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Management of Drought Stressed Corn for Silage

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Harvesting Drought Stressed Corn

Drought stressed corn should be harvested at the same dry matter (DM) for normal corn: 32-35% DM (a little drier if going into an upright tower silo). ***Determining whole plant dry matter or moisture is critical because visual assessments can be very inaccurate! Many plants that look dry contain a significant amount of moisture in the stalk.*** Use of a microwave oven or Koster Moisture Tester is recommended. Under hot dry conditions, plants may dry down at 1-2 points per day. Ensiling corn at less than 28-30% DM will result in excess nutrient runoff and extremely acidic silages that may result in negative effects on dry matter intake. Harvesting corn too dry (greater than 40% DM) restricts fermentation, reduces the loss of nitrates, results in forage that is difficult to pack, and can result in excessive spoilage and poor bunk stability.

Chop forage at a theoretical setting of 3/8 to 3/4 inch if harvested at the optimum DM. If you have already missed the optimum dry matter for harvest and the plants are very dry, (more than 40% DM) consider, chopping your forage finer to improve packing (but remember you will have to balance the TMR for adequate effective fiber during feedout).

If the forage is not well eared, mechanical processing may not be needed. Process if the amount and maturity of the kernels warrants it.

As always, filling fast, packing tight and sealing immediately will help to ensure a good fermentation. Be sure to have adequate tractor weight on the pile as drier forages are more difficult to pack. Allow silage to ferment for at least 3-4 weeks (longer would be preferable) prior to feeding and gradually introduce new silage to animals.

Silage Additives for Drought Stressed Corn

- ◆ Homolactic acid bacteria (microbial inoculants): Severely drought stressed corn forage may contain lower numbers of naturally occurring lactic acid bacteria and may need some help during fermentation. If forage is in the normal range for DM, consider

using a homolactic acid bacteria. Some strains of *Lactobacillus plantarum* may help with the reduction in nitrates.

- ◆ Heterolactic acid bacteria – *Lactobacillus buchneri*: Drought stressed corn silage often has a high sugar content and can be highly prone to spoilage when exposed to air. *Lactobacillus buchneri* is an organism that safely produces acetic acid, which reduces aerobic spoilage organisms and improves bunk life.
- ◆ Buffered propionic acid-based preservatives: Silage additives based on buffered propionic acid may be an acceptable additive for drought stressed forage especially if the DM% of the whole plant is high: greater than 38 - 40%. Addition of 2-4 lb./ton of such products per ton of wet forage can improve aerobic stability of the silage and reduce DM losses in the silo and during feedout. Higher application rates will increase the probability of effectiveness. Although this may seem costly, such preservation easily pays for itself by preventing drops in intake and milk production that would occur if cows were fed spoiled silage.
- ◆ Water: Water can be added to increase the moisture level of overly dry forage, but the amounts needed to have a substantial impact are large. For example to decrease the dry matter of forage at 50% to 45%, one would have to add 200 lb of water per ton of forage! In addition, added water can cause run off problems as it is not absorbed efficiently by the forage mass.
- ◆ Sugars/molasses: Drought stressed corn forage may contain moderate to high concentrations of fermentable sugars. Thus, the addition of molasses or other fermentable substrates is usually not warranted if the forage is harvested at the proper DM content.
- ◆ Non protein nitrogen additives: Non protein nitrogen (NPN) additives (urea and anhydrous ammonia) should not be used on very dry, drought stressed forages.

Nitrate Poisoning

Many plants can accumulate nitrate under stressful conditions (excessive fertilization or water stress from rain after a drought). Sunflowers, corn, wheat, barley, rape, bromegrass, and sweet clover are some of the more common plants that can accumulate high levels of nitrates. High nitrates cause toxicity because once they are absorbed into the blood stream, they are converted to nitrites that binds to hemoglobin and reduces the oxygen carrying capacity of the blood. Acute poisoning can be observed within 6 hours of forage consumption and is characterized by dark-brown blood, labored breathing, tremors, and weakness.

Problems with nitrates are dictated by two factors, 1) total nitrate consumed and 2) the amount of nitrate consumed in a single meal. Reviewing the published information on nitrate toxicity from various universities can often leave one very confused because 1) nitrate can be presented as nitrate-nitrogen (nitrate-N) or nitrate ion (nitrate), 2) safe levels of nitrate to feed are sometimes on a “forage basis” and other times are on a total DM intake basis, and 3)

nitrate concentrations are listed as ppm (on a DM basis) or directly on a % DM basis. I suggest you look at total nitrate intake (based on nitrate consumption from forages and in some instances concentrates and water) to calculate what levels are safe to feed (see table below).

