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Pathogen Best Management Practices (BMPs)

Richard K. Koelsch
University of Nebraska - Lincoln, rkoelsch1@unl.edu

NEWSLETTER

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This month, the Heartland Animal Manure Management Newsletter contains articles titled:

Program to Provide Training in Developing and Implementing MMP's/NMP's/CNMP's

Joe Lally, Iowa State University

A continuing education program for technical service providers involved in writing comprehensive nutrient management plans will be March 11-13 at the Comfort Inn and Suites Hotel in Omaha, Neb. It is being sponsored by the Heartland Regional Water Coordination Initiative's Animal Manure Management Team.

Participants will learn the latest research-based information on manure and nutrient management and will acquire the skills for helping clients achieve their goals. The program covers three content areas — manure management, design and engineering, and software tools — which are addressed in half-day sessions. Participants may pick and choose sessions among the three content areas, as well as attend the full three-day training or just individual workshops. "They are going to get the latest nutrient research that's been conducted for preparing nutrient management plans," said Joe Lally, project coordinator for the program. "It will be hands-on training, so they will be able to take the materials home and put them to work right away. In addition, we're especially pleased to offer the Manure Management Planner (Purdue) software training."

Participants should receive credit for about four continuing education units (CEUs) for each half-day session they attend. This applies to technical service providers (TSPs), certified crop

advisers (CCAs), consulting engineers, and members of the American Registry of Professional Animal Scientists (ARPAS).

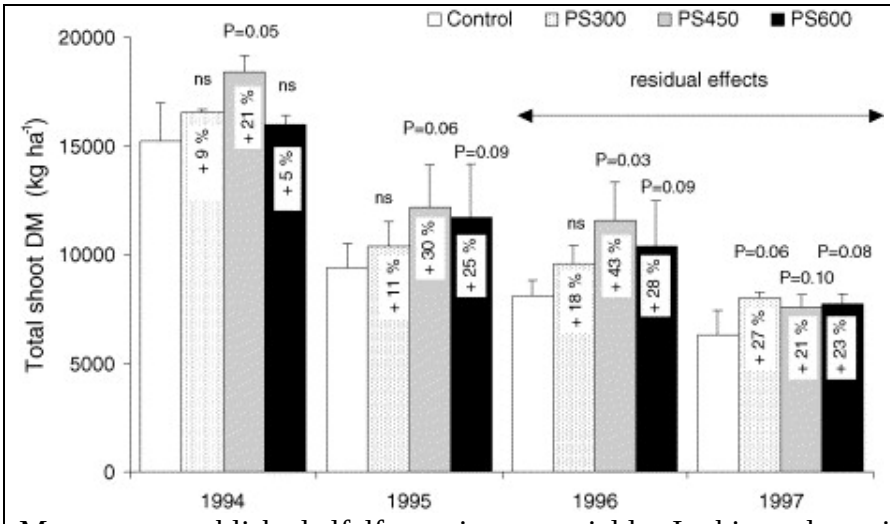
Pre-registration is required; fees include two lunches and refreshment breaks. Early bird registration is due Feb. 24 and costs $100 for each half-day session or $350 to attend the entire three-day program. Registration after that date costs $125 per session or $450 for the entire program. Registrations will be accepted through March 7. To register online, visit Heartland Animal Manure Management or http://cariregistration.unl.edu and follow the link. To register via mail, download a form from web site above. For more information, contact: Joe Lally at 515-294-1496 or lally@iastate.edu or Teshome Regassa at 402-476-6844 or tregassa2@unl.edu.

Manure Applications for Alfalfa

John Lory, University of Missouri

Alfalfa has many characteristics that make it a desirable crop for manure applications:

1. Alfalfa requires high phosphorus (P) and potassium (K) soil fertility and has a high demand for these nutrients.
2. Alfalfa can benefit from the micronutrients in manure, particularly boron.
3. Alfalfa removes large amounts of nitrogen (N) and K from the field when harvested as hay.
4. Alfalfa has the ability to draw down nitrate levels within its root zone.
5. Forages like alfalfa have low erosion, nutrient runoff and nutrient leaching potential.
6. Alfalfa offers opportunities for manure application throughout the year.



