

Using Behavioral Principles to Increasing Use of Medusahead by Livestock

Beth Burritt, Extension Associate Professor
Department of Wildland Resources
Utah State University Extension

Over the last 30 years, behavioral studies at Utah State University focused on understanding how livestock learn about foods. One of our goals was to increase intake of unpalatable forages, if possible. Our research has led to the following principles of diet selection: 1) animal that eat forages early in life eat more of those forages later in life compared to animals without early experiences; 2) many unpalatable plants cause food aversions; 4) the correct supplement can increase intake of unpalatable forages; and 4) intake of unpalatable species varies greatly from animal to animal. Our studies to understand and increase intake of medusahead began with these findings in mind.

Before our studies on medusahead began, we knew the following: Medusahead is mostly stem with a few small leaves, its seedheads have nasty awns, it's high in silica and low in nutrients and it produces a thatch that smothers other plants, doesn't readily breakdown, and is highly flammable.

How much medusahead can sheep eat? Studies at USU were the first to document intake of medusahead by sheep. Medusahead was collected fresh each morning and offered to sheep in individual pens for 6 hours each day. Sheep ate from 6 to 20% of the diet at seedhead emergence, 3 to 6% of the diet of mature medusahead and 10 to 25% of the diet as medusahead thatch (Hamilton et al. 2015).

In pen studies, sheep preferred seedheads (60%) to leaves and stems (40%). Seedheads contained more protein (10.3%) than leaves and stems (7.5%). They also contained lower levels of fiber but more ash. Ash can be an indication of silica content. These results are contrary to the idea that the awns of medusahead seedheads cause medusahead to be unpalatable (Villalba and Burritt 2015).

Aversion. Many unpalatable plants cause food aversions; they make animals sick. Medusahead does not cause an aversion but we did see a cyclic intake pattern of medusahead, high one day, declining the next. Indicating that silica may be affecting rate of passage though the rumen and affecting rumen fill.

Early Experience. As stated earlier, experiences early in life often increase intake of forages later in life. Lambs ate similar amounts of medusahead as their mothers even when foraging alone. However, in pen studies, when medusahead was offered to yearling sheep with and without experience early in life, intake was not affected by early experience. Medusahead intake across days was cyclic with more pronounced intake peaks at the beginning and end of the experiment for inexperienced animals. Experienced sheep had a greater gain-to-feed ratio, and tended to have greater average daily body weight gains and salt intake than inexperienced sheep. On rangeland, the proportion of bites of medusahead by sheep both experienced and inexperienced with medusahead was almost nil, although more medusahead tillers were grazed

in pastures with experienced than inexperienced animals (Montes-Sánchez and Villalba. 2017ab).

Supplements. Supplementation did not improve intake of medusahead. In pens, sheep fed either a high protein (29%) or high energy (3.5 Mcal/kg) supplement or a choice of the two did not eat more medusahead than sheep not offered a supplement. Sheep supplemented with propionate, a yeast culture, or alfalfa also did not increase intake of medusahead (Hamilton et al. 2015, Villalba and Burritt 2015, Montes-Sanchez 2017).

Intake on rangeland

Supplementation of sheep does not affect intake of medusahead on rangelands. However, Montes-Sanchez et al. (2017) found that when medusahead was 10% of the plant community, the amount of medusahead in sheep diets was also about 10%. Thus, sheep neither preferred nor avoided medusahead when the proportion of the weed in the plant community was as low as 10%. This suggests that proper grazing in areas with low levels of medusahead will not likely increase the spread of the weed.

Cattle grazing pastures inter-seeded with wheatgrasses and forage kochia spent 9% of their time grazing medusahead, 70% grazing other annual grasses, and 20% grazing forbs, wheatgrasses, and forage kochia. In the medusahead-infested plant community, cattle spent 32% of their time grazing medusahead, 66% on other annual grasses and 2% on forbs. Grazing the improved pasture before grazing medusahead-infested plant community did not influence the use of medusahead or other annual grasses. Both groups of cattle spent more than 95% of their time grazing medusahead and other annual grasses (Spackman et al. 2016).





Cattle did increased intake of medusahead when supplemented with canola meal. However, cost of the supplement and feeding it on rangelands covered with medusahead may be impractical for producers. Nevertheless, these costs may be outweighed by improvements in animal body condition and reproductive output. (Stonecipher et al. 2016).

