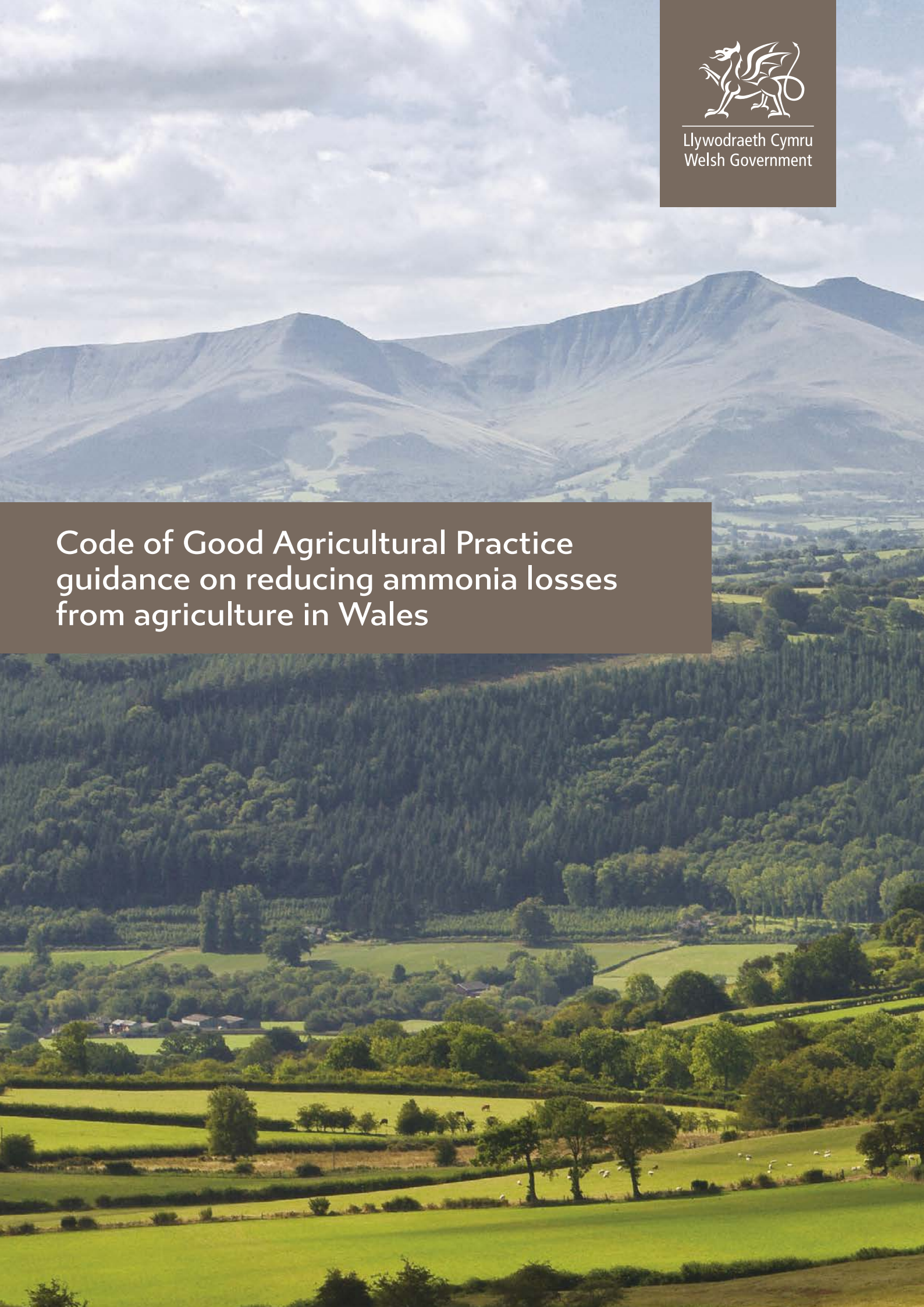


Llywodraeth Cymru
Welsh Government

Code of Good Agricultural Practice guidance on reducing ammonia losses from agriculture in Wales

