ANIMAL BEHAVIOR: IMPACTS ON GRAZING

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I am not an expert on this subject and give all credit for my limited understanding of this subject to Dr. Fred Provenza, Utah State University; Katy Voth, Livestock for Landscapes, LLC; Jim Gerrish and others. I have tried to put into practice, both personally and with other producers, many of these principles to aid in improved grazing management. This presentation will address only 2 aspects of animal behavior; 1) How animal behavior impacts grazing distribution and forage utilization over the landscape, and 2) How animal behavior affects diet selection.

Impacts on grazing distribution/forage utilization over the landscape

Most, if not all, of the grazing animals that we work with evolved as herd animals. The herd mentality developed as a means of protection, safety in numbers. Herd animals like to stay in close proximity of their herd mates for protection. This instinct can have an effect on the grazing distribution and utilization of the overall pasture. When some of the animal's basic needs such as shade, water, salt and/or minerals are located some distance away from where the animals are grazing, they will travel as a herd to these areas. This reduces the herd's ability to uniformly graze throughout the entire pasture. Conversely, if all of these basic needs are in close proximity to each other, it can cause the herd to camp out in this area for an extended period causing overgrazing, reduced plant vigor, increased soil erosion, increased weed invasion, soil compaction, increased pollution potential from runoff and degraded wildlife habitat. Research at the Forage Systems Research Center in Linneus, Missouri shows that as travel distance to water increased above 800 feet, then the animals traveled as a herd to water and utilization of the pasture beyond 800 feet was greatly reduced. When travel distance to water is kept below 800 feet then the animals normally drink individually or in small groups and resume grazing across the pasture. Subsequent research shows the effect that water location, shade and paddock size have on grazing distribution and manure distribution. Pasture utilization is affected by the length of the grazing period and stock density. Grazing period is the length of time grazing animals are in any one pasture. The longer grazing animals are in a pasture the lower the utilization rate will be. This is due to the animal's ability to selectively graze choice plants and new regrowth while letting others go to maturity and desiccation. Losses due to trampling, soiling, manure and urine are greater with longer grazing periods. When pastures are sub-divided into smaller units, stock density increases and grazing period length decreases. As stock density increases this decreases the animal's ability to selectively graze due to competition from herd mates. As grazing period length and selectivity are decreased, pasture utilization is increased.

Effects on diet selection

Grazing animals have the ability to select a higher quality diet than the average for the pasture. This is due to the animal's ability to select particular plant species, individual plants and plant parts to eat. Selection is driven by: 1) Availability; 2) Palatability; 3) Differential access due to plant growth form;

and 4) Habit and experience. Each of these four factors will be discussed in more detail.

Availability

Dry matter intake on pasture is based 75% on availability and 25% on forage quality. The reason availability is so important is due to the mechanics of grazing. Intake is driven by: time spent grazing; biting rate; and bite size. Grazing animals spend 6 – 10 hours per day grazing. During this time they can only take so many bites per minute. Cattle generally take 30,000 to 50,000 bites per day. This seems like a lot but it is still a limited number. There is quite a difference in intake between 50,000 mouthfuls and 50,000 small bites. The only thing that we as managers can regulate is bite size. To maximize intake each bite needs to be a mouthful. Research shows that for animals to reach potential intake, 1800 – 2400 pounds of forage dry matter per acre should be on offer. In our cool season grass/legume mixed pastures this equates to approximately 6 – 8 inch tall pasture sward. This would give a good bite size of high quality forage. Conversely, animals forced to graze on 2 inch tall pasture will be limited on intake due to bite size.

Palatability

Palatability also drives diet selection. Palatability is often defined as pleasant tasting, but research by Dr. Fred Provenza shows that palatability is more than a matter of taste. Palatability is determined by post-ingestive feedback interrelationships between nutrients, toxins and flavor. Animals associate a particular flavor to either a positive or negative post-ingestive feedback. All plants contain differing levels of nutrients and toxins. Some common plant species that contain toxins include:

Toxin	***Plant Species***
Cyanide compounds	White clover, Sudan grass, Johnson grass, Chokecherry, Serviceberry
Alkaloids	Reed canarygrass, Bindweed, Jimsonweed
Fungal endophytes (ergot alkaloids, ergovaline)	Tall fescue, Perennial Ryegrass
Nitrate	Oats, Wheat, Rye, Pigweed, Sweet clover, Alfalfa, Sudangrass
Tannins and phenolic compounds	Birdsfoot trefoil, Serricea lespedeza, Crown Vetch, Walnut, Oak
Terpenes	Juniper, Pine, Bitterweed

Palatability operates along a continuum to influence preferences. When nutrients are eaten in proper amounts the post-ingestive feedback is positive and the animals develop a liking for the flavor. However, when animals overingest either nutrients or toxins a negative post-ingestive feedback occurs and they develop a dislike or aversion to the flavor. Aversions can be strong or mild, long lasting or short-lived depending on the severity of the post-ingestive feedback and other factors we will discuss later. Nutrient and toxin concentrations limit the amount of feed an animal can ingest. Excesses or deficits of nutrients decrease palatability. Animals show little preference for foods low in nutrients and eat limited amounts of foods too high in nutrients. Excess protein reduces palatability and intake because of an increased production of ammonia. Excess energy can cause acidosis which reduces palatability and intake.

