

TREATING FERTILIZER INGESTIONS? AS EASY AS N-P-K



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Welcome to **Practical Toxicology**, brought to you in partnership between *Today's Veterinary Practice* and the ASPCA Animal Poison Control Center (APCC) (aspcapro.org/about-animal-poison-control-center). This column will provide practical clinical information about diagnosing and treating pets that have been exposed to potentially harmful substances.

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- Provides 24-hour diagnostic and treatment recommendations by specially trained veterinary toxicologists
- Protects and improves animal lives through toxicology education, consulting services, and case data review
- Developed and maintains AnTox, an animal toxicology database system that identifies and characterizes toxic effects of substances in animals
- Works closely with human poison control centers to provide animal poisoning information
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It's the first warm Saturday after a long cold winter. Every appointment is booked. Midmorning the frantic calls from clients start rolling in:

- *I diluted fertilizer and watered a plant, and now my kitten is drinking from the overflow saucer.*
- *I had a bag of fertilizer sitting in the garden, and my dog ripped it open and started eating the fertilizer.*
- *I was planting flowers when my dog ate the fish meal in the bucket. Now his breath stinks.*

Each and every client wants to know: What should I do? Will my pet live? You need to know whether the client should treat the pet at home, bring the pet to the clinic, or rush the pet to a 24-hour-care facility.

FERTILIZER FACTS

Fertilizers, which can be organic or synthetic, are designed to be applied to soil (or sometimes plant tissue) to supply one or more nutrients needed for plant growth.

Ingredients

There are many different brands, manufacturers, and distributors of fertilizers. Common ingredients are listed in **Table 1**. Fertilizers may be formulated

for specific types of plants (eg, acid loving plants), vegetables, or flowers. Sludge fertilizers are sometimes used as deer repellent.

Fertilizers generally contain nitrogen, phosphorus, and potassium (N-P-K). N-P-K represents the percentage of these ingredients in the fertilizer. A lawn fertilizer may have an N-P-K of 29-3-4 (29% nitrogen, 3% phosphorus, and 4% potassium), while bone meal often has an N-P-K of 0-12-0, reflecting the mineral composition of bone. Product packaging typically includes this information in the fertilizer name or near the name on the package.

TABLE 1.

Common Ingredients in Fertilizers

- Chicken manure, bat guano
- Cocoa bean mulch
- Meals, including fish, bone, blood, and chicken feather
- Seaweed extract
- Sewage sludge*
- Small amounts of minerals, including iron, copper, boron, cobalt, manganese, molybdenum, and zinc
- Triple phosphate

* Poor bioavailability; heated at high temperatures to kill pathogens; frequently has high iron levels and may contain heavy metals, such as cadmium

Formulations

Once liquid fertilizers dry, they are not bioavailable to a pet, even if the plant material is ingested.

Therefore, owners should keep pets inside during application and until the fertilizer has dried.

When watering potted plants with diluted fertilizers, some of the fertilizer will filter through the soil, collecting in the overflow base of the pot. Although drinking from the overflow base is unlikely to cause any significant clinical signs in pets, owners should place freshly watered potted plants out of reach.

When fertilizer granules are spread evenly on lawns, it is highly unlikely that a significant ingestion will occur if pets lick their paws after contact with treated lawns. Even so, granular fertilizers rarely cause more than mild, self-limiting gastrointestinal upset. Significant ingestions typically occur when a bag or broadcast spreader filled with fertilizer is left where a dog can reach it.

Many granular products use corn cobs as a base; when the product is watered, the fertilizer is washed off this base and into the soil. However, even after watering, the corn cob base does not dissolve, and clients may assume that the fertilizer is still present. To determine if a fertilizer is on a base, such as corn cobs, and if it should dissolve, contact the manufacturer.

Combination Products

Fertilizers are not required to have an Environmental Protection Agency (EPA) registration number. However, many products combine fertilizer with an herbicide or insecticide. If a fertilizer package or label lists an EPA registration number, or an herbicide, insecticide, fungicide, or combination thereof is included in the product, pets need to be evaluated for exposure to these ingredients as well as the fertilizer.

Combination products may include the words *weed and feed* in the fertilizer name, or may be listed as a fertilizer *plus an herbicide, insecticide, or fungicide*. Rose growers frequently use combination insecticide/fertilizer products, and such product names frequently contain the word *systemic*, with an EPA registration number listed on the package.

