Polyunsaturated fatty acid supplementation reduces methane emissions from grazing dairy cows

J.D Rowntree[1], K.M Pierce[1], F. Buckley[2], D.A Kenny[3] and T.M Boland[1]

[1]School of Agriculture, Food Science and Veterinary Medicine, University College Dublin, Belfield, Dublin 4, Ireland; [2] Teagasc, Moorepark, Fermoy Co. Cork, Ireland; [3]Teagasc Grange, Dunsany, Co Meath, Ireland.

Introduction

Methane (CH_4) is a potent greenhouse gas with 25 times the global warming potential of carbon dioxide

It accounts for 50% of the total greenhouse gas (GHG) emissions from the average Irish dairy farm

The majority of this CH_4 comes from enteric fermentation

Dietary polyunsaturated fatty acid (PUFA) supplements have been shown to reduce CH_4 in housed animals, however there have been few studies investigating the effects of PUFA on CH_4 emissions of grazing animals

The aim of this study was to investigate the use of dietary PUFA supplementation as a grass-based CH_4 mitigation strategy

Materials and Methods

- Forty-five Holstein Friesian cows were allocated to one of 3 dietary treatments (n=15)
- Balanced for parity, days in milk and pre-experimental milk yield in a randomised block design.
- All treatments were allocated daily 17 kg grazed grass DM per cow and 4kg (DM) of concentrates containing 160g/kg (DM) of
  - stearic acid (CO)
  - soya oil (SO)
  - linseed oil (LO).
- Individual CH_4 emissions were measured using the SF_6 technique at 17 (PI) and 44 (PII) days post diet introduction
- 28 days after the removal of oil supplementation carry over effects on CH_4 output were examined on the C and LO groups

Results

•The LO diet reduced daily CH_4 output compared to the CO (-16%) and SO (-15%) diets (Fig.1)

•The LO diet had reduced CH_4 output (grams) per kg of milk and DMI, compared to the CO and SO diets (Fig.2)

•The SO and LO diet showed a trend towards increased milk & milk solids yield compared to the CO diet (Table 1)

•The LO diet had reduced CH_4 output (grams) per kg of milk solids and reduced CH_4 loss as a percentage of G.E.I (Table 1)

•No effects were seen on CH_4 output between the LO and CO diets, 28 days after the removal of oil supplementation