Manure on established alfalfa can increase yields. In this study, swine slurry (4.5% dry matter) was surface-applied to alfalfa at four rates (0, 300, 450 and 600 kg/ha/year) in 1994 and 1995. Manure was applied four times per year typically a few days after cutting. Alfalfa yield was increased in the years of application and the two years following application. *Source: Ceotto, E and P. Spallacci. 2006. Pig slurry applications to alfalfa: Productivity, solar radiation utilization, N and P removal. Field Crops Res. 95:135-155.*

However there are significant challenges in managing manure on alfalfa:

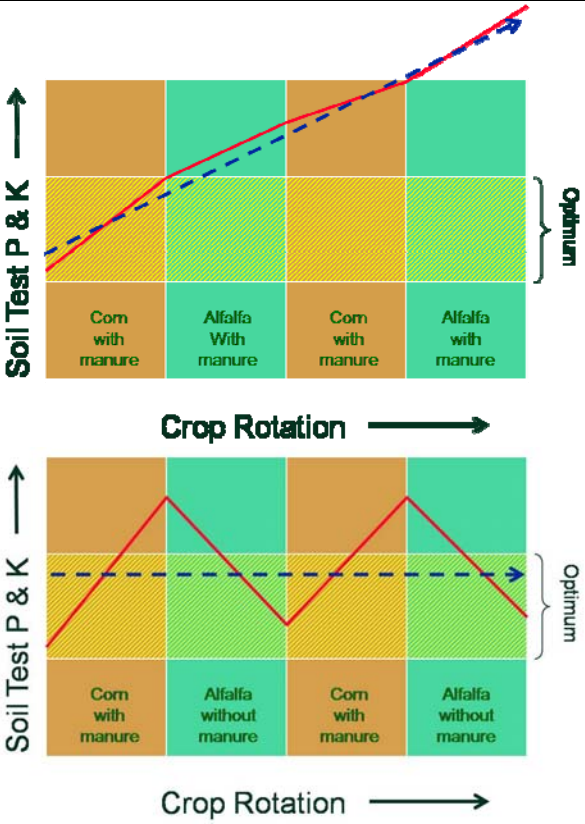
1. Poorly timed applications can damage the alfalfa stand through physical damage to plants.
2. Manure applications can increase weed competition particularly in mixed grass-alfalfa stands.
3. Alfalfa is a legume so has no requirement for applied N limiting manure nutrient value.
4. Manure can be an unbalanced fertilizer (ie. does not exactly match crop needs for all nutrients) so applying manure based on N often results in the build up of excess P and K in the soil.
5. Manure applications at the end of stand life can result in soil N supply in excess of the following crop needs potentially increasing N losses to water and the atmosphere.

Alfalfa is predominantly grown in alfalfa-corn rotations associated with dairy production. The alfalfa stand can last five years or more and then the field is rotated to corn for two to three years before returning to alfalfa. In these systems the crop rotation has the dual role of utilizing the fertilizer value of manure and providing a place to apply manure to prevent overflow of manure storage facilities.

One challenging characteristic of alfalfa-corn rotations is the relatively low demand for external inputs of N. Alfalfa, as a legume crop, fixes the N it needs and typically requires no N applications to maximize yield. Residual benefits from the N fixed by alfalfa will provide most of the N needed by first-year corn following alfalfa and frequently reduce N needs in the second-year crop following alfalfa. See state-specific recommendations on the N value of an alfalfa stand to the subsequent crop. In most states the only significant fertilizer N need in alfalfa-corn rotations is on second- and third-year corn following alfalfa.

The best opportunity to maximize the value of manure in alfalfa-corn rotations is to apply manure to second- and third-year corn following alfalfa to at rates that meet N needs of corn. In this system all the N, P and K fertilizer value will be realized. Manure eliminates the need to purchase N, P and K fertilizer for corn and any excess P and K reduces fertilizer need of the following alfalfa crop.

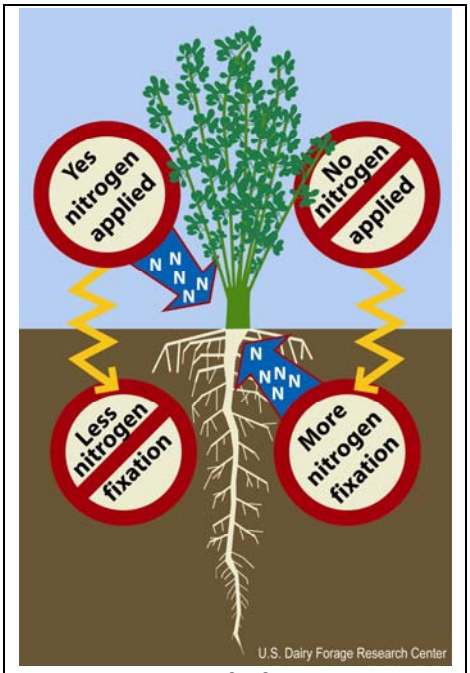
Farmers benefit from maximizing manure applications to this portion of the rotation but there are limitations. The optimal timing of application is limited to a relatively short period in spring prior to planting and early in crop growth. There also typically is not enough land in second- and third-year corn following alfalfa to utilize all manure produced by the farm. Consequently dairy farmers frequently are looking for opportunities to apply manure on the alfalfa phase of alfalfa-corn rotations. However, this can result in a steady buildup of P and K in the soil.



