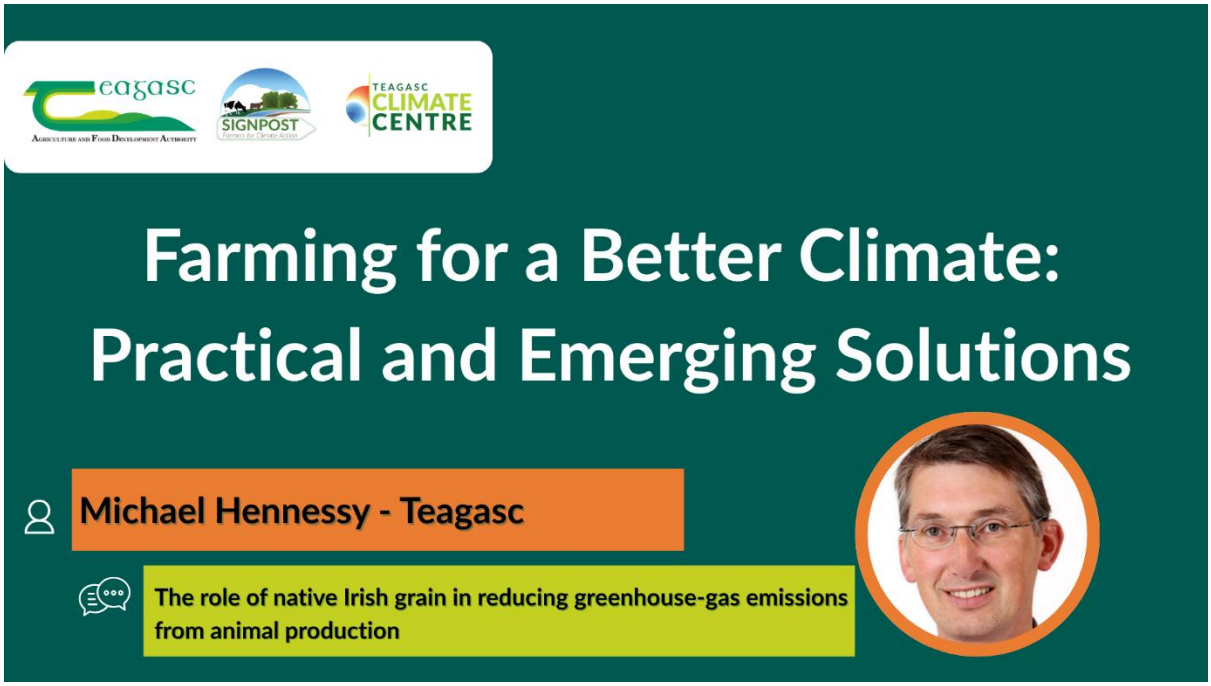

The role of native Irish grain in reducing greenhouse-gas emissions from animal production

Michael Hennessy,

Head of Crops Knowledge Transfer, Teagasc, Oak Park, Carlow

Introduction

Irish agriculture faces growing pressure to reduce greenhouse gas (GHG) emissions while maintaining competitiveness and food security. Replacing imported feed with native grain can reduce the carbon footprint of milk by ~7%. Animal production remains Ireland's largest agricultural enterprise, contributing significantly to national emissions. At the same time, the tillage sector offers potential for emissions mitigation through the production of low-carbon, home-grown feed ingredients.

Recent Teagasc and industry work (including Tirlán and the Signpost Programme) shows that Irish grown or native grains have a substantially lower carbon footprint than many imports.

The inclusion of the tillage model for calculating emissions in AgNav (the farm level climate and sustainability tool) now enables accurate linking of native grain crop LCA results to livestock GHG accounting.

Grain Production in Ireland

Ireland's tillage area typically accounts for around 7% of the total agricultural land, with an annual cropped area of approximately 350,000 hectares. Grain production averages 2.0 to 2.4 million tonnes annually, dominated by barley and wheat, followed by oats, oilseed rape, and beans. Of the total tonnage produced, approximately 1.0 million tonnes are traded annually.

Ireland is not self-sufficient in grains used for concentrate animal feeds and imports around 5 million tonnes per year of ingredients (maize, soyabean meal, distillers grains, maize gluten, wheat, beet pulp etc.) to meet this demand. These imported feed materials can carry higher embedded GHG footprint per kg product due to lower yields, cultivation practices, transport, and land-use change in exporting countries.

Development of AgNav for Crops

The AgNav platform, developed jointly by Teagasc, ICBF, and Bord Bia, provides an integrated digital tool to support farmers in climate action and sustainability improvements. Initially developed for cattle systems, a tillage module has been established in AgNav to assess the carbon footprint of Irish grain and tillage crops.

