# Nutrient digestibility, production performance, and enteric methane emissions in grazing dairy cows fed flaxseed-based feed supplement

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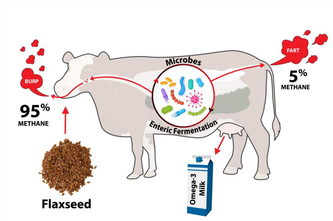
## INTRODUCTION

- During the grazing season, organic dairy farmers generally feed high-forage diets and rely heavily on grazed herbage to reduce feed cost.
- Pasture-based diet lack energy. So grazing cows often need to be supplemented with energy sources to mitigate production losses. Information on the use of fat-based supplement for grazing cows is limited.
- LinPRO-R, a flaxseed-based feed supplement is rich in omega-3 fatty acids that have been shown to improve animal reproductive health (Swanepoel and Robinson, 2019a; a).
- Residual oil from flaxseed may inhibit the growth of rumen microorganisms that may reduce methane (Beauchemin et al., 2009) from grazing ruminants.

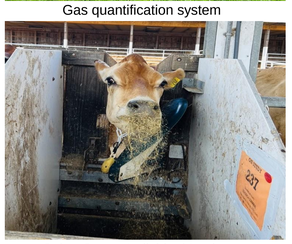

## OBJECTIVE AND HYPOTHESIS




- The objective of this study is to evaluate the effects of LinPRO-R on nutrient digestibility, milk production and compositions, and enteric methane emissions in grazing dairy cows.
- We hypothesized that animals consuming a diet with LinPRO-R would provide more dietary energy, therefore milk production will increase while enriching omega-3 FA in milk.
- Oil in flaxseed would inhibit methanogens that will decrease methane production in cows.

## MATERIALS AND METHODS

Gas quantification system



Calan Gates: Individual Intake

- 18 multiparous and 2 primiparous Jersey cows (128 ± 52 DIM) were used in a randomized complete block design (RCBD)
- Cows grazed a mixed grass-legume pasture (herbage allowance = 15 kg of DM/cow daily) overnight and received a partial total-mixed ration (pTMR) during the day
- The pTMR were formulated to contain (DM basis) 37.5% mixed, mostly legume baleage and 62.5% of a soybean meal/ground corn-based concentrate mash.
- Cows were randomly assigned to 1 of 2 diets:
  1. pasture plus pTMR (control = **CTRL**)
  2. pasture, pTMR, and 6% LinPRO-R (**LIN**)
- Ground corn and soybean meal were replaced with LinPro-R in the LIN diet.
- The experiment lasted 12 wk with a 2 wk for covariate period followed by 3 sampling periods during wk 4, 7, and 10
- Milk, blood, ruminal fluid, urine, feces, BW, and BCS were taken during sampling week
- Data were analyzed using MIXED procedure of SAS with repeated measure over time

## RESULTS

**Table 1.** Ingredients and chemical composition of the diet fed to all experimental cows

| Item | Diet (% of diet DM) | |
|---|---|---|
| | CTRL | LIN |
| Pasture | 37.0 | 37.4 |
| pTMR | | |
| Baleage | 23.6 | 23.6 |
| GRC-SBM[1] | 39.4 | 0.0 |
| GRC-SBM[2] | 0.0 | 33.0 |
| LinPRO-R | 0.0 | 6.0 |
| Composition | | |
| DM | 67.4 | 64.2 |
| CP | 14.2 | 14.0 |
| Ash | 8.9 | 8.5 |
| NDF | 35.7 | 36.1 |

[1]Consisted (DM basis) of 25.9% corn meal, 3.0 % extruded soybeans, 5.95% barley grains, 2.3% roasted soybeans, 0.5% plain salt, 0.21% magox (54% mg), 0.13% Dikal - 21, 0.16% limestone, 0.19% magnesium sulfate, 0.63% sodium carbonate, 0.07% XP yeast, 0.26% Morrison dairy premix
[2]Consisted (DM basis) of 22.7% corn meal, 1.48 % extruded soybeans, 5.23% barley grains, 1.49% roasted soybeans, 0.49% plain salt, 0.19% magox (54% mg), 0.12% Dikal - 21, 0.14% limestone, 0.19% magnesium sulfate, 0.61% sodium carbonate, 0.06% XP yeast, 0.25% Morrison dairy premix, 0.01% calcium sulfate granular

**Table 2.** Nutrient composition of LinPRO-R (% of DM)

| Item | LinPRO-R[1] (Mean ± SD) |
|---|---|
| DM | 96.0 ± 0.40 |
| CP | 21.0 ± 0.78 |
| Ash | 3.89 ± 3.19 |
| ADF | 8.33 ± 0.35 |
| NDF | 12.5 ± 1.08 |
| Lignin | 3.27 ± 2.81 |
| Starch | 25.0 ± 2.03 |
| Ca | 0.29 ± 0.03 |
| P | 0.46 ± 0.03 |
| Na | 0.13 ± 0.01 |
| K | 0.94 ± 0.05 |

[1]Consisted 54.7% extruded flaxseed, 37.8% ground field peas, 6.9% dehydrated alfalfa, 0.15 vitamin E, 0.3% mold inhibitor, 0.05% ethoxyquin (O&T Farms, Canada)

