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Toxicities found in livestock during winter

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Abstract

Toxicity in livestock is more common in the winter because of a scarcity of forage, forcing animals to consume unfamiliar or less appetizing, harmful plants, as well as the physiological effects of cold and frost on some plants, which increase the intensity of their toxic components. Disturbed plant metabolism, inadequate ventilation, physiological stress, and an increasing dependence on chemicals and stored feed all contribute to a marked increase in toxicities from plants, chemicals, air pollution, salt, heavy metals, and mycotoxins. For maintaining animal health and production in winter, make sure feed is free of mould and routinely tested for nitrates and mycotoxins. To avoid freezing and sudden changes to animal ration, always provide them access to water. Avoid burning fuels indoors, keep sheds well-ventilated, and clean them frequently.

Introduction

Toxicity found in livestock is more prevalent during the winter, due to a combination of the lack of forage, which forces animals to consume unfamiliar or less appetising, dangerous plants, and the physiological effects of cold and frost on some plants, which increase the potency of their toxic components. Moreover, several toxicities, including those related to plants, chemicals, air pollutants, salt, heavy metals, and mycotoxins, are significantly increased due to disturbed plant metabolism, insufficient ventilation, physiological stress, and an increased reliance on chemicals and stored feed [1].

These toxicities belong to the following categories:

1. PLANT TOXICITIES IN WINTER

Cyanogenic Plants

Toxic cyanide can be released by cyanogenic plants like sorghum, Johnson grass, linseed, and bamboo shoots, particularly in stressful situations like frost, which greatly increases cyanide liberation. Cellular anoxia results from the released cyanide's inhibition of cytochrome oxidase in the mitochondrial electron transport chain. Clinical symptoms in affected animals include seizures, fast breathing, and distinctively bright red blood.

Treatment: Sodium nitrite (20mg/kg Bwt IV slowly over 3-4 minutes) + sodium thiosulfate (500-660 mg/kg IV).

Prevention: remove frost-damaged forages

Nitrate-Accumulating Plants

High nitrate levels can be accumulated by amaranthus, pigweed, and beet tops, especially when intense fertilization is combined with little sunlight. Nitrates are transformed by the body into nitrites, which lower blood's ability to carry oxygen and result in methemoglobinemia. Animals that are afflicted usually exhibit symptoms like chocolate-brown blood and dyspnoea.

Treatment: Methylene blue (8-10mg/kg IV slowly).

Prevention: test forage for nitrate levels

Oxalate-Rich Plants

Oxalate-containing plants such as spinach, beet leaves, dock, and sorrel can be poisonous when ingested in excess amounts. These plants accumulate oxalates that bind with calcium in the body, leading to hypocalcemia and potential kidney damage. Clinical signs include muscle tremors, weakness, and reduced appetite, and in severe cases, renal failure may occur.

Treatment: calcium borogluconate 20-25% (250-500ml IV slowly).

Lantana camara

Lantana camara is a toxic plant commonly affecting grazing animals. It contains pentacyclic triterpenoids (lantadenes) that cause hepatotoxicity and secondary photosensitization by damaging the liver and impairing bile excretion. Affected animals show signs such as anorexia, constipation, jaundice, photosensitization of unpigmented skin, and liver dysfunction.

Treatment: Activated charcoal (1-4g/kg bwt Po) and saline purgatives (Magnesium sulfate @0.5-1g/kg orally).

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Bracken Fern

Bracken fern (*Pteridium aquilinum*) is a toxic plant affecting livestock when ingested over time. It contains ptaquiloside and other toxins that cause bone marrow suppression, thiamine deficiency, and carcinogenic effects. Affected animals may show signs such as weight loss, haemorrhages, anemia, incoordination, and in severe cases, urinary bladder tumours or acute bleeding syndromes

Treatment: Administration of thiamine (vitamin B_1 5-10mg/kg, IV or IM, Antibiotics

2. PESTICIDE TOXICITIES

Rodenticides & Pesticides are commonly used by spraying or treating grain stores and for effective rodent control. At low temperatures, the degradation of these chemicals is reduced, which increases their persistence in the environment and raises the risk of accidental exposure or poisoning [2].

Organophosphate & Carbamate Insecticides

Organophosphate and carbamate insecticides cause toxicity by inhibiting acetylcholinesterase, leading to the accumulation of acetylcholine at synapses. Affected animals show characteristic SLUD signs including salivation, lacrimation, urination, and diarrhea, along with miosis, muscle fasciculations, and dyspnea.

Treatment: Atropine (0.2-0.5 mg/kg IV or IM), Pralidoxime (2-PAM) @20-50 mg/kg,IV q8-12 hrs, if needed, Activated charcoal (1-4g/kg bwt Po).

