Manure on Perennial Forages: Benefits & Challenges, Part 2

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While manure topdress applications may increase perennial forage yields and provide other benefits (Part 1, May 2016 *Forage Focus*), there are a number of challenges associated with broadcasting manure after harvest.

1. Excessive manure rates can cause smothering and coating of plants, resulting in leaf scorching and clogging of pores.
2. Wheel traffic from loaded spreaders can damage crowns and compact soil, especially under wet soil conditions. This can sometimes result in stand loss and yield decline.
3. Manure often contains pathogens, so there is a risk of feed contamination and aerial or runoff transport.
4. Odor may be a nuisance issue affecting neighbors.
5. Ammonia emission can represent a significant grass forage economic loss and is a growing environmental concern.
6. Nutrient runoff can lead to lake and stream eutrophication, especially with late-fall and winter applications.

The impact of these concerns can be minimized by careful management (e.g., spreading soon after harvest, avoiding wet soil traffic, avoiding excessive rates). Use of alternative application methods can offer another approach to limit negative effects.

Alternatives to Broadcast Application

Concerns about broadcast manure have led to the development of alternative application methods including shallow injection, surface banding above canopy, banding on soil surface with drag-shoe or trailing-foot, and tine aeration band application. These methods can reduce potential damage since manure is applied in narrow bands directly in soil or on soil surface, often underneath crop canopy, thereby limiting direct contact of foliage with manure.

Aerator/banded manure – aerator slots

What does the research say? Grass forage yields in British Columbia increased 7% by banding dairy slurry with a drag-shoe compared to broadcast application, but yields increased more by banding manure with tine aeration (Bittman et al., 2005). Banded manure/tine aeration also reduced ammonia emission ~50% and runoff nitrogen and phosphorus loss 50-90% (Bittman et al., 2005; van Vliet, 2006). Band application of liquid dairy manure in Vermont reduced ammonia emission 27-46% (depending on rate) and increased yields in two of four site-years compared to broadcast application (Pfluke et al., 2011; Carter et al., 2010).

There has been less research with alternative application methods on alfalfa. Ontario research (Bowley et al., 2009, discussed in the first article) showed a 14% yield increase from surface-banded dairy slurry compared to a no-manure control, but only a 10% yield increase from banded manure following tine-aeration. Authors suggested this may have been the result of increased manure-root contact by infiltration of manure into the aerator slots. In a Saskatchewan study (PAMI, 2001), injection of manure increased alfalfa yields on a low fertility site, but decreased yields on a high fertility site due to stand damage, suggesting yield effect depended on the balance between yield response to manure nutrients and mechanical damage from injection.

Ongoing Wisconsin Research

The U.S. Dairy Forage Research Center has completed two years of a three-year study evaluating different methods for applying liquid dairy manure on alfalfa. The following treatments were applied to established alfalfa on Withee silt loam (somewhat poorly drained, 1-3% slope): control (no manure, fertilizer based on need), broadcast liquid dairy manure, surface banded manure; aerator/banded manure (AerWay SSD), and shallow injection (Yetter Avenger).

Manure was applied annually after first (2015) or second (2014) harvest with an 1,800 gallon research model spreader (Nuhn Industries), with a target application rate of 4,000-5,000 gal/ac. Equipment adjustment problems in 2014 resulted in an excessive rate (~10,000 gal/ac). There were no significant treatment effects on yields in the first harvest after the August 2014 manure application, nor on the next harvest in June 2015, suggesting there was little or no stand damage due to manure or mechanical effects of application equipment (despite high application rate); neither was there a yield benefit from manure nutrients. However, yield from shallow injection was slightly lower than most other treatments in the first harvest (July 22) following the 2015 manure application. But the yield effect had disappeared by the next harvest in August.


Shallow injection application

Preliminary results from the first two study years show minimal effects of manure application on yield compared to the no-manure control (optimum or higher soil test phosphorus and potassium); however, there was some indication of a short-term (one harvest) decrease in yield from the injection treatment. Injection greatly decreased ammonia emission, but there may be a trade-off with increased greenhouse gas (nitrous oxide) emission.

Conclusion

Potential benefits of applying manure on perennial forages include increasing acreage for manure application and timing flexibility. Yield may be increased, especially for grass forages and on sites needing nutrients. However, yields may be unaffected or even decreased in some cases. Potential advantages need to be considered in the context of some concerns – manure or wheel traffic plant damage, nutrient runoff, excessive nitrogen at stand termination, and others.

Most of these risks can be minimized by careful management (e.g., spread soon after harvest, avoid excessive rates and traffic on wet soils, avoid application at stand termination if the nitrogen credit is adequate for the next crop). Several innovative liquid manure application methods offer additional options to improve nitrogen utilization, minimize forage contamination, decrease nutrient runoff, and provide more uniform application. Success of manure application on alfalfa depends on the specific conditions at the site and good decision-making by the manager.

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