

Handling

Liquid Feed Commodities

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Ethanol production is increasing in several Midwestern states. Consequently, availability of liquid by-products, such as corn condensed distiller's solubles, is also increasing. Liquid feeds are useful for conditioning rations, improving palatability, reducing dustiness and providing nutrients to livestock. Many liquid by-product materials are available for use in beef cattle rations. In addition, a number of commercial products which can be formulated to rigid specifications are available.

By-products, including corn condensed distiller's solubles and condensed steep liquor, are high in moisture and subject to freezing during the winter. Others, such as molasses and molasses-based products, are considerably lower in moisture but will thicken at low temperatures, making pumping difficult.

Due to the liquid nature of these by-products, tanks, pumps and other equipment designed to handle liquid feeds are needed in order to utilize them. The objective of this bulletin is to provide guidelines for installing equipment to handle liquid feed commodities.

Equipment Options

In North Dakota's winter climate, there are essentially two options for installing tanks and pumps designed to handle liquid feed commodities. The first is to bury a tank underground and the second is to house the tank and pumping equipment indoors. In most cases, storing liquid feed commodities outside is not an acceptable option, given North Dakota's harsh winter conditions. For low-moisture products such as molasses or molasses-based supplements, storage indoors allows easier pumping as well. Freezing problems and a high level of frustration will result from improper storage.

Figures 1 and 2 give a diagram of the installation of the underground and above-ground storage systems.

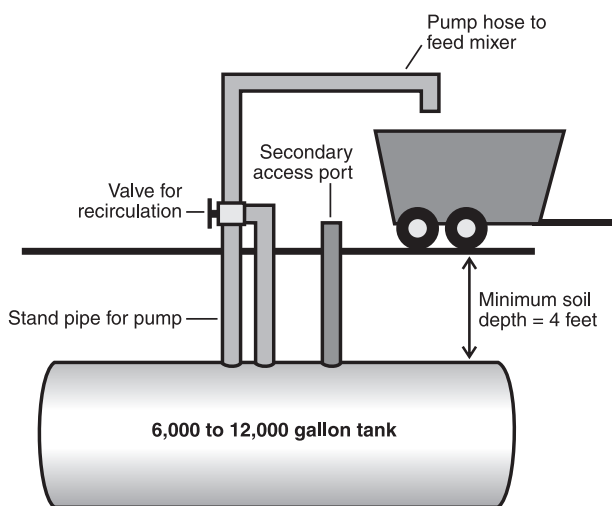


Figure 1. Typical setup for underground storage tank for liquid byproducts such as corn condensed distiller's solubles.

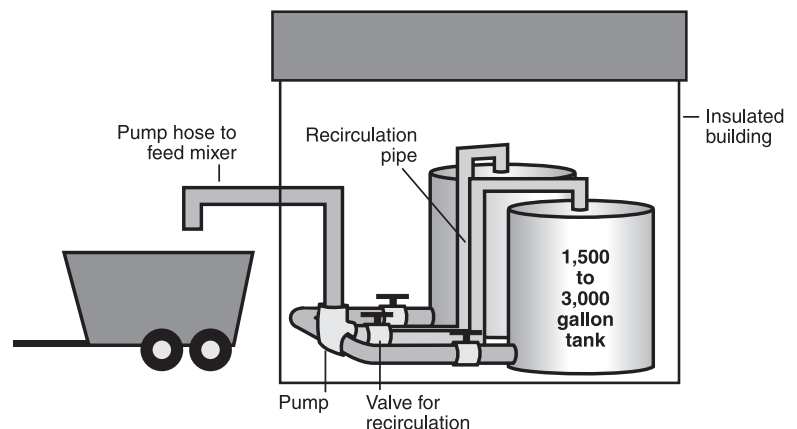


Figure 2. Typical tank setup for above ground liquid supplement storage in a building.

Selection and Installation Considerations

Buried Tanks

Advantages

- Essentially no worries about freezing the commodity, if the tank is buried four feet (or more) deep. The hoses can also be easily drained after each use.
- May be less costly than erecting and heating a building for tank storage.

Disadvantages

- Possibility that the tank will rust and leak.
- Difficult to determine if a leak has occurred.
- Must excavate the tank in order to repair any leaks.
- Difficult to visually measure and monitor commodity usage.
- Cannot be moved easily once it is placed underground.

Indoor Housing of Liquid Tanks

Advantages

- Easy to repair and maintain the pump, tank and associated equipment as needed or when problems occur.
- Easy to visually measure tank volume and monitor commodity usage.
- Tanks and equipment can be moved relatively easily.

Disadvantages

- Cost of building construction is typically greater than the cost of tank burial.
- Insulated building may be required to prevent freezing. In most cases, supplemental heating from a furnace or other heating source will be required to keep the products from freezing. Some products, such as corn condensed distiller's solubles, will leave the plant at temperatures of 120-140 degrees Fahrenheit. These products will provide some heating in the building but external heat sources will likely be required to keep the product from freezing.

Producers should consider the following prior to purchase and installation of liquid handling equipment.

- Type of product to be handled (commercial supplement, molasses or other sugar by-products, corn condensed distiller's solubles, condensed steep liquor).
- Volume of liquid commodities which will be handled.
- Can delivery of a tanker load (50,000 pounds or approximately 6,000 gallons) of product be accepted?
- Amount of feed needed on a daily basis.
- Feeding method (mixer wagon, lick wheel, other).
- Cost of liquid supplements relative to other feeding options, such as dry supplements or other high-moisture feeds.

Types of Equipment Needed

Tanks

Typically, polyurethane (poly) tanks are used in above-ground applications. Metal or steel tanks are typically used when tanks are buried.

