

Re-defining efficiency of food production by livestock

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Livestock, particularly ruminants, can eat a wider range of biomass than humans. In the drive for greater efficiency, intensive systems of livestock production have evolved to compete with humans for high-energy crops such as cereals. Feeds consumed by livestock were analysed in terms of the quantities used and efficiency of conversion of human-edible (“edible”) crops and crop co-products into milk, meat and eggs, using the United Kingdom as an example of a developed livestock industry.

Some 45 million tonnes of forage DM were consumed in 2008/9 by the UK ruminant livestock population, of which 70% was grazed pasture. Almost 13 million tonnes of raw material concentrates were used in the UK animal feed industry in 2008/9, of which cereal grains comprised 5.3 and soyabean meal 1.9 million tonnes. The proportion of edible feed in typical concentrate formulations ranged from 0.36 for milk production to 0.75 for poultry meat production.

Example systems of livestock production were used to calculate feed conversion ratios (FCR- feed per unit of whole milk, carcass fresh weight or total egg mass). FCR for concentrate feeds was lowest for milk at 0.27 and for the meat systems ranged from 2.3 for poultry meat to 8.8 for cereal beef. Differences in FCR between systems of meat production were smaller when efficiency was calculated on an edible input/edible output basis, where spring-calving/grass finishing upland suckler beef and lowland lamb production were more efficient than pig and poultry meat production. Despite the significant roles of grassland and crop co-products in the nutrition of UK livestock, with the exception of milk and upland suckler beef production, FCR for edible food protein into animal protein were greater than 1.0. FCR may be improved to give values less than 1.0 by substituting concentrates with high-quality grazed and conserved forages in lowland grass-fed beef systems and in lamb production. With the exception of cereal beef it was possible to achieve edible protein FCR of 1.0 by replacing cereal grain and soyabean meal with cereal co-products in concentrate formulations, highlighting the potential for reducing the proportion of edible ingredients in concentrate formulations to increase efficiency of edible feed use by livestock. Total water use was lowest for milk (746 litres/kg whole milk) and highest for beef (7952 litres/kg bone-in carcass). There is need for research to improve efficiency of supply, conservation and delivery of water to livestock units.

Greenhouse gas emissions per kg edible protein were highest for ruminant meat production and lowest for poultry meat. The potential of grazing in carbon sequestration in soil and in habitat conservation for enhancing biodiversity and landscape value should be recognised and factored into debates on future land use and rural development.