Prevention: Keep pesticides away from feed, and avoid use in enclosed sheds

Pyrethroids

Pyrethroids are insecticides whose toxicity is enhanced in cold conditions due to increased persistence. Affected animals commonly show signs such as tremors and hypersalivation.

Treatment: sedatives (diazepam @0.1-0.5mg/kg IV slowly), detoxification(charcoal 1-4g/kg Po).

Rodenticides

Anticoagulant rodenticides such as warfarin and brodifacoum cause toxicity by interfering with blood clotting mechanisms. Affected animals typically show signs of bleeding, anemia, and widespread hemorrhages

Treatment: Vitamin K1 @0.5-2.5mg/kg bwt (3–4 weeks) Bromethalin is a neurotoxic rodenticide that causes cerebral edema by disrupting energy metabolism in the central nervous system. Affected animals show neurological signs such as tremors and progressive paralysis.

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Treatment: Activated charcoal (1-4g/kg bwt Po), mannitol 20% (0.5-1g/kg IV slowly), anticonvulsants (diazepam @0.1-0.5mg/kg IV slowly).

3. WEEDICIDE (HERBICIDE) TOXICITIES

Paraquat

Paraquat is a highly toxic herbicide for which cold stress can worsen lung injury. It produces free radicals that cause severe oxidative damage, leading to pulmonary fibrosis. Affected animals show signs such as difficulty breathing and cyanosis. **Treatment:** Fuller's earth (0.5-1g/kg bwt Po), antioxidants **Prevention:** restrict access to sprayed fields

Glyphosate

Glyphosate is a widely used herbicide that primarily causes gastrointestinal irritation when ingested. In most cases toxicity is mild, but rarely it may lead to renal damage.

Treatment: Activated charcoal (1-4g/kg bwt Po), fluid therapy **Prevention:** proper storage and handling of glyphosate, restricting animal access

2,4-D Herbicide

2,4-D herbicide toxicity in animals can cause gastrointestinal and neuromuscular effects due to its corrosive nature and its ability to disrupt cellular metabolism and cell membrane integrity. Affected animals typically show signs such as rumen atony, muscle rigidity, and ataxia.

Treatment: Activated charcoal (1-4g/kg bwt Po), sodium bicarbonate 5% or 8.4% (1-5 mEq/kg IV slowly), and methocarbamol (44-220mg/kg IV slowly, careful administration to avoid excessive CNS depression).

Prevention: restricting animal access till drying

4. CHEMICAL FERTILIZER TOXICITIES

Following decreased rumen microbial activity, decreased water intake, and spilt fertiliser ingested owing to hunger, chemical fertiliser toxicities, especially those involving nitrogen-based chemicals like urea and ammonium nitrate are much more common throughout the winter[3].

Urea Fertilizer Toxicity

The rumen becomes highly alkaline (pH rises beyond 7.5–8.0) when urea increases the quantity of NH_3. In this alkaline environment, ammonia transforms from its "safe" form to its "toxic" form. Common signs of urea fertilizer toxicity include convulsions, tremors, bloat, and salivation.

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Treatment:_1L vinegar + cold water, Rumen lavage

Prevention: mix urea properly; avoid feeding hungry animals

Ammonium Nitrate Fertilizer

Rumen microorganisms convert ingested nitrates to nitrites, which subsequently enter the bloodstream and oxidize hemoglobin iron from the ferrous to the ferric state. This results in tissue hypoxia and the distinctive "chocolate brown" blood because methemoglobin cannot bind or carry oxygen.

Treatment: Methylene blue (8-10mg/kg IV slowly).

5. AIR POLLUTANT & GAS TOXICITIES

Carbon Monoxide (CO)

Winter increases the risk of Carbon Monoxide (CO) poisoning in livestock due to the use of coal or wood heating inside closed sheds with poor ventilation, which traps the colorless, odorless gas. Ataxia (staggering), abrupt collapse, and cherry-red mucous membranes are signs of oxygen deficiency caused by high CO levels binding to hemoglobin to produce carboxyhemoglobin [4].

Treatment: 100% oxygen

Prevention: ventilation, dry bedding

Ammonia

Ammonia gas builds up from the bacterial decomposition of urine and manure in poorly ventilated, enclosed barns, reaching hazardous amounts close to the floor. Extended inhalation results in significant mucosal irritation, which damages the respiratory defense mechanisms and increases the risk of subsequent pneumonia, conjunctivitis, and persistent coughing.

Treatment: Antibiotics, Meloxicam(0.5 mg/kg s/c,IM)

Prevention: ventilation, dry bedding

Sulfur Dioxide & Nitrogen Oxides

Acidic compounds are created when moisture in the respiratory system combines with these oxides, which are byproducts of burning fossil fuels in heaters with insufficient ventilation. Inhalation causes immediate respiratory irritation, coughing, and difficulty breathing; these symptoms can progress to irreparable lung damage and perhaps fatal pulmonary edema (fluid in the lungs).