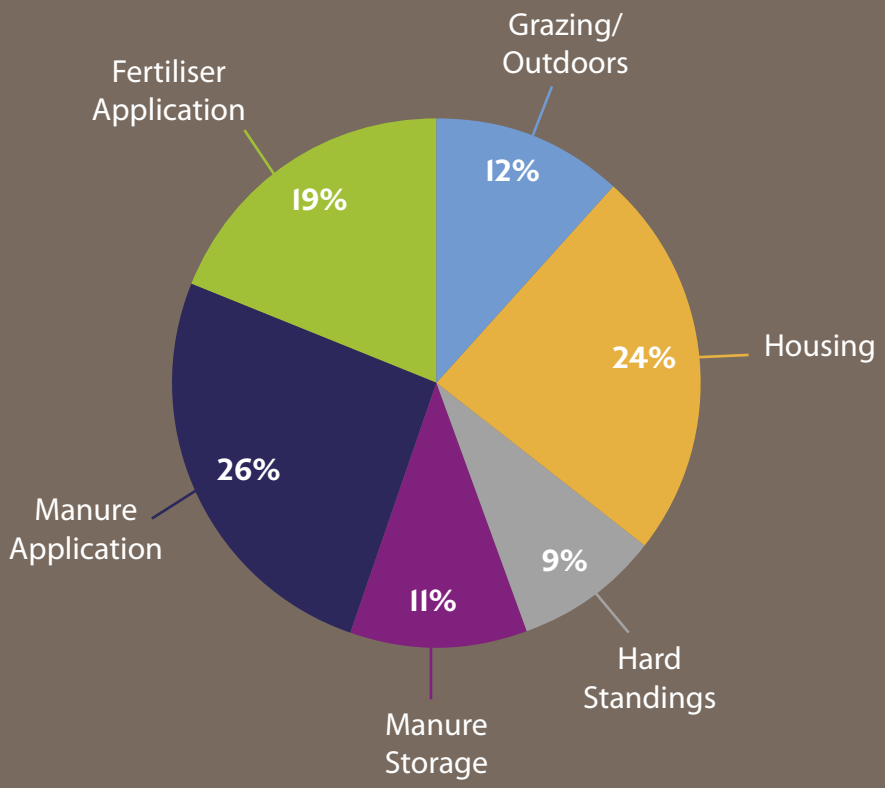
Contents

Mae'r ddogfen yma hefyd ar gael yn Gymraeg.
This document is also available in Welsh.

 WG37520 Digital ISBN 978-1-83876-149-3

Introduction

Ammonia (NH_3) is a major atmospheric pollutant which is harmful to human health and causes acidification and eutrophication of soils, habitats and fresh waters. Agriculture contributes to over 85% of ammonia emissions in Wales, originating largely from manure management, and from applications of urea based fertilisers in particular.



The UNECE Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions of 2015 (UNECE CoGAP)

UNECE CoGAP[1] is an international advisory code which provides a range of mitigation options for reducing ammonia emissions from agriculture. In Wales, the Code of Good Agricultural Practice for the Protection of Water, Soil and Air (2011)[2] (CoGAP for Wales) provides advice and guidance for farmers and land managers to protect the environment in which they operate.

This guidance supplements the CoGAP for Wales and provides additional information on relevant issues regarding ammonia emissions including its risk to human health and the wider environment, and practical ammonia management options for Welsh farmers. The advice contained in this supplement provides guidance on UNECE CoGAP principles, pertinent to agricultural production in Wales.

[1] www.unece.org/fileadmin/DAM/env/lrtap/Publications/Ammonia_SRI36_28-4_HR.pdf

[2] www.beta.gov.wales/code-good-agricultural-practice

Effect of ammonia emissions on human health and the environment-background

In low concentrations on its own, ammonia has no direct impact to human health but combined with other industry pollutants e.g. carbon dioxide and sulphur dioxide, the particulate matter created can cause major cardiovascular and respiratory diseases of the body. This particulate matter can travel afar, contributing the air pollution background levels in urban areas.

