

Diet Mixing: Increasing Intake of Unpalatable Plants



The cows at Ray Banister's ranch in eastern Montana readily eat plants that cows don't normally eat, such as sagebrush and snowberry. Banister uses a management style he calls boom-bust grazing. It involves short, intensive periods of grazing followed by two growing seasons of rest. He monitors the least palatable plants and moves his cows only after they eat most of these species reducing the competitive advantage unpalatable plants normally have over more palatable species. As a result his ranch has some of the best biodiversity and cover in the area.

Implementing the new system came with a cost. It took Banister's cows three years to adapt to boom-bust grazing. During that time weaning weights of his calves plunged from over 500 pounds to 350 pounds, then rebounded to over 500 pounds. Initially when cows first entered a pasture, they ate only the most palatable species before eating the unpalatable plants. Today, cattle eat both palatable and unpalatable species as soon as they enter a new pasture. The cows evidently have learned how to mix their diets in ways that enable them to eat unpalatable species.

Recent research demonstrates that animals *learn* to eat unpalatable plants and to mix unpalatable and palatable plants in their diets. Furthermore, the nutritional composition of an animal's diet affects how much of these unpalatable plants animals can eat.

Do unpalatable plants taste bad?

Many people believe unpalatable plants taste bad but that's not the case. Unpalatable plants

contain toxins that often limit intake. As demonstrated by a recent experiment, ingesting high levels of plants that contain toxins makes animals sick causing them to reduce intake or avoid the plant in the future. Lambs were offered a ground food and while they ate, terpenes (the potentially toxic compounds found in sagebrush) were slowly infused into their blood stream. These lambs stopped eating 30 minutes sooner than lambs fed the same food but not infused with terpenes. Thus, when animals feed on sagebrush, the level of terpenes in the blood stream, not the flavor of the terpenes, causes them to stop eating.

Experience affects intake. Experience eating toxins increases the likelihood animals will eat substantially more high-toxin foods both voluntarily and when forced. When two groups of sheep had free access to ground alfalfa and a 50:50 alfalfa-barley ration, sheep experienced with toxins (three rations containing either oxalate, terpene or tannin) ate 11 times more of the high-toxin foods compared with sheep with no experience with toxins. When ground alfalfa and alfalfa-barley were severely limited, experienced sheep ate 2.5 times more of the high-toxin foods compared with sheep with no experience with toxins. Throughout the study, sheep showed no ill effects from eating diets high in toxins.

First Impressions Matter. Animals are more likely to continue to eat plants high in toxins if their first experience with the plant is positive. Sheep first exposed to a toxin in a diet high in nutrients include a greater amount of the toxin-containing food in their diet than

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sheep first exposed to the toxin in diets low in nutrients. In addition, nutrients and toxins don't have to be in the same food to improve intake. Feeding animals nutrients before and after eating an unfamiliar high-toxin food increases acceptance of the high-toxin food. In one study, lambs were either fed an alfalfa-grain ration immediately before and after eating an unfamiliar, poor-quality, high-toxin food or they were fed the alfalfa-grain ration and the unfamiliar poor-quality, high-toxin food at different times of the day. During the trial, lambs introduced to the high-quality and high-toxin foods closely in time ate more of the toxin-containing food and spent less time searching for other foods than lambs introduced to the two foods at different times of the day.

Supplements Help. Supplementing ruminants with moderate amounts of protein and energy increases their intake of foods containing toxins such as terpenes, menthol, lithium chloride or tannins because nutrients enable animals to detoxify toxic compounds in plants. Sheep and goats receiving supplemental nutrients nearly doubled their intake of chopped sagebrush. In a grazing study, sheep receiving supplemental protein and energy for 15 min/day spent 12% more time feeding on sagebrush compared with sheep that did not receive the supplement. Supplemented sheep continued to increase intake of sagebrush throughout the study while sheep without supplements decreased intake of sagebrush near the end of the study.

Herbivores must have access to the proper mix of nutrients, not just more nutrients, to enable them to eat toxin-containing foods. For example, sheep and goats fed a diet high in protein were able to eat greater amounts of sagebrush and high-tannin foods than those offered a diet high in energy and low in protein. Ratio of energy/protein and the degradability of nutrients (how quickly they are broken down in the rumen) must be considered when formulating a supplement to increase intake of unpalatable plants. When the correct supplement is unknown, provide animals with a choice of high-protein or high-energy foods for a limited time each day until it becomes clear which proportions of foods they prefer when eating particular plants.

Availability of Alternatives. Managers can affect the likelihood herbivores will eat unpalatable plants on rangelands by limiting alternative foods. Sheep in good body condition are more likely to eat greater amounts of high-toxin foods, especially those containing terpenes, as the amount of low-toxin food becomes more limiting. In fact, when the amount of low-toxin food was severely limited, sheep inexperienced with toxins (oxalate, terpenes, and tannins) ate more food and gained more weight than when the amount of low-toxin food was only moderately limited. These results support the idea that animals must be pressured into trying new foods especially those with strong flavors. However, these results do not support the notion that sheep are more likely to eat foods high in toxins if they have no alternative foods. During the trials above, lambs were fed limited amounts of high quality foods each day in conjunction with foods high in toxins. Providing animals with some nutrients each day is essential if they are to eat and detoxify plants high in toxins.

Once animals start including unpalatable plants in their diet, people are often tempted to force animals into areas that contain the unpalatable species with limited amounts of alternative forages. Unfortunately, forcing animals to eat a diet too high in toxins with few alternatives often results in animals forming an aversion to the plant. This is especially true if animals are becoming acquainted with a new food. Once animals are eating unpalatable species, they must have choices to keep from ingesting too much toxin and to provide nutrients to detoxify toxic compounds in plants.

Conclusion. Animals can eat substantially more toxins than once believed. Providing animals with positive experiences with unpalatable species and adequate nutrients for detoxification are key to helping animals eat unpalatable species.

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