Disulfoton (Di-Syston, cropsience.bayer.com/) is a potent organophosphate insecticide frequently used as a systemic rose insecticide. Many gardeners mix disulfoton with bone meal and spread it in the soil surrounding the roses. Dogs may eat the soil for the bone meal and be poisoned by the disulfoton. Fortunately, extremely toxic insecticides, such as disulfoton, are being replaced with safer ones, such as imidacloprid.

Additives

Agricultural fertilizers may include the following minerals that can cause adverse reactions:

- Calcium carbonate, which is found in agricultural or garden lime and dolomitic lime; while acute single doses may produce gastrointestinal upset, hypercalcemia is not expected.
- Calcium chloride may cause significant vomiting and diarrhea that requires treatment.
- Calcium cyanamide can cause skin irritation and ulceration.
- Calcium oxide (quick lime) and calcium hydroxide (hydrated lime) are corrosive.

Anhydrous ammonia is a compressed liquid used as a fertilizer in agricultural settings. While it is not typically available for home lawn use, pets on farms may be exposed. Contact can result in severe burns to the skin, eyes, or mucous membranes; acute lung injury with pulmonary edema; bronchiectasis; and hypoxemia.

Contamination

Fertilizer in opened packaging may be contaminated with tremorgenic mycotoxins even if the fertilizer does not look moldy. These mycotoxins can cause hypersalivation, ataxia, tachycardia, tremors, fasciculations, or seizures. Death is possible in severe untreated cases.

Old, moldy fertilizer may also be contaminated with bacteria, resulting in bacterial gastroenteritis if ingestion occurs.

Plants Fertilized

It is important to know what kinds of plants have been fertilized.

Although diluted fertilizer is not expected to cause significant clinical signs, some plants leach toxins into the soil that mix with water in the overflow base of the pot. For example, lily of the valley (*Convallaria majalis*) contains several cardiac glycosides, and pet owners should be aware of clinical signs associated with exposure to these glycosides, including vomiting, diarrhea, lethargy, cardiac arrhythmias, hypertension, hyperkalemia, and hypoglycemia.

When bulbs are planted, fertilizer is frequently added to the hole, and dogs often eat the bulbs when ingesting the fertilizer. Autumn crocus (*Colchicum autumnale*)—which is planted in late summer or early fall—is highly toxic, and ingestion is potentially life-threatening. Clinical signs of autumn crocus ingestion include vomiting and diarrhea (potentially hemorrhagic), lethargy,

arrhythmia, liver enzyme elevations, multiorgan system failure, and bone marrow suppression. Signs resulting from plant ingestion are far more serious than those from fertilizer ingestion.

DIAGNOSIS

Fertilizer Dose

In rats, an acute lethal dose (50%) of most fertilizers is 5 g/kg body weight. **Table 2** provides the formula to determine the dose of fertilizer ingested.

Clinical Signs

In dogs and cats, toxic components of fertilizers are typically nitrogen, phosphorus, and potassium, which are poorly absorbed. Systemic clinical signs are rare but, when present, primarily relate to gastrointestinal irritation.

Fertilizers with high concentrations of iron (> 1%) may cause iron toxicosis. However, the poor bioavailability of fertilizers probably prevents significant iron toxicosis in most cases.

Clinical signs related to the dose of fertilizer include:

- Small ingestions (< 0.5 g/kg) range from no clinical signs to vomiting, diarrhea, hypersalivation, and lethargy.
- Ingestions of greater than 0.5 g/kg may cause impaction or constipation.
- Large ingestions may result in abdominal pain, hindlimb weakness, and muscle stiffness or rigidity; in some cases, stiffness and rigidity are

TABLE 2.

Fertilizer Dose Calculation

Formula*	(Amount of fertilizer ingested)/ (body weight) × 100 = % of fertilizer ingested
Conversions	1 mL = 1 g 30 g = 1 oz (rounded) 1000 g = 1 kg 1 kg = 2.2 lb 1% = 10 g = 0.33 oz = 2 teaspoons 0.5% = 5 g = 0.16 oz = 1 teaspoon
Example	<ul style="list-style-type: none"> • A 9.9-lb dog ingests 1 oz of fertilizer. • 1 oz of fertilizer ingested = 30 g; the dog weighs 9.9 lb, or 4.5 kg, or 4500 g. • 30 g fertilizer/4500 g body weight = 0.0066 × 100 = 0.67% fertilizer ingestion. • Since the dose is > 0.5%, decontamination should be initiated.

* The fertilizer and body weight should be calculated using the same units (g fertilizer/g body weight).

Fertilizer Toxicity: Ask the Pet Owner...