Treatment: Oxygen Therapy, Methylprednisolone (1-2mg/kg IV or IM), Albuterol bronchodilator @0.025-0.05mg/kg nebulization.

Prevention: ventilation

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6. COAL EMISSIONS–RELATED TOXICITIES

A hazardous mixture of pollutants, including carbon monoxide, sulfur dioxide, nitrogen dioxide, and fine particulate matter (PM2.5), are released when coal is burned. These drugs enter the lungs deeply, causing systemic respiratory inflammation, impairing the immune system's capacity to combat infections, and increasing the incidence of pneumonia [5].

Treatment: Oxygen Therapy, Methylprednisolone (1-2mg/kg IV or IM), Albuterol bronchodilator @0.025-0.05mg/kg nebulization.

Prevention: avoid indoor coal burning, improve airflow

7. SALT TOXICITY

When frozen reservoirs cause dehydration, livestock are forced to seek moisture by licking salt blocks or eating high-salt feeds that stay undiluted in the digestive track. This is known as winter salt poisoning. If this sodium imbalance is not treated with progressive, controlled rehydration, fluid rushes into brain cells (osmosis), causing severe neurological symptoms as head pressure, blindness, whirling, and seizures, which sometimes result in fatal cerebral oedema [6].

Treatment: Slow, controlled rehydration, Mannitol for brain oedema(20% solution 0.5-1g/kg IV slowly),

8. HEAVY METAL TOXICITIES

Lead

Lead poisoning in animals and pets has increased due to the burning of old batteries for warmth in cold weather and the idling of cars in sheds with inadequate ventilation, which produces concentrated lead-laden exhaust. Severe neurological and digestive crises brought on by these exposures are marked by rumen stasis, violent convulsions, and abrupt blindness [7].

Treatment: Ca-EDTA (50-75mg/kg/day IV,slowly 3-5 days), thiamine (2-5mg /kg slowly)

Cadmium

The main cause of cadmium toxicity is prolonged usage of phosphate fertilizers, that are composed of cadmium that plants absorb and pass on to grazing animals. Chronic exposure interferes with iron absorption and damages red blood cells, resulting in anaemia and irreversible kidney damage (tubular dysfunction).

Treatment: none specific

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Mercury

Mercury poisoning from processed fungicides or industrial waste is extremely harmful since it damages the kidneys and brain. Immediate medication is crucial because the toxic effects are frequently irreversible, which include blindness and tremors to kidney shutdown.

Treatment: chelators (DMSA) 10mg/kg orally, q8-12hrs

Zinc

Animals that lick or chew on galvanised wire, pipes, or containers frequently develop zinc poisoning because the zinc reacts with stomach acid. This chemical reaction creates corrosive zinc salts that cause hemolysis, jaundice and severe diarrhoea as the body struggles to process the resulting cellular debris.

Treatment: Ca-EDTA (50-75mg/kg/day IV, slowly 3-5 days), supportive care

9. ENTEROTOXEMIA

Enterotoxemia caused by *Clostridium perfringens* Type D is more common in winter due to sudden shifts to high-energy diets, low roughage availability, and weakened immunity from cold stress. Affected animals may show diarrhea, bloating, and opisthotonus, often leading to sudden death.

Treatment: antitoxin (if early), fluids

Prevention: vaccination, diet management

10. MYCOTOXINS

Mycotoxin contamination is more likely in the winter due to high humidity in feed stocks, sluggish crop drying, and inadequate ventilation that promotes mould growth. Aflatoxin, which is hepatotoxic, ochratoxin, which is nephrotoxic; fumonisin, which causes pulmonary oedema, and ergot alkaloids, which cause vasoconstriction and gangrene, are the main mycotoxins. Animals affected by ergotism may exhibit decreased milk production, jaundice, stunted growth, and lameness [8].

Treatment: Mycotoxin binders [Activated charcoal (1-4g/kg bwt Po)], Hepato-protectants

Prevention: Remove contaminated feed

Conclusion

Make sure feed is free of mold and routinely tested for nitrates and mycotoxins as general prophylactic measures for all winter toxicities. To avoid freezing and sudden changes to your ration, always have access to water. Keep sheds appropriately aired, clean them frequently, and avoid burning fuels indoors to reduce hazardous exposure. Pesticides and chemicals should not be applied near animals, stored securely, and kept away from feed and bedding. Give animals a well-balanced diet, prevent them from overgrazing snow-covered

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pastures, gradually introduce winter food, and keep them away from contaminated feed and known toxic plants. Vaccinate against enterotoxemia, provide the necessary mineral supplements, and avoid overusing urea and fertilizers.

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