

# Low Disturbance Manure Injection

Wisconsin Nutrient Management (590) Guidance Document

## Introduction and Background

In the development of a conservation plan and a nutrient management plan for a farming operation that applies manure we need to account the impact of the manure application on the resource concerns.

- **Surface application** of manure minimizes the tillage, reducing the erosion potential and the breakdown of soil organic matter. However, it increases the risk of ammonia volatilization and of odor release. In a heavy rainstorm causing significant runoff, surface application creates a high risk of manure runoff which can contaminate surface water.
- **Incorporation** of surface applied manure using tillage reduces ammonia volatilization and odor release. The risk of runoff is reduced and the soil contact will immobilize phosphorus in most soils. However, the increased tillage can increase the erosion delivering more total P to surface water.
- **Injection** of liquid manure products reduces ammonia volatilization and odor release even more than most incorporation systems. The amount of soil disturbance varies greatly depending on the aggressiveness of the implement, the depth, the soil conditions, and the speed. However, injection can be designed to minimize soil disturbance and the subsequent increased risk of soil erosion and organic matter breakdown.

Low Disturbance Manure Injection (LDMI) equipment – alternatively called Low Disturbance Manure Application (LDMA) equipment – are manure injection implements developed by industry to:

- apply the liquid manure below the surface of the soil while
- minimizing the soil surface area disturbed and
- minimizing the depth and degree of soil disturbance and fracturing below the surface.

How effective they are at doing this depends on the design, the adjustments made to the implement, the speed of application, and the soil conditions.



It is important to note that even a well designed injection implement can cause extensive soil disturbance depending on how it is used. In the end *“low disturbance” is the result in the field. It is not the implement itself.*

## Criteria for Low Disturbance Manure Injection (LDMI)<sup>i</sup>

To meet the definition of LDMI meet all five of the following criteria.

- No more than 30% of the soil surface is disturbed across the operational width of the equipment.**
  - This includes soil removed from the tilled zone and “splashed” onto the untilled zone.
- Inject to a subsurface depth of approximately 4” and no more than 6”.**
  - This avoids placing manure too deep – beyond the optimal crop rooting depth – and minimizes the amount of soil disturbed.

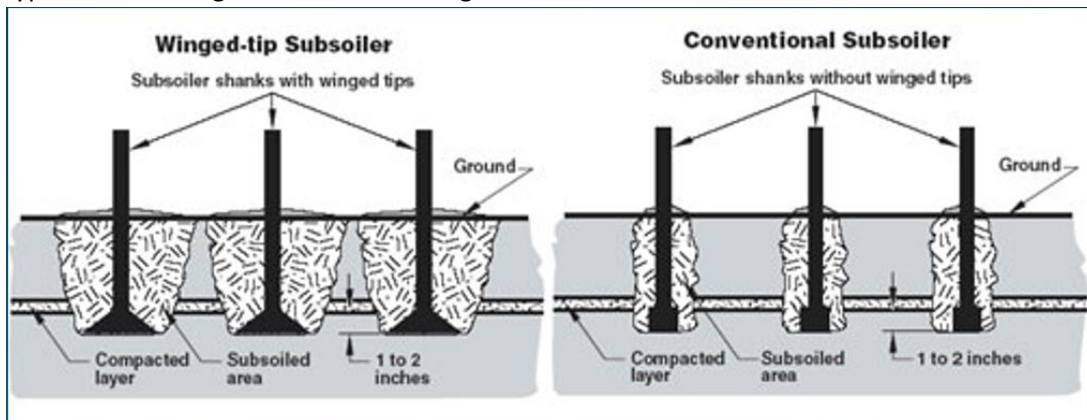


- ❑ **Minimal manure is present or visible on the soil surface after the pass is complete.**
  - Adjust manure injection rates so that the manure is placed below the soil surface.
- ❑ **After application, no additional tillage passes are needed to level a field prior to planting the next crop including a cover crop.**
- ❑ **Implement a Nutrient Management (590) plan. Design the manure application source, rate, placement, and timing to meet 590 criteria.**

## LDMI Operational and Equipment Configuration Factors

Below are some LDMI implement design and setup considerations to manage the amount of disturbance during injection.

- Injection tips, chisel points, sweeps or rolling points may contribute to more soil lifting and fracturing. Don't use injectors with subsoiling shanks. The deep knife and blade/tip depths lift and fracture large volumes of soil. The figure below demonstrates the soil disturbing impact of two types of subsoiling shanks on an analogous subsoiler.



- Single disk blades that create an offset slice tend to disturb less soil.
- Closing blades ideally just skim the soil surface to re-direct loose soil clods back over the disturbed injection slot and minimize the soil splash. They minimally disturb the soil.
- Wide row, 30" on center, units tend to disturb the lowest percent of the operational width of the equipment. Narrow row, 9" to 15", results in a higher percentage of soil disturbance.
- Some LDMI implements use flat disc blades that run straight. These are often used in sod or similar fields and often result in very low disturbance.
- Heavy construction-style disk units often use concave, scalloped disc blades and are designed for full-width disturbance and manure incorporation. These cause high disturbance.
- The slower you go and the less deep the injection knife the less the disturbance.

## "Certifying" Low Disturbance Manure Injection (LDMI) Equipment

NRCS does not "certify" any specific LDMI implement. We did this in the past, but field observations demonstrated that "low disturbance" depended not just on well-designed implements, but also the angle the closing blades were set, the depth of soil disturbance and injection, the speed of application, soil texture, soil moisture, and gallons injected. These application variables make certification of an implement impossible.

<sup>i</sup> This LDMI criteria is designed to estimate a Soil Tillage Intensity Rating (STIR) of  $\leq 15$ . Over the next years we will test this estimate. Separately, watch for guidance on how to assess the STIR.