When deposited on land, ammonia can acidify soils and freshwaters, 'over-fertilising' natural plant communities. The extra nitrogen can increase the growth of some species such as rough grasses and nettles, which out-complete other species such as herb species which have lower nitrogen requirements. Ammonia also has a direct phytotoxic impact particularly on lower plants such as lichens.

Long-term damage from ammonia and excessive nitrogen into the environment can be permanent or costly to restore. The location of ammonia sources can be very important for reducing the risk of effects on plants and people.

Practices to reduce ammonia emissions

Emissions from manures can occur at each stage of the manure management process, i.e. at source, storage and application. Farmers can participate in reducing ammonia losses into the environment by implementing good practice at all stages, including:

- Livestock diets
- Livestock housing
- Storage
- Land application
- Inorganic fertilisers

It is important to take a whole systems approach to managing nutrients on-farm when considering emissions. The implementation of ammonia mitigation is most successful when it is targeted at each management stage, for example placing a cover on a slurry store would better result in ammonia savings if the slurry is applied on the land using precision spreading.

Livestock feeding strategies

(Information provided supplements section 4.2.3 in the CoGAP for Wales)

Under optimal conditions, animals excrete more than half the protein intake in feed in the form of different nitrogen (N) compounds. However, there are often excesses in the protein supply for almost all livestock classes and production systems. Therefore improving protein efficiency within livestock diets will help to reduce ammonia emissions.

The amount of nitrogen excreted by livestock can be reduced by matching (as closely as possible) the protein content of diets to the expected level of production and the particular growth stage of the stock. The aim should be to achieve good health and welfare and feed optimisation to improve nitrogen use efficiency. Consider the following techniques for reducing ammonia emissions through diet selection and management:

- Improve feed conversion to weight gain and reduce feed surplus by adopting high standards of management and welfare and by monitoring feed and water intake and growth rate
- Match the nutrient requirements at all stages of production to improve the precision of nutrient supply
- Nutritionists can help to regularly review diets and adjust least-cost formulations to meet nutrient requirements

With reference to home grown feed:

- Know the dietary crude protein (CP) content of your home grown forage. Where possible, this should involve regular, representative sampling of Total Mixed Rations (TMR) and/or feeds with variable CP content (such as fresh grass and silage)

- Consider the farm-specific situation: higher and successful CP reductions (2-3 percentage units) can be achieved more easily in TMR-based feeding systems. For example, CP content can be decreased from 18% to 15% (dry matter basis) in housed early lactation dairy cows fed a maize-silage based TMR with no negative effect on production
- Maintain the quality of crude protein when making silage for winter feeding by:
  - Ensiling grass as fast as possible after cutting;
  - Excluding oxygen from the silo quickly after filling;
  - Avoiding heat damage.

Grass which is not taken up by livestock will risk losing its Nitrogen to the environment. Therefore, match nitrogen applications to grassland with animal requirements.

Reducing housing emissions

(Information provided supplements section 3.2 in the CoGAP for Wales)

Livestock housing is the source for around 24% of ammonia emissions from agriculture in the UK. The basic principle is to reduce the area of ammonia emitting surfaces. This can be achieved by actions such as frequent cleaning/scraping of yards, cubicles and passage ways or by amending building design & ventilation system. Good practice techniques are as follows:

- Regularly scrape floors, scrapings should occur at least twice daily.
- Design floors to drain effectively so urine and slurry are not allowed to pool.
- Frequently transfer slurry to a suitable store. Ensure slurry channels and collection systems are regularly cleaned from grit and sediment.
- Grooved floors with perforations can channel urine and improve drainage.
- Reduce the surface area of the slatted area. Maximise the transfer of excreted material to channels. Solid floor areas should have provisions such as a slight slope to allow urine to drain to the channels. Channels should be emptied frequently by the use of scrapers (unless designed to drain by gravity), a vacuum system or by untreated liquid manure (under 5% dry matter) or separated slurry.
- Avoid ventilation directly above the surface of the slurry in the channels.
- Straw soaks up urine and helps to keep floors dry, preventing pooling of urine. Use the appropriate amount of straw depending on the breed, feeding system, housing system and climate conditions.

