Under Pressure: Managing Manure Application and Field Compaction

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Key Points
Avoid soil compaction from manure application equipment by:

- Limiting axle loads to 9.1 tonnes (10 tons) and preferably 5.4 tonnes (6 tons) to prevent subsoil compaction.
- Keeping tire pressures as low and tire footprints as large as possible to prevent topsoil compaction.
- Using a drag hose system instead of liquid manure tankers for field application.
- Using an automatic air inflation deflation (AAID) system on heavy equipment.

Agricultural equipment has increased in size over the years due to increased farm sizes and increased efficiencies. A major concern with the larger and heavier equipment is soil compaction. Some operations such as manure application sometimes have to be performed when soils are moist. Increased soil moisture results in increased soil compaction with heavy agricultural equipment. It is important to avoid soil compaction during operations such as manure application. This article will discuss methods to manage agricultural equipment to avoid soil compaction.

Axle load is very important to consider when avoiding soil compaction. Axle load is the total load supported by one axle. Agricultural equipment with high axle loads will cause soil compaction in the topsoil and the subsoil. Low axle loads will usually cause soil compaction in the topsoil and the upper part of the subsoil. Higher axle loads cause the pressure gradient to penetrate deeper into the soil. Soil compaction in the subsoil is very difficult to correct. Research has shown that axle loads should be limited to 9.1 tonnes (10 tons) and preferably 5.4 tonnes (6 tons) to prevent subsoil compaction. The number of axles can also be increased to reduce the load on each axle.

Contact pressure is the pressure that is exerted by a tire or track on the soil surface. Surface contact pressure is 7 to 14 kilopascals (1 to 2 pounds per square inch) higher than tire pressure with agricultural tires. Higher surface contact pressures will result in more topsoil compaction. Tire pressures should be reduced to the minimum allowable pressure for the tire size and load to prevent topsoil compaction. Other methods to reduce topsoil compaction are by using flotation tires, radial-ply instead of bias-ply, and by using larger diameter tires to increase the tire footprint. Tractors with four-wheel drive, front-wheel assist, tracks or duals will also spread the load over a larger area and result in lower surface contact pressures. Tractors should also be properly ballasted for each operation to minimize tire pressures.

Using a tractor with low-pressure radial tires will result in similar soil compaction as a tractor with tracks. Belts on track tractors are flexible and there are pockets of high pressure under the axles of the belt that result in pressures similar to tractors with tires.

Other management methods to avoid soil compaction are to travel over a lower percentage of the field, concentrate repeat traffic in travel lanes, and to drive faster to shorten the load dwelling time.

Equipment management methods specific to manure application to avoid soil compaction include using side discharge or vertical beater solid manure spreaders instead of horizontal beater solid manure spreaders. Side discharge and vertical beater spreaders spread solid manure over a wider area and result in less of the field travelled. These spreaders also allow the use of travel lanes for repeat traffic. Using a

hose drag system for liquid manure prevents heavy loads such as tankers from operating on fields. A hose drag system consists of a field applicator, which is usually pulled by tractor, and a drag hose, which supplies manure to the applicator. A pump at the liquid manure storage unit transports the manure through a hose to the applicator in the field. Booster pumps are sometimes used for long distances of hose.

AgriBrink manufactures an automatic air inflation deflation (AAID) system specifically for agriculture (AgriBrink 2014). The system consists of an air compressor, air tank, control box and hoses, and swivels to connect to the tires. The system can inflate tires for road transport and deflate tires for field operation from the tractor cab. For instance, the tires on a large tanker system for liquid manure use 100 kilopascals (15 pounds per square inch) in the field to reduce soil compaction and 240 kilopascals (35 pounds per square inch) on the road to allow for higher road speeds. The system is different from conventional AAID systems because of the fast deflation time and the ease of moving the system to other pieces of equipment.

References

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