



## CHEMICAL CONTAMINATION IN FEED FOR LAYER HENS: CAUSES, IMPACTS, AND NUTRITIONAL STRATEGIES TO SUPPORT RECOVERY OF AFFECTED FLOCKS

### OVERVIEW

Chemical contamination (pesticide, heavy metal and chemicals) in raw materials used for layer hen feed is due to the widespread use of agricultural chemicals. Contamination can occur through improper handling, storage, or sourcing of feed ingredients, which poses significant health risks to layer hens. Additionally, pesticide residues can enter the poultry production system via feed, water, or environmental exposure. This bulletin outlines the sources of chemical contamination, its impact on layer hens, and effective strategies to mitigate and recover from chemical exposure.

### SOURCES OF CHEMICAL CONTAMINATION

- **Feed Contamination:** Feed ingredients (e.g., maize, soybeans, oilseed meals) can be contaminated with pesticides during cultivation, storage, or processing.
- **Storage Practices:** Poor storage conditions in feed mills or storage facilities can lead to contamination from residual pesticides or fumigants.
- **Water Contamination:** Chemicals used in agriculture can enter water sources through runoff, potentially contaminating drinking or cooling water.
- **Regulatory Gaps:** Inconsistent enforcement of pesticide residue limits and inadequate testing procedures can result in contamination going undetected.

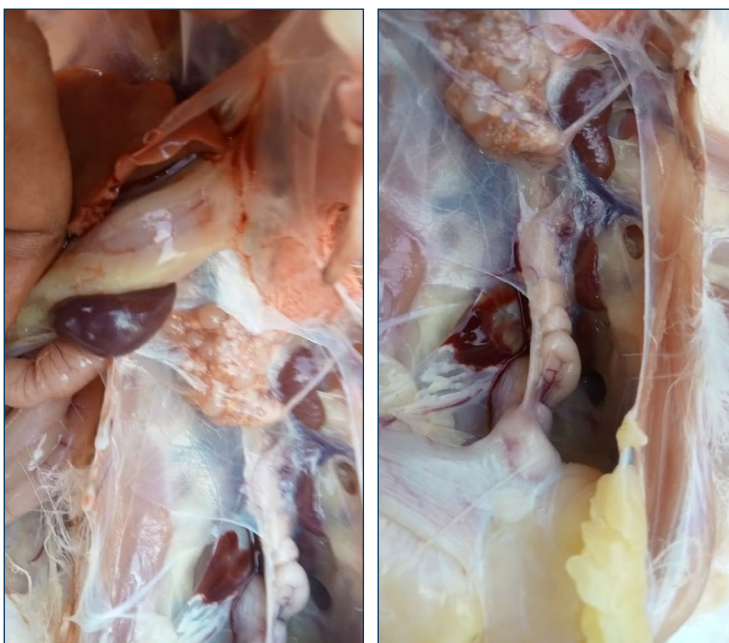
**Maximum Levels for Pesticides, Heavy Metals, and Chemicals in Layer Feed**  
(specific regulations may vary by country)

Category	Substance	Maximum Level	Source
Pesticides	Chlorpyrifos	0.01–0.05 mg/kg (ppm)	Codex Alimentarius/EU Regulations
	DDT	≤ 0.05 mg/kg	Codex Alimentarius
	Carbaril	≤ 0.2 mg/kg	Codex Alimentarius
	Malathion	≤ 0.05 mg/kg	Codex Alimentarius
	Permethrin	0.05 mg/kg (ppm)	EU MRL
Heavy Metals	Lead (pb)	≤ 5 mg/kg	EU Guidelines
	Cadmium	≤ 0.5 mg/kg	EU Guidelines
	Arsenic	≤ 2 mg/kg	EU Guidelines
	Mercury	≤ 0.1 mg/kg	EU Guidelines
Chemical Residues	Aflatoxin B1	0.02 mg/kg (ppm)	Codex Alimentarius/EU Guidelines
	Dioxins and PCBs	0.5 ng TEQ/kg	EU Regulations
	Melamine	2.5 mg/kg (ppm)	US FDA

## IMPACT ON LAYER HENS

Health Effects: Pesticides and another chemical contamination can negatively impact bird health, including:

- **Reduced Feed Intake and Growth:** Pesticide may alter the palatability of feed, leading to reduced feeding intake. This can negatively impact growth and body weight development during the rearing phase.
- **Organ Damage:**
  - o **Liver:** Chemicals can induce liver damage, leading to fatty liver syndrome and impaired metabolism, reducing overall health and egg production.
  - o **Kidneys:** Pesticides may impair kidney function, affecting waste excretion and electrolyte balance.
- **Immunosuppression:** Chemical contamination residues can weaken the immune system, increasing susceptibility to diseases like *E. Coli*, *Coryza*, and respiratory issues.
- **Reproductive Issues:** Pesticide toxicity can disrupt hormone regulation, leading to irregular laying cycles, reduced egg production, and poor eggshell quality. In breeders, residues may cause embryotoxic effects, reducing hatchability.
- **Neurological and Behavioral Effects:** Neurotoxic pesticides can cause tremors, flightiness, or abnormal behavior in hens.
- **Gut Health Disturbance:** Chemical contamination may disrupt the gut microbiome, leading to poor digestion, malabsorption of nutrients, and secondary infections such as *Clostridium perfringens*.
- **Studies have shown that pesticide exposure can lead to changes in organ weight, blood chemistry, and damage to intestinal tissues** (Lowry et al., 1951; Toxicol, 1995; Sec. Veterinary Pharmacology, 2022).
- **Residue Accumulation:** Pesticides can accumulate in the fat, liver, and other tissues of hens, and residues can transfer to eggs, presenting a food safety risk.



*Figure 1. Ovary atrophy (left) and oviduct atrophy (right) by chemical contaminations.*

## **ADDRESSING THE ISSUE: PREVENTION AND MITIGATION**

- Strengthen Feed Ingredient Quality Control and Purchasing Management
  - Only source cereals from recognized suppliers who adhere to international quality standards.
  - Avoid sourcing materials from 3rd party agents particularly those who do not follow international quality standards.
  - Routine Testing: Conduct regular testing of raw materials (e.g., maize, soy, oilseed meal) for pesticide residues using accredited laboratories.
  - Certified Suppliers: Source feed ingredients from suppliers who follow strict pesticide residue limits and Good Agricultural Practices (GAP). Certifications such as ISO 22000, HACCP should be provided.
- Proper Storage Practices:
  - Ensure raw materials are stored in clean, pesticide-free facilities to prevent secondary contamination.
  - Hygiene Protocols: Implement strict hygiene practices in feed mills and storage areas to prevent contamination from fumigants or environmental sources.

## **NUTRITIONAL STRATEGIES TO SUPPORT RECOVERY OF AFFECTED FLOCKS**

- Withdraw Contaminated Feed: Immediately remove contaminated feed from the system and replace it with clean feed.
- Detoxifying Additives: Add activated charcoal, bentonite clay, or other mycotoxin binders to absorb and reduce toxins in the gastrointestinal tract.
- Antioxidants and Supplements: Provide antioxidants (e.g., Vitamin E, Selenium) to help minimize oxidative stress and support recovery.
- Improve Gut Health: Incorporate probiotics, prebiotics, and organic acids to strengthen gut health and resilience.
- Hydration and Electrolytes: Ensure access to fresh, clean water, potentially supplemented with electrolytes and vitamins to promote metabolic recovery.
- Liver Support: Add hepatoprotective agents like betaine or choline chloride to support liver detoxification and repair.
- Include B-complex vitamins to help repair liver damage and boost metabolism.
- Optimized Nutrition: Formulate high-energy, high-protein diets with essential amino acids (e.g., lysine, methionine) to support liver function and tissue repair.
- Add Vitamin C to the feed to support immune health.
- Support Oviduct Function: Organic Selenium, particularly in the form of selenomethionine, is crucial in mitigating oxidative stress in the reproductive organs and helping to restore normal egg production.

## **EXPECTED RECOVERY TIME**

The recovery time for layer hens after pesticide exposure can vary, depending on the severity of contamination and the overall health of the flock. Typically, recovery may take 4–6 weeks, or longer, with continuous monitoring for health and production improvements.

## PREVENT FUTURE ISSUES

- **Strengthen Raw Materials Sourcing:** Work with reliable suppliers and implement strict quality control measures.
- **Monitor the origin and history of all ingredients** to ensure they haven't been exposed to pesticides during cultivation or storage.
- **Routine Feed Testing:** Regularly test raw materials for pesticides, mycotoxins, and other contaminants.
- **Conduct random sampling of feed batches** to check for unexpected contamination, even if the supplier has guaranteed pesticide-free ingredients.
- **Regularly clean feed mill, mixers, and storage silos** to prevent cross-contamination between batches. Residues from previous batches can contaminate new batches of feed.
- **Implement cleaning protocol for the feed mill** – apply and register regularly a thorough cleaning of the facility, equipment, mixer, augers, conveyor belts, and mainly the feed and ingredient silos.
- **Ensure that no poison baits are present in the internal area of the feed mill.** In this area, only covered glue/trap baits should be used.
- **Water Quality:** Ensure clean, uncontaminated water sources for poultry.

## CONCLUSION

Swift action is critical to mitigate the effects of pesticide contamination in layer hen flocks. By addressing the root causes of contamination, implementing detoxification protocols, and optimizing nutrition and recovery, poultry producers can protect flock health, ensure food safety, and prevent recurrence of pesticide-related issues in the future. Through strong quality control measures, effective mitigation strategies, and proper monitoring, producers can reduce the risks associated with pesticide, heavy metal and chemicals exposure and ensure the ongoing health and productivity of their flocks.

