

Does Ammoniating Forages Make “Cents”?

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With drought hitting the Central and Northern Plains, good- or medium-quality hay may be difficult to find. Ammoniated forages can be an alternative to expensive forages. Ammoniating low-quality forages can turn wheat straw, corn residue, or low-quality CRP (Conservation Reserve Program) hay into medium-quality forage that meets dry cow requirements without supplementation. Ammoniation is not new but has received attention in the last decade. When medium- to high-quality hay is available, ammoniating forages has little value. The cost to treat crop residues or low-quality forages with ammonia is typically reasonable in drought conditions. However, anhydrous ammonia prices doubled in the last year. So, does it still make “cents” to ammoniate low-quality forages?



How it works. Anhydrous ammonia reacts with moisture in forages. The reaction causes plant fibers to swell, allowing better access for microbes to digest fiber. Therefore, using forages with a moisture content of $\geq 10\%$ is important, as lower moisture forages won't properly cure. In addition, low-quality forages treated with anhydrous ammonia can serve as a non-protein nitrogen source for cattle. Ammoniation can also increase forage consumption by 15-20%.

Cows consuming forages treated with anhydrous ammonia will not gain condition. Therefore, cows should be in moderate condition when fed ammoniated forages. Generally, cows receiving ammoniated residues will maintain weight and condition during gestation until ~90 days prior to calving. Additional supplementation will be required prior to calving and during lactation.

After treatment, most forages have a darkened caramel-type color. Ammonia can act as a fungicide and prevent mold and fungus growth, effectively preserving forages containing $\leq 30\%$ moisture.

Ammoniation is a temperature-dependent process with faster cure times at higher ambient temperatures. This is one reason treating straw works well following summer cereal grain harvest. It is possible to treat corn residue or other low-quality forages in colder temperatures, but prepare to leave stacks covered longer before opening to feed.

At temperatures of $\geq 86^\circ\text{F}$, the minimum time to seal the stack is one week. At $60^\circ - 85^\circ\text{F}$, the stack needs to remain sealed for 2-4 weeks. At $< 60^\circ\text{F}$, the stack will need 4-8 weeks before opening.

How to do it. It is relatively easy, but be cautious when handling anhydrous ammonia and follow safety precautions. Prepare for ammoniation by leveling an area big enough for the bale stack. Place dirt around area edges. The dirt will be used later to seal plastic on the edges of the stack. If using round bales, stack forage in a 3-2-1 pyramid from bottom to top, leaving several inches around each bale so ammonia can access all bales. Completely cover stack with a 6- to 8-mm black plastic sheet. Leave black side face up to collect heat from the sun to speed up the chemical reaction. Typically, plastic comes in 40' x 100', allowing you to cover pyramid stacks 10-12 bales long. Seal stack edges with loose soil and patch any holes in the plastic to prevent ammonia from escaping.

Precautions. Ammoniation of medium- or high-quality forages can cause toxicity known as “crazy cow syndrome” or “bovine bonkers.” Symptoms include hyperexcitability, circling, convulsions, and death. Do not apply $> 4\%$ (80 lbs) ammonia per ton of dry matter (DM). Avoid feeding cows with young calves or wait until calves are ≥ 1 month old.

What it costs. It is recommended to apply 60 lbs anhydrous/ton DM. If wheat straw were 88% DM, it would take ~53 lbs anhydrous to treat a ton of straw. Currently, if anhydrous ammonia is priced at \$1,300/ton, this equates to 65¢/lb. If it takes 53 lbs of anhydrous to treat wheat straw at 88% DM, the anhydrous cost would be \$34.45/ton (as-fed).

The plastic costs ~\$8/ton. Assuming labor and machinery use cost ~\$6/ton, the total cost to ammoniate, not including forage, would be \$48.45/ton. Larger stacks are more cost-effective to ammoniate since labor, plastic, and machine use are spread over more forage tons. Depending on your area, wheat straw can be purchased for ~\$60/ton, totaling \$108.45/ton (as fed).

Right now, the price for fair- or good-quality grass hay (51% TDN) is ~\$110/ton. Wheat straw is 40% TDN, and treating straw with ammonia increases digestibility or TDN 15%. Therefore, treated wheat straw would be ~46% TDN. Treated wheat straw would be ~90% of the hay value. Breakeven for the treated straw would be \$99 (\$110/ton x 90%). In this situation, if you could buy and ammoniate wheat straw for <\$99/ton, this management practice should be considered an affordable option to supply TDN.

So, I will leave it to you to decide if treating low-quality forages with anhydrous ammonia makes “cents.”