The effect of application timing on ammonia emissions from cattle slurry in Ireland

S T J Lalor, G J Lanigan
Teagasc, Johnstown Castle, Wexford, Ireland
Email: Stan.Lalor@teagasc.ie

Introduction Ireland is currently meeting its ammonia emission target of 116 kt per annum up to 2010. However, the requirement to further reduce ammonia emissions in the future is unknown. The volatilization of ammonia following land application of cattle slurry accounts for over 30% of the ammonia emissions from Irish agriculture. As a result, the management of slurry application has been identified as a measure that has a high potential to reduce national ammonia emissions (Hyde *et al.*, 2003). Slurry application methods such as band spreading, trailing shoe and injection are widely used in some countries as a tool for reducing ammonia emissions. However, the high cost of adopting this technology is not always compensated through increased N fertilizer value benefits. Improved management of land application, using the cheaper and more conventional splashplate method in association with optimum weather conditions, also offers benefits of reduced ammonia emission and improved N efficiency (Lalor *et al.*, 2009). The objective of this study is to estimate the potential of application timing management using the splashplate method to reduce ammonia emissions following cattle slurry application.

Materials and methods The ALFAM model (Søgaard *et al.*, 2002) was used to predict the total ammonia emissions following cattle slurry applications based on weather data (mean daily air temperature (T) and wind speed (W)) recorded at eight geographically dispersed Met Éireann synoptic weather stations, over a twenty year period (1988-2007). The following assumptions were applied to the ALFAM model: soil water content = dry (i.e. not waterlogged); slurry type = cattle; slurry dry matter content = 70 g/kg; total ammoniacal nitrogen (TAN) content of slurry = 1.8 g/kg; application rate = 30 m^3/ha; application method = splashplate; and technique for measuring ammonia loss = Micrometeorological mass balance technique. The effect of the month, year and weather station on the predicted total ammonia emissions (N_{loss}), expressed as a percentage of the TAN applied, was statistically analysed using PROC GLM in SAS.

Results Month, year and weather station all had a significant effect on N_{loss} ($P<0.001$ in all cases). However, only the monthly emissions over all stations and years are presented here. The month with the highest median value of predicted emissions was July (63.1%), and was significantly higher than December (52.1%), which had the lowest predicted emissions (Figure 1). This indicates that switching application timing between months would have an effect on the total emissions from land application of cattle slurry. The variation in the predicted emissions within each month is reflected in the large difference observed between the 10 and 90 percentile values for each month. These ranged from 8.7% in June to 14.1% in December, and were greater than the difference in the median value between July and December in six of the twelve months.

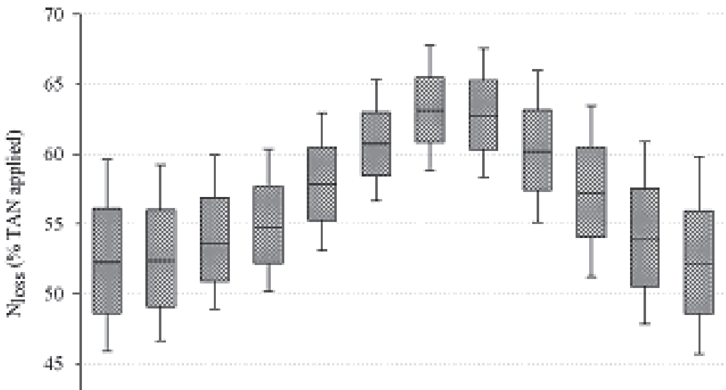

Figure 1 Box plot showing median (centre line), interquartile range (boxes) and 10th and 90th percentile (whiskers) of ammonia emissions predictions (N_{loss}) from cattle slurry application using splashplate for each month.

Conclusions Based on ammonia emissions predictions using the ALFAM model, managing application timing on the basis of monthly averages, and exploiting optimal weather conditions within each month, has the potential to decrease the total ammonia emissions from slurry application with splashplate. However, the development or adaptation of other ammonia emission models for Irish conditions merits further study in order to improve the prediction of ammonia losses following land application of cattle slurry.

References

Hyde, B.P., Carton, O.T., O'Toole, P. and Misselbrook, T.H., 2003. Atmospheric Environment 37, 55-62.
Lalor, S.T.J., Lanigan, G.J., Dowling, C. and Schulte, R.P.O., 2009. 16th Nitrogen Workshop, Turin, Italy, 167-168.
Søgaard, H.T. et al., 2002. Atmospheric Environment 36, 3309-3319.