Research Summary

To what extent could water quality be improved by reducing the phosphorus content in animal feed?

Scotland's centre of expertise for waters

KEY FINDINGS

- In the monogastric sector (pigs and poultry), dietary phosphorus levels have reduced in recent years due to the use of phytase enzyme in compound feeds, combined with a shortage of mineral phosphorus and thus increased prices, in and around 2008.
- There is limited scope for further change in the monogastric sector. Although it can be locally important, the sector is relatively small countrywide and so any changes are insignificant at the national level.
- In the ruminant sector, significant levels of mineral phosphorus were previously included in supplementary feeds. The increased prices of phosphorus since 2008, coupled with improved understanding of nutritional requirements have reduced its use.
- Opportunities exist to further reduce phosphorus levels, particularly in the dairy sector, where the fear of under-supplying means that many farmers still add supplementary phosphorus in mineral form.
- Reductions could be made to compound feeds supplied to ruminants. This typically requires replacing ingredients such as maize (comparatively high in phosphorus) with lower phosphorus alternatives such as soya hulls, soya bean meal and sugar beet pulp. These alternatives can be more expensive and/or need to be imported.
- Complete removal of mineral phosphorus in dairy diets could reduce national phosphorus losses by almost 1%. The reduction in excretal phosphorus may also cause soil losses to be reduced, such that the national load would be reduced by another 1-2% over the next 10-20 years as the soil phosphorus status reduces.
- Such removal of mineral phosphorus would be a cost saving to the farmer.
- Reducing the phosphorus content of compound feed to ruminants, particularly dairy cattle, could reduce the national phosphorus load by 2-3% (including the changes to soil phosphorus status). This would require an increase in the overall feed costs and the importing of feed ingredients.
- Although these reductions of up to 5% in the national phosphorus load appear small, they are comparable to estimated reductions for regulatory compliance and agri-environment scheme uptake.
- Reductions are in areas where there are more livestock, particularly intensive livestock farming, which are typically areas with greater diffuse phosphorus losses.

BACKGROUND

The latest River Basin Management Plan for Scotland identifies 16% of waterbodies below good status for water quality. Rural diffuse pollution is identified as the number one water quality issue. Phosphorus is an essential nutrient for livestock, being a constituent of bones and teeth and used for essential functions, such as energy utilisation. However, livestock may be fed diets with higher levels than are needed and any surplus will not be utilised and will be excreted, leading to the pollution of freshwaters. Thus, reducing the phosphorus content of livestock diets closer to the required

levels has been identified as a potential mechanism by which to reduce rural diffuse pollution.

There are currently 1.8 million cattle in Scotland, 6.7 million sheep, 0.3 million pig places and 14.7 million poultry places, which in total excrete 28 million kg of phosphorus per year, with the cattle responsible for two thirds of this. The national annual average diffuse phosphorus load from agriculture is 2.8 million kg, with about 15% of this resulting directly from livestock – either due to excreting whilst grazing or to the application of manure. The majority of the phosphorus load entering watercourses come from the soil (74%), but the phosphorus status of the soil is partly controlled by the livestock returns so there is an indirect contribution from livestock additional to the 15%. The livestock contribution to the national phosphorus load is thus significant.

RESEARCH UNDERTAKEN

The objectives of this project were to:

- determine the current contribution of livestock to phosphorus pollution in water courses in Scotland;
- establish the current phosphorus levels within finished compound feeds and key raw materials used in livestock diets;
- establish the scope for and cost implications of feed and diet formulation changes;
- determine the impacts of any changes in livestock diets on the amount of phosphorus in excreta and the consequences of this for diffuse phosphorus pollution and water quality status in water courses;
- determine any changes to feed costs and relate these to the total costs of production for the stock or product in question (e.g. the production cost of meat, milk, eggs etc.), to assess their significance and thus the likelihood of voluntary uptake.

RESEARCH TEAM AND CONTACTS

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