What's Cropping Up?

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New Bulletin: Manure Use for Alfalfa-Grass Production

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From a nutrient use efficiency standpoint, corn and forage grass fields tend to be the preferred fields for manure application on dairy farms. Alfalfa typically meets its nitrogen (N) requirement through biological N fixation so N from other sources is unnecessary if conditions for N fixation are satisfactory. However, nutrient management plans require that manure application to corn and forage grasses be limited to crop N needs, increasing the likelihood that manure will need to be applied to alfalfa fields. In addition, alfalfa fields may at some times be the only fields accessible for manure application. In this extension bulletin we summarize scientific literature on the impacts of manure application to alfalfa and mixed alfalfa-grass stands in the establishment year and beyond, describe current Cornell University fertility guidelines for alfalfa and alfalfa-grass mixtures, and give guidelines for manure management of such stands in situations where manure application to alfalfa is necessary.

Executive Summary[1]:

1. Nutrient management plans require manure application to corn and forage grasses to be limited to crop N needs possibly resulting in manure having to be applied to other cropland such as alfalfa fields.

2. The deeper rooting system of established alfalfa as compared to grasses and/or corn, its relatively high P and K demands, and its ability to reduce N fixation upon availability of a readily available N form, make alfalfa a more appropriate alternative (assuming odor is controlled) for manure application than corn or grass fields for which N needs have already been met.

3. Established stands with non-fixing alfalfa varieties or mixed alfalfa-grass stands with more than 50% grass are better alternatives for manure application than newly established monocultures of N-fixing alfalfa cultivars or fields that still need to be seeded to alfalfa or alfalfa-grass mixes.

4. It is recommended to test soils for P and K (and other nutrients) at least once in three years to determine P and K needs. Phosphorus needs in the seeding year (for soils with a Cornell Morgan P test <80 lb/acre P) can be met with spring-applied manure but rates should be limited to 3,000-4,000 gallon/acre and manure should be incorporated to reduce N loss in the seeding year as very little N uptake occurs in the first 4-6 weeks after germination. If soil test P levels are ≥80 lb/acre, manure applications in either fall or spring prior to seeding of a new alfalfa-grass stand should be avoided to reduce N loss and enable P drawdown.

5. When soil nitrate levels are above 15 ppm, soil pH is 6.8 or higher, soil temperature is 60°F or higher within 3-4 weeks after germination, soil P and S fertility is optimal, and healthy populations of N-fixing bacteria are present, applying pre-plant N (either with manure or fertilizer) to a new alfalfa or alfalfa-grass seeding will not increase yield and may negatively impact N-fixation. Thus, N application to a new alfalfa or alfalfa-grass seeding is typically discouraged.

6. Seedings with companion crops harvested for silage or grain (e.g. oats, spring barley, triticale) will require N for optimal establishment and growth of the companion crop. Fertilizer N applications should be limited to 60-80 lb fertilizer N/acre for agronomic returns. Manure can be applied to meet the N needs of the companion crop. However, spring manure application rates in excess of 6,000-8,000 gallon/acre can lead to lodging of the companion crop and increase N loss to the environment.

7. For established stands (topdressing), smothering and/or salt injury to the stand increases with manure application

[1]Average crop and manure analyses were used to derive estimates of crop removal and manure N, P, and K application rates. More accurate estimates will be obtained from farm-specific manure and forage quality analyses.

rates in excess of 4,000 gallon/cut, especially when applications are delayed beyond 3-4 days after cutting.

8. Alfalfa-grass harvest typically removes about 13 lb of P_2O_5 and 56 lb of K_2O per ton dry matter (DM) and, assuming an average crude protein (CP) content of 15% of DM (grass dominated grass-alfalfa mixture), an alfalfa-grass crop contains about 40 lb of N/ton DM whereas a 20% CP crop (pure alfalfa) contains 55 lb N/ton DM.

9. Recognizing that crop nutrient removal is a management concept rather than a goal or requirement, given a typical P and K content of manure, it would on average require less than 2,000 gallon of liquid manure to apply the equivalent of P removal and slightly more than 4,000 gallon to equate to K removal of a 2 ton DM/acre yield. For N, established stands could receive 6,000-8,000 gallon/acre for each 2 ton of forage removal assuming N fixation is reduced to 20% of the total N uptake and taking into account soil N uptake as for corn.

10. In cases where maintaining (not increasing) P levels is part of the management strategy, manure application rates should be limited to 4,000 gallon/acre for the year (across all years of the stand). Manure application in the seeding and early production years is not recommended, a practical approach to maintaining P levels could be to apply manure at 4,000 gallon/acre after cuttings (where field conditions allow) in the final years in the stand, rebuilding P (and K) levels after drawdown in years 1-3. Manured fields should be checked for forage K content when the forage is being considered for feeding to nonlactating cows.

11. If manure is being applied in the last production year to address P and K levels that have been reduced over the life of the alfalfa-grass stand, it is recommended to apply the manure while the crop is still actively growing to enhance N uptake (during summer or early fall) and to kill the alfalfa-grass in the following spring (rather than the previous fall) to prevent large N fluxes prior to establishment of the following corn crop.

12. Wheel traffic damage can be minimized by planting traffic tolerant varieties, using small tractors if possible, avoiding unnecessary trips across the field, using larger harvesting equipment, and driving on fields as soon after cutting as possible.

13. Application of manure from animals infected with pathogens, particularly Johne's disease is a potential method of spreading these infections. In the case of Johne's disease, exposure of young animals (<1 year old) to contaminated pastures or to feed coming from these fields should be prevented.

14. Plant breeding and/or genetic engineering for selection/development of germplasms should focus on ways to effectively reduce N fixation in high N situations without compromising yield and/or quality.

15. The management guidelines in this bulletin are based on our current knowledge of N use and N dynamics in alfalfa-grass systems, derived from the studies referred to in section 2 of this bulletin. Additional (local) research is ongoing and these guidelines will be updated once additional research findings with relevance to New York State become available.

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http://nmsp.css.cornell.edu/publications/articles/extension/Manureandalfalfa.pdf