strategies with emphasis on biosecurity.

The last Newcastle disease outbreak occurred in 2002-2003. This outbreak began in a backyard game flock in California. The disease eventually spread to commercial flocks which led to the quarantine of 19 counties in California, Arizona, New Mexico, and Texas. This outbreak led to a depopulation of 4.5 million birds from 2,700 facilities. The estimated indirect and direct cost was $395 million according to the USDA.

Newcastle disease is one of the most important infectious diseases in poultry in the world. The virus varies from a mild form to a severe form. Chickens are very susceptible to this virus. Other domestic and wild birds may also be infected with the virus. The virus may survive and be shed for several days in exotic birds. The virus survives for several weeks in warm and humid environments. It can be found on feathers and in manure. If the virus is frozen, it can survive for a longer period. The virus is destroyed by heat and ultraviolet light. Several disinfectants can eliminate the virus.

The virus is transmitted by inhalation and ingestion. Birds shed the virus in their feces and respiratory secretions. Birds may breathe in the respiratory droplets or they may consume fecal material from an infected bird.

The virus is spread by movement of live birds. These may be wild birds, exotic birds, game birds, pigeons, or commercial poultry. People may unknowingly spread the virus through contaminated shoes and clothing. The sharing of contaminated equipment is a good way to spread the virus.

The time that it takes for clinical signs to appear following exposure to the virus is 2 to 15 days. Clinical signs of the disease can range from none to sudden death. The respiratory, digestive, and neurological systems are usually affected by the virus. If it affects the respiratory system, signs seen include coughing, sneezing, gasping, and nasal discharge. Other signs may include swollen eyes and head. If the digestive system is involved, birds will have a greenish diarrhea. When the neurological system is affected, signs may include muscle tremors, droopy wings, torticollis, paralysis, and circling. In extreme virulent strains of the viruses, mortality may be 100%.

The best way to prevent the disease is to prevent exposure to other birds. Producers should follow their biosecurity plan. For a detailed biosecurity plan go to https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-inform. A vaccine is available and reduces the severity of the disease, but it does not prevent infection.

Humans may be infected with the Newcastle virus. The people most likely to be infected with the virus are those who have close contact with live poultry. Humans infected with the virus usually have eye infections but no human infections have been associated with the consumption of poultry.

The chances that vND shows up in Oklahoma are very low. However, poultry producers must always be on guard for poultry diseases. If producers would like more information about Newcastle disease they should contact their veterinarian, local County Extension educator or go to the Center for Food Security and Public Health at http://www.cfsph.iastate.edu.
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Scott Clawson

Area Ag Economics Specialist

Oklahoma State University

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<th>Class</th>
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<th>MOA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Durashield CS</td>
<td>O</td>
<td>20% Chlorpyrifos</td>
<td>1B</td>
</tr>
<tr>
<td>Beetle Shield (Raben 3% Dust)</td>
<td>O</td>
<td>3% tetrachlorvinphos</td>
<td>1B</td>
</tr>
<tr>
<td>Rabon 50 WP</td>
<td>O</td>
<td>tetrachlorvinphos</td>
<td>1B</td>
</tr>
<tr>
<td>Revap</td>
<td>O</td>
<td>tetrachlorvinphos</td>
<td>5% dichlorvos</td>
</tr>
<tr>
<td>Pyn-Shield SC Anchor 1.3</td>
<td>IGR</td>
<td>1.3% pyripyrifen</td>
<td>2B</td>
</tr>
<tr>
<td>ActShield</td>
<td>P</td>
<td>7.5% bifenthrin</td>
<td>3A</td>
</tr>
<tr>
<td>Optshield CS</td>
<td>P</td>
<td></td>
<td>3A</td>
</tr>
<tr>
<td>Standguard</td>
<td>P</td>
<td>5.9% cyfluthrin</td>
<td>3A</td>
</tr>
<tr>
<td>Tempo 20 WP</td>
<td>P</td>
<td>cyfluthrin</td>
<td>3A</td>
</tr>
<tr>
<td>Tempo 1% Dust</td>
<td>P</td>
<td></td>
<td>3A</td>
</tr>
<tr>
<td>Tempo SC Ultra</td>
<td>P</td>
<td>11.4% cyfluthrin</td>
<td>3A</td>
</tr>
<tr>
<td>Grenade ER, OxyFly, Cyonara 3.7</td>
<td>P</td>
<td>9.7 % λ-cyfluthrin</td>
<td>3A</td>
</tr>
<tr>
<td>ZetaGard LBT</td>
<td>P</td>
<td>37.5% Z-cypermethrin 1% 7% chlorpyrifos</td>
<td>3A+N</td>
</tr>
<tr>
<td>Credo SC, Midash Forte others</td>
<td>N</td>
<td>42.8% tetrachlorvinphos</td>
<td>4A</td>
</tr>
<tr>
<td>Ector PSP</td>
<td>SI</td>
<td>44.2% spinosad</td>
<td>5</td>
</tr>
<tr>
<td>Boric Acid</td>
<td>BA</td>
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<td>8D</td>
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**O** = organophosphate, **P** = Pyrethroid, **N** = Neonicotinoid, **I** = Insecticide

