TIMELY TOPICS

By Amir Sadeghpour, Karl Czymmek and Quirine Ketterings

Value of manure lingers long after application

Study tests impact of manure, semi-composted solids and N fertilizer applied during corn years on hay after corn years.

What is the value of manure? Is it just the recoverable fertilizer value? Does the value last more than one year? We often approach this from the perspective of how much the equivalent in nitrogen, phosphorus and potassium fertilizer would cost. This underestimates the actual value of the manure primarily because it not only does not consider the benefits of organic matter, sulfur, magnesium and other micronutrients, but also because manure can stimulate microbial activity that is good for soil health. Dairy managers who seek to share manure with neighboring crop farms often encounter resistance about payment for the manure, or even covering the cost of transportation and application. For many dairies that run a corn-alfalfa/grass rotation, manure is applied at relatively high rates to meet most or all nitrogen needs during the corn years, then avoided for some or all the hay years to favor the alfalfa and allow for some drawdown of phosphorus.

This project tested the impact on hay yields after corn was grown with two rates each of liquid dairy manure and semi-composted dairy solids (the separated solids were piled and aged, but not routinely mixed), as well as fertilizer only treatments.

Here's the question: Does manure applied during the corn years provide measurable benefits to the alfalfa/grass, and if so, for how long?

An experiment was conducted from 2001 to 2010, including five years of silage corn (2001-2005) and five years of alfalfa/grass (2006 - 2010). During the corn years two treatments each of liquid dairy manure and semi-composted dairy solids were applied. In spring, liquid dairy manure was surface applied at 21,000 gallons/acre (designed to meet N needs with a surface application of manure); 7,000 gallons per acre were incorporated immediately (designed to meet N needs and not exceed P removal); semi-composted dairy solids were applied at 32 tons per acre (designed to meet N needs); and semi-composted dairy solids were applied at 20 tons (designed to meet P removal) per acre.

Plots with no manure or compost were fertilized with 0 and 100 pounds N per acre at sidedress time. All corn plots received 20 lbs N-P_2O_5-K_2O per acre as banded starter fertilizer. After five years of corn, alfalfa/grass was planted in late April in 2006 with 20 lbs/acre of P_2O_5 and K_2O. Beyond the starter fertilizer at establishment, no manure, compost, or inorganic N was applied during the alfalfa/grass years. The crop was harvested twice in the establishment year (2006, a dry year), three times in the second year (a drought year), and four times from 2008 to 2010.

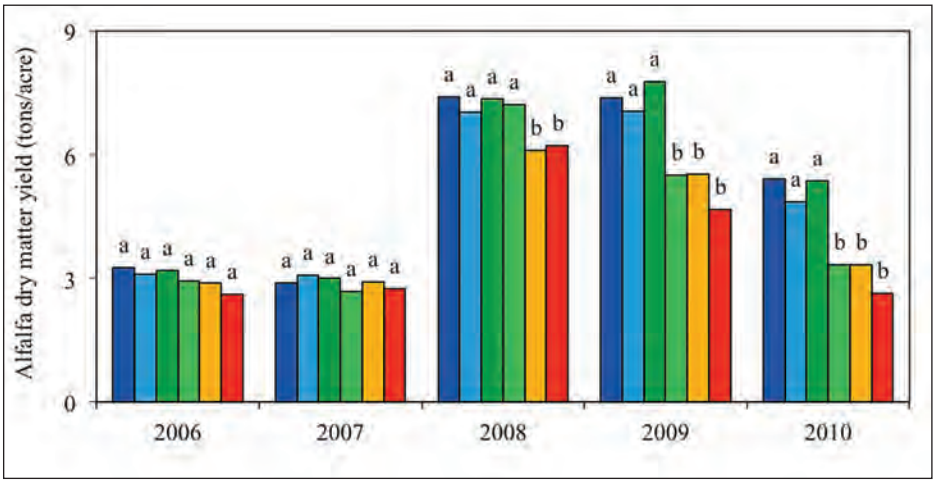

Figure 1. Alfalfa yield (sum of cuts in each season) as influenced by HC: High rate of compost (32 tons/acre); LC: Low rate of compost (20 tons/acre); HM: High rate of manure without immediate incorporation (21,000 gallons/acre); LM: Low rate of manure with immediate incorporation (7,000 gallons/acre); 0N: no inorganic N addition (0 lbs N/acre) and 100N: addition of 100 lbs N/acre. Treatments were applied during the corn years and alfalfa did not receive any manure or inorganic N.

Clear benefit of manure on alfalfa

Results show that alfalfa/grass benefitted from the addition of manure and semi-composted dairy solids during the corn years (Figure 1). Alfalfa/grass dry matter (DM) yield was similar among all treatments in the establishment year (2006) and in the first production year (2007), which were both dry years. In 2008, growing conditions were excellent and plots that had received manure or compost had greater yields compared to those that only received inorganic fertilizer in the corn years. No differences were observed between manure or compost plots, regardless of rate that year. Alfalfa/grass DM yield in the high manure and both composted dairy solids treatments remained high. Averaged

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the same yield with N applied at planting, 180 lbs/acre were needed (Figure 2), and likely more N would have been needed for the early season surface application if a urease inhibitor had not been used. This research shows that in a weather challenging year, sidedressing N provides the most efficient method of N fertilization for corn, as long as sidedressing can be done. Past research, in dry to average years, where early season N losses from urea was expected to be low, pre-plant N application at normal rates worked as well as sidedress N. It is likely that similar results would be observed in cases where manure applications were not sufficient to meet crop N needs. Sidedressing is the ideal "just-in-time" application method for optimum N recovery because N is applied when rapid crop uptake is imminent. Using a nitrification inhibitor when N fertilizer applications are done at planting (and also a urease inhibitor if urea cannot be incorporated) can reduce N losses during growing seasons like those experienced in 2015. These results also suggest that farms could benefit from testing N rates, or at least leaving untreated or half-rate check strips when adding supplemental fertilizer as a way to get better information about how fields respond to N. This can help improve decisions in future years and help the wallet and the environment at the same time. ❐

Figure 2. Corn grain yield as affected by rate and time of inorganic N application in 2015. Application rates are sum of starter band N rate at each application timing. At the end of the growing season, yield leveled off at the 150 lbs/acre sidedress N (121 bu/acre). To obtain the same yield with N applied at planting, 180 lbs/acre were needed.

Amir Sadeghpour (as3289@cornell.edu) is a Post Dr Associate in the Cornell University Department of Animal Science. Karl Czymmek (kjc12@cornell.edu) is a Senior Extension Associate with Cornell PRO-DAIRY. Quirine Ketterings (qmk2@cornell.edu) is a Professor in the Cornell University Department of Animal Science.

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over five years, total alfalfa/grass DM yield was 21% higher in compost and high manure plots (average of three treatments) than low and non-manure plots (average of three treatments) (Figure 1). The lower manure rate was not able to maintain the higher yields in the fourth year of the stand, showing lower alfalfa/grass yields in 2009 and 2010 than where the compost or the higher manure rates were applied. During the alfalfa years, P and K levels remained optimal. The decreased alfalfa/grass yield observed with the low manure rate in the fourth and fifth year of the stand may in part reflect a difference in sulfur supply in those years. Producers should check their alfalfa/grass stand for sulfur status if manure has not been applied more than two years previously.

Manure or compost applications on a field can have significant impact on crop yields, even years after the last application. These results should help dairy producers have productive discussions with crop neighbors about the value proposition associated with manure. Crop producers who have had manure applied for free or for the cost of application have been getting a pretty good deal! ❐

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