Increasing food production from grassland with reduced environmental impact - progress in red meat production from grassland

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Introduction This paper will review recent research into the impacts of grazing on biodiversity and environmental characteristics in the hills and uplands, strategies to reduce environmental impacts of lowland grazing systems', mitigation strategies to reduce greenhouse gas emissions (GHG) from grass-based systems and how grazing can impact on the nutritional quality of red meat.

Impact of grazing in maintaining biodiversity in the hills and uplands Reducing sheep grazing intensity has been found to lead to rapid increases in sward height and herbage mass, but only slow changes in structural diversity and plant species and no appreciable short-term increases in biodiversity (Holland *et al* 2008). Consequently, environmental policies which involve simple reductions in numbers of livestock may not lead to increased biodiversity. Reports suggest that suckler cows selectively graze grass species such as *Molinia caerulea* (Critchley *et al*, 2005) implying that management options which increase structural diversity such as seasonal grazing or mixed grazing may be more effective. As well as animal species, breed effects may be relevant as research with sheep (McCloskey *et al* 2009) and cattle (Umstatter, personal communication) has demonstrated that choice of breed has an impact on grazing patterns in hill environments (McCloskey *et al* 2009). These factors may affect the land manager's ability to manage biodiversity.

Strategies to reduce nutrient losses from lowland grassland systems Nutrient losses from grazing systems can be reduced by appropriate management of fertiliser applications and adopting new techniques for spreading slurry (Frost *et al* 2007). However, the main challenge facing grassland systems is to reduce nitrogen (N) losses resulting from urine deposition. Evidence that N losses from mixed grass/clover swards are lower than pure grass or pure clover swards (Loiseau *et al* 2001) suggests this may be one mechanism by which losses can be reduced.

Mitigation strategies to reduce GHG emissions from beef & sheep production systems The key mechanism by which carbon footprint of beef and sheep production can be reduced is to improve efficiency i.e. reduce dry matter intake/kg output (Dawson *et al* 2009). As well as improving overall feed efficiency, Hyslop (2008) has shown that using rapid finishing systems significantly reduces the overall GHG emissions from suckler beef production systems compared to longer duration finishing periods. For conserved forage-based diets this can achieved through improving diet quality (Yan *et al* 2009). However, conflicting reports between quality of grass-based diets and methane emissions has been obtained (Hart *et al* 2008; Yan and Mayne (2008). The potential benefits of grazing forages containing condensed tannins (Woodward *et al* 2001) or with a high proportion of clover and high sugar grasses (Lovett *et al* 2004) as a strategy to reduce methane emissions is also recognised.

Nutritional quality of meat produced from grassland A number of research studies have demonstrated the beneficial effects of offering fresh grass relative to conserved forages or concentrates on fatty acid composition of meat. In addition, there is evidence that meat produced from botanically diverse pastures has higher concentrations omega-3 polyunsaturated fatty acids (PUFA) and conjugated linoleic acid (CLA) relative to ryegrass-based pastures (Moloney *et al* 2008).

Conclusions The appropriate selection of animal species or combination of species and breed will influence the ability to manage biodiversity in extensive areas of the UK and Ireland and must form an integral part of future strategies for these areas. Current research indicates that mitigation strategies to reduce the carbon footprint of red meat production systems involve high output rapid finishing systems using cereal inputs. The challenge is to achieve this from grazed resources through increased use of grass/clover swards and more efficient grass-based systems. In terms of meat quality, the benefits of grass-based systems of beef production are recognised and should be harnessed as a marketing tool to promote these systems.

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