

Effects of circular food resources inclusion in diets on ruminant productivity: A mixed-effects meta-regression analysis

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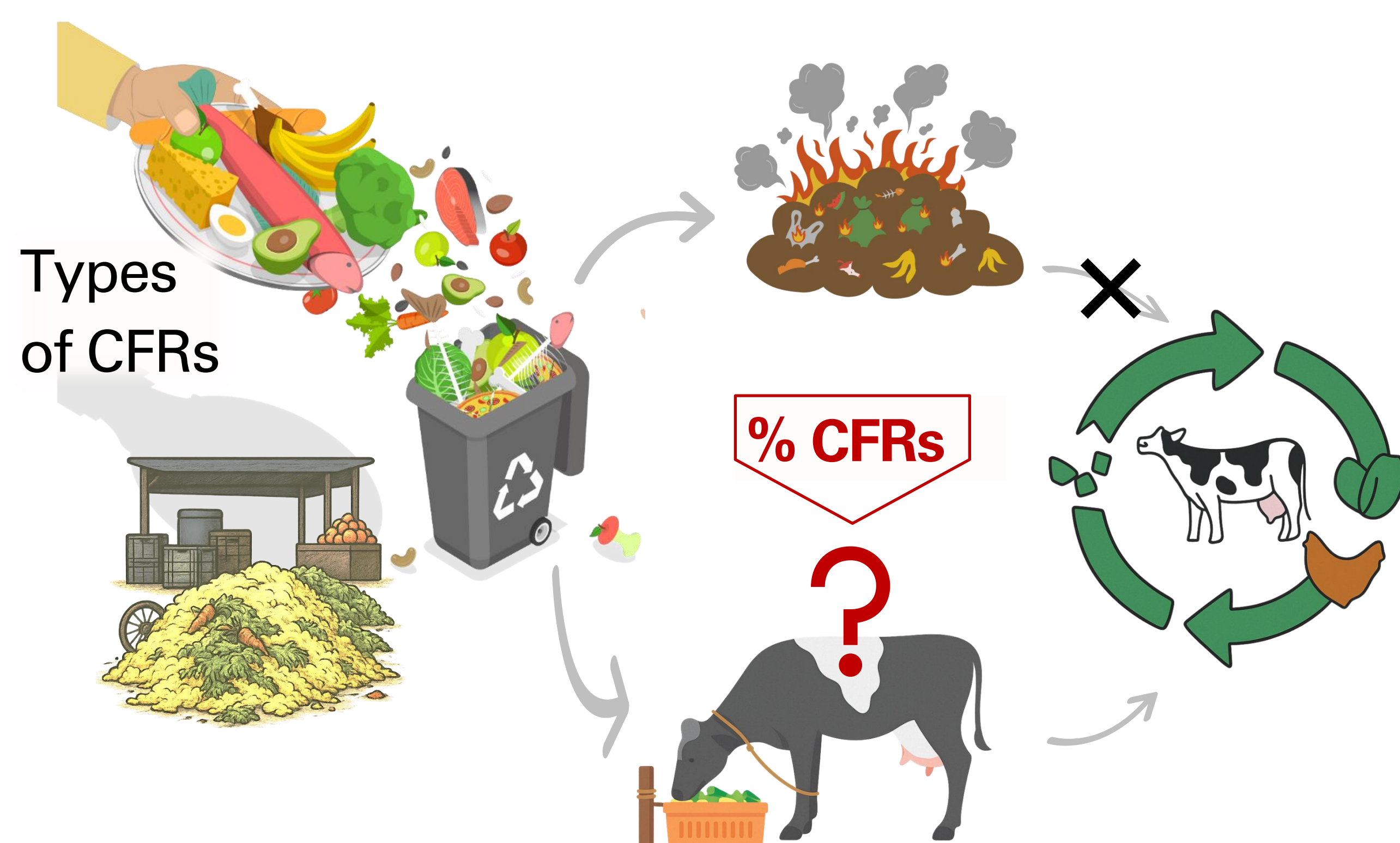
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Background

