PRACTICAL GUIDE / October 2025

Livestock nutrition

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This Practical Guide concentrates on how farmers can manage the feeding of livestock to help reduce GHG emissions.

The impact of livestock farming on climate change comes from:

- Emissions arising from the fermentation of feeds in the gut of animals
- Emissions from stored manures

Greenhouse Gas (GHG) emissions from gut fermentation are in the form of methane (CH_4) and from manure are CH_4 and nitrous oxide (N_2O).

- **Methane** – this gas is 21x more potent than carbon dioxide (CO_2) and is produced by certain types of bacteria in the gut. The major source of CH_4 is associated with the fermentation in the rumen of cattle and sheep with a smaller contribution from the hindgut of horses and other forage utilisers. CH_4 is also produced when bacteria break down undigested nutrients that are excreted in manure.
- **Nitrous oxide** – is 312x more potent than CO_2 and is produced by the action of bacteria on manure.
- **Carbon dioxide (CO_2)** – is produced by animals during respiration and is unavoidable.
- **Ammonia (NH_3)** – is released from manure and, although it is not a GHG, it accelerates the greenhouse effect.

Key Fact

Ruminants produce most of the CH_4 arising from livestock yet this is a necessary part of their utilisation of fibrous forages – feeds that cannot be used by man or non-ruminants. So ensuring the maximum production from each animal is essential. Of course, this also ensures the maximum return to the farmer.

WIN + WIN

Risk factors

- Poor diet formulation.
- Inappropriate use of feeds.
- Carrying unproductive stock (eg barren cows).
- Overfeeding protein.

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Grazing management

The digestive system of ruminants, with microbial fermentation in the rumen, allows them to use the fibre in grass very effectively, providing it is not too mature. To ensure that grass use is as effective as possible attention to pasture and grazing management is essential.

Selection of the appropriate grass varieties and re-seeding old pastures to match animal requirements both for grazing and forage conservation will improve the supply of nutrients to the animal.

It is important that good quality grass is available and this can be achieved by carefully managing the grazing. Graze at a target grass height to supply sufficient dry matter but not so high that the grass has become mature and of lower digestibility.

Dairy farmers are now using a closely controlled system with small paddocks used in rotation to achieve optimum nutrient supply and this has potential for beef cattle.

Winter feeding of ruminants

During the winter cattle and sheep are usually given roughage (hay, silage or straw) supplemented with energy and protein concentrates.

Hay and particularly silage vary widely in their composition and using average values can lead to inappropriate supplementation with production targets missed or nutrients wasted. So it is essential that forages are analysed at the start of the winter to allow the formulation of appropriate rations.

Beef cattle producers could consider intensive finishing since high concentrate diets reduce the amount of CH_4 produced per kg of product. However, be aware that this can use a large quantity of cereals that could be used directly by man or nonruminants.

High quality co-products from the human food industry can make a significant contribution to such diets.

Alternative sources of protein

There are a variety of options that are available as alternative sources of protein to feed during the winter ration period. Options include distillers' grains, like maize and wheat; and nitrogen fixing legumes, like clover, lucerne, peas and beans.

Forage legumes can be utilised in different ways, clover and lucerne are typically used as a silage which can be fed as part of the ration. Peas and beans can be used as an ensiled forage; however, it is common to include them as a straight. All forage legumes are typically high in crude protein, varying between 17 and 22% which can reduce the reliance on purchased protein. Forage legumes provide starch and effective fibre alongside the protein content, which are important in rumen function. Peas and beans can be grown alongside cereals like barley, wheat or oats to produce a wholecrop silage, the inclusion of peas and beans increases the protein content of the silage.

Maize and wheat distillers' grain are high energy and mid-level protein sources. Typically, maize has a crude protein content of 28% whilst wheat is slightly higher at 35%. Both are palatable feeds which can assist in stimulating intakes of less palatable feeds in the ration, with the potential to increase milk yields and daily liveweight gains. Maize and wheat distillers' grain are good sources of bypass protein which can reduce the amount of soyabean or low protein sources in the diet without reducing the energy of the ration. Due to the presence of yeast fragments in distillers' products, these can improve rumen efficiency by stimulating rumen activity and promoting fibre digestion.

Including alternative sources of protein in the diet can reduce the reliance on purchased protein and therefore, overall feed costs. However, it is important to consider the livestock class and their protein requirements to determine the quantity required in the diet. Discussing your options with your nutritionist is important to determine how these protein sources may work within your system.