- Consider the Best Available Techniques for the rearing of pigs and poultry as outlined in Reference Document for the Intensive Rearing of Poultry or Pigs, even if the unit is below the Environmental Permitting Regulation threshold.

www.eippcb.jrc.ec.europa.eu/reference/BREF/IRPP/JRC107189_IRPP_Bref_2017_published.pdf

Manure storage systems

(Information provided supplements sections 3.1 and 3.2 in the CoGAP for Wales)

Manure storage systems account for 11% of ammonia emissions from agriculture in the UK.

Slurry stores must comply with The Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) Regulations (SSAFO). If your farm is within a Nitrate Vulnerable Zone (NVZ) there are additional requirement for storing organic manures. You are required to notify NRW, in writing at least 14 days before using a system that is new, substantially enlarged or substantially re-constructed. WQE3 forms from NRW are available to provide the necessary information.

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www.naturalresources.wales/guidance-and-advice/business-sectors/farming/good-farming-practice/?lang=en

Slurry–liquid manure systems

Covered slurry stores are effective in reducing the loss of ammonia to the atmosphere. Covering the manures or reducing the surface area of exposed material reduces the contact with air. This reduces the amount of ammonia formed, resulting in more nitrogen retained in the slurry.

Ensuring sufficient manure storage capacity allows you to spread slurry and manures onto land when your crops need it and when weather and soil conditions are suitable.

Slurry store capacity should be calculated around the availability of land and opportunities for spreading so maximum benefit can be obtained from the nutrients available. This will help to minimise the loss of nitrogen to air and water. This can reduce the amount of any additional manufactured fertiliser required. It is also important to ensure your slurry store is well maintained and replaced when necessary to reduce the risk of pollution incidents.

A cover on your store will reduce the amount of ammonia emitted into the air and help retain valuable nutrients within the slurry. The slurry surface will be shielded from wind, allowing ammonia concentrations to build up beneath the cover, suppressing further ammonia emissions from the slurry. Impermeable slurry store covers may divert rainwater from entering the store which will also reduce your slurry storage and application costs, particularly in areas of high rainfall where rain can dilute slurry.

Where the fibre content of the cattle or pig slurry is high and it is not necessary to regularly mix and spread the slurry, allowing the slurry to develop a natural crust can reduce ammonia emissions during storage by up to 40%. Similar effects can be achieved by adding chopped straw or LECA (light expanded clay aggregate) pellets to non-crusting slurry, as long as it won't cause management problems. These fibres rise to the surface and act as a barrier, reducing the interaction between the movement of air and the nitrogen in the slurry. However, a natural crust will not reduce the amount of rainfall which can get into the store. Storage systems which have a large surface area per unit volume (such as a lagoon) have a greater potential for ammonia emissions as more slurry is exposed to the movement of air. It is more difficult to reduce ammonia emissions from lagoons than from tanks. Before constructing a lagoon, you should plan effective mitigation measures for reducing emissions, such as installing a cover.

There are currently three main styles of covers available for slurry storage: Tight lid; roof or tent structures can be built on concrete or steel tanks; or silos. They are highly effective, reducing ammonia emissions during storage by around 80% and they prevent rainfall entering the store.

Please remember slurry gases can kill. Ensure all slurry stores and working practices comply with the necessary regulations. If adding a cover to an existing store, seek advice before starting construction to ensure the structure can support the extra weight. You can get general guidance from the Health and Safety Executive.

Floating sheeting can be used on concrete or steel slurry tanks but is best suited to small earth-banked lagoons. The sheeting may be made of plastic, canvas or other suitable materials. They are moderately effective, reducing ammonia emissions during storage by around 60%, and some types will also prevent rainfall entering the store.

Additional/complementary methods include the use of trees as a shelterbelt to reduce the air velocity around the slurry surface and the use of a high freeboard, which helps reduce air velocity.

Solid manure

Wherever possible, store solid manure in covered stores on impermeable surface. However if storing manure in field heaps, making the surface area of the manure stack as small as possible helps to reduce emissions, for example by storing in 'A' shaped heaps.