Repeated applications of manure to meet both the nitrogen need of corn and the nitrogen removal capacity of alfalfa can excessively raise soil test P and K levels. Use nutrient management planning to balance manure application rates with rotation P and K needs. Manure on second- or third-year corn following alfalfa has the added benefit that the crop needs N. *Figures from D. Beegle, Pennsylvania State University.*

Opportunities to Apply Manure on Alfalfa

A prerequisite to making smart decisions about applying manure on alfalfa requires an understanding of the impact of applied N on alfalfa stands. Alfalfa has the capacity to fix N from the atmosphere to meet its needs. Each ton of harvested alfalfa can contain 50 pounds of N and in low N-supply soils most of this N will be derived from N fixation. Total N fixation can reach hundreds of pounds of N per acre per year. There is an energy benefit to the alfalfa plant to use N from the soil in preference to fixing N from the atmosphere. Alfalfa plants that have access to alternative N supplies will reduce N fixation and preferentially use the alternative N supply. This buffering process means manure applications that meet alfalfa N need will not lead to over-application of N. Such applications are not economically beneficial because there is no yield value to the applied N. But there is no water quality cost from applying this N even though the alfalfa does not need it.



Legumes like alfalfa have the capacity to buffer applications of manure N. When manure is applied alfalfa fixes less nitrogen. *Figure is used with permission from US Dairy Forage Research Center.*

There are three potential opportunities to apply manure on alfalfa:

1. Preplant applications.
2. Application to established productive stands.
3. Post production applications prior to destroying the stand.

The first two strategies can be conditionally recommended as long as farmers are aware of the limitations and challenges of manure applications during these periods of alfalfa production. The final strategy, post production applications, cannot be recommended because manure applied at this time is likely to lead to potential increases in N loss.

Preplant applications:
Preplant manure applications for alfalfa can meet P and K requirements of manure for the first years of production. The application rate is limited by the lower yield and N demand during alfalfa establishment. Care must be taken insure that the seed is not in direct contact with fresh manure through injection or incorporation of manure. The N in the manure can promote weed competition during establishment. It also can promote lodging of oats if oats are used as a nurse crop for establishing alfalfa.

Application to established stands:
Manure applications to established stands can provide needed P, K and boron. Alfalfa also provides windows of opportunity for manure application through the whole growing season. High yielding alfalfa has a high capacity to buffer high amounts of manure N. The primary concern with manure applications to established alfalfa is damage to the stand from the manure. Alfalfa plants can be damaged by high salt or ammonia concentration in the manure, by physical damage to the crowns by manure application equipment or by water deficits induced by high salt concentrations in the manure. The greatest danger is from slurry or solid manure that is applied with large manure spreaders. Lagoon water from unagitated lagoons typically posses less risk because nutrient and salt concentrations are lower. Another concern is manure may increase competition from grass or weeds if they are present in the stand.

To minimize potential damage to the stand:

- Make sure application equipment breaks up large lumps of solid manure and applies manure in a uniform pattern on the field.
- Limit manure application rates. High rates increase potential for stand damage.
- Apply manure immediately after cutting alfalfa and before budding on the alfalfa crowns. The alfalfa plant is less vulnerable to salt damage when no green leaves are showing. This is particularly important for surface applications of slurry.
- When using manure that has a high potential to damage the stand apply to older stands that have a high grass or weed component. Mistakes with manure applications on these stands are less costly.

Applications at or near the end of stand life:
Applications at or near the end of stand life cannot be recommended because they lead to applications that exceed N utilization capacity of the rotation. Farmers frequently want to apply manure to alfalfa in the fall just prior to killing the stand. Manure applications at this stage occur after alfalfa N demand. It is really an application that will supply the subsequent crop with N; typically there is limited need for added N in the crop following alfalfa. Under these conditions manure applications will easily lead to excess N in the soil profile. Such conditions promote N losses to water and air resources.

Other Resources
There are excellent extension publications further detailing the opportunities and challenges of managing manure for alfalfa. These include:

Easy does it with manure on alfalfa and grass. M. Russelle and B. Jokela. USDA-ARS US Dairy Forage Research Center Fact Sheet (http://www.ars.usda.gov/sp2UserFiles/Place/36553000/px-based_v3.2/educ-matrls/pdfs/FS_manure-apply-perennial-forage.pdf).

Applying manure to alfalfa: Pros, cons and recommendations for three application strategies. 2003. K.A. Kelling and M.A. Schmidt. North Central Regional Research Report 346 (http://www.soils.wisc.edu/extension/publications/Manure%20Alfalfa.pdf).

