Nitrogen Efficiency on Dairy Farms

Department of Agriculture and Rural Development
www.dardni.gov.uk

NITROGEN EFFICIENCY ON DAIRY FARMS

Introduction

Northern Ireland dairy farms produce over 3,000,000m^3 of undiluted slurry from housed animals each year, containing approximately 12,000 tonnes of nitrogen. All of this slurry is applied as a fertiliser, yet only approximately one quarter of the nitrogen content is utilised. This low level of nitrogen efficiency represents a huge loss in financial terms to the dairying industry and has contributed to the deterioration of our water quality.

What can be achieved?

Some European countries are achieving a high level of efficiency. In Northern Ireland the same levels of efficiency cannot be achieved because of limitations in soil type and farm practices, but there is significant scope to improve.

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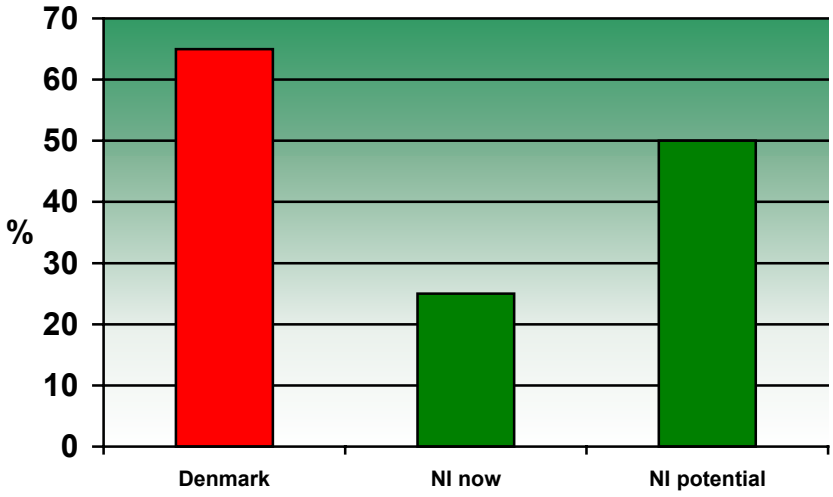


How do losses occur?

There are two major ways in which nitrogen is lost after slurry is applied:

- Nitrate leaching
- Volatilisation – a process which converts the nitrogen into ammonia.

To make optimum use of the nitrogen content of slurries they should be applied at times of maximum grass growth to minimise leaching and managed in a way to minimise losses to the atmosphere.

How can this be achieved?

(A) Prevent Leaching

(i) Timing of slurry applications

Currently approximately one quarter of dairy slurries are applied during the winter months. However, the Nitrates Directive will prohibit slurry applications during this time. This will result in two thirds of dairy slurries being applied in spring, the most beneficial time for grass and crop growth.

The required minimum storage period of 22 weeks for dairy farms will ensure that farms have flexibility with the timing of slurry applications. Farmers will be able to apply slurry when they will derive most benefit from it, rather than when forced to by the risk of overflowing tanks.

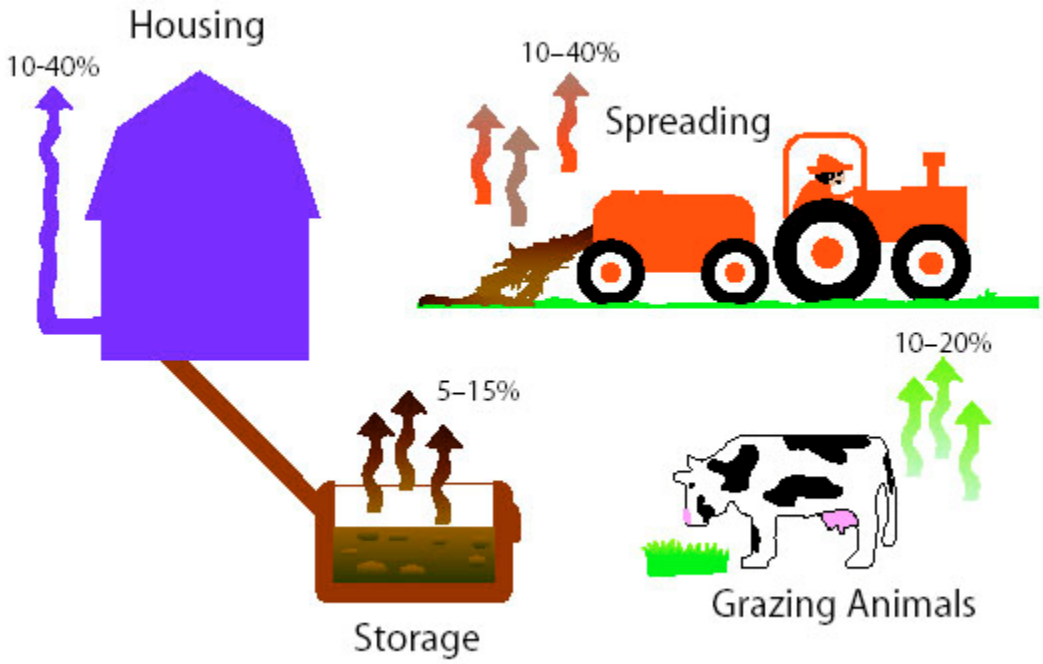
(ii) Spreading conditions

The Nitrates Directive will also demand that slurries be applied only when soil conditions are favourable. This will again ensure that nitrogen is taken up by plants instead of being lost through leaching or runoff.

