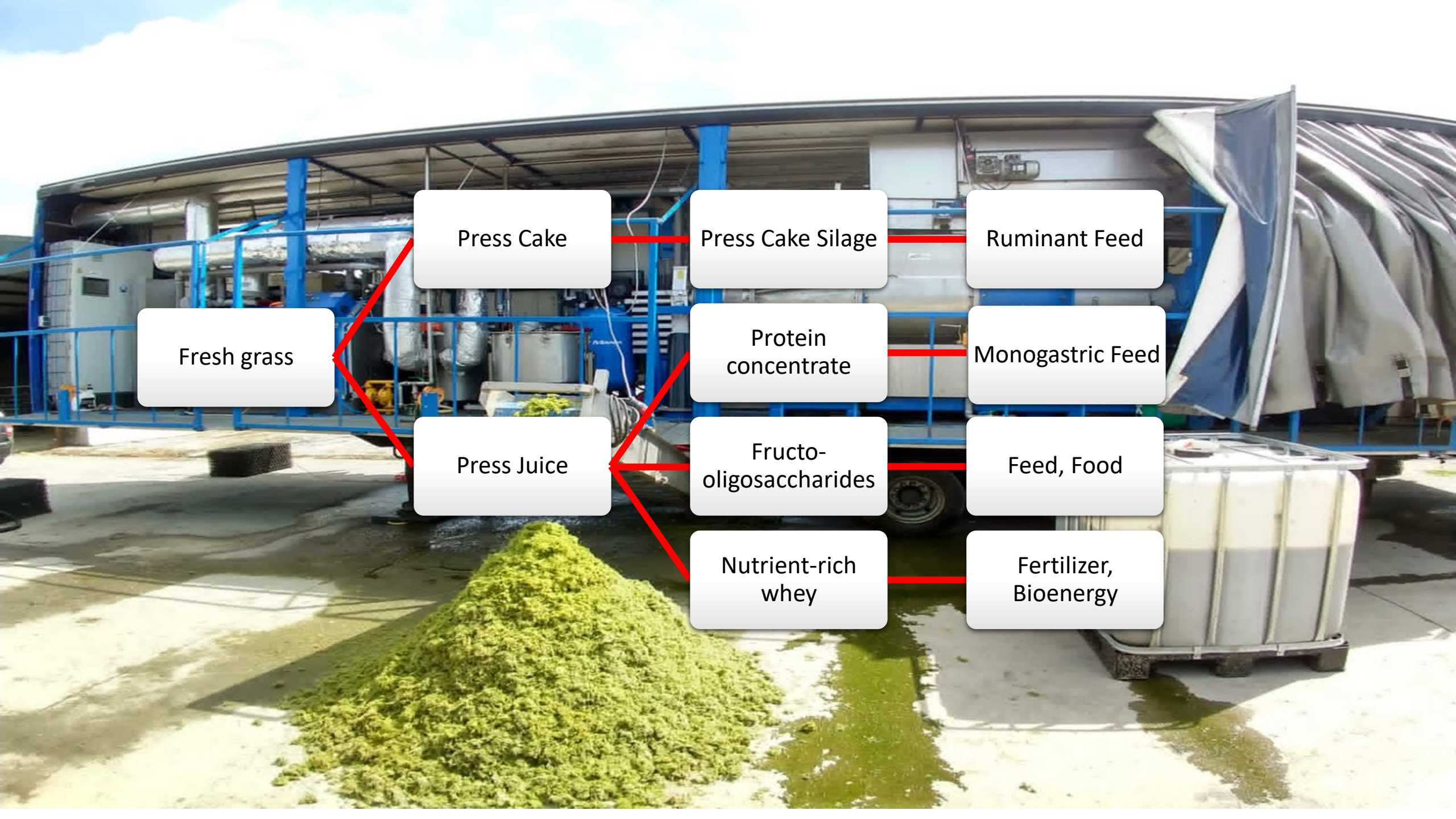




Biorefinery Glas and the potential of the bioeconomy to transform grassland agriculture in Ireland