Application of manure to established alfalfa. 2006. Q.M. Ketterings, E. Frenay, J.H. Cherney, K. Czymmek, S.D. Klausner, L.E. Chase and Y. Schukken. Cornell University Cooperative Extension Agronomy Fact Sheet 16. (http://nmsp.css.cornell.edu/publications/factsheets/factsheet16.pdf).

Handling manure on forage crops. 2007. M.P. Russelle. In Proceedings of the 2007 Idaho Hay and Forage Conference (http://www.idahohay.com/Russelle_MPR.pdf).

Managing manure on Alfalfa Hay. 2000. J.A. Lory, R. Kallenbach and C. Roberts. Univ. or Missouri Extension Guide G4555 (http://extension.missouri.edu/explorepdf/agguides/crops/g04555.pdf).

Alfalfa production, weed occurrence and economic risk from dairy manure applications of alfalfa. 1996. J. Daliparthy and S. Herbert. Univ. of Massachusetts Crops, Dairy and Livestock News 1.1 March 1996 (http://www.umass.edu/cdl/publications/n_manure_alf.htm).

Recommendations

- In alfalfa-corn rotations maximize manure value by applying to second- and third-year corn following alfalfa.
- Applications to established alfalfa stands are conditionally recommended to meet P, K and boron needs.
    - Manure N will have no value but alfalfa can buffer applied N minimizing over application concerns.
    - If manure is applied based on N need of the corn and N uptake by alfalfa, excess P and K buildup can be a problem. Therefore, try to balance P and K over the whole rotation.
    - Steps need to be taken to minimize potential damage to established alfalfa stands particularly when applying slurry or solid manure.

Pathogen Best Management Practices (BMPs)
(Part 3 of a 4 part series)

Rick Koelsch, University of Nebraska, and Janice Ward, US Geological Survey

Management practices targeting pathogens focus on establishing multiple barriers between the pathogen source and water, with each barrier designed to lessen the risk of pathogens. The “Agricultural Environmental Management” program developed at Cornell University for dairy producers in New York watersheds promotes a four-barrier approach.

Barrier 1 targets reducing the potential for pathogens to enter the farm through:

- Identifying and quarantine of infected animals.
- Preventing transport of infected manure onto the farm on clothing, boots, or equipment;
- Controlling pets, rodents, and other animals that can introduce pathogens to the farm.

Barrier 2 focuses on minimizing cross-contamination among animals including:

- Keeping calf-raising areas clean;
- Controlling pets, rodents, and other animals that can transport pathogens between groups of animals;
- Ensuring that all feeds and feeding utensils are clean.

Barriers 1 and 2 will vary with species from this dairy targeted approach. A species specific bio-security program encouraged by industry or veterinarian organizations is the foundation for the first two barriers. The farm's veterinarian is an important partner in implementing the first two barriers.

Barrier 3 addresses manure collection, storage, and treatment. Practices include:

- Elimination of runoff from animal housing and manure storage (e.g. runoff collection ponds, vegetative filters).
- Extended storage of manure. Extended storage of slurry and liquid manures typically produces a 10-fold reduction in pathogens. Two separate storage facilities (no fresh manure additions for two months prior to land application) can further reduce risk.
- Composting. Well managed composting systems can eliminate most pathogens.
- Anaerobic digestion. Digesters operating at 100 degrees F can produce a 100-fold or greater reduction in pathogens.

Uncontrolled runoff from open lot housing is a high risk source of pathogens

Avoiding application on tile drained areas during periods of tile flow is an example of a barrier 4 practice.

Photo source: Jane Frankenberger, Purdue University

Barrier 4 focuses on minimizing risk associated with land application of manure through such practices as:

- Immediate incorporation of manure into soil. This practice must be balanced with residue loss and increased erosion potential.
- Implementing sound soil conservation and runoff management practices in crop land (e.g. reduced tillage systems, grassed filters).
- Applying manure from higher risk animals (e.g. calves) to crop land with lowest risks of runoff, erosion, or groundwater infiltration.
- Applying manure to tile drained fields only when the soil is relatively dry. Tile drained fields present a unique risk due to macropores caused by roots, earthworms, or cracks. Managing drainage water by raising drain outlets before manure application also reduces pathogen risk (see Drainage Water Management for the Midwest …
- http://www.ces.purdue.edu/extmedia/WQ/WQ-44.pdf).

To reduce the threat to surface and ground water from contamination by pathogenic organisms found in farm animals, USDA Natural Resources Conservation Service for New York has developed a Pathogen Management Conservation Practice Standard (ftp://ftp-fc.sc.egov.usda.gov/NY/eFOTG/Section_4/Practice_Standards/PathogenManagement_NY783_ps_2002_02.pdf. The standard utilizes the four barrier approach described previously.