(B) Preventing Atmospheric Losses

Slurry contains up to 50% of its nitrogen content in the form of ammonium which is readily lost as ammonia. The amount of nitrogen contained in the slurry and available for swards to utilise will depend on the type of cattle housing, slurry storage facilities and slurry spreading methods.

Average N losses from slurry



Managing slurry at each stage will have a major impact on the amount of nitrogen being applied and the overall efficiency with which it is utilised.

(i) Housing

Losses of ammonia are related to the surface area of the exposed slurry or manure. Passages and roaming areas should be cleaned frequently to remove the slurry to storage and minimise ammonia losses.

(ii) Storage

Tank Surface to Volume Ratio

Losses are related to the surface area to volume ratio. Large shallow tanks tend to have higher losses than smaller deeper tanks, with above ground slurry stores having the least potential for ammonia emissions.

Covers

Above ground stores have the added advantage of the potential of fitting specially engineered covers to reduce ammonia emissions. These covers ensure that a concentration of ammonia is maintained above the slurry in the store to restrict further volatilisation and can reduce emissions by up to 80%.

However, the covers must not be completely sealed. Venting must be possible to prevent the build up of methane. Roofs and floating covers exclude rainfall and reduce the volume of stored slurry. The reduction in the storage capacity requirement, the higher nitrogen content of the stored slurry and the savings associated with having less slurry to spread can partially offset the cost of the covers.

Crusts

Cattle slurries will normally build up a natural crust, if relatively undiluted at 7% dry matter and above, and where stirring is minimised. Maintaining this crust is an inexpensive option, giving some reduction in emissions, but may be difficult to manage.

Mixing

Frequent mixing and emptying increases ammonia emissions and therefore should be minimised wherever possible. However, mixing and removal of slurry for spreading is likely to be more frequent on grass than on arable farms to ensure effective utilisation of the slurry.

The mixing of slurry releases gases that are lethal to both operators and livestock. Always follow the advice given in the leaflet, *Slurry Gases can Kill*, available from the Health and Safety Executive for Northern Ireland (Tel: 028 9024 3249, www.hseni.gov.uk).

(iii) Spreading Techniques

Land spreading is where the largest loss of ammonia occurs from livestock slurry. Spreading techniques minimising the surface area of the spread slurry exposed to air reduce the loss of ammonia to the atmosphere. Under the Nitrates Directive only certain spreading techniques will be permitted.

Band Spreading

The application of slurry in narrow bands, rather than over the entire soil or crop surface, can reduce emissions significantly. It is most effective when slurry is applied to well developed swards where the plant canopy reduces the risk of volatilisation. Emission reduction will be minimal if the crop is poorly developed or there is significant canopy contamination.

There are two types of band spreader. The trailing hose deposits slurry at ground level via flexible hoses and reduces emissions by 10-50%. Trailing hoses are in general more effective when used with dilute than with more viscous slurries. The trailing shoe type deposits slurry through pipes that end in metal shoes designed to ride over the soil surface lifting the grass so that slurry is applied to the soil surface beneath the grass canopy to minimise herbage contamination. Ammonia emissions can be reduced by up to 70%.

ARINI compared slurry applications after first cut silage with conventional splash plate and trailing shoe methods. Trailing shoe application increased grass yield by 21% due to the higher nitrogen efficiency this technique can achieve.

Injection

Deep injection places slurry below the soil surface, so decreasing the surface area exposed to air and increasing contact with the soil. Depending on depth of injection, ammonia emissions may be reduced by up to 90% but the method is impractical on most soils due to stones.

However, shallow injection is a viable option for many farms. These machines cut narrow slots 4-6cm deep and 3-5 cm wide that hold the slurry.
Effective reduction in ammonia emissions of up to 80% is achieved, provided that the slurry application rate does not exceed the capacity of the injection slots to accommodate the slurry.

Soil Incorporation

Emissions from slurries are greatest immediately after spreading.
Incorporating slurry into cultivated land by ploughing within a few hours of spreading can reduce emissions by up to 90%. The effectiveness decreases quickly if the incorporation is delayed.

Summary

It makes good sense to make best use of the nitrogen contained in slurries. Many farmers, however, make no allowance for the nitrogen applied in slurries when estimating the fertiliser nitrogen requirements for grass or crops. This represents a substantial waste of nutrients and money as the fertiliser value of the slurry produced over winter by one dairy cow is worth approximately £40.

Complying with the Nitrates Directive for many dairy farmers will undoubtedly result in significant costs. Recoup these costs by reaping the benefits - ensure you use your slurry efficiently.

COUNTRYSIDE MANAGEMENT BRANCH POINTS OF CONTACT

Countryside Management Branch provides advice on all aspects of countryside management. Local Countryside Management Branch staff can be contacted at the following locations.

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