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1. Test soils: Know what nutrients the soil already contains, including residual N, plant available phosphorus (P) and potassium (K), as well as soil pH.

2. Analyze poultry litter: Take samples before applying. Results should include dry matter content, N, P and K contents.

3. Determine when to apply: Apply litter as close to crop needs as possible to improve nutrient use efficiency and reduce nutrient loss to the environment.

4. Determine how much to apply: To best calculate application rates, balance the nutrient levels in the soil and manure with the needs of the crop.

5. Calibrate manure spreader: By calibrating the equipment, one can deliver the right amount to the field.

6. Use supplemental fertilizer as needed: Extra N may be needed if application rates are based on P. Phosphorus and K can build up in the soil if manure is used to meet the N needs of a crop.

7. Consider conservation measures: Maintain grass waterways, buffer strips and other best management practices to prevent nutrients from reaching nearby water supplies.

Related Extension Publications

- PSS-2207 - How to Get a Good Soil Sample
- PSS-2246 - Using Poultry Litter as Fertilizer
- PSS-2248 - Sampling Animal Manure
- PSS-2249 - Managing Phosphorus From Animal Manure

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Protecting Poultry Flocks from Darkling Beetles

Brian Freking
Area Livestock Specialist
Oklahoma State University

Poultry producers can prepare for pest problems before they become an issue by focusing on the challenges faced, type of insecticides needed and rotation efforts.

Reducing the occurrence of darkling beetles and pests is imperative for poultry production to be profitable. Despite industry advances, insect control is not a simple matter and takes a dedicated effort on the producer’s part to be successful.

While it’s difficult to predict poultry pest pressures, producers can get in front of issues by preparing for pest problems before they become an issue — focusing on the challenges faced, type of insecticides needed and rotation efforts.

Controlling darkling beetles

In the broiler industry, the most important aspect of insect control is controlling darkling beetles. They can cause significant damage and be a nuisance to a poultry operations through disease transmission, structural damage and even invasion of neighboring buildings. These insects are persistent in poultry houses and can act as carriers of zoonotic bacteria, such as Salmonella and Campylobacter, and viruses such as corona virus.

The destruction of insulation materials causes a loss in the R-value (measure of the resistance of a material to conduct heat as indicated by the difference between inside and outside surface temperatures) of the building and a decrease in the “tunnel effect” as the house becomes more leaky. This drives up the amount of run time the fans have to maintain a constant static pressure to keep air speed up especially in the summer. As a result, there is loss both in the summer (leaky houses with increase electric bills) and winter (loss of R-value with increase in propane costs).

A key time in management is when litter is taken out of the houses and the beetles may spread toward the walls.

Defending your operation

When it comes to helping control beetle populations, create an effective pest control strategy that covers your entire operation as well as other pests that may be of concern — including flies, spiders and mites.