Università degli Studi della Campania *Luigi Vanvitelli*

Dipartimento di Scienze e Tecnologie Ambientali Biologiche e Farmaceutiche

FOOD CHEM LAB

Valorisation of forest by-products: the chestnut case as renewable source of bioactives for sustainable livestock diets

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Dipartimento di Agraria

Società Italiana di Orticoltura – SOI – Italus Hortus

Regione Campania

VIII CONVEGNO NAZIONALE DEL CASTAGNO
14, 15 e 16 settembre 2022 - PORTICI - NAPOLI

Castanea sativa Mill.

Distribution

chestnut fruits can be used as good source of energy due to its **starch**, **carbohydrates** and **fatty acids**

Chestnuts are finding a new application in nutrition; an example is a significant importance of chestnut fruits in **coeliac disease** as regard the production of marron glacé, purée and **chestnut flour,** which find application as an ingredient in gluten-free diets

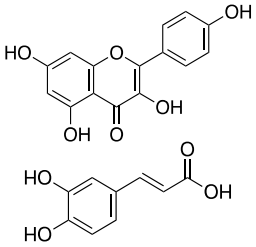
The **waste** of *Castanea sativa* Mill., namely **leaf**, **shell**, and **bur**, could contain bioactive with marked biological activity

Natural waste

Sustainable use

Valorization

Recovery of bioactives



CIRCULAR ECONOMY

Agroforestry
Raw materials

Plant-derived
Natural product

Waste prevention

Reuse/Recovery

Recicle/Compost

Energy/Recovery

molecules MDPI

Article

UHPLC-ESI-Q*q*TOF Analysis and In Vitro Rumen Fermentation for Exploiting *Fagus sylvatica* Leaf in Ruminant Diet

Marialuisa Formato [1], Simona Piccolella [1], Christian Zidorn [2], Alessandro Vastolo [3], Serena Calabrò [3], Monica Isabella Cutrignelli [3] and Severina Pacifico [1,*]

…not waste but **RESOURCE**

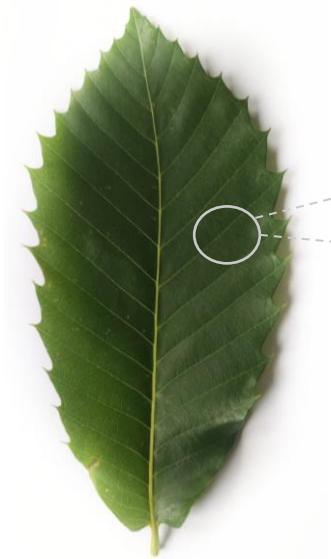
…formulation of **animal feed** and/or supplements using forest plant **BiOaCtIvE** compounds

↓ greenhouses gasses (i.e, feed production, digestion process)

↑ animal health condition (i.e., SARA, mastitis)

↑ quality of products (i.e., milk, meat)

Plant sampling, extraction and analysis



Castanea sativa Mill.

UAM

Cs/1/1

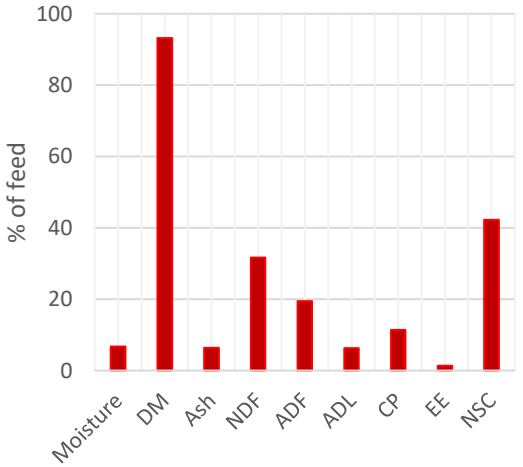
LLE

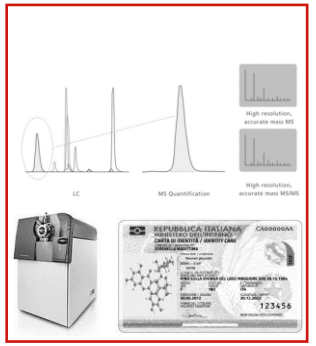
Cs/2/1 + **HaF**

XAD-4

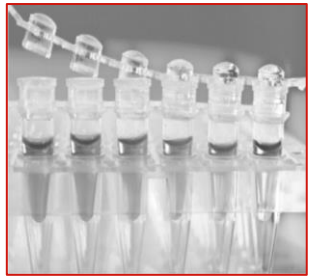
Cs/3/2

UAM: Ultrasound assisted maceration
LLE: Liquid-liquid extraction
XAD-4: Amberlite absorbent resin
HaF: Hydroalcoholic fraction