Animals like variety in their diets. Variety in the diet helps reduce the chance of overingesting toxins. Diversity or variety also helps meet the nutritional needs. Different types of plants supply differing levels of protein, energy, minerals and vitamins. Animals can develop aversions to foods when they become satiated on that particular food flavor. Providing animals

with a variety of foods (diversity) may provide animals with a more balanced diet, increase intake, decrease stress and increase efficiency.

Plant Growth Form/Physical Attributes of Plants

Grazing animals must deal with plant physical characteristics such as standing dead material in some grasses, thorns in some forbs and woody plants, leaf size, and plant canopy shape and structure. These physical features can facilitate or inhibit foraging and increase or decrease intake. Some animals such as goats and sheep with their small mouths and prehensile lips have the ability to select the most desirable parts of plants. Cattle on the other hand, with their large rumen capacity can handle more volume and thus can digest lower quality material. Any combination of plant physical and nutritional characteristics that optimizes intake will be a preferred food.

Habit and Experience

Research indicates that animals learn which plants to eat and which to avoid through three avenues: watching mothers, interacting with peers, and reinforced through personal experience. Young animals learn about every facet of their environment from socializing with their mothers. As young animals begin to forage, they quickly learn to eat the foods mother eats and they remember those foods for years. Research also shows that a mother can help reduce her offspring's risk of eating toxins. If a mother avoids harmful foods the offspring will also avoid ingesting those foods in any large quantity. Young animals acquire preferences for foods its mother eats and aversions for foods she does not eat. This training from mom is further reinforced by personal experiences. If the young animal eats a plant that mom avoids and later has a negative post-ingestive feedback, then a more definite aversion to that food is formed.

As young animals grow older they interact increasingly with their peers. Peers become a major influence on each others behavior. Young animals encourage one another to try new things. Each young animal may have different past learning experiences. Socializing enhances the learning efficiency of the group. Each individual animal no longer has to discover everything by itself.

Animal behavior is a function of consequences. Consequences come in two forms – reinforcement and punishment. Behavior results from various combinations of these consequences. Consequences that increase the probability of a behavior are called reinforcement and they can be either positive or negative. By nature, animals seek positive reinforcement and avoid negative reinforcement. Consequences that decrease the probability of a behavior are called punishment. Positive punishment is based on the presence of positive aversive stimuli, such as an electric fence shock. Negative punishment is based on the removal of a positive re-inforcement, such as when an animal eats a plant that was once nutritious but is no longer nutritious. They no longer receive positive post- ingestive feedback and decrease the occurrence of this behavior. There is a growing movement away from the use of negative reinforcement and punishment and towards the use of positive reinforcement. Punishment often times arouses anger and fear. Whereas the removal of positive stimuli of leads to disappointment or depression. This happens when animals are removed from familiar environments and placed in unfamiliar environments. Performance is poor and stress is high because all familiar positive reinforcements have been removed. Behavior is better developed by positive reinforcement than by negative reinforcement or punishment. A combination of positive reinforcement and punishment or negative reinforcement may

be the most effective means to change a particular behavior. Through punishment (electric fence, removal of nutrients or addition of toxins), animals can be trained to avoid palatable plants. However, the aversion may not be long lasting unless the animals are given access to nutritious alternatives (positive reinforcement). For training to be most effective, it's not enough to simply discourage unwanted behavior. Animals also need to be encouraged to change behavior.

By using the information of how animals choose foods, they can be trained (taught) to eat unfamiliar and/or less preferred foods by creating a positive reinforcement. Animals can also be trained to avoid preferred foods by creating an aversion through negative reinforcers, positive punishment or negative punishment. Kathy Voth, Livestock for Landscapes, LLC, has developed a 7 step process for training animals to eat unfamiliar foods. This process has been used to train animals to eat foods such as weeds that they normally wouldn't eat. Below is a summary of the 7 step process:

1. Know your plants.
    a. Know what toxins they contain
    b. Know their nutritive value

2. Choose your animals to train
    a. Younger animals are more likely to try new things
    b. Females will tend to teach offspring

3. Maintain a healthy herd
    a. Healthy animals can handle toxins better

4. Reduce the fear of new things
    a. Feed a series of unfamiliar, nutritious foods to produce positive post-ingestive feedback.
    b. Use familiar feed tubs or troughs

5. Make the unfamiliar seem familiar
    a. Add the novel plant to the familiar feed and feeder

6. Field test your animals
    a. Pasture size is critical
        i. Too large and animals can be selective
        ii. Too small and they may not be able to adequately mix toxins and nutrients

7. Observe and adapt
    a. Monitor and make adjustments in pasture size, timing and duration of grazing

References

Provenza, Frederick d., Foraging Behavior: Managing to Survive in a World of Change, 2003

Voth, Kathy; Teach Your Cows to Eat Weeds, Proceedings 2005 MFGC Annual Conference

Gerrish, etal. Missouri Grazing Manual, 1999

BEHAVE – Behavioral Education for Human, Animal, Vegetation & Ecosystem Management, www.behave.net

Livestock for Landscapes, Kathy Voth, www.livestockforlandscapes.com