Above-ground tanks can be horizontal or vertical and have either a flat bottom or conical bottom. All types are functional for handling liquid by-products and supplements. Tanks with a conical bottom require a metal stand since the pump and hoses will be placed at the bottom of the cone. Conical bottom tanks allow all of the material to be pumped from the tank.

An access cover for buried tanks provides an entry point for cleaning tanks, removing any sludge buildup, allowing inspection and to drop a second pump in case of breakdown with the primary pump.

Blending Products. Separate tanks should be used for each individual liquid feed commodity or product. Mixing products in the same tank can sometimes result in reactions which make pumping difficult or cause ingredients to separate or precipitate. Products can be blended with other ration ingredients in the feed mixer without problems.

Pumps

Positive displacement pumps or gear pumps are typically most effective in handling liquid commodities. For tanks housed indoors, the key is to keep the distance from the bung of the tank to the pump as short as possible. This minimizes the chance of freezing problems in the hose.

Many producers have utilized manure pumps in buried tank applications to recirculate and pump corn condensed distiller's solubles (corn syrup). These pumps are typically a minimum of five horsepower and are electric powered.

Pump capacity should be considered prior to purchase. The pump and motor should be large enough to efficiently deliver the product to the feed mixer in a short period of time. Small pumps will result in inefficient recirculation and long mixer loading times.

Some raw commodities, such as corn condensed distiller's solubles or condensed steep liquor, are corrosive and can cause increased pump and tank maintenance. Other products, such as molasses-based supplements, are typically less corrosive.

For above-ground applications, one pump can be used to service several tanks provided proper hoses and valves are used to direct product flow.

Liquid feed products should be agitated or recirculated prior to feeding as product separation can occur. Pumps are used to agitate or mix the product.

Why is Recirculation Necessary? Recirculation is the process of mixing the liquid supplement by pumping it out of and back into the tank. This process mixes and agitates the product. In some cases, bulk commodities, such as corn condensed distiller's solubles, can separate during storage. Agitation or recirculation helps mix and blend the separated components back into a homogeneous mixture prior to placement in the feed mixer. Other products can precipitate or 'salt' out prior to feeding. Most commercially prepared products contain suspension agent to help prevent micro-ingredients from separating. However, it's a good idea to agitate and recirculate these products to ensure even distribution of all ingredients prior to feeding.

Most feed labels on commercial products will indicate the time necessary to adequately agitate these products.

Associated Handling Equipment

Hoses which carry product from the pump to the mixer or delivery vehicle or into recirculation, should be equal to or larger in diameter than the hose leading to the pump. Restricting output volume will lead to excess pump wear and an inefficient pumping process. Outlet hoses should be set up to allow material to either drain back into the tank or into the mixer. Freezing problems will occur during winter months if material is allowed to remain in the outlet hose.

Cost

Table 1 details the projected costs associated with underground and above-ground storage applications. The cost estimates are for new equipment. Taking advantage of used or reconditioned materials may lower costs.

Table 1. Cost estimates for underground and above-ground liquid materials handling systems.

Underground Tanks	
Item	Cost*
6,000-gallon steel tank (12,000-gallon tank \$7,500)	\$5,000
Vertical manure pump	\$3,500
Excavation work	\$1,000
Miscellaneous costs (hoses, valves, other materials)	\$1,000
Above-ground Tanks	
Item	Cost*
2 - 3,000-gallon poly tanks or 1 - 6,000-gallon poly tank	\$2,000
1.5" to 3" pump (depending on tank size and pumping volume)	\$1,200
Insulated building (minimum 8' x 12' x 10' ceiling for 6,000 gal.)	\$3,000-\$5,000 for materials (labor extra)
Miscellaneous costs (hoses, valves, other materials)	\$1,000

*All costs are approximate.

Other Recommendations

Sampling. Liquid feed commodities, such as corn condensed distiller's solubles and other by-products, can vary greatly in moisture content from load to load and plant to plant. Sample each load and conduct moisture analysis prior to feeding.

Back-hauls. Back-hauling is the process of hauling another load with the same truck and trailer rather than returning to the plant or place of origin empty. It helps trucking companies lower costs because the fixed costs associated with the truck can be spread over more loaded miles.

Liquid feed commodities should not be back-hauled with chemicals, petroleum products or other products which may be hazardous or toxic to livestock.

Foaming. Some liquid by-products, particularly corn steep liquor, can foam during storage. Adequate tank head space is required to deal with these situations as they arise. If foaming occurs, tanks should be cleaned thoroughly before adding additional product.

Heating. Some liquid by-products, such as corn condensed distiller's solubles, are approximately 140 degrees when they leave the plant. The heat from these products can provide some or all of the heat necessary to heat properly insulated storage buildings. Design of building heating systems should take this into account.

Mixing. The addition of a 'spreader' to the end of the discharge hose may help distribute the liquid product in the feed mixer more rapidly and facilitate rapid, even mixing. See Figure 3 for a diagram of a simple spreader which can be installed at the end of the discharge hose.

Liquid feed materials should be added to the mixer after all other ingredients have been added to the ration. Thorough mixing should occur for two to four minutes after the addition of the liquid material (depending on the mixer type).

Summary

Availability of liquid by-products is increasing throughout the Upper Midwest. Additional handling equipment will be required to handle liquid by-products. Producers with questions on proper handling of these materials should visit existing feedlots to view successful installation and handling practices.

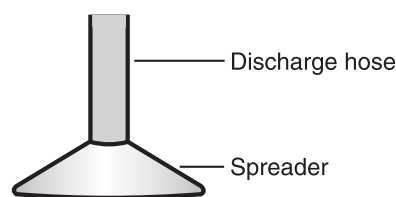


Figure 3.

For more information on this and other topics, see:

www.ag.ndsu.nodak.edu