UHPLC-HRMS/MS



Colorimetric assays

***In vitro* fermentation parameters**

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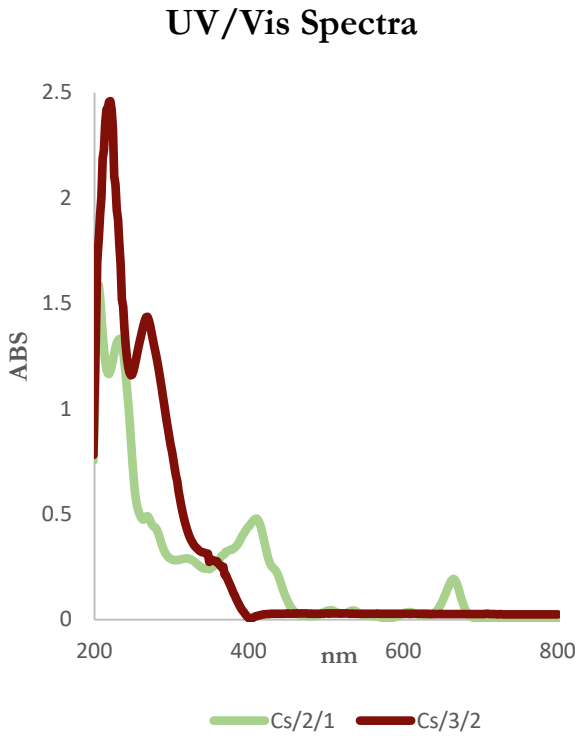

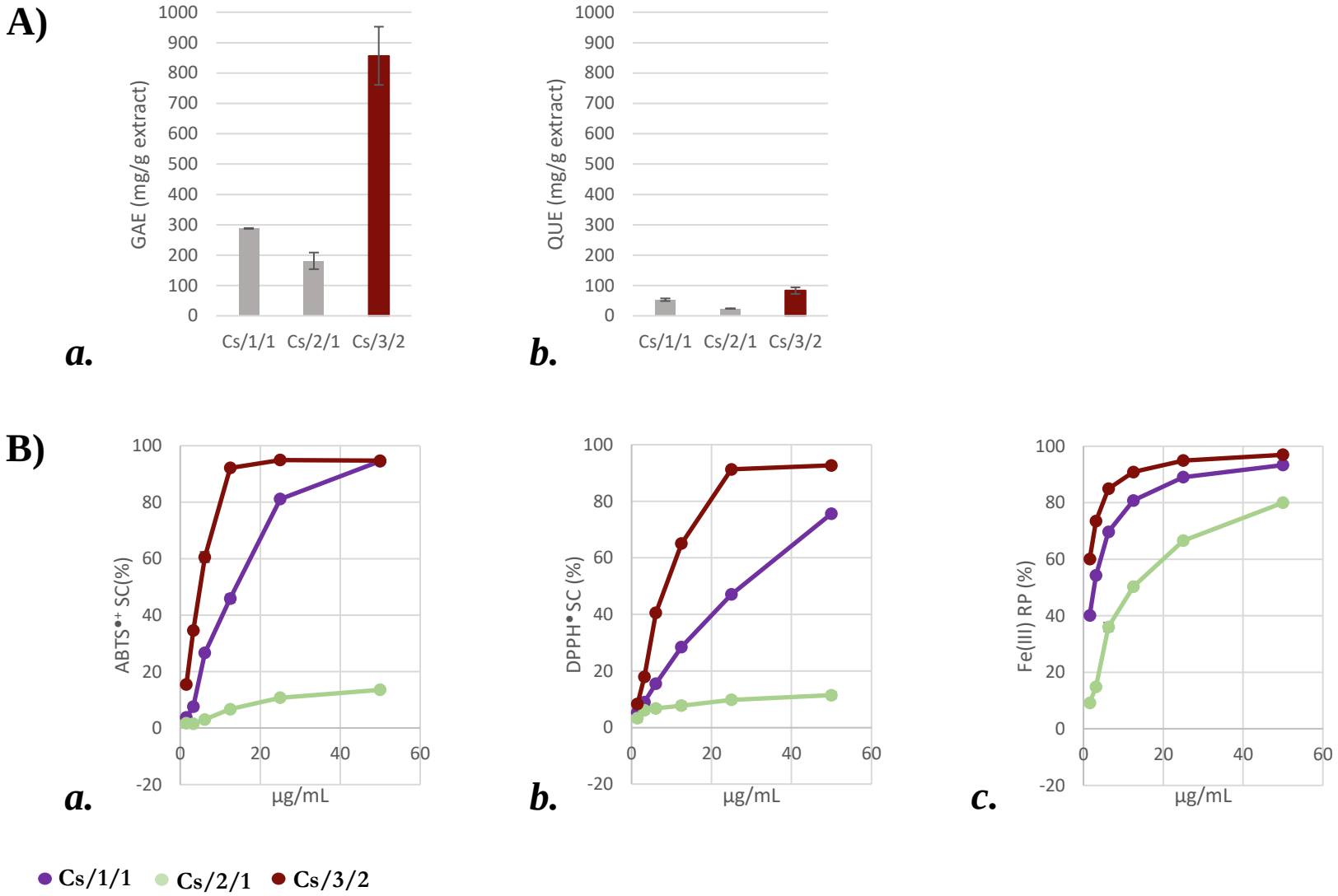

A) a. Total Phenol Content, expressed as mg of gallic acid equivalent (GAE) per g of extract; **b**. Total Flavonoid Content, expressed as mg of quercetin equivalent (QUE) per g of extract; **B) a.** Scavenging activity (SC%) of C. sativa extract and organic fraction therefrom vs. 2,2'-azino-bis(3-ethylbenzothiazoline)-6-sulfonic acid (ABTS) radical cation; **b.** SC% vs. 2,2-diphenyl-1-picrylhydrazy (DPPH) radical; **c.** Fe (III) reducing power (RP).

