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Using Waste Grain as a Fuel for a Forage Sample Drying System

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At the Penn State Agronomy Research Farm, researchers generate lots of forage samples that need to be dried down for moisture determination and then need to be ground for nutrient analysis. On a good day, 50 to 60 wet forage samples that weigh about 500 grams each need to be dried. The farm has three forage sample dryers that used electric heat to dry the samples at 140 F for about 48 hours until the samples are dried. Electric costs often topped \$45 per day for drying costs. Dick Todd, one of the research staff at the research farm began to explore the potential of alternative system for drying the samples. One option Dick focused on was the use of unmarketable grain. Often the research farm produces small quantities (10-20 bushels) of grain that are not marketable through commercial channels. Dick decided to pursue the use of this unmarketable grain as a fuel source for the drying ovens.

He purchased a 180,000 BTU furnace from LMF Manufacturing in Lock Haven, PA which came equipped with a 14 bushel corn bin with automatic feed. The furnace is controlled by a thermostat regulated by temperatures in two of three crop dryers. Todd also installed duct work and fans to move the hot air from the furnace to the crop dryers. The system shuts down until the temperature drop to a critical level. Grain is automatically augured into the system to supply the firebox as dictated by the thermostat. Todd and Chris Houser, another technician worked to get the bugs out of the system. The system was installed in 2007 and has worked well since then. Todd estimates the system costs less than

\$20/day now and is saving the farm about \$1400/year in electricity costs and does not require a lot of extra labor. The bin needs to be refilled about once every other day, and when operating the system uses about 1-4 bushels of grain a day, depending on temperature and heat demand. Ashes need to be removed daily. These are collected from an ash box on the bottom of the unit.



Figure 1. Corn furnace and bin.

Todd uses a gravity wagon as storage for his summer supply of grain. A livestock watering tub and bushel basket are used to collect the grain from the wagon and transfer it to the feedstock bin. Ash is collected in an ash bucket and Todd has used corn, small grain, and soybeans to feed the furnace. He installed a screen over the top of the corn bin to remove and coarse particles entering in the bin. One issue is monitoring the moisture content of the grain. Wet grain has not fed well and has lower energy content.



Figure 2. Gravity wagon and tub for grain transfer.

Rodents and birds can be a problem, so he tries to keep the bin covered while in use. One question has been the use of outdated seed corn, which is treated with insecticides. At this point, Dick has opted not to use the seed corn but it might be ok to use with proper ventilation. This installation is an excellent example of how a low value commodity can be used effectively in a farm application to avoid use of a high priced energy source.

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