Frothy Bloat Mitigation in Grazing Cattle

Frothy bloat impacts on cattle production in the United States in 1999 were estimated to be greater than $300 million dollars. Frothy bloat is the major nonpathogenic cause of death loss and depressed weight gains in stocker cattle grazing winter wheat in the Southern Great Plains. Frothy bloat risk precludes more extensive use of alfalfa as grazed forage. Frothy bloat is a multi-axes complex, comprised of an animal axis, plant axis, and environment axis. Superimposed over the plant and animal axes are management decisions. For discussion purposes, focus is placed on the wheat pasture frothy bloat complex.

The animal axis is comprised of genotypic, phenotypic, and in vivo components. Frothy bloat was deemed heritable more than 30 years ago. Heritability has been variously postulated to be linked to saliva production and chemical characteristics, rumen motility, and gut chemistry. A general perception exists that better-performing animals are more bloat prone, though objective scientific data are lacking. The better-performing-animal postulate may be a manifestation of greater overall forage intake, more intensive intake within a grazing session, and overall gastrointestinal tract volume and kinetics. The grazing patterns of bloated animals differ from those of nonbloated animals, though phenotypic behavior patterns that contribute to bloat susceptibility remain unknown. Scientists at Texas AgriLife Research and Extension Center at Chillicothe/Vernon are working with USDA-ARS MARC at Clay Center, Nebraska, to secure funding to test their genotypic candidate regions for bloat susceptibility in a large-scale (300 head) phenotypic and intra-ruminal physiology characterization of wheat pasture frothy bloat. The heritability of frothy bloat susceptibility clearly points to need for detailed integrated genomic and phenotypic analyses. Emerging technologies in remote biotelemetry and active radio frequency identification will support this type of research at a representative population level of up to 500 animals per experiment. The animal axis is further defined by the symbiotic rumen microbial ecosystem. Research in our laboratory has found rumen bacterial populations differ between bloated and nonbloated animals within an experiment. This research has also revealed bacteria that produce substantially greater amounts of low-gas permeable biofilms and that also proliferate under wheat pasture rumen conditions. Mitigation strategies directed to altering the specific growth rate of candidate rumen bacteria are warranted. Collectively, the need for genomic quantification at multiple scales in the bloat animal axis is clear.

The plant axis is comprised of presence and abundance of bloat precursors. Candidate precursors have been suggested to be soluble proteins in general, RUBISCO and chlorophyll specifically, soluble carbohydrates, and fiber. Cause-and-effect data on precursors and bloat are limited. Most research to date has been correlative. Given the substrate preference of candidate rumen bacteria and the physiochemical properties of rumen contents from bloated animals, there is clear evidence that precursor intake and/or ruminal availability are closely tied to bloat incidence and severity. This research has found that increasing preplant nitrogen fertilization rate leads to increases in bloat frequency and severity, further supporting precursor intake and bioavailability as causal factors.

The environmental axis is implicated because bloat does not occur at all times on wheat pasture and usually is preceded by changes in environmental conditions during periods of active plant growth. This research is exploring a number of plant × environment interactions at this time.

The research has resulted in discovery of several effective mitigation strategies. The focus is on discovering value-added mitigation strategies that enhance productivity in the presence or absence of bloat. Supplementation with secondary plant compounds has been particularly effective in reducing bloat incidence and severity while improving animal weight gains during peak bloat risk periods. Certain ionophore-type compounds have been effective. There are various by- or coproduct supplements that hold promise, as well. To be cost and time effective, mitigation chemistries should be delivered through a self-fed approach. Development of formulations and quantification of among-animal variability in self-fed supplement consumption are needed to ensure that targeted daily intake levels are achieved.

This research team has made more progress in understanding and mitigating the frothy bloat complex in wheat pasture-stocker cattle systems in the last six years than had been made in the previous 40 years.