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Dairy Briefs

The Latest Information on Dairy Cattle Nutrition

Hygienic Quality of Silage

By Pedro Nogueira

The last two summers have been relatively wet. Producing good silage under these conditions can sometimes be difficult. The first issue is that the cut crop will not be easy to wilt, making it difficult to achieve good dry matter content, and the second is an increased risk of soil contamination due to the wet ground and naturally sticky nature of mud. According to Dr. Dave Davies (UK), the risks are manifold. First, fields are soaked and traffic on them is likely to mean soil will rise up into crops as they are baled or chopped. Second, tractors are likely to carry large amounts of soil back to the silo. Soil contamination of silages has two main aspects: it increases the amount of inert inorganic material (detected on a normal analysis as ash) and it may inoculate the silage with yeasts, moulds, and other organisms that could inhibit fermentation and impact silage stability.

Ash is simply the residue that remains after a sample is burned. It indicates the total mineral content of a forage or diet. This includes those that are a natural part of the plant like calcium, phosphorus, potassium, magnesium etc., and those that are exterior to normal plant minerals, primarily the minerals associated with soil such as silica. If the sample is from a TMR, the supplemental premixes, salt and buffers will also be included in the ash content. If the ash content is abnormally high there is a very good chance the forage or TMR is contaminated with soil which is not desirable (we can consider normal values for ash as 8-10%, 8-10% and 3.5-5% for TMR's, haylage and corn silage respectively).

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Other than the fact that ash is occupying rumen space with inert material, with no nutritional value and no ability to ferment, one particular mineral can have a negative impact on the health of the animals: iron (Fe). The National Research Council recommends levels of 15-30 mg of Fe/kg of DM for a mature dairy cow across multiple stages of production. It's not unusual to see haylage samples with values of 800 mg/kg DM which, depending on the amount of haylage in the diet, will normally provide much higher iron levels clearly in excess of the recommendations (a normal value of Fe in haylage is around 200-400 mg/kg). Soil contamination of silage is the most likely explanation for these high levels of iron. Iron has many chemical forms, and normally the form present in soil is in a form thought to be mostly unavailable for absorption by animals, so pasture animals are not affected even when they eat dirt. Recent research published in the Journal of Dairy Science in 2009 however, indicates that exposure to an acidic environment similar to that occurring during silage fermentation may cause part of this Fe to be transformed to a more soluble and bioaccessible form. The potential problem of this contamination is that many studies have demonstrated that excessive levels of dietary Fe decreased the copper status of cattle, and high dietary Fe may also negatively affect manganese status of cattle.

Another potential source of silage contamination is with manure used to fertilize the forage. Dr. Sheila M. McGuirk from Wisconsin University, indicates that forages can become contaminated by organisms like Clostridium, E. coli, Listeria, Mycobacterium avium (MAP) (Johnes disease) and others and that fecal pollution is the principle means by which forages become contaminated with most of the above agents. Contamination can occur through manure application to the field in which the forage grows. Because some level of contamination is almost inevitable it is important to follow the correct procedures to obtain proper fermented silage. In fact, research has shown that in properly fermented silages the risk posed by these organisms is very small or inexistent. Dr. Everett Thomas from the Miner Institute, refers two Japanese studies which found 100% mortality of MAP in properly ensiled alfalfa that was inoculated with the pathogen. The important thing is that some MAP survived when alfalfa wasn't properly fermented due to high forage dry matter (DM) content. Dr. Everett advises that since fermentation often isn't as good in the spoiled silage layer on top of the silo, this is one more reason to remove and discard this material. He also indicates that it appears that ensiled forages that were top dressed with manure can safely be fed to cows and older heifers providing these steps are taken:

1. Top dress manure as soon as possible following forage harvest to permit sufficient time for environmental conditions to reduce MAP levels. Both sunlight and drying have been found to kill MAP.

2. Use care in mowing and raking or combining windrows, to avoid contamination of forage with manure residues.

The main concerns with silages are an inability to limit oxygen, lower pH to appropriate level of acidity or inadvertent storage of dead animals or animal excrement. For example the spores of Clostridium botulinum have caused severe herd mortality when they develop in hay bales or haylage. This can happen when there is fermentation failure. If stored haylage fails to become acidic enough to lower the pH to 4.5, the level below which C. botulinum growth is inhibited, the risks involved are greater. Fortunately C. botulinum is relatively rare, but other types of Clostridium are more common. Dr. Chri Rammer, from Sweden, explains that the main habitat of

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Clostridia is the soil, where their normal condition is spore form. Spores of Clostridium usually are scarce on the growing crop, and their occurrence in silage is probably due to soil contamination. Besides being negative to the silage process, spores of Clostridium may contaminate milk and, being able to survive pasteurization at the dairy, causing "late blow" in hard cheeses (this is one of the reasons some specific types of cheese producers don't accept milk produced from silages). As Dr. Stone from Cornell put it, silage that goes through clostridial fermentation stinks! Clostridial fermentations are so malodorous because of the high levels of butyric acid, amines (e.g. putrescine and cadavarine), and ammonia that typify these fermentations. Clostridial growth in silage is stimulated by high storage temperature, low dry matter content, low sugar content, and high buffering capacity of the crop, and by delayed sealing of the silo. Other than reducing the nutritional value of the forage, clostridium fermentations (butyric silages) can also cause health problems for cows, especially transition cows namely through increased susceptibility to ketosis. In well preserved silage, the acid content is too high to permit the survival of vegetative forms of clostridia.

The same principles apply to Listeria. The bacteria, commonly believed to gain access to the brain via ingestion in contaminated silage, lives naturally in plant and soil environments and poorly fermented silage. Listeria monocytogenes is frequently responsible for listeriosis in ruminants: after ingestion of feeds contaminated, it causes abortions, septicaemia and meningitis. Infected cows without symptoms can still shed the organism in feces. Epidemiologic studies show that the risk of milk contamination in farms increases significantly when the following conditions are present: silages badly preserved and lack of hygiene in the barn and/or during milking. The predominant method of contamination is through silage. The animals eating it excrete Listeria in the manure which contaminates bedding material and the skin of the udder. The transmission to the milk occurs during milking.

Soon another haylage season is beginning. Again this is a reminder of the importance of having good procedures when doing silage.

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