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The Many Uses of Straw

Straw...it's more than just the leftover from wheat harvest. This agricultural byproduct has a huge number of uses. While some are quite traditional like the bedding for animals and mulch in the garden, it can also be used as a quality cattle forage, heating fuel, ethanol production, or even as a building material. Far from waste, straw has so many better uses than being burned in the field.

First let's take a look at what straw is made of. Wheat straw is about 40% cellulose, 40% hemi-cellulose, and 15% lignin. The cellulose and some of the hemi-cellulose it what is digestible by cattle but the lignin is what keeps it all together. Hay has less lignin, usually less than 10%, while wood has more, usually over 25%. So wheat straw is somewhere in between hay and wood in structure content. Straw also has 11 lbs of nitrogen, 3 lbs of phosphorus, 15 lbs of potassium, and 2 lbs of sulfur per ton and the average wheat harvest leaves 2.5 tons of straw per acre. Nearly half of wheat straw is carbon. It's a far cry from alfalfa but burning in the field will take half of the nitrogen and sulfur and leave the soil bare, risking erosion of soil with the phosphorus and potassium ash with it.

Wheat Straw as a Cattle Forage

Wheat straw must undergo an ammonization process before it is suitable to feed to livestock. The process is fairly simple to do. The straw bales are stacked up in a big pyramid and covered in air tight plastic. Anhydrous ammonia is then pumped into the stack and then let sit for a 2 weeks to 2 months, depending on temperature. The ammonia reacts with the moisture in the bale and also works to break down the structure of the straw. This increases the digestibility 10 to 15% and the ammonia incorporated acts to increase the protein, making the ammoniated straw similar to hay. This processing of straw bales isn't common in this part of Kansas as we often have plenty of hay and there is some cost to the process, but it could be an important consideration during drought years. The Oklahoma Extension Service has a great publication describing this process in detail, "Ammonization of Low Quality Roughages - AFS-3037". It is important to note though that the ammonization process only works to improve low quality forage. It doesn't make good quality forage better, it just makes it toxic.

Wheat Straw as a Heating Source

Wheat straw has a lot of heat energy potential in it. Depending on the moisture content, straw has 6,000 to 7,600 btu per lb. That puts it nearly in line with soft firewood. It is possible to mechanically pack straw into logs to be used like regular firewood but special straw burners do exist to handle not only a few little square bales but also the big round bales. Straw bale burners like wood burners are around 40 to 65% efficient and this depends on the quality of the burner. While straw bale burners might not as practical as outdoor wood burners for house heating, the big bale burners are often used in grain bin drying, calf or swine barn heating, or other industrial sized heating. With an average sized straw round bale and decent efficiency, it's possible to get 3 million btu out of a bale. The equivalent of 32 gallons of propane.

Wheat Straw in Ethanol Production

Wheat straw, corn stover, switch grass, and others have been looked at for ethanol production. The process first involves hydrolysis with enzymes to convert the cellulose into sugars to be fermented, much like grain ethanol production. This research topic popular in the 2010s showed that it was a possible process but it was expensive to ship such a bulky byproduct at those volumes and not a great idea from the field soils point of view. For now anyways, grain is just too cheap to consider other as byproducts.

Wheat Straw as a Building Material

Wheat straw has been used as a building material since the ancient Egyptians used it as the binding material in clay bricks. Today wheat straw is still used as insulation in eco-friendly house construction. A straw bale has an R value of over 35 which is more than most house wall insulation. Once stacked the bales are incased in plywood or can be coated directly with stucco. Walls have to be built wider and it very important the bales stay dry. While this construction type might seem odd, it is common place in eco-centric and dryer climates in the Southwest. A straw bale constructed heated garage or shop might be a cheap and cool idea for this area.

If you have any questions over these topics, most likely ammonization of straw bales or other low quality forage, please give me a call at 620-724-8233 or email jcoover@ksu.edu. K-State Research and Extension is always ready to help and answer your questions.

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