Storing Corn Biomass - Wet vs. Dry Storage
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When it comes to storing corn residue for use as bio-fuel, the debate of wet versus dry storage may be resolved by the type of storage capacity you have or by the harvesting methods currently used on your farm. This article investigates the pros and cons of both methods and how they might best fit into your current system. If one is planning on using the bales on farm for feedstock or bedding rather than bio-fuel, not all of the following explanations may apply.

Many researchers have indicated that dry storage is not nearly as desirable as wet storage. One reason dry harvest and dry storage might be considered is that cutting and baling procedures fit better into their system. There are very few benefits of dry storage except that the final product is light and less costly to transport to the end use.

On the other hand, there are drawbacks of dry storage. First of all, square and round bales take a lot of handling to move from the field into storage which can be time consuming and costly. Once in the storage area, they require a lot of space. Many livestock farmers may already have their barns full of straw and hay and may find it difficult to provide indoor storage. If indoor storage is not available outdoor storage may be considered. Again, a great deal of space is required to store these residue bales and there is a high degree of loss even if the bales are wrapped or covered (Figure 1). In general, the bales need to be below 20% moisture to minimize loss during storage (Atchison and Hettenhaus, 2003). Once stored, dry residue bales have a high potential to catch fire (Atchison and Hettenhaus, 2003). To prevent fire, the bales need to be precisely stacked to allow for proper ventilation (Atchison and Hettenhaus, 2003).

Figure 1: Outdoor storage losses

Wet storage is the preferred method of residue storage by many researchers (Atchison and Hettenhaus, 2003; Shinners and Binversie, 2004). The moisture content of the residue during wet storage is about 65-85%. As such, the benefits are numerous. In terms of actual storage procedures, there is no waiting time for drying or need for specific piling techniques. Storing wet

residue is quick and easy and there are no costs associated with baling and wrapping. Once removed from the field, storage is required. The weight, bulk density, and shape of the residue when it is wet allows for high density storage (2 times that of bales) and self compacting piles. Some researchers say that wet residue takes up 90% less space than dry residue (Atchison and Hettenhaus, 2003). The piles can be stored in unused bunker silos or existing bags which frees up barn space. In terms of losses, there is substantially less loss with wet storage; wet anaerobic conditions result in less oxidation and lower losses (<5%). In terms of quality changes, only 1-3% of holocellulose and hemicellulose is lost during extended storage. In addition, during wet storage, dirt and soluble compounds are leached out and there is less process ash and more process capacity when being processed. Another benefit of wet storage is that the potential for fire is almost non-existent. There can also be benefits to the soil with wet storage. If the pile is stored in a field, nutrients from the residue can leach back into the soil adding to reserves.

There are also some negative aspects for wet storage. During storage over winter there is a potential for the residue to freeze which would compromise the quality. In places where quick, deep freezes occur, wet storage may not be the best option. In terms of moving the residue to and from storage there are high costs incurred as the product is heavily weighted and requires more frequent trips than drier residue. Atchison and Hettenhaus (2003) determined that wet storage and rail transport would result in 1.5-2 times more net profit to the farmer than baling and truck transport. However, in Ontario rail systems are not highly accessible. One final drawback of wet storage is that the influence it has on bio-processing is still uncertain and requires further investigation.

In conclusion the decision to store residue wet or dry depends on your farm. Space and time are required for dry storage but transportation to the processing plant is much cheaper. In terms of wet storage, it is quick, easy, and there's less loss, but transportation costs can quickly add up. Since transportation seems to be the underlying factor, your proximity to the closest rail or processing plant may be the decision maker!

Notes:

Atchison, J.E. and Hettenhaus, J.R. 2003. Innovative Methods for Corn Stover Collecting, Handling, Storing and Transporting. Available at: www.nrel.gov/docs/fy04osti/33893.pdf

Shinners, K. J., and B. N. Binversie. 2004. Harvest and storage of wet corn stover biomass. ASAE Paper No. 041159. St. Joseph, Mich.: ASABE.