James Gaffey



Press Cake

Press Cake Silage

Ruminant Feed

Fresh grass

Protein
concentrate

Monogastric Feed

Press Juice

Fructo-
oligosaccharides

Feed, Food

Nutrient-rich
whey

Fertilizer,
Bioenergy

Presscake as a replacement for silage in Ruminants



Dry Protein concentrate as a replacement for soyabean meal in pigs



Date of Weighing	Daily Feed Intake (kg/d)		Feed Conversion Ratio		Average Daily Gain (kg/day)	
	Treatment	Control	Treatment	Control	Treatment	Control
Period 1	1.022	0.991	1.77	1.67	0.577	0.592
Period 2	1.247	1.182	1.83	1.83	0.683	0.646
Period 3	1.386	1.301	1.90	1.86	0.729	0.699
Period 4	1.512	1.400	2.04	2.05	0.742	0.682

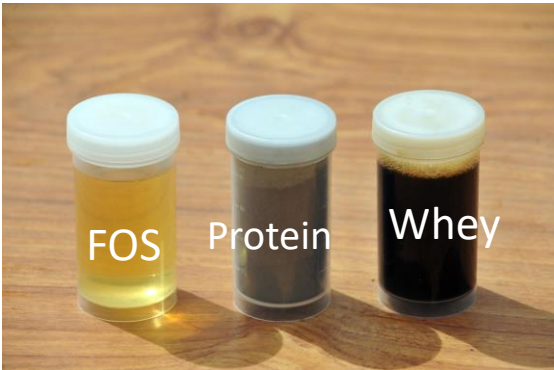
Results of weaner trial comparing treatment (grass-protein based) v/s control diet

Animal Feed Protein Sources	Crude Protein	Lysine	Methionine	Cysteine	Threonine	Crude Fibre
Soybean Meal	44–48	2.81–3.20	0.60–0.75	0.69–0.74	0.71–2.00	3.0–7.0
Sunflower Meal	24–44	1.18–1.49	0.74–0.79	0.55–0.59	1.21–1.48	12.0–32.0
Rapeseed Meal	36	2.00–2.12	0.67–0.75	0.54–0.91	1.53–2.21	10.0–15.0
Cottonseed Meal	24–41	1.05–1.71	0.41–0.72	0.64–0.70	1.32–1.36	25.0–30.0
Grass Protein Concentrate	33.9	1.81	0.65	0.18	1.5	6.1

Ravindran, R.; Koopmans, S.; Sanders, J.P.M.; McMahon, H., Gaffey, J. (2021) Production of Green Biorefinery Protein Concentrate Derived from Perennial Ryegrass as an Alternative Feed for Pigs, Clean Technol. 2021, 3(3), 656–669, <https://doi.org/10.3390/cleantechnol3030039>

Crude fibre, crude protein and amino acid profile of oil seed meals (represented as g per 100g of feed)

Production of value-added co-products



Downstream (juice) products produced from grass



Compound	Conc (mg/ml)
Glucose	4.79
Nystose	2.53
Fructofuranylnystose	1.14
2-Kestose	0.98

