Reducing Ammonia Volatilization by Improved Techniques of Field-applying Manure Slurry to Grassland

Laurens J.P. van Vliet*[1], Shabtai Bittman[1], Sean M. McGinn[2], Naveen K.Patni[1] and C.Grant Kowalenko[1]
Agriculture and Agri-Food Canada
[1]Pacific Agri-Food Research Centre
P.O. Box 1000, Agassiz, B.C. V0M 1A0
[2]Lethbridge Research Centre, Lethbridge, AB
vanvlietl@em.agr.ca

Abstract Urban emissions of nitrogen and sulphur oxides cause air quality to be poor in the Fraser Valley of British Columbia, particularly during periods of stagnation in summer when air masses are stationary. The dominant agricultural industry in the eastern part of the valley is dairying. Land-applied manure slurry from these operations causes ammonia to be volatilized, contributing to the air quality problem by enhancing atmospheric aerosol formation of ammonium nitrates and sulphates. Finding ways to reduce the volatilization of ammonia from agricultural activities is the focus of this research. The objectives are to quantify the amount of ammonium-N volatilized from spreading (broadcasting) manure slurry onto grassland, and to evaluate improved manure application techniques that will result in reduced ammonia volatilization. To measure ammonia in the field, two methods were used. A micro-meteorological method, using passive flux samplers, mounted at each of four heights (25, 50, 100, and 300 cm) on perimeter masts perpendicular to each other around a treated plot (20 by 20 m). Each passive flux sampler consisted of a pair of oxalic acid-coated glass tubes. Broadcasting manure slurry using a splash-plate was compared with banding manure over surface openings made by an aerator implement, the AerWay SSD. The passive flux samplers performed well under dry conditions. Samplers exposed over a 2-week period in 5 shifts captured up to 50 % of the amount of ammonium-N applied. For the second method, we used semi-open static chambers, containing polyurethane foam pads (samplers) soaked in phosphoric acid, set on manure-exposed plots (6 by 15 m) to trap volatilized ammonia. Broadcasting manure slurry was compared with banding manure without- and with surface openings made by the aerator. The chamber method confirmed the relative treatment differences found with the micro-meteorological method, but captures much lower absolute amounts of ammonia. Results from several trials over two years showed that banding manure slurry significantly reduced the amount of volatilized ammonia, and banding manure slurry over surface openings made by the aerator implement reduced ammonia volatilization by up to 50% compared with broadcasting manure slurry using the splash-plate. Reduced ammonia volatilization from field-applied manure does not only benefit air quality, but will also result in less noticeable odor and in more nitrogen from manure being available for crop production.