Don't forget that sometimes, water can contain high levels of nitrates that may add to a problem. Get your suspect forage and water tested if need be. Although it is a bit complicated, the Pennsylvania State University fact sheet on nitrate toxicity is a good source of information (<http://www.das.psu.edu/dairynutrition/documents/nitrate.pdf>).

The following information is primarily aimed at the management of drought stressed corn silage but general concepts are valid for other forages as well.

- Do not graze or feed green chopped forages that have been drought stressed.
- Ensiling is the best method to manage forages with potentially high levels of nitrates.
- Wait at least 4 to 5 days before chopping drought stressed forage if it is heavily rained on.
- Although extremely high nitrate levels are rare, we recommend that you test your corn forage before chopping and after ensiling (before feeding).

Test for nitrates at chopping: If the levels of nitrates are extremely high (Table 1) you may want to raise your cutter bar during harvest and leave about 10-12 inches of stalk in the field (this is because nitrates tend to accumulate in the stalk of the plant). We realize this will further lower yields, but high yields with toxic levels of nitrates are undesirable.

When sending samples into the lab, you must obtain representative samples from the field. It is best if this material is chopped. (Do not send in large pieces of plants and stalks.) Many forage labs can return results to you within 24 h.

Test for nitrates before feedout: Although ensiling will decrease nitrate levels by about 50 to 60% we would recommend that you test your drought stressed corn silage before feeding according to the guidelines in Table 1 and 2. If nitrate levels are high in feeds, check for nitrates and nitrites in water as these can also contribute to toxicity issues.

Table 1. Safe and toxic nitrate (NO₃) levels in forages.

Nitrate ion, % dry matter basis	Recommendations
0 – 0.44	Safe to feed.
0.45 – 0.88	Usually safe to feed with balanced diet. Limit to 50% of DM intake in pregnant animals.
0.89 – 1.50	Limit intake to 20-25% of DM intake. Use caution. Do not feed to pregnant animals.
> 1.50	Toxic!

For safety reasons, calculate the entire potential intake of nitrate.

Table 2. Guidelines for total nitrate intake for ruminants.

Total NO ₃ -N intake		Total NO ₃ intake		Recommendations
ppm	%	ppm	%	
up to 400	up to 0.04	up to 1700	up to 0.17	Safe to feed under most conditions.
>400 to 1300	>0.04 to 0.13	>170 to 5700	>0.17 to 0.57	May see reduced fertility (increase services, repeat breeding).
>1300 to 1700	>0.13 to 0.17	>570 to 7500	>0.57 to 0.75	May see reduced gains and increased abortions.
> 1700	> 0.17	> 7500	> 0.75	Clinical symptoms (respiratory distress).

Feeding Value of Drought Stressed Corn Silage

The feeding value of drought stressed corn silage will vary greatly depending on the severity of the drought, kernel development and maturity at harvest. In general (assuming that nitrates are low) drought stressed corn silage will have a lower feeding value than normal corn silage because of poor ear and kernel development. However, even in plants with no ears the nutritive value of drought stressed corn silage is relatively good.

With low yields and poor forage quality it is even more important to assess your forage supplies and to test feeds so that rations can be balanced correctly. Your nutritionist can then rebalance your ration based on the nutritive value of your forages. Once you know your forage quality and inventory, target the “best quality forage” to early lactation and high producing cows. We usually suggest that if you are going to be short on forage, to limit your current supply in the diet and try to make it last longer throughout the year rather than to use it all up, and have to later rebalance completely based on purchased forage. This approach minimizes drastic rations changes, which upsets the cows. When forage supply is short, also consider the use of highly digestible by-products that can supply fiber. Feeds such as beet pulp, cottonseed hulls, brewers grains, and soyhulls are great feeds. However, be sure your nutritionist balances your TMR for effective fiber (many by products feeds are low in effective fiber) and nonstructural carbohydrates (for fermentable energy in the rumen).

Silo Gas Caution

Use extreme caution around silos because nitrogen oxide gasses that are generated during the first few days of ensiling are lethal to animals and humans! These gasses tend to accumulate in low areas and are colorless to orange or reddish-brown. Run the blower for 15 to 20 minutes before entering an upright silo and use caution around vents in silo bags. Use a respirator before entering a silo. In severe cases, the gasses will stain forages and other items. In some instances patches of yellowish silage may be observed. If these spots of silage have a very low pH (1 - 3) it is possible that nitric acid was formed.