**Table 3.** Effects of LinPRO-R on apparent total-tract digestibility (%) in grazing dairy cows

| Item | Treatment | | SEM | *P*-value[1] | | |
|---|---|---|---|---|---|---|
| | CTRL | LIN | | TRT | Week (W)[2] | TRT × W |
| Intake, kg/d | | | | | | |
| DM | 23.3 | 23.2 | 0.32 | 0.70 | <0.0001 | 0.48 |
| OM | 21.3 | 21.1 | 0.29 | 0.64 | <0.0001 | 0.55 |
| NDF | 9.19 | 9.00 | 0.14 | 0.21 | <0.0001 | 0.50 |
| ADF | 6.12 | 6.03 | 0.10 | 0.37 | <0.0001 | 0.49 |
| CP | 0.06 | 3.95 | 3.86 | 0.16 | <0.0001 | 0.47 |
| Total-tract digestibility, % of intake | | | | | | |
| DM | 61.3 | 61.9 | 0.64 | 0.48 | <0.0001 | 0.41 |
| OM | 62.6 | 63.3 | 0.65 | 0.46 | <0.0001 | 0.55 |
| NDF | 52.5 | 53.6 | 0.61 | 0.17 | <0.0001 | 0.98 |
| ADF | 49.1 | 50.0 | 0.69 | 0.39 | <0.0001 | 0.79 |
| CP | 56.1 | 56.2 | 0.97 | 0.94 | <0.0001 | 0.69 |

[1]Significance was declared at P ≤ 0.05 and trends at 0.05 < P ≤ 0.10
[2]Wk 4 (August 5 to August 11); Wk 7 (August 26 to September 1); Wk 10 (September 16 to September 22)

**Table 4.** Effects of LinPRO-R on Methane and Carbon Dioxide ($CO_2$) emissions

| Item | Treatment | | SEM | *P*-value[1] | | |
|---|---|---|---|---|---|---|
| | CTRL | LIN | | TRT | Week (W)[2] | TRT × W |
| $CH_4$, g/d | 353.1 | 346.9 | 15.3 | 0.74 | 0.312 | 0.79 |
| $CH_4$ per DMI, g/kg | 15.17 | 15.30 | 0.65 | 0.85 | 0.001 | 0.80 |
| $CH_4$ per MY, g/kg | 13.01 | 13.14 | 0.85 | 0.88 | 0.026 | 0.83 |
| $CH_4$ per ECM, g/kg | 11.42 | 10.92 | 0.57 | 0.5 | <0.001 | 0.97 |
| $CO_2$, g/d | 10930 | 10841 | 261.9 | 0.79 | 0.027 | 0.79 |
| $CO_2$ per DMI, g/kg | 470.0 | 477.0 | 10.90 | 0.77 | <0.001 | 0.10 |
| $O_2$, g/d | 8070 | 8003 | 203.0 | 0.76 | 0.09 | 0.20 |

[1]Significance was declared at P ≤ 0.05 and trends at 0.05 < P ≤ 0.10
[2]Wk 4 (August 5 to August 11); Wk 7 (August 26 to September 1); Wk 10 (September 16 to September 22)

**Table 5.** Effects of LinPRO-R on milk production and milk components

| Item | Treatment | | SEM | *P*-value | | |
|---|---|---|---|---|---|---|
| | CTRL | LIN | | TRT | Week (W) | TRT × W |
| Milk yield, kg/d | 27.6 | 27.1 | 0.91 | 0.89 | <0.0001 | 0.47 |
| 4% FCM, kg/d | 30.3 | 29.4 | 1.09 | 0.58 | <0.0001 | 0.82 |
| ECM yield, kg/d | 32.5 | 31.7 | 1.13 | 0.65 | <0.0001 | 0.91 |
| Milk fat, % | 4.67 | 4.65 | 0.14 | 0.85 | <0.0001 | 0.12 |
| Milk fat, kg/d | 1.26 | 1.27 | 0.04 | 0.82 | <0.0001 | 0.77 |
| True protein, % | 3.51 | 3.47 | 0.04 | 0.37 | <0.0001 | 0.55 |
| True protein, kg/d | 0.95 | 0.95 | 0.03 | 0.78 | <0.0001 | 0.50 |
| Milk lactose, % | 4.78 | 4.80 | 0.01 | 0.08 | 0.0002 | 0.67 |
| Milk lactose, kg/d | 1.31 | 1.32 | 0.04 | 0.80 | 0.0009 | 0.69 |
| MUN, mg/dL | 11.04 | 8.38 | 0.39 | <0.01 | <0.0001 | 0.27 |
| SCC, × 1,000 | 137 | 141 | 35.8 | 0.93 | 0.0918 | 0.78 |

## CONCLUSIONS

- LinPRO-R fed 6% diet DM had little to no effect on milk production and milk components
- Replacing ground corn and soybeans with LinPRO-R had no effect on total-tract digestibility
- No effect was observed for methane production and $CO_2$ emissions
- A higher inclusion in the diet my elicit a response

## REFERENCES

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