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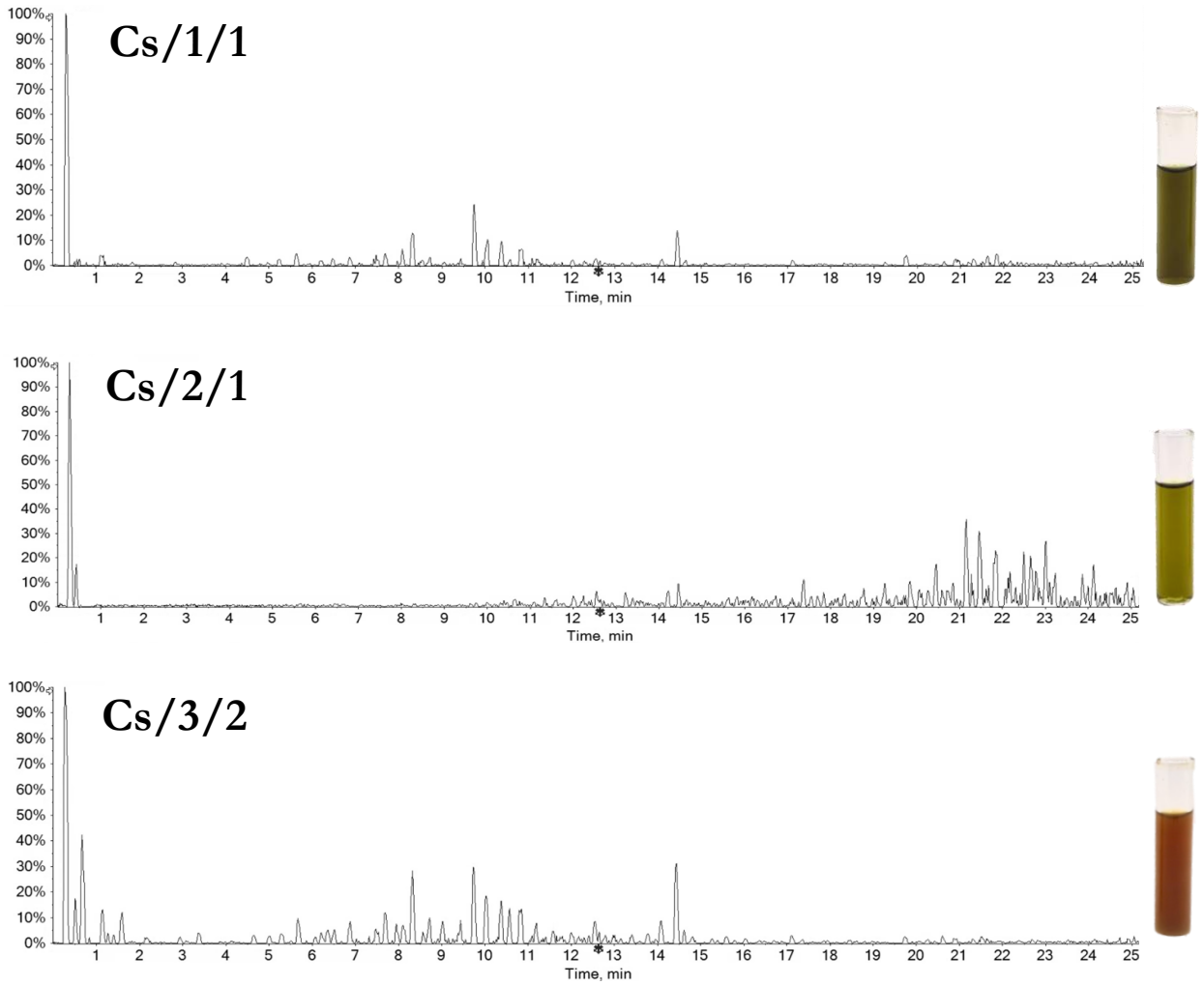
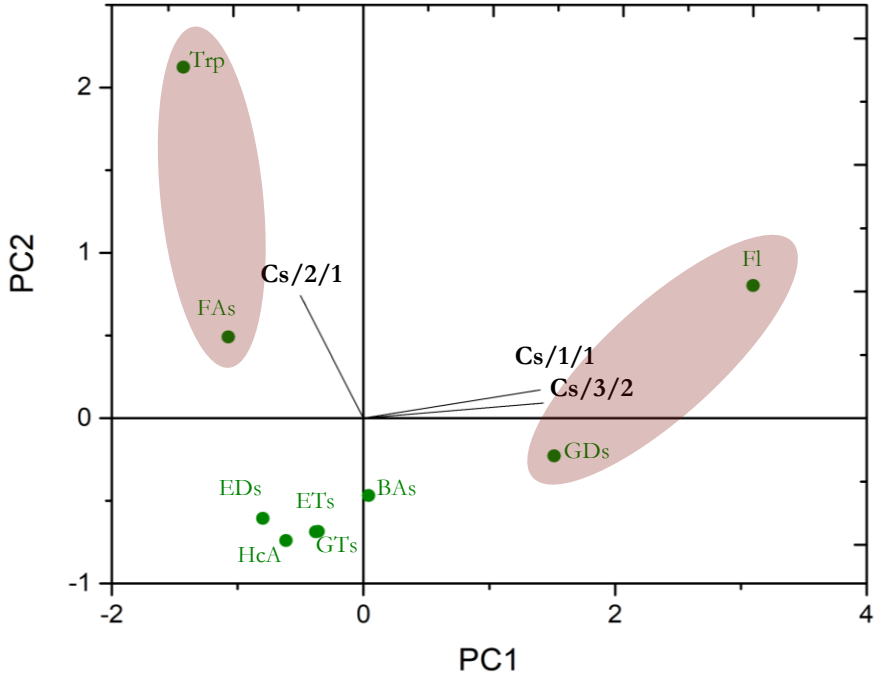
