

THE EFFECT OF TWO HOP VARIETIES (*Humulus lupulus* L.) ON *IN VITRO* GAS AND VOLATILE FATTY ACID PRODUCTION IN DAIRY COWS



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Introduction

- ban of the use of nutritive antibiotics → research of other chemical substances
- alternatives to antibiotics → secondary plant metabolites (plant essential oils ...)
- hop (*Humulus lupulus* L.)
 - antimicrobial properties in beer production → increased resistance to microbial spoilage
 - herbal medicine → antimicrobial properties + estrogenic and anticarcinogenic properties + alleviate digestive upsets.
- hops production >> hop utilization

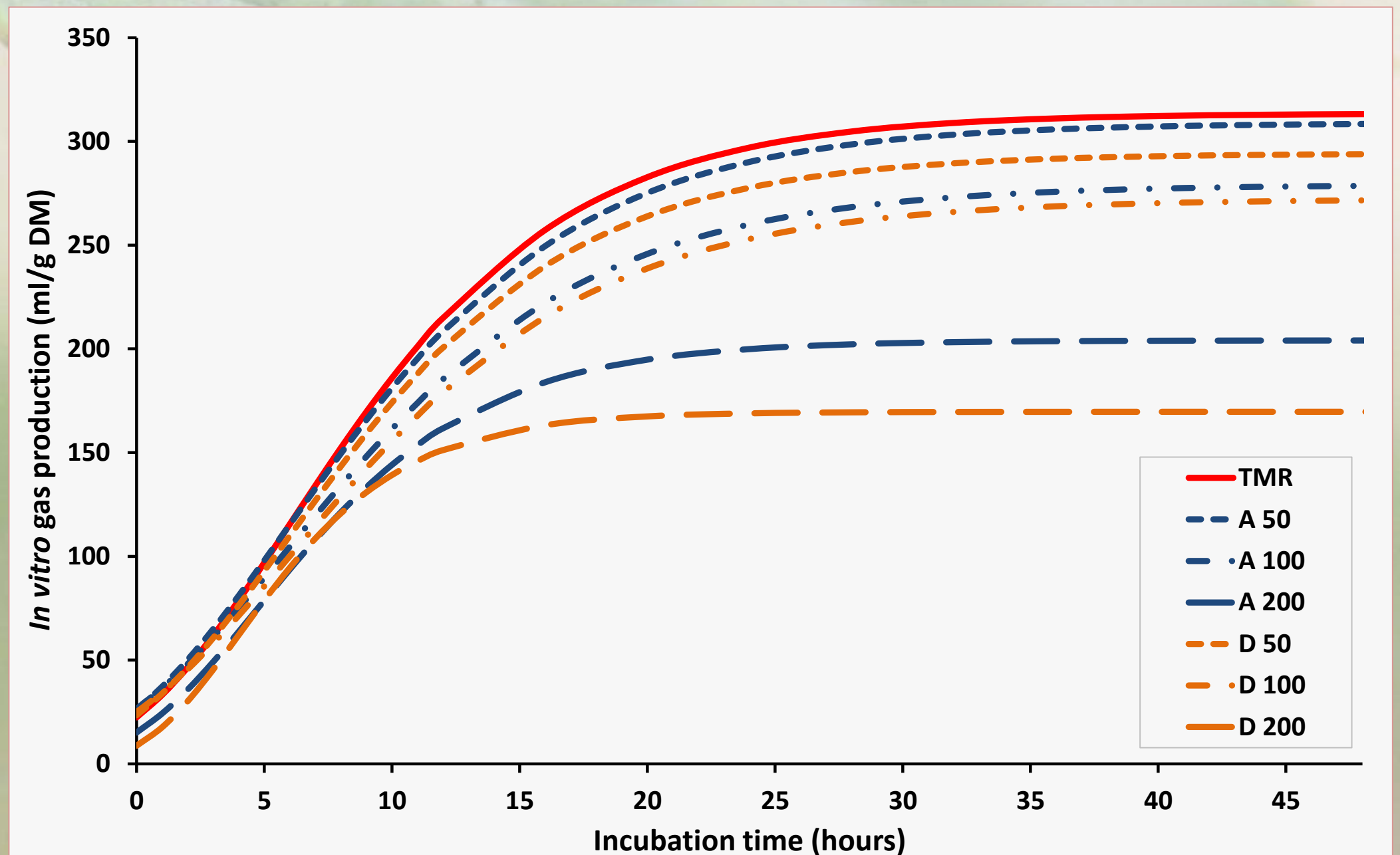
Objectives

- information on the use of hops as feed additives for ruminants
- to determine the effects of the two hop varieties, differing in the ratio between alpha- and beta-acids on fermentation in the rumen

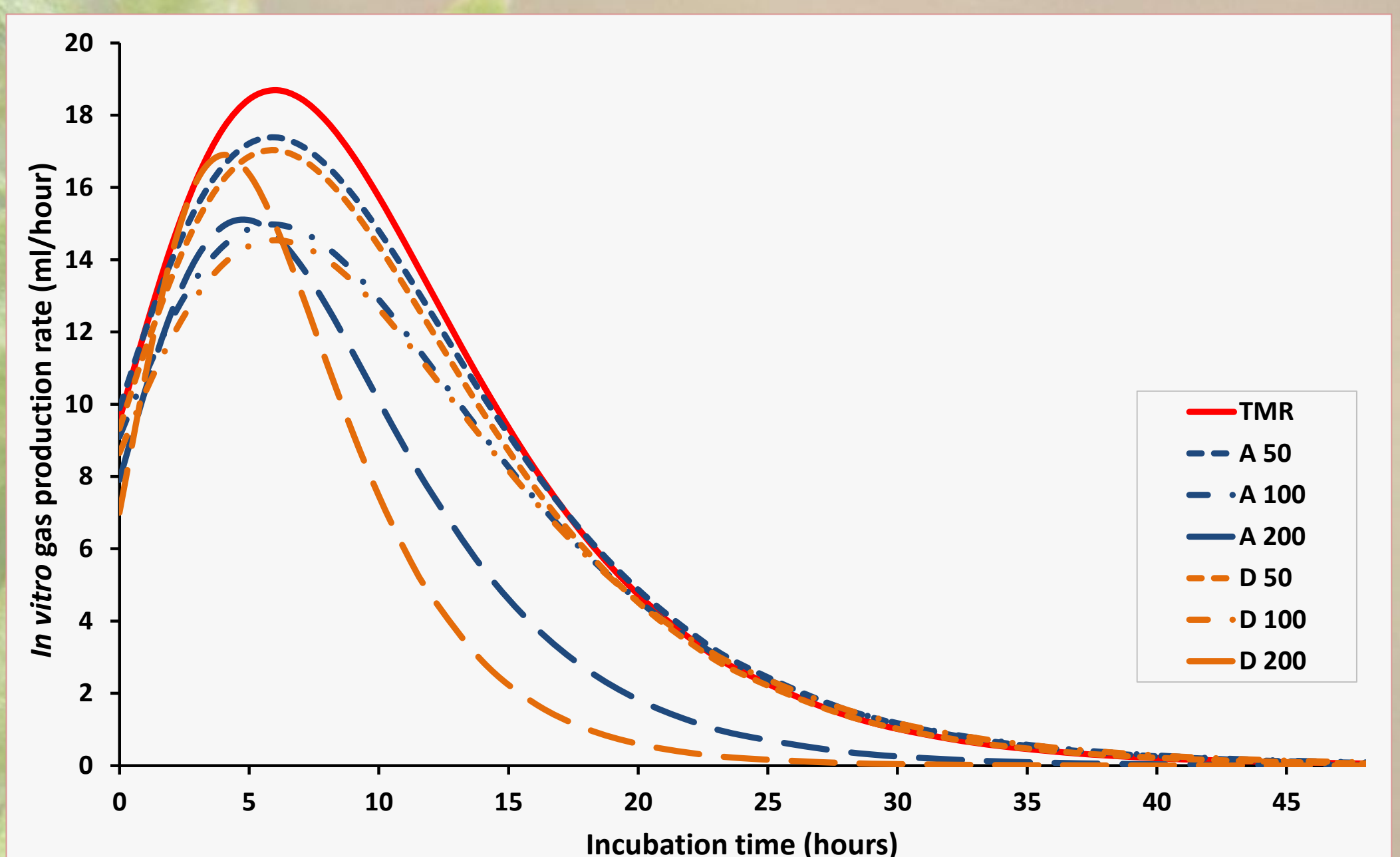
Material and methods

- **Diet:** total mixed ration (TMR) with two varieties of hop cones, Aurora (A) and Dana (D) were added in amounts corresponding to their concentration in the rumen of cow consuming 50, 100 and 200 g daily
- **In vitro test:**
 - *in vitro* gas production (Menke and Steingass, 1988)
 - 4 samples/batch (2) incubated for 0, 2, 4, 6, 8, 10, 24, 36, 48, 72 and 96 h
 - after 24 h two syringes → short-chain fatty acids (SCFA) analysis (Holdeman *et al.*, 1977)
- **Calculations and statistical analysis**
 - *in vitro* gas production data fitted with the Gompertz model (estimated and calculated parameters were "B", "C", "D", maximum fermentation rate („MFR“), time of maximum fermentation rate („TMFR“), volume of gas produced in 24 h („Gas24“)
 - differences were tested for the effects of hop variety, hop concentration and their interaction

Results



Gas production curves of TMR and TMR containing different varieties and amounts of hops fitted with the Gompertz model



Gas production rates of TMR and TMR containing different varieties and amounts of hops

Short-chain fatty acid concentrations (mmol/g DM) in the buffered rumen fluid after 24 hours of *in vitro* incubation

Substrate	Acetic	Propionic	Butyric	ΣSCFA
TMR	3.28 ^a	1.14	0.78 ^a	5.20 ^a
A50	2.82 ^{ab}	0.90	0.57 ^b	4.30 ^{abc}
A100	3.20 ^a	1.27	0.48 ^b	4.94 ^{ab}
A200	2.18 ^{bc}	1.36	0.26 ^c	3.79 ^{bc}
D50	3.24 ^a	1.29	0.71 ^a	5.24 ^a
D100	3.07 ^a	1.01	0.45 ^b	4.63 ^{abc}
D200	2.07 ^c	1.40	0.21 ^c	3.67 ^c
RMSE [§]	0.440	0.356	0.078	0.758
Variety				
Concentration	***		***	*
Var. × conc.				

^{abc} = Means in columns with different superscripts are significantly different at the level P = 0.05

[§] Root mean-square error

Conclusions

- the supplementation of diets with hops changed the fermentation pattern *in vitro* → hop cones contain antimicrobial substances which modulate rumen fermentation
- these data are not sufficiently conclusive to give a definitive recommendation about the variety and amount of hops fed to ruminant animals → other *in vitro* and *in vivo* studies should be performed before thorough conclusions could be made

References

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