Silica. Inclusion of powdered silica (silica dioxide) into ground alfalfa decreased intake of alfalfa, but did not account for the unpalatability of medusahead (Hamilton et al. 2015). Thus, the structure of silica in the plant and not silica per se likely affects the palatability of medusahead.

Individual Variation. Some sheep ate 20 to 100% more medusahead than others, those that ate more medusahead also ate more silica when added to the diet. Selecting and breeding animals that eat more medusahead may provide a method to use grazing to reduce medusahead infestations using custom bred animals.

Digestibility of Medusahead. Digestibility of medusahead at different phenological stages (64 to 71% range) was similar to that of tall fescue hay (67%) and greater than digestibility of alfalfa hay (53%). Thus, medusahead is marginal in protein but adequate in energy according to laboratory analysis.

Digestibility is determined by grinding dried plant material through a 1 mm screen. Ground plant material is then incubated in rumen fluid for 48 hours followed by an enzyme solution for another 48 hours. However, ruminants do not chew their food to a 1 mm size during grazing and rumination. Furthermore, while total digestibility is a good indicator nutritional value, it is a poor indicator of preference. Instead, rate of digestibility is a better indicator of preference because the quicker a food is digested the sooner nutrients are released and can be detected by the brain.

	1 mm	Medusahead has similar rates of digestibility as tall fescue hay but lower than those of alfalfa. Larger particle sizes (5 to 20 mm) reduced rates of digestibility of medusahead to a greater extent than either alfalfa or tall fescue. It took at least 24 hours before larger particles of medusahead began to break down in rumen fluid. Thus, rates of digestibility and particle size not total digestibility explain the low intake of medusahead. The high silica content of medusahead likely decreases the mechanical and enzymatic breakdown of the plant in the rumen, decreasing passage rate in the rumen (Montes-Sánchez and Villalba. 2017a).
	5 mm	
	10 mm	
	20 mm	

Cows Versus Sheep. Cows are likely better medusahead eaters than sheep. In general, cows are better at digesting grasses which are often high in silica and fiber. Cows with more powerful jaws and rumen contractions can reduce particle size of medusahead more efficiently than sheep. The smaller opening between the second and third stomach of cattle compared to sheep means forages stay in the rumen longer and are digested more completely in the rumen. As for goats, they are even less likely to be able to digest medusahead compared to sheep or cattle.

Conclusions. Our efforts to increase use of medusahead largely failed. We did learn many procedures that did not work and why sheep and cattle avoid medusahead. Please see fact sheet on using glyphosate (Roundup) to increase use of medusahead. The technique was discovered by an rancher in eastern Washington.

References

Hamilton, T., E.A. Burritt, and J.J. Villalba. 2015. Assessing the impact of supplements, food aversion, and silica on medusahead (*Taeniatherum caput-medusa* (L.) Nevski) use by sheep. *Small Ruminant Research* 124: 45–54.

Montes, J.J., H. Van Miegroet, and J.J. Villalba. 2017. Effects energy supplementation and time on use of medusahead by grazing ewes and their lambs. *Rangeland Ecology and Management* 70:380-387.

Montes-Sánchez, J.J. and J.J. Villalba. 2017a. Understanding medusahead low intake and palatability through in vitro digestibility and fermentation kinetics. *Animal* 26:1-9.

Montes-Sánchez, J.J. and J.J. Villalba. 2017b. Effects of early experience and alternative feeds on medusahead (*Taeniatherum caput-medusae ssp. asperum*) intake by sheep. *Applied Animal Behaviour Science* 188: 9–16.

Spackman C., K. Panter, C. Stonecipher, and J. Villalba. 2016. Grazing rotations on restored land as a new tool for medusahead control. 2016 Sagebrush Ecosystems Conservation: All Lands, All Hands Conference. February 23-24. Salt Lake City, Utah.

Stonecipher, C.A., K.E. Panter and J.J. Villalba. 2016. Effect of protein supplementation on forage utilization by cattle in annual grass-dominated rangelands in the Channeled Scablands of eastern Washington. *Journal of Animal Science* 94:2572–2582.

Villalba, J.J. and E.A. Burritt. 2015. Control of medusahead by sheep: influence of supplements, silica and individual animal variation. *Invasive Plant Science Management* 8:151–159.