- Global availability of circular food resources (CFRs): ~132 kg/capita/year
- CFRs: surplus crops, food-processing by-products, discarded plant-based materials
- CFRs inclusion in ruminant diets ranges widely
- Animal productivity varies with CFRs inclusion level
- Dietary inclusion level of CFRs remains unclear



Aim

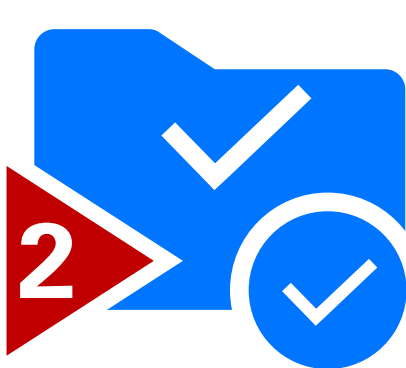
To determine the optimal inclusion level of CFRs in ruminant diets for maintaining or improving animal productivity, particularly milk yield and average daily gain, using mixed-effects meta-regression.

Methodology



Literature search

- Cattle, Buffalo, Sheep, Goat
- Milk yield, Daily gain, CFRs inclusion



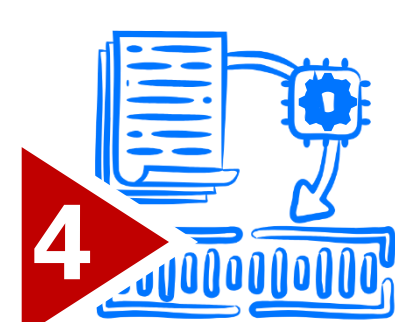
Screening & database creation

- Total documents: 965
- Selected documents: 35



Data extraction

- Animals: 2418, Treatments: 154
- CFRs inclusion level in diet: 1-90%



Mixed-effects meta-regression

- Daily milk yield, Average daily gain
- R software

Results

Dry matter intake (DMI), crude protein (CP), and acid detergent fiber (ADF) were comparable between CFR-containing and no-CFR diets. This suggests that CFR inclusion maintained a comparable nutrient supply in the diet (Table 1).

Table 1. Study characteristics by circular food resources (CFRs).

Parameters	ECM		ADG	
CFRs inclusion	Yes	No	Yes	No
% CFRs in diet, Ranges	0.96-62.0	0	3.3-90.0	0
Number of treatments	35	22	38	74
Number of animals	537	561	881	635
TLU	1.72	1.97	0.85	1.16
DMI (kg/TLU)	8.1	7.2	8.9	8.4
CP (%)	15.3	14.5	15.3	14.6
ADF (%)	23.0	23.2	26.8	28.8

ECM, Energy corrected milk (kg/kg metabolic body weight), ADG, average daily gain (gm); TLU, tropical livestock unit (1 TLU = 250 kg live body weight); DMI, dry matter intake, CP, crude protein; ADF, acid detergent fiber

Energy-corrected milk (ECM) increased with CFRs inclusion up to a model-predicted maximum of ~32.7% of diet in dry matter and declined thereafter (quadratic $p = 0.016$) (Figure 1).

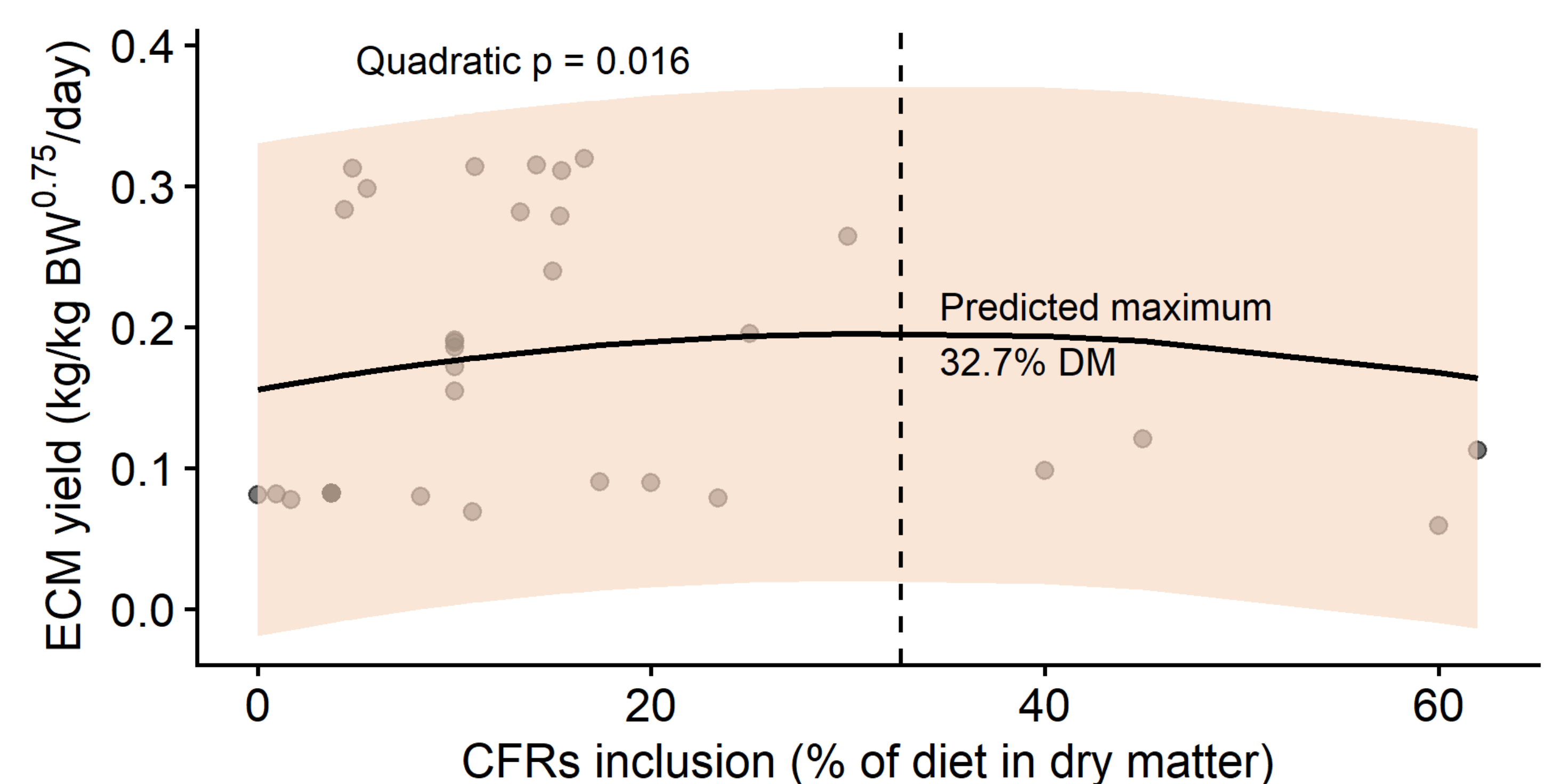


Figure 1. Dose-response of energy-corrected milk (ECM) yield to circular food resources (CFRs) inclusion.

CFRs-containing and no-CFRs diets showed comparable body weight-adjusted average daily gain (13.1 vs. 12.9 g kg⁻¹ BW^{0.75} d⁻¹; $p = 0.808$). No significant dose-response was detected across CFRs inclusion levels (3.3–90% DM; $p > 0.05$).

Highlights

- Higher milk productivity with CFRs inclusion.
- Comparable daily gain with CFRs feeding.
- Animal trials needed to validate the predicted inclusion level.
- Further research on nutrient utilization, rumen fermentation, and microbiome responses.