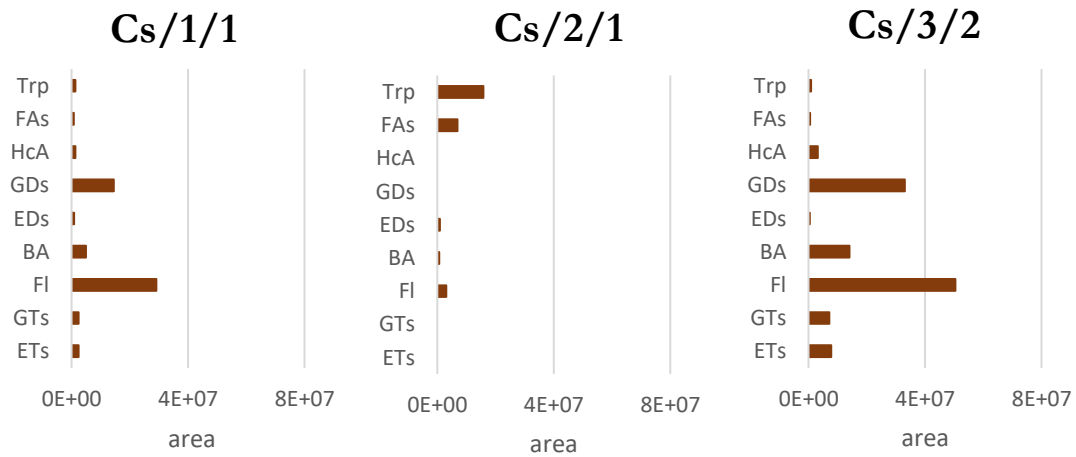
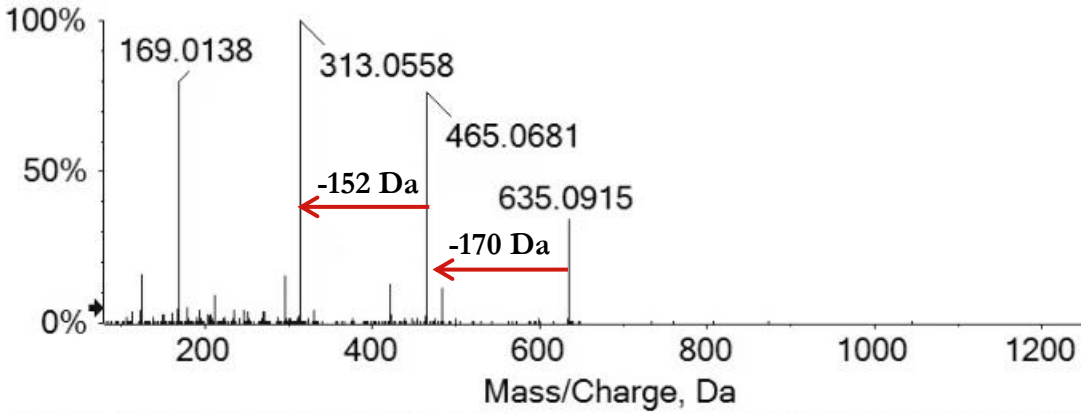
Chemical investigation

