Why Animals Die From Eating Poisonous Plants

If animals can learn which plants are toxic and which are safe, then why do they eat poisonous plants and die? Under most circumstances animals can learn if a plant is safe or harmful because eating results in feedback from the gut to the brain. Feedback tells the body whether or not a food is safe. Unfortunately, in some situations this mechanism for identifying harmful foods is circumvented causing animals to suffer from overingestion of poisonous plants.

Toxins are everywhere. Many people assume that only poisonous plants contain toxins but in reality toxins occur in all grasses, forbs, shrubs, and trees. Even the vegetables we grow in our gardens contain low amounts of toxins. Tomatoes and potatoes contain alkaloids, spinach contains oxalates, corn contains cyanogenic glycosides, and cabbage contains glucosinolates. Poisonous plants are simply a subset of plants that cause obvious signs of poisoning or death.

Not all toxins produce nausea. In order for animals to learn that a plant is harmful, they must experience nausea after eating the plant. Nausea causes animals to form an aversion to the plant, meaning they either stop eating or reduce intake of the plant. The alkaloids in locoweed, for example, don't seem to cause nausea, so animals can't learn locoweed is harmful. Of the toxins tested most cause nausea and animals can learn to avoid them. Unfortunately, most toxins haven't been tested.

Compounds that cause bloat evidently do not affect the emetic center. These compounds produce excess gas and foaming in the rumen causing distention of the rumen that can be deadly. The animal may feel uncomfortable due to excessive gas but the body doesn't associate food with excess gas and discomfort. In addition, most plants that cause bloat are also very nutritious which encourages animals to eat these plants.

Feedback must occur soon after eating. Animals can learn to avoid eating foods provided the delay between eating and illness is 12 hours or less. Mice over-ingest d-Con because illness and death don't occur until 4 to 5 days after eating the food. Thus, plants causing chronic problems that occur over weeks or months, such as liver disease, or sloughing of the hoofs are not likely to produce food aversions. Likewise, plants that causes birth defects may not be aversive enough to keep animals from eating them.

No role model. Livestock reared in areas with acutely toxic plants generally don't die from eating these plants, but naive animals may eat them and die. Young animals learn to avoid the plant their mothers avoid. When naive animals have no role model to teach them about acutely toxic plants, they may eat too much and die before they can learn from feedback that these plants are harmful. On the other hand, if youngsters reared by experienced mothers do eventually eat small amounts of the plants and get sick, they form a stronger aversion to these plants than if they experienced sickness without having mom as a model.

Producers in some areas with acutely toxic plants make new animals taste the plants and then stomach tube them with a sub-lethal solution of the toxic plant in water to teach them to avoid the plant.

Nutrients send mixed signals. While most toxins produce food aversions, many toxic plants are also nutritious. Intake of nutritious foods that contain toxins tends to be cyclical. Animals increase intake of a nutritious, toxic food until they experience illness from the food and then they decrease intake of the food. After the animal recovers from illness it again increase intake due to the feedback from the nutrients in the food and the cycle repeats.

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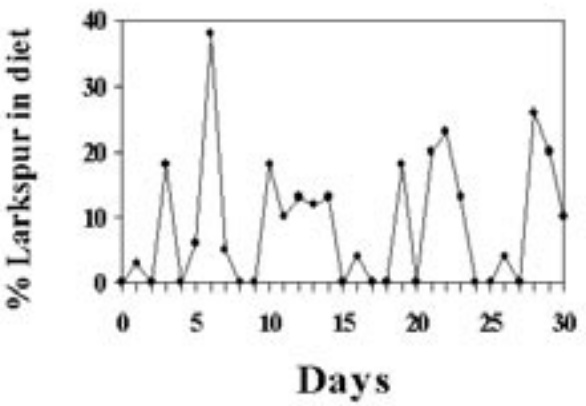
Unfortunately, sometimes they eat too much and die. Below is a graph of larkspur intake by a single cow over 30 days.

Toxins must have a flavor. Animals must be able either to taste the toxin or a flavor paired with the toxin to detect changes in toxin concentrations in foods. If the toxin concentration increases but the flavor of the plant doesn't change then animals cannot detect the increase and they may eat too much of the plant.

In some circumstances the concentration of the toxin doesn't change but its availability increases. For example, plants that contain cyanogenic glycosides are relatively safe for ruminants to eat. The cyanide in these compounds is not released until they interact with the correct enzyme in the plant as the animal chews the food or during digestion. However, after a frost, plant cell membranes rupture allowing cyanogenic glycosides and the enzyme to mix. Thus, all of the cyanide in the plant is available as soon as the animal eats the plant making it very toxic. The flavor of the plant doesn't change but the toxicity increases.

Stress increases toxicity. Stress increases the potency of a toxin. For example, aside from being aversive, alkaloids in larkspur cause muscular paralysis and respiratory failure. If an animal eats larkspur and then is stressed by a predator or a herder, muscles cannot function properly due to the toxin in larkspur and the animal dies of respiratory failure.

New environments also cause stress. The same dose of a toxin has a much greater effect in an unfamiliar environment than in a familiar one. The stress heightens the toxin's action on the animal, likely by diminishing the effectiveness of detoxification processes, much as chronic stress suppresses immune responses. Thus, eating toxic plants in amounts that were sub-lethal in familiar settings may be deadly in unfamiliar areas.



In new environments, animals are also less likely to try new foods and aversions to foods are more likely to break down. Thus, if a new location contains novel foods and familiar toxic foods, animals may choose familiar toxic foods over novel foods.

Lack of water or alternative foods. Thirsty animals often have no appetite. If poisonous plants abound near watering points, animals may eat too many of these plants soon after they drink and while waiting for the rest of the herd to water.

If animals have a choice between eating a toxic food or starving, in most cases they'll eat the toxic food. Animals need to have nutritious alternatives when toxic plants are present. Animals on a good plane of nutrition are less likely to eat poisonous plants and are better able to detoxify them if they do eat them. In addition, thin animals may be more likely to suffer from the effects of poisonous plants than animals in average body condition. When consuming toxic plants, animals in poor body condition have higher concentrations of toxins in their blood than animals in average body condition.

Conclusions. Managers may be able to reduce losses due to poisonous plants if they understand why animals succumb to poisonous plants. Introducing animals slowly to areas that contain poisonous plants, knowing how the toxin in the poisonous plant of concern affects animals, providing alternative forages and ample water, and removing toxic plants near watering points will help keep animals safe.

References

Provenza, F.D., J.A. Pfister and C.D. Cheney. 1992. Mechanisms of learning in diet selection with reference to phytotoxicosis in herbivores. J. Range Manage. 45:36-45.

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