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## **Dairy Cattle Stresses Caused by Forages What I Have Seen and How To Avoid Them**

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Forages are the most important ingredient in a dairy cow's ration. She is a ruminant and to be a healthy, productive cow she needs a healthy, productive rumen. **High quality forages** are the key to achieving a healthy rumen and a productive cow. However, because of the importance of forages in maintaining rumen health and cow performance, when deficiencies in the amount or quality of the forage in the ration occur, major health problems are the result. There are many possible causes of forage-related health problems in dairy cattle. Attention is often focused on molds, mycotoxins, and high nitrate levels (especially in drought years). While all of these are important, a majority of the forage-related health problems in the dairy cattle that we deal with as veterinarians can be traced to rumen acidosis. Rumen acidosis commonly results from feeding inadequate levels of "effective" fiber and high levels of highly fermentable carbohydrates (grain). The end product of the rumen fermentation of this type of ration is lactic acid, which drops the normal rumen pH from 6-7 to as low as 4. With such decreases in rumen pH many of the normal microorganisms in the rumen are killed and the rumen may become static. The final results are poor digestion of feed, decreased appetite, poor performance, liver damage, and laminitis. Acidosis can be prevented, however, with adequate levels of **effective fiber** in the ration. Because of the importance of rumen acidosis to the productivity and profitability of dairy cows, this article will concentrate on how the lack of adequate fiber in the rations of dairy cows can result in rumen acidosis. More specifically, this paper will concentrate on how silage chop length, TMR mixing/feeding problems, and the use of low-lignin corn silage can produce a deficiency in effective fiber.

### **CHOP LENGTH AT HARVEST**

The most common forage problem we see is forages that are chopped too finely at harvest. Chopping forages finely aids packing in the silo and the resulting fermentation may be excellent. However, it may not be good for the cow. Although on paper a ration may appear to have adequate levels of both acid detergent and neutral detergent fiber, the ration may still not be rumen healthy. This is due to the lack of "effective" fiber. Effective fiber is the longer fiber

particles required by the rumen to create the rumen mat and produce the "scratch factor" The creation of the rumen mat is essential for proper rumen fermentation and nutrient digestion to occur. Long fiber is also the stimulus of cud chewing. Cud chewing stimulates the production of saliva that is rich in sodium bicarbonate and acts as the primary rumen buffer. A normal cow may produce up to 45 gallons of saliva per day, which will contain 4-7 lbs. of sodium bicarbonate. For the rumen mat to form, adequate amounts of larger pieces of forage or fiber must be present. This can be accomplished in a variety of ways. If 25-50% of the ration dry matter is in the form of long-stemmed dry hay the forages may be chopped at a theoretical length of cut (TLC) of 1/4". However, if less hay is used in the ration the TLC should be increased to 3/8 – 1/2". This TLC cut will result in 15-20% of the particles being over 1.5 inches long, which should be adequate for rumen mat formation. As veterinarians concerned about the rumen health of our bovine patients, we are strong believers that to be on the safe side of chop length the goal for TLC should be 1/2". We commonly see problems on farms that have decreased the amount of long-stemmed forages in their rations but have not increased their TLC. Rumen acidosis is the result of such management oversights. Although adjusting the TLC on some harvesters may be difficult, improved cow health will make it well worth the time invested.

Recent equipment innovations have forced us to change some of these recommendations. With the advent of "kernel" or "forage" processors, the 3/8" TLC is no longer adequate. Because of the processing of the forage, inadequate amounts of longer fiber particles will be produced if the TLC is left at 3/8". Therefore, it is recommended that the TLC be increased to 3/4" to produce the recommended amount of 1.5" long fiber particles.

A very useful piece of equipment that has been developed for measuring the effective fiber in a batch of corn silage, haylage, or a total mixed ration is the Penn State Forage Separator. This piece of equipment consists of three boxes stacked on top of each other. The top box has holes 3/4" in diameter, the middle box has holes .31" in diameter, and the bottom box has a solid bottom. When stacked together a sample of the forage can be shaken through the separator, separating the feed into long, medium, and fine portions. The relative amounts of each one of these portions may then be compared to accepted values. (See Appendix 1) It has proven to be a very valuable piece of diagnostic equipment to us in the field.

### **TMR MIXING/FEEDING PROBLEMS**

Many of the nutritional stresses caused by a lack of effective fiber are rations that start out with forage that was chopped at the proper TLC. However, due to a variety of human, mechanical or cow problems associated with the mixing and/or feeding of a TMR the effective fiber in the ration has been drastically reduced.

## **Overmixing**

In herds experiencing this problem forage may have been chopped at the proper theoretical length of cut, but then mixed for too long in a TMR mixer. Overmixing will cause the physical breakdown of fiber particles and greatly reduce the effective fiber available from the ration. The lack of effective fiber will lead to rumen acidosis and its related health concerns.