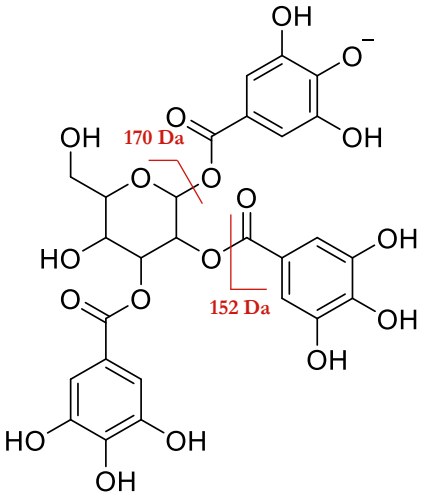




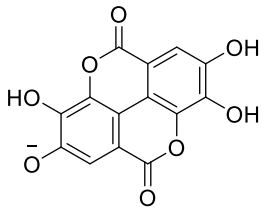


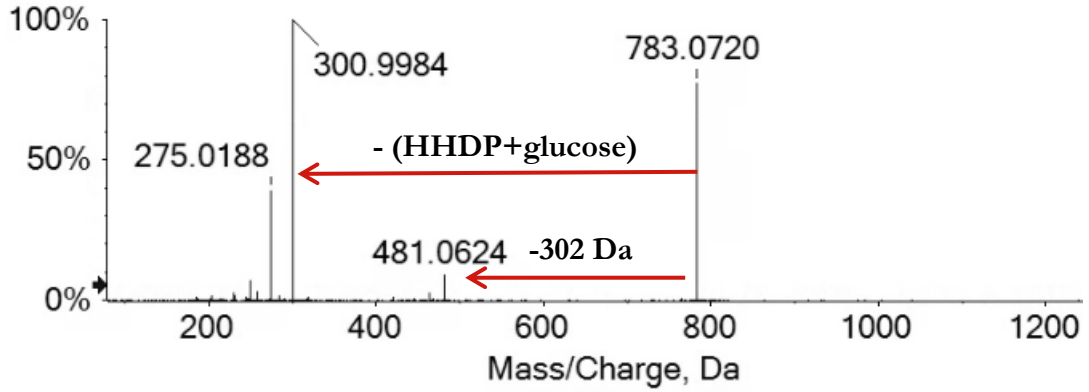
Ellagitannins and gallotannins in *C. sativa* leaves