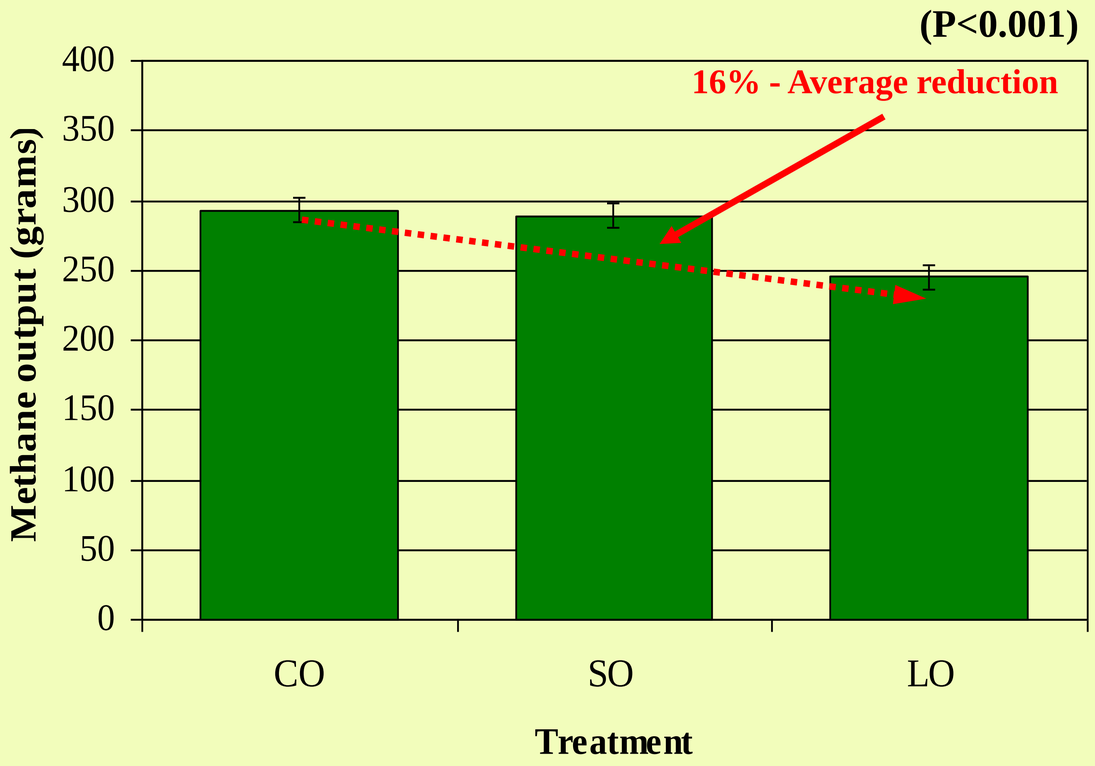

Figure 1. Effect of oil supplementation on daily CH_4 output

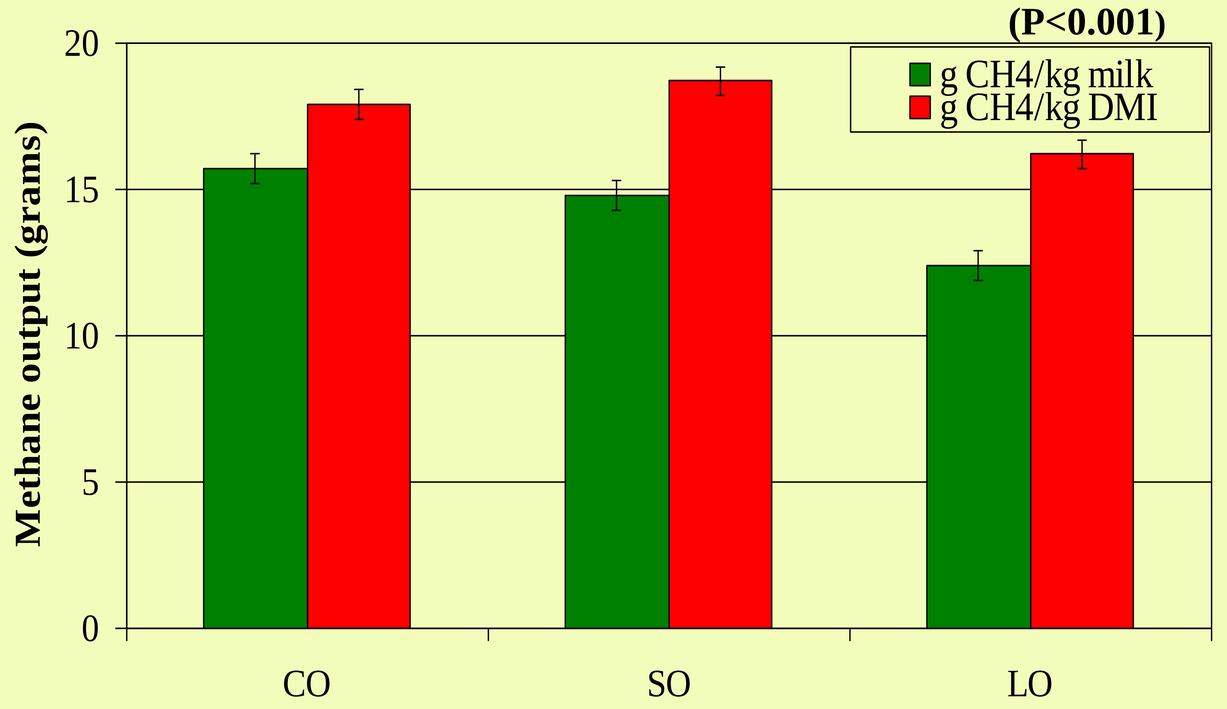

Figure 2. Daily CH_4 output (grams) per kilogram of milk and DMI

Table 1. Effect of treatment on milking performance & % CH_4 loss

	Trt				Period				
	CO	SO	LO	s.e.m	I	II	s.e.m	Trt	Period
Milk yield (l)	18.9	20.2	19.9	0.4	20	19.4	0.3	N.S	N.S
Milk solids production (kg)	1.4	1.52	1.5	0.04	1.48	1.49	0.03	N.S	N.S
gCH_4/kg milk solids	207^{a}	195^{a}	165^{b}	6.3	166^{a}	211^{b}	5	0.001	0.001
CH_4 % of G.E.I	5.2^{ab}	5.5^{a}	4.7^{b}	0.15	4.5^{a}	5.8^{b}	0.12	0.01	0.001

Summary & Conclusions

Dietary linseed oil supplementation to dairy cows reduced daily CH_4 emissions, % of G.E.I lost as CH_4 and CH_4 output per kg of DMI, milk and milk solids compared to the CO and SO diets (P<0.001)

No negative effects of the LO inclusion on milk parameters observed

Linseed oil has the potential to be used as a dietary supplement to reduce enteric CH_4 emissions from grazing dairy cows

The mitigation effects of linseed oil appears to be related to the FA profile rather than lipid inclusion

The CH_4 mitigation potential of the LO was lost within 4 weeks after dietary oil supplementation was discontinued

Acknowledgements

Funding for this research was provided under the Irish National Development Plan, through the Research Stimulus Fund, administered by the Department of Agriculture, Fisheries & Food.