

Indiana - May 2009 (ver. 1.1)

Residue Management and Waste Utilization

Factors affecting success:

Today's producers who use manure or bio-solids in their nutrient management system have a much broader selection of tools and technology than a decade ago. This is particularly true for low disturbance or no-till/strip-till injectors and applicators.

Environmental benefits from waste utilization are generally much greater as application precision increases and soil disturbance and compaction decreases. Adding manure or bio-solids to the soil can significantly improve soil organic matter and build soil nutrients, but if the application process has a high level of soil disturbance then the CO₂ and nutrient losses can exceed the potential gains. Likewise, manure and bio-solids have the potential to improve soil bio-mass and bio-diversity, but these benefits may be offset if the application process causes significant soil compaction, or if excessive rates prove toxic to beneficial soil organisms.

Applications should always be on land evaluated and planned under a Waste Utilization (633) Plan.

The following are recommended application methods and tools which optimize the above factors and meet the following IN-NRCS Standards: Residue and Tillage Management-No-Till/Strip-Till (329) or "Modified No-Till" criteria for Mulch-Till (345).

Liquid No-Till/Strip-Till Injection: Ensure the injector is designed to handle heavy crop residues. This will usually involve a tool bar equipped with a large (>18") coulters to cut through crop residues followed by a knife that has a sharp leading edge on a nearly vertical shank with a shoe at the bottom that creates a cavity to hold the slurry. Generally, the shoe should not exceed 6" inches in width. Others utilize a large (>20") single disk that is slightly angled to allow room for a side shoe to deliver the slurry. Both should have a sealing disc or wheel to close the trench. Soils that are too wet can cause compaction and make sealing the trench difficult. Both types of injectors should leave the soil surface level enough for no-till planting or seeding without further tillage. Ideally the shanks are spaced the same as the producer's planter enabling planted

rows to be placed on, or very near, the same disturbance strip. Planting and manure injection shall disturb no more than one third of the row width.

Modified No-Till Injection: If the aforementioned tools leave the soil too rough for no-till planting, a modified no-till system may be needed. A separate rotary harrow or coulters harrow operation may be added to the above system to level the soil. The harrow should be set to run no deeper than 1" and not be designed to invert the soil or to bury the crop residue. Coulters will be set to run straight and not be cupped or concave. This prevents excessive soil disturbance that will reduce the benefit of the manure or bio-solids.



Coulters knife injector tool bar used with a drag line.



Coulters knife injector with closing wheels attached to a flotation nurse truck.

No-Till/Strip Till & Modified No-Till with aerator directed placement:

Slurry is directed into 4" - 6" deep holes made in the soil with an aerator. For a **no-till** application, the tool is set to run nearly straight to reduce the soil disturbance, and leave the soil surface level enough for no-till planting or seeding without further tillage. In a **modified no-till** system, the tool is run at a slight angle with a follow-up secondary pass with a rotary harrow or a coultter harrow for additional incorporation and leveling. The harrow should be set to run no deeper than 1" and not be designed to invert the soil or to bury the crop residue. Coultters will be set to run straight and not be cupped or concave. This prevents excessive soil disturbance. Moderate application rates (6000 gals. or less) are best suited to this system. Applications are not made to frozen ground.



Aerator directed placement

Modified No-Till incorporation for dry manure/compost:

Material that is broadcast on the surface can be incorporated with aerators, rotary harrows, coultter harrows or no more than 2 combinations of these. The guidelines for **modified no-till** under **No-Till/Strip Till & Modified No-Till with aerator directed placement** should be followed. Moderate application rates (4 tons or less) are best suited to this system.

Cover crops: Where possible, establish a cover crop prior to, during or immediately after a summer or fall application of manure. The benefit of trapping nutrients, controlling compaction, increased nutrient cycling, and erosion control are too great to not have as an integral part of a waste utilization system.

Soil compaction:

- Where possible, liquid waste is best applied utilizing a drag line hose transport system. This eliminates the risk of compaction from pulling the nurse tank through the field as the manure is applied.



Rotary harrow incorporation into light residue with mounted air delivery seeder for no-till cover crop seeding.



Coultter harrow incorporation while seeding a cover crop with a mounted air delivery seeder.

Surface application without incorporation on soil with heavy crop residues or growing cover:

Liquid or dry manure can be applied to heavy crop residues such as corn, wheat, milo (grain sorghum) stalks or into a growing vegetative cover. Moderate application rates (4 tons dry or 5000 gals. or less) are required for this system. Applications are not made to frozen ground.

General recommendations:

- Nurse tanks or dry boxes on multi-axle flotation tires or tracks will be very beneficial for reducing the depth of compaction.
- Establishing a cover crop prior to application will greatly increase the soils weight bearing capacity and resistance to compaction.
- Never apply when soil moisture is at field capacity near the surface. If the soil is wet enough to make a ribbon through your fingers...it is too wet to apply.