1. What are the ingredients in the fertilizer? What is the N-P-K ratio?
2. Is the fertilizer in liquid or granule formulation?
3. Is the fertilizer combined with an herbicide, insecticide, and/or fungicide?
4. Does the fertilizer contain any additives, such as lime?
5. Does the fertilizer appear moldy, or has it been opened and then stored for a period of time?
6. What types of plants were fertilized?



severe enough that the dog cannot stand or walk. Rarely, dogs may develop urticaria, pruritus, and swollen muzzles.

- Extremely large ingestions of blood meal, bone meal, or fish meal may trigger pancreatitis in predisposed dogs, but death is extremely rare.

Differential Diagnosis

When clinical signs do not correlate with the history provided by the owner (eg, product, potential amount ingested), rule out other causes. Obtaining additional history, as well as diagnostics, may help determine the true cause of the clinical syndrome.

TREATMENT

Treatment involves symptomatic and supportive care.

Small Ingestions

Small ingestions can be managed by the owner at home. If the pet vomits, the owner can withhold food and water for 1 to 2 hours; then gradually reintroduce water to the pet. Only 1 or 2 episodes of diarrhea is expected; no antidiarrheal medication is needed.

Large Ingestions

When recent large ingestions of fertilizer (> 0.5 g/kg) occur, emesis is recommended in asymptomatic animals.

At Home. Owners can induce vomiting at home with hydrogen peroxide (2.2 mL/kg body weight PO). If a significant amount of fertilizer is recovered, further treatment may not be required.

Fertilizer Ingestion in Ruminants

Fertilizer ingestion in ruminants is potentially life-threatening. When nitrates are the primary nitrogen source, methemoglobinemia may develop. While urea and ammonium salts cause only mild, self-limiting gastrointestinal upset in monogastric animals, in ruminants, urea can cause systemic ammonia toxicosis due to rumen microbes converting the urea to ammonia. For information on treating methemoglobinemia or ammonia toxicosis in ruminants, consult other texts.

In Hospital. In the hospital, apomorphine (0.023 mg/kg IV) can be administered to induce vomiting. Activated charcoal is not recommended because it binds poorly to minerals and is unlikely to be beneficial.

If the elemental iron dose is greater than 20 mg/kg and the animal is asymptomatic, milk of magnesia, which complexes with the iron and decreases its absorption, can be administered (5–15 mL/dog Q 12 H).

Additional Therapy

- **Antiemetics**, such as maropitant (1 mg/kg SC Q 24 H) or ondansetron (0.1–0.2 mg/kg IV Q 8–12 H), are recommended if significant vomiting develops.

- **Gastrointestinal protectants** may be used as needed, including sucralfate (0.25–1 g/kg Q 8 H for 3–5 days), omeprazole (0.5–1 mg/kg Q 24 H), and/or a histamine-2 blocker, such as famotidine (0.5–1 mg/kg Q 12 H).
- **Metronidazole** (10–20 mg/kg Q 8–12 H for 3–7 days as needed) is recommended when large ingestions result in bloody diarrhea.
- **Fluids** are recommended if an animal seems to show signs of shock or has significant vomiting and diarrhea.

Pain Management

Analgesics are recommended for animals with significant abdominal or musculoskeletal pain.

Opioids are preferred over nonsteroidal anti-inflammatory drugs (NSAIDs) because large ingestions of fertilizer that result in abdominal pain may also cause significant gastrointestinal irritation and hemorrhagic gastroenteritis; NSAIDs are more likely to irritate the gastrointestinal system than opioids.

For animals exhibiting stiffness, muscle relaxants, such as methocarbamol (132 mg/kg IV or PO per day, divided Q 12 H; then 61–132 mg/kg IV or PO per day, divided Q 8–12 H), are recommended until stiffness resolves.

Other Considerations

When dogs have gorged on bone and blood meal, pancreatitis may occur. Gorging may also result in bloat. If these conditions develop, treatment should follow standard protocols for pancreatitis and bloat.

IN SUMMARY

For small animal practitioners, most fertilizer ingestions can be managed easily. Counsel clients on the safe use of lawn and garden products. Just as easy as N-P-K.

APCC = Animal Poison Control Center; EPA = Environmental Protection Agency; N-P-K = nitrogen, phosphorus, potassium; NSAIDs = nonsteroidal anti-inflammatory drugs

Suggested Reading

- Albretsen JC. Fertilizers. In Plumlee KH (ed): *Clinical Veterinary Toxicology*. St. Louis: Mosby, 2004, pp 154-155.
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