Diagnosis of overmixing can be accomplished through the visual comparison of the machine mixed TMR and a hand mixed sample of all the ingredients needed for one cow. If there is a large disparity between the two samples overmixing is occurring. The Penn State Forage Separator may also be used for comparing the two samples. To avoid overmixing, one should follow the manufacturer's mixing recommendation, however the general recommendation is for a total mixing time of a surprisingly short 5-6 minutes. This is much shorter than the 20+ minutes we see on many farms. If overmixing is a concern then one may wish to consider adding forages at the end of mixing to reduce the time that they are exposed to the forces of mixing. Some of the newer mixing wagons with reels or vertical screws may aid in the avoidance of overmixing. Additionally, we recommend having one very responsible person handle all the TMR mixing, if possible, to increase the consistency of the final product.

## **Poor Mixing**

Another concern of TMR mixing is mixing wagons that don't produce a homogenous TMR mix. Such mixing results in portions of the feedbunk with either too much or too little effective fiber and will produce inconsistent intakes in the herd. Diagnosis of this problem may be possible by visual inspection of the feedbunk or by performing Penn State Forage Separator analysis of different spots along the feedbunk. A final diagnostic tool is the use of a non-toxic marker such as gumballs or colored paper that can be added to the TMR during mixing. If poor mixing is occurring there will be a large amount of variability in the amount of the marking material along the feedbunk.

## **Sorting**

This lack of consumption of adequate amounts of effective fiber occurs when cows are able to pick through the TMR and preferentially select smaller ingredients (grain) over longer forage particles. Although this is a cow produced problem it occurs most frequently when there is a large amount of both very large (or long) ingredients and fine- sized ingredients, but not much medium-sized ingredients in the ration. To avoid this problem it may be necessary to chop the long-stemmed forage to reduce its length and increase its mixing ability. Sorting may also be accentuated in rations that are lower in moisture. It may therefore be necessary to add water to the ration. Sorting can be diagnosed by performing

Penn State Forage Separator analysis of the feedbunk immediately after putting out the TMR and then after the herd has been allowed to feed for several hours. If there is a large discrepancy between the two analyses (a higher percentage of large particles in the second sample) sorting is occurring. Sorting may also be suspected when there is a large amount of variation in the consistency of the manure of the herd with firm manure coming from cows that consume more fiber and looser manure being produced by those cows that consumed higher levels of concentrates.

Sorting may also be a man-made problem. This occurs through the use of a so-called "poor man's TMR" which consists of a mix of corn silage and concentrates fed separately from long-stemmed hay. In this type of feeding system dominant or "boss" cows may overconsume the silage/concentrate mix and underconsume the hay. Conversely, cows that are low on the pecking order tend to consume more hay and less of the silage/concentrate mix. Just as in the cow-produced sorting, this problem will manifest itself in varying degrees of rumen acidosis, inconsistent dry matter intakes, and variable manure consistency. To avoid this problem the effect of dominant cows must be controlled. This may be accomplished by providing adequate bunk space for consumption of both the corn silage/concentrate mix and the hay. Common bunkspace requirements are 2 feet of bunkspace/cow for the silage/grain mix and 6 inches/cow of hay manger space. If adequate bunkspace is not available, it is imperative that feed be made available to the cows 22-23 hours/day.

### **LOW LIGNIN CORN SILAGE**

A problem we have seen recently in several herds occurred with rations that appeared marginally adequate for fiber on both paper and after analysis with the Penn State Forage Separator. However the herd seemed to be showing signs of more severe acidosis than we would expect. In investigating further it was discovered that most of the corn silage in the ration was brown midrib or low-lignin corn silage. While this silage provides some advantages it must be managed carefully when used in rations. In rations using conventional corn silage we aim for 18-21% ADF, 30+%NDF, and <40%NFC to produce a rumen healthy diet. However, due to the increased digestibility of brown midrib corn silage these goals will produce a borderline "hot" ration that is inadequate for effective fiber and may cause rumen acidosis. If brown midrib corn silage makes up more than 50 % of the forage source of the ration then ADF values need to be 19-21% (19% for cows producing > 70# of milk, 21% for cows producing < 70# of milk), NDF values need to be a minimum of 32%, and NFC levels should be kept in the 37-38% range. These fiber/carbohydrate levels should produce a healthy rumen as long as fiber length is adequate.

## **SUMMARY**

Rumen acidosis is the most common forage related stress that we see in dairy cattle. Rumen acidosis is primarily due to inadequate levels of effective fiber in the rations of those cows. The lack of effective fiber can occur in many ways – from improper harvesting to cow behavior. The two most important methods to ensure adequate effective fiber in the ration of dairy cows is to chop all wet forages at the proper TLC, and then to not overmix or overprocess the forage prior to feeding. If you suspect that your cows are experiencing a problem due to the lack of effective fiber, contact your veterinarian, nutritionist, or Purdue University Extension specialist for help in diagnosis.