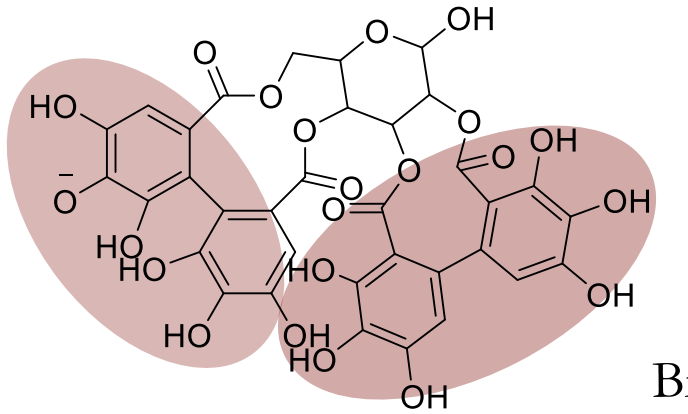




Tri-galloyl hexose

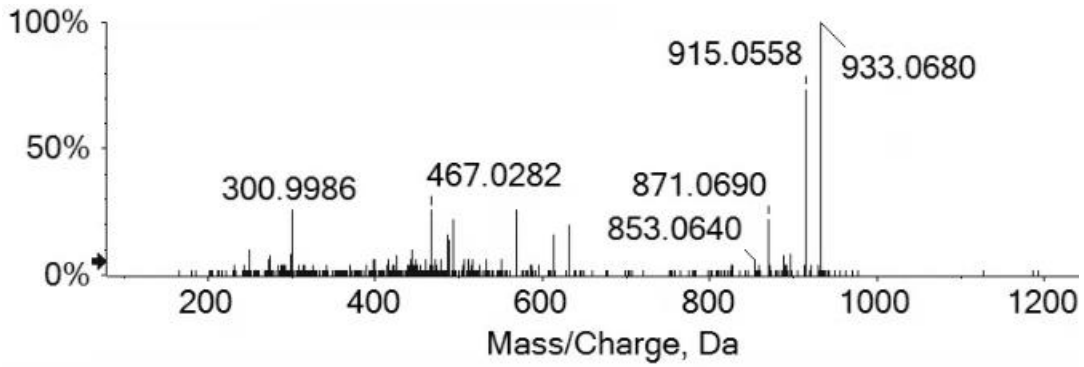


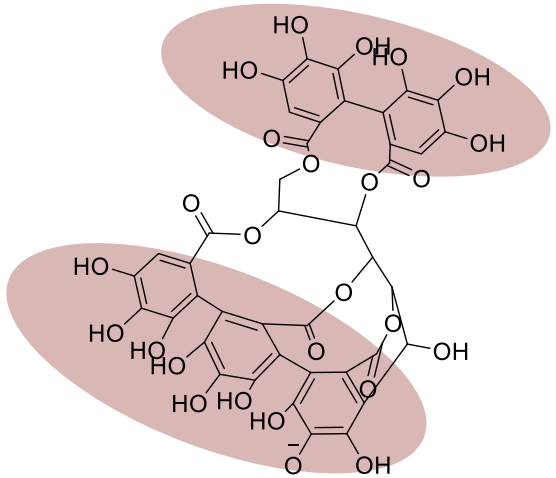




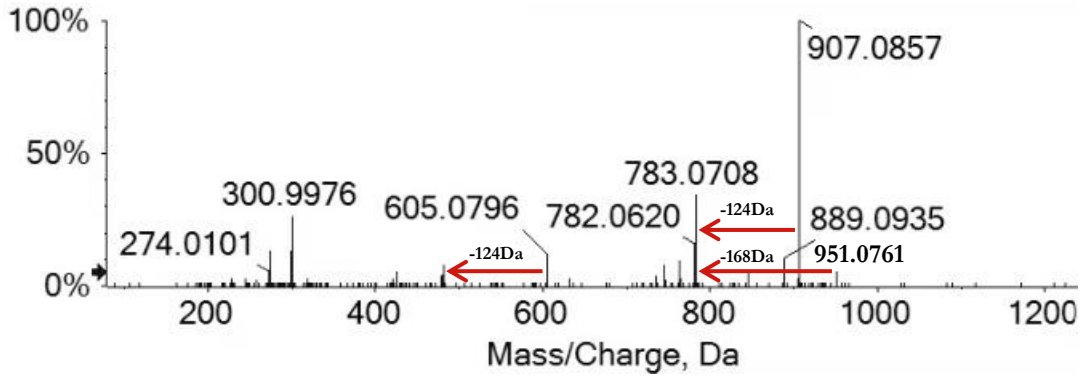
Bis-HHDP-glucose

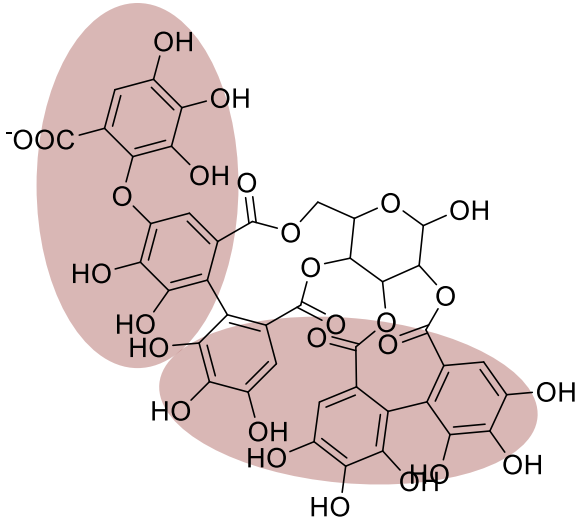
Ellagitannins and gallotannins in *C. sativa* leaves