Forage sampling

Forage sampling and analysis is important for understanding the nutritional composition of the silage. Analysis should be completed each year as there are multiple factors which can influence the nutritional composition including weather, crop maturity and wilting periods. A silage sample can be collected anytime after 6 weeks of fermentation in the pit or bale. Silage samples from a pit should be taken in a 'W' shape or from multiple bales in a stack to give a representative sample, ideally bales from different fields should be sampled separately. The nutritional parameters that should be considered at analysis are dry matter (DM), metabolizable energy (ME), crude protein (CP), D value, pH and ash. This information is key for formulating rations which meet the nutritional requirements of the livestock. As seen in the table, targets for silage quality and recommended livestock classes depending on quality.

Targets for silage quality

	Good	Moderate	Low
D-value	70	65	60
ME (MJ kg/DM)	11.5	10.5	9.5
Crude protein (%)	16	12	10
Feed to	Finishing stock, ewes carrying multiples	Growing cattle, autumn calving suckler cows, ewes carrying singles	Dry stock, spring calving suckler cows

Source: AHDB

Winter rations

Following the completion of a forage analysis, there is an opportunity to formulate a ration that meets the nutritional requirements of the livestock class. Utilising the silage results, the ration can be formulated to balance energy and protein with the addition of concentrates, straights, other cereal based silages or straw depending on the livestock class and stage of production. Formulating rations can aid in reducing waste, determining forage quantity available and ensures the animals reach their potential performance. Rations should be completed for different livestock classes on the farm, if possible and practical, lean cows should be prioritised for the better-quality forages and concentrates to meet their energy and protein requirements to improve body condition score. Youngstock require rations that are going to ensure steady growth rates that will hit their daily liveweight gain targets for finishing or breeding purposes. Working with a nutritionist to formulate the winter rations can assist in selecting the most cost-effective ration for your farm.

For sheep, generally rations are required in the pre-lambing period, last two months of pregnancy, to ensure energy and protein requirements are being met dependent on the number of lambs being carried. Energy and protein requirements increase as the ewe gets closer to lambing, ideally, ewes should be split into groups of singles, twins and triplets. If practical, ewes that are lean should be in a separate group to allow a ration to be formulated for them which has potential to improve body condition score. If grass quality and quantity are low and limiting prior to the last 2 months of pregnancy, providing concentrate or forage could be considered as an option depending on practicalities, ewe condition and weather conditions. Blocks are palatable, energy and mineral sources which can be used in this period; however, it is important to remember that not every ewe will utilise the block. Discussing your options with your nutritionist will ensure that the ewe's energy and protein requirements are being met during her pregnancy.

Urea treated barley

This winter, 2025, there is a large amount of cheap barley available due to it not meeting the malting requirements due to higher moisture contents. To combat these higher moisture contents, barley can be treated to reduce the risk of fermentation and mould. Barley which is harvested with a moisture content of 30-40% may be treated with urea, this is the most common source of ammonia used in this treatment. During the process, urea is converted to ammonia allowing the grain to be preserved which makes the seed coat easier to digest and therefore, the grain can be fed whole to cattle. The process of urea treatment increases the protein content of the barley from 11% to between 14 and 18%, this is dependent on the protein levels prior to treatment. Therefore, it is important to test the barley before and after treatment to confirm the protein levels. The crude protein has increased; however, half of this will non-protein nitrogen from the ammonia so the by-pass protein has not increased. If feeding urea treated barley in the ration, it is important to consider what by-pass protein is available in the diet depending on the livestock class.

Pigs and poultry

Unlike ruminants, pigs and poultry require their protein (amino acid) needs to be met directly from the diet.

In order to avoid wastage of dietary amino acids, they should be supplied from feeds with a high digestibility and in the proportions that are required by the animal.

Any excesses due to imbalance will be wasted as nitrogen in the urine, a process which requires energy and is thus a double waste of nutrients, as well as raising the potential for ammonia emissions.

Maximise use of feeds by:

- Planning winter feeding to achieve target production efficiency.
- Analysing forages so that they can be supplemented appropriately.
- Using distillery co-products which produce less CH_4.
- Paying attention to grazing management to obtain maximum livestock production from the potential grass growth.
- Formulating diets for pigs and poultry so that protein is not wasted.
- Calibrating weighing equipment so that quantities of feeds are correct.
- Ensuring mixing equipment is well-maintained and delivers a uniform product.

Top tips for livestock farms

- Analyse forages to determine supplementation requirements.
- Get advice on diet formulation and feeding to optimise productivity.
- Maintain equipment used for weighing and mixing so that you are actually feeding what you think you are feeding.
- Follow guidelines on manure management.
- Apply an effective grazing strategy to make best use of pasture.

Updated by Dr Cara Campbell, SAC Consulting (October 2025)

This document references information gathered by Farming For a Better Climate (FFBC), a Scottish Government initiative that is now closed.