The Teagasc life-cycle assessment (LCA) uses Tier-2 emission factors (i.e. source-specific, activity-based factors) tied to fertiliser type and rate, fuel use, soil type and residue management. The initial results covered 48 growers across 11,500 ha, O'Brien et al (2025).

The results demonstrated that:

- The carbon footprint of Irish grains is low by international standards, with mean emissions typically between 170-250 kg CO_2e per tonne of grains
- Incorporation of straw residues significantly enhances carbon sequestration, with oats and winter wheat often approaching net-zero GHG balance.
- Crop nutrition (fertiliser type and rate) and yield per hectare are the dominant drivers; higher yields and optimised fertiliser use reduce the LCA per tonne of grain.

GHG of Native versus Imported Grains

Substituting imported feed grains, particularly those that are associated with deforestation, with native cereals can therefore substantially reduce the greenhouse gas intensity of compound feed and, in turn, lower the carbon footprint of the milk and meat produced on Irish farms. Table 1 presents the emissions associated with native and imported grains.

Table 1. The GHG Emissions Associated with Native Irish and Imported Grains (GFLI, 2024)

Grain	Native Irish Grain (kg CO_2e / t)	Imported Grain (kg CO_2e / t)
Winter wheat	204	370–420
Spring barley	222	360–400
Oats	187–206	300–380
Field beans	190–270	>460

Use of Concentrates in Irish Dairy Systems

The average Irish dairy cow consumes approximately 1,250 kg of concentrate feed annually (Teagasc NFS, 2023) with the many of these ingredients imported into Ireland. The use of native grains, particularly barley, oats, wheat and beans, could replace much of this imported component without compromising energy density or animal performance. Given that feed accounts for roughly 12–15% of total dairy system emissions (Herron et al. 2022), improving the carbon profile of feed offers a meaningful abatement opportunity.

Emission Reductions from Native Grain Use in Dairy Feed

The GHG intensity of conventional ration using all imported feed ingredients outlined below is 0.83 kg CO_2e / kg of ration (Table 2). When imported grain, and protein sources are replaced with native grains (64% of the ration), the GHG intensity reduces to 0.42 kg CO_2e / kg of ration, or a 50% reduction. Both rations deliver similar energy and protein concentrations.

Table 2. Formulations of a conventional dairy concentrate feed, and "native" concentrate feed that prioritised the use of native grains

Conventional **0% native grain**		**Native Ration** **64% Native Grains**	
Ingredients	**% as fed**	**Ingredients**	**% as fed**
Beet pulp unmolassed	30	Barley (rolled)*	40
Maize distillers (dried)	20.5	Beans*	24
Barley (rolled)	20	Beet pulp unmolassed	11.5
Soyabean meal 48% CP	10	Rapeseed meal	15
Maize	10	Post-calver 25kg/ton	3
Post-calver 25kg/ton	3	Oil Vegetable	1.5
Oil Vegetable	1.5	Molasses cane	5
Molasses cane	5		
Carbon footprint of ration	0.83 kg CO_2e / kg	Carbon footprint of ration	0.42 kg CO_2e / kg

*Native grains

Feeding this ration at 1.25 t /cow per year reduces the total GHG emissions per cow by 520 kg CO_2e or a 7.4% reduction in GHG emissions per kg of fat and protein corrected milk.

Comparison with MACC Measures for Dairy Systems

The Teagasc Marginal Abatement Cost Curve (MACC) identifies several key measures for reducing GHG emissions from dairy systems outlined below. Taking a typical dairy farm not currently using these technologies, then fully adopting each of the measures could reduce the carbon footprint of milk production by the amount shown in Table 3.

Table 3. The potential reduction in the carbon footprint of milk production from the adoption of key MACC technologies

Technology	Potential Reduction in the Carbon Footprint of Milk Production
NBPT Protected urea fertiliser use	6% to 8%
Low-emission slurry spreading (LESS) and timing of slurry application	1% to 2%
Improved nitrogen use efficiency and clover incorporation	3% to 5%
Improved animal genetics and EBI	1% (per year)
Utilising native grains in concentrates:	7% (LCA)

*Dependent on a reduction in chemical N iuse

The potential of a 7% reduction in the carbon footprint of milk from using 64% native grains in the ration would place this measure on a par with mid-tier MACC options. Unlike those measures, it requires no capital investment or major practice change—simply a shift in sourcing and feed formulation. Although there isn't enough native grain to meet the entire feed demand of the dairy industry, there is sufficient native grain to include it in a significant proportion of herds, which may suit certain supply chains.

It is important to note emissions embedded in imported feeds are not counted in Ireland's national GHG inventory. Therefore, substituting native grain mainly reduces milk carbon footprints rather than the total GHG emissions from dairying.

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