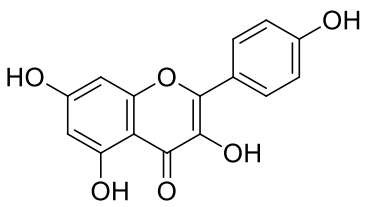
NHTP-HHDP-glucose



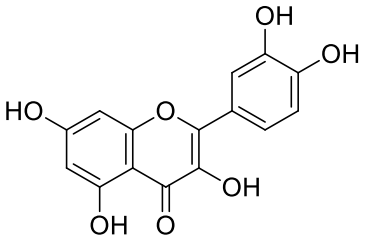


HHDP-valoneoyl-glucose

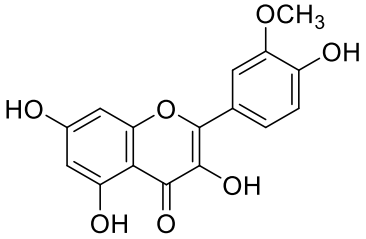
Flavonols in *C. sativa* leaves



Kaempferol

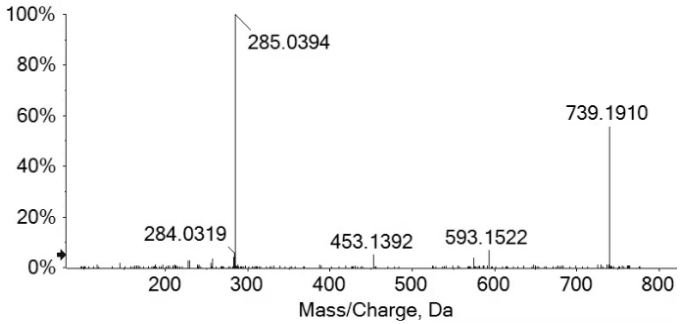


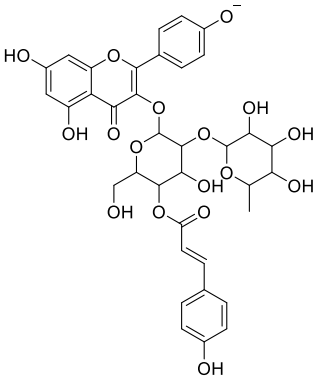
Quercetin

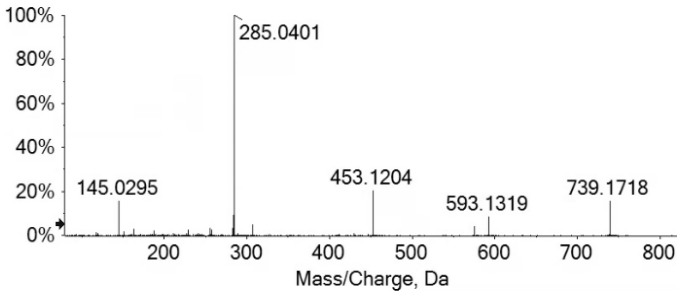


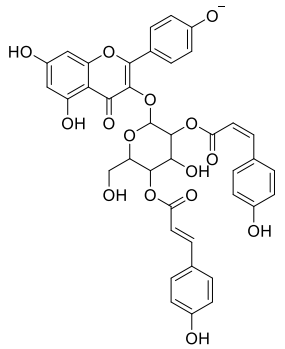
Isorhamnetin

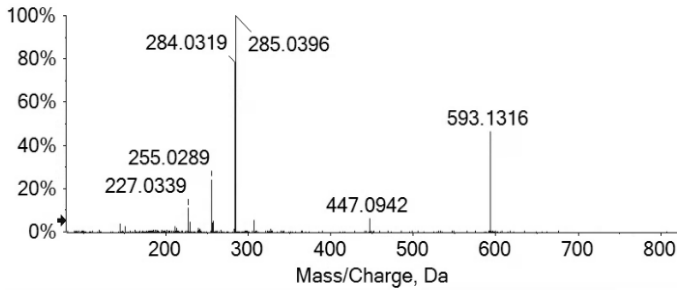
	Moiety	Neutral loss
Monoglycosylated flavonols	pentose	132.04 Da ($C_5H_8O_4$)
	hexose	162.05 Da ($C_6H_{10}O_5$)
	hexuronic acid	176.03 Da ($C_6H_8O_6$)
	deoxyhexose	146.05 Da ($C_6H_{10}O_4$)
Diglycosylated flavanols	pentosil-hexose	294.09 Da ($C_{11}H_{18}O_9$)
	hexosyl-deoxyhexose	308.11 Da ($C_{12}H_{20}O_9$)
Acylglycosylated flavonols	acyl *p*-comaroyl-hexose	350.10 Da ($C_{17}H_{18}O_8$)
	acyl-hexose	204.06 Da ($C_8H_{12}O_6$)
	p-coumaroyl hexose	308.08 Da ($C_{15}H_{16}O_7$)
	p-coumaroyl deoxyhexosyl-hexose	454.14 Da ($C_{21}H_{26}O_{11}$)
	di-*p*-coumaroyl hexose	454.12 Da ($C_{24}H_{22}O_9$)