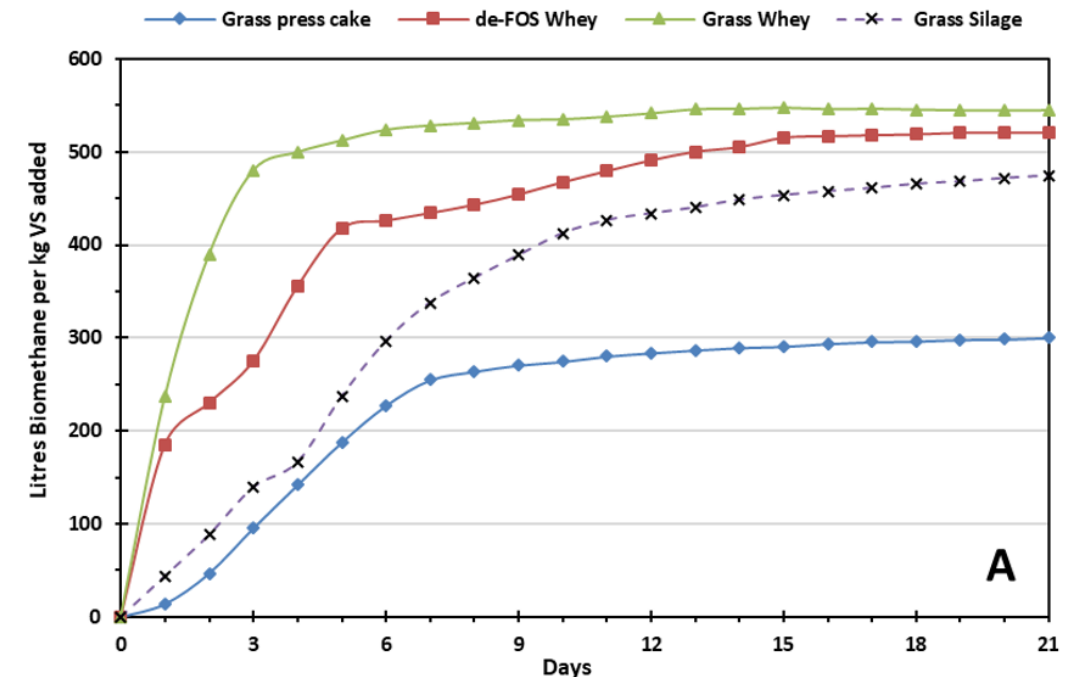
FOS sugars contained in grass

Prebiotic Index			
Probiotic Strain	Grass FOS	Commercial FOS	Inulin
<i>L acidophilus</i>	1.12±1.3	1.09±0.8	0.88±0.6 *
<i>L fermentum</i>	1.67±0.9	1.32±0.8	3.67±0.7 *
<i>L plantarum</i>	1.44±0.5	0.78±0.7 *	-0.354±0.6 *
<i>B animalis</i>	1.89±0.45	2.05±0.11	5.98±0.41*
<i>B breve</i>	3.65±0.98	4.01±1.12	2.76±0.23 *

Prebiotic index comparing Grass-based FOS with Commerical FOS and Inulin

Whey and de-FOS whey as substrates for anaerobic digestion

		Grass press cake	Grass whey	de-FOS whey	Grass silage	Dairy whey
C:N ratio		19:1	17:1	9:1	17:1	-
Biogas and biomethane production (L/kg)	VS	510.7 (300.3)*	895.8 (544.6)*	597.4 (520.3)*	808.1 (479.0)*	(510-600)*
	DM	486.9 (286.2)*	707.7 (430.3)*	478.2 (416.5)*	737.2 (436.9)*	(280-330)*
	FM	189.9 (111.6)*	14.3 (8.7)*	41.5 (36.1)*	132.9 (78.8)*	-
Final weighted biogas composition	CH ₄ (%)	58.8	60.8	87.1	59.3	-
	CO ₂ (%)	43	39.1	14.8	41.1	-
	O ₂ (%)	0.1	0.2	0	0	-
	H ₂ S (ppm)	17.6	6.7			
	NH ₃ (ppm)	0	3.7			
Biodegradability	%	55	70			



Litres of biomethane per Kg/VS of grass whey, de-FOS whey, presscake and grass silage

Special thanks to our amazing farmers



Vanessa Kiely O'Connor



Kevin Ahern



Michael Dullea



Michael Hayes

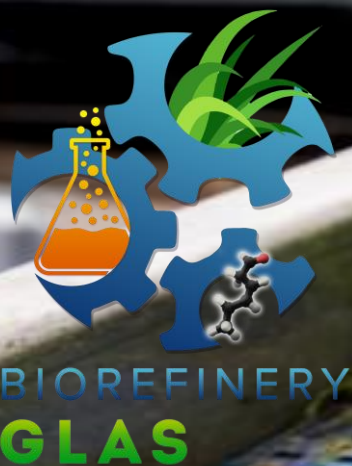
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