RESEARCH ABSTRACT

ENVIRONMENT

Title: Adding Value to Swine Manure Through Accurate Prediction of Organic Nitrogen Availability – revised
NPB #06-140

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Scientific Abstract: Animal manure contains organic and inorganic nitrogen. The inorganic N, which is mostly ammonium-N but nitrate-N can be significant in composted manure, is typically considered to be 100% plant available if there are not significant losses, especially due to volatilization of ammonia-N. The availability of organic N, which is mostly from undigested and partially digested plant material needs to be mineralized to become plant available, is less predictable. Field research was conducted in eastern Nebraska to improve the basis for estimating organic N availability from injected or incorporated swine manure and from surface applied composted and stockpiled FM. The factors studied included manure type, time of application, soil texture, and soil water management. The three manure types were incorporated swine slurry and surface-applied composted or stockpiled feedlot manure. The three application times were in October, March and May. The soil textures were silt loam and loamy sand. Soil water management was irrigated or rainfed. Experimental units consisted of PVC tubes of 50 mm inside diameter fitted with soil-resin traps to retain inorganic N moving downwards with percolating water. Nitrogen release was monitored through out the season by replacing and sampling the traps at 6-week intervals. Manure application rates were determined to supply approximately 180 kg ha^{-1} of plant available N during the crop season. Time of application was important with more manure N available with the October compared with the March and May applications. Soil water management was important as 85% more N from manure became plant available with irrigation than with rainfed conditions. Soil texture was also important with 46% more N plant available N with a silt loam compared with a loamy sand soil. The mean amount of organic N mineralized, by application time ranged from 0 to 82% for swine slurry, 0 to 7% for composted feedlot manure, and 7 to 9% or stockpiled feedlot manure. By the end of July and mid-September, means of 104 and 125 kg ha^{-1} N, respectively, had become plant available with the swine slurry application. However, mean plant available N from the applied feedlot manures by the end of July and mid-September were only 55 and 65 kg ha^{-1} N, respectively. Mean N availability from swine manure was very near expectations for the irrigated treatment and greater than expected with the irrigated silt loam treatments. Plant available N from swine slurry under rainfed conditions, especially with the loamy sand soil, and from the feedlot manure treatments was less than expected. In addition, results were quite variable across application times and sampling dates with a significant margin of error in estimation of plant available N from manure, especially if the manure is high in organic compared with inorganic N as is the case with feedlot manures. High efficiency of use for manure N, while ensuring adequate crop N and preventing excess nitrate-N leaching, may require that estimated N available from applied manure N be no more than 75% of the crop N need. Additional fertilizer N can then be applied in-season by sidedressing or fertigation after assessing N need using the pre-sidedress nitrate test or based on leaf chlorophyll content.