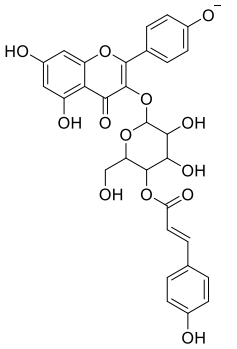












In vitro fermentation analysis

UAM → Cs/1/1

↓ LLE

Cs/2/1

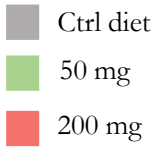
HaF

↓ XAD-4

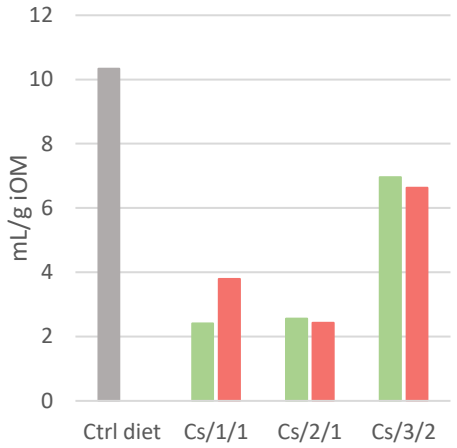
Cs/3/2

Cs/1/1 Cs/2/1 Cs/3/2

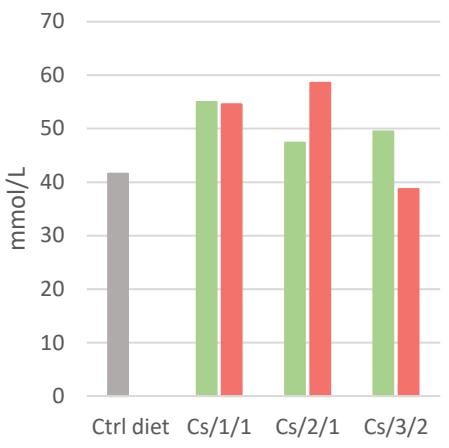
Ctrl diet 50 mg 200 mg



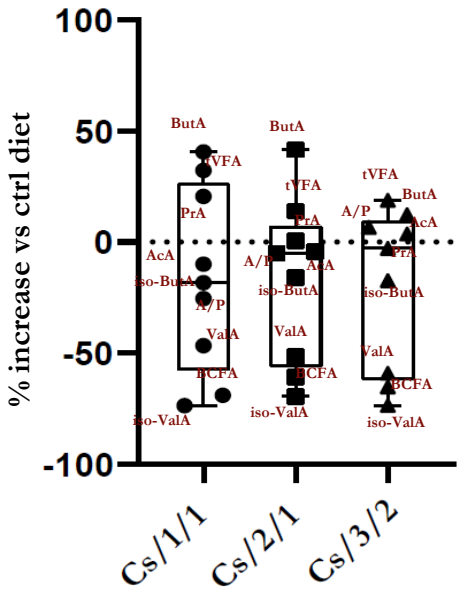
dCH_4 after 24h



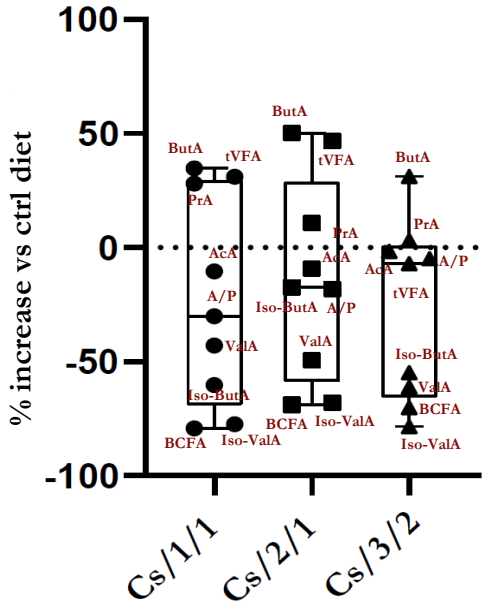
Total VFA after 24h



50 mg



200 mg



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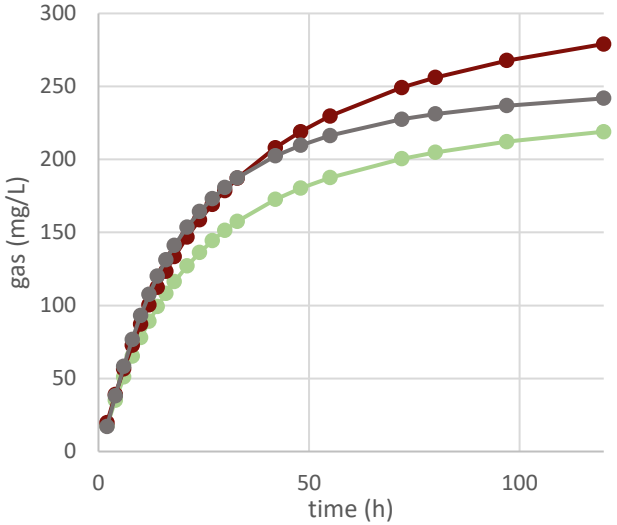
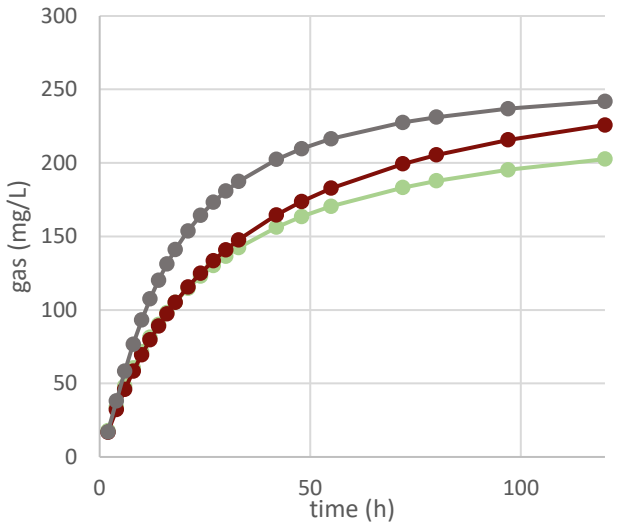
In vitro gas production

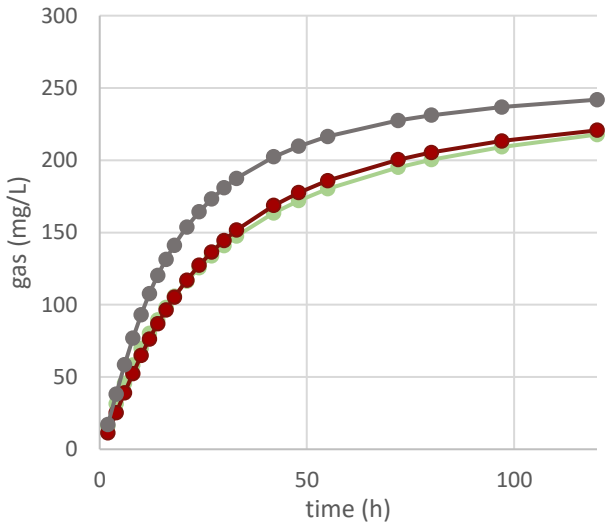
Cs/1/1



Cs/2/1