It is particularly important you keep poultry manure and litter dry. When it becomes wet it can lead to higher emissions of ammonia. Keeping litter from layers dry could also help to make it a more desirable fertiliser for sale. In Nitrate Vulnerable Zones, you must cover temporary heaps of poultry manure without bedding or litter with waterproof material.

Application of manures, organic material and mineral fertilisers

To increase both the efficiency of organic manure and mineral fertilisers, it is good practice to undertake Nutrient Management Planning to ensure applications are meeting soil and crop requirements, with no unnecessary loss of nutrients to air or water. Effective use of manure can reduce the need for additional mineral fertiliser.

Application of organic manures

(Information provided supplements sections 5.2 in the CoGAP for Wales)

The application of organic manures account for 25% of ammonia emissions from agriculture in the UK. It is important to minimise losses at the application stage because any ammonia saved benefits made earlier in the manure management system are likely to be lost if appropriate in-field methods are not used.

Timing of manure applications should follow good practice as outlined in section 5.2.4. This includes the following principles:

- Avoid winter conditions of frost, snow and heavy rain which can exacerbate ammonia losses and reduce the value of nutrients.
- Soil conditions also influence nitrogen efficiency; compacted and saturated soil won't allow the filtration of nutrient as quickly leading to further ammonia released into the air.

- Aim to spread manures under windless, cool and humid conditions for optimal nutrient uptake.
- If cultivating, prioritise the application of dryer matter material for incorporation into the soil.

Spreading liquid organic manures using surface broadcasting (splash plate) can result in high ammonia emissions, odour and can also increase the risk of surface run-off into water courses. Trailing shoe, trailing hose and injection systems are collectively known as 'Precision spreading'. The liquid manure is placed onto and into the soil retaining more nitrogen in the soil resulting in less ammonia emissions.

Precision spreading can also result in a more even distribution of fertiliser and reduced odours, compared to broadcast application methods. A comparison of surface broadcasting with precision techniques is provided in the following table.

	Surface broadcast	Trailing hose	Trailing shoe	Shallow injector
Typical range of dry matter	Up to 12%	Up to 9%	Up to 6%	Up to 6%
Requires separation or chopping	No	Yes (if over 6% DM)	Yes	Yes
Relative work rate	High	Medium	Medium	Low
Uniformity of spread	Adequate	Good	Good	Good
Crop damage	Moderate	Low	Low	Moderate
Relative odour	High	Moderate	Low	Low
Relative ammonia reduction	0%	30-35%	30-60%	70-80%
Capital cost	Low	Medium	Higher	Higher

Application of mineral fertilisers

The application of mineral fertilisers account for 18% of ammonia emissions from agriculture in the UK. Best practice when using mineral fertilisers, includes:

- Application of manufactured nitrogen fertilisers should be based on a Nutrient Management Plan, integrating fertiliser and manure supply and taking into account your Soil Management Plan.
- As with organic manures, you should only apply manufactured nitrogen fertiliser according to crop requirement and when weather and soil conditions are right.
- Regularly maintain, calibrate and test all application equipment to ensure efficient distribution and utilisation of nutrient supplied.
- Aim to apply mineral fertilisers in ideal conditions for:
    - grassland soils with pH 6-6.5
    - moist soil and in cool temperatures for optimal filtration into the soil
    - limiting fertiliser contact with air.

Typically, around 20% of the nitrogen supplied by urea applications can be lost by ammonia volatilisation.

- Consider switching from urea to ammonium nitrate (AN). While AN can be more expensive, the net cost difference may be negligible due to lower nitrogen losses.
- Use urea with urease inhibitors – these can delay the breakdown of urea to allow subsequent rainfall to wash it deep into the soil.
- Incorporate urea fertilisers into the seedbed whenever possible.

Further Support

Support is available to support on farm efficiencies and reduce ammonia emissions. Eligable businesses can access subsidiced technical advice on Livestock Management and Performance; and Grassland and Crop Management through the Farming Connect Advisory Servive. For more information telephone the Farming Connect Service Centre on 08456 000 813.

www.businesswales.gov.walesfarmingconnect/livestock-management-andperformance

www.businesswales.gov.walesfarmingconnect/grassland-and-crop-management