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on the Nutrition of Herbivores

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Herbivore nutrition supporting sustainable intensification and agro-ecological approaches

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These proceedings of the International Symposium on the Nutrition of Herbivores constitutes summaries of papers presented at the 10th conference in Clermont-Ferrand, France, 2nd – 6th September 2018.

Summaries have been reviewed and edited for English language; however, the Organising Committee and publisher accept no responsibility for their accuracy. Views expressed in all contributions are those of the authors and not those of the symposium's committee members.

This publication contains all summaries that were available at the time of going to press.

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FOREWORD

It is our pleasure to welcome you to the 10th Meeting of the International Symposium on the Nutrition of Herbivores (ISNH 2018). The objectives of the Symposium series are “to provide a forum for development, exchange and presentation of knowledge in the nutrition of terrestrial farmed and wild herbivores”.

The role of herbivores in food security and in the emergence of developing economies out of poverty is a key issue for the sustainable development of many countries. At the same time, however, herbivore production systems are major players in global environmental issues -due to their contribution to greenhouse gas emissions- and facing an increasing societal concern for farmed animal welfare and human health linked to meat and dairy consumption.

In this context, producing better with fewer inputs is the main challenge imposed to animal production by the increase of global food demand and environmental issues. Agro-ecology, mainly by stimulating natural processes to reduce inputs, proposing a framework to cope with this challenge is an emerging field in animal science. At the same time, precision techniques and the digital revolution in animal husbandry create opportunities for herbivore production systems that are more efficient and more respectful of animal welfare and health. ISNH 2018 will be a unique opportunity for scientists and other stakeholders to discuss herbivore nutrition in relation to these issues.

As previous Symposia in the series, ISNH 2018 covers a wide range of topics: from feed resources and basic herbivore nutrition to nutritional strategies to improve nutritional efficiency, health and animal welfare, reduce emissions and waste, and improve product quality. The sessions will address organisational levels from the genome to organ, animal, herd (and farm), and consider herbivores under temperate, Mediterranean and tropical climates. To address these topics, we have selected 22 invited conferences with the International Advisory Committee of the Symposium series. The programme also includes 422 selected communications, presented either orally (40) or as short presentations of posters (65), or as free-viewing posters. These communications come from 46 countries from all continents, showing the world-wide interest in herbivore nutrition.

We would like to address our warmest thanks to the members of the International Advisory Committee of the Symposium and Local Scientific Committee who built the Symposium programme; to all authors whose efforts allow us to propose this rich and diversified program; to the reviewers whose expertise was essential to the publication of the scientific contributions; to the editorial teams of Advances in Animal Biosciences and Animal journals; to all scientists and technicians involved in the organisation of the Symposium; to the management of INRA and to the numerous sponsors who supported us in setting up this Symposium.

Finally, we hope that the reading of this issue of Advances in Animal Biosciences will help you learn more about herbivore nutrition and find inspiration for future research and development in this area.

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In vitro methane and ammoniacal nitrogen production of Marandu grass supplemented with lipid sources

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Take home message The corn oil appears to be efficient in mitigating methane production in 24 hours.

Introduction Ruminal fermentation is a process resulting from the set of microbial activities (metabolism) that transform dietary constituents into products considered useful to animals, such as volatile fatty acids, or useless as methane gas (CH_4) which represents a consequent energy loss, resulting in lower animal performance (Valadares Filho and Pina, 2006), besides being considered as one of those responsible for the greenhouse effect. Aiming at efficient production, ruminal fermentation modulation strategies have been used to maximize the fermentation of cellulosic compounds, to reduce fermentation losses (methane and ammonia) and to optimize the synthesis of microbial protein. One of these is the inclusion of lipids in the diet. However, little is known about its effect on tropical forages. The objective of this work was to evaluate the isolated effect of lipid sources from corn and soybean on the production of methane and ammoniacal nitrogen using the *in vitro* gas production technique.

Material & methods Two lipid sources (corn and soybean oil) and their inclusion levels (0, 3, 6 and 9% DM) were evaluated in a tropical forage diet (*Brachiaria brizantha* cv. Marandu), divided into a 2×4 factorial by means of the *in vitro* gas production technique. Ruminal fluid (inoculum) from 2 adult donor cattle, provided with permanent ruminal cannulae. The inoculum samples were collected and filtered in a cloth with a porosity of 250 µm and packed in preheated thermos flasks with water at 39 ° C. The pH was measured and the CO_2 kept constant, until the moment of inoculation. In the 120 ml amber flasks, 500 mg of forage (CP = 99.5 g, NDF = 640 g / kg DM) or the association thereof with the treatment levels. 40 mL of McDougal's buffer (1949) duly reduced with addition of reducing solution were added and inoculated with 10 mL of ruminal liquid, under a constant CO_2 sparge. The vials were sealed and placed in a water bath at 39 ° C under constant stirring. At 24 and 48 hours incubation, a pressure gas volume and pressure (Data Logger GN200) and a gas sample (10 mL) of each vial were collected using a graduated syringe and samples of its contents and were used for the determination of methane. The determination of methane concentration was carried out by means of a Gas Chromatography (GC-2014 Shimadzu Corporation, Kyoto, Japan). The NH_3-N was determined according to the methodology described by AOAC (1990). The datas of the factorial design 2×4 (two sources of oils and four levels of inclusion) were analyzed using the MIXED procedure of SAS (version 9.3) The model includes fixed source effect, oil inclusion level and oil source interaction × inclusion level. Differences between treatments were declared significant at $P<0.05$.

Results & discussion Methane concentration was higher in treatments supplemented with soybean oil (4.09 mg/mL) when compared to corn oil (2.00 mg/mL) ($P<0.05$) at the 24 hours, however, there was no effect after 48 hours of fermentation. The level of oil had no effect on methane or ammonia production (Table 1). However, there was an interaction between lipid source and inclusion level at 48 hours ($P<0.05$) for NH_3-N. This indicates that the concentration of NH_3-N produced probably differ in the presence of different sources of lipids in the rumen (Villaça *et al.,* 1999). As a consequence, as concentrations of NH_3-N, independently of the lipid source, can be strongly related to the high degree of unsaturation of the same, which may contribute to a reduction of the protozoan population (Ivan *et al.,* 2001).

Table 1 *In vitro* concentration of methane and NH_3-N as a function of the inclusion of sources and levels of oil under fermentation of Marandu grass.

Parameters	Corn oil [a]				Soybean oil [a]				SE	P-value		
	0	3	6	9	0	3	6	9		Oil	Level	O*L
24 hours												
Methane [b]	1.76	2.87	2.16	1.21	3.42	2.90	5.54	4.51	2.38	0.031	0.778	0.530
$NH_3 - N$ [c]	3.49	2.57	2.47	3.37	2.05	2.29	2.82	2.28	0.64	0.186	0.930	0.513
48 hours												
Methane [b]	6.16	5.58	5.74	8.88	4.71	6.69	13.62	5.89	2.62	0.530	0.374	0.174
$NH_3 - N$ [c]	2.51	1.96	3.92	1.75	1.56	4.56	1.60	2.04	0.61	0.835	0.119	0.004

[a]: % DM; [b]: mg/dL; [c]: mL/L; SE: standard error.

Conclusion In our experimental conditions, corn oil appears to be efficient in mitigating methane production in 24 hours and is an efficient short-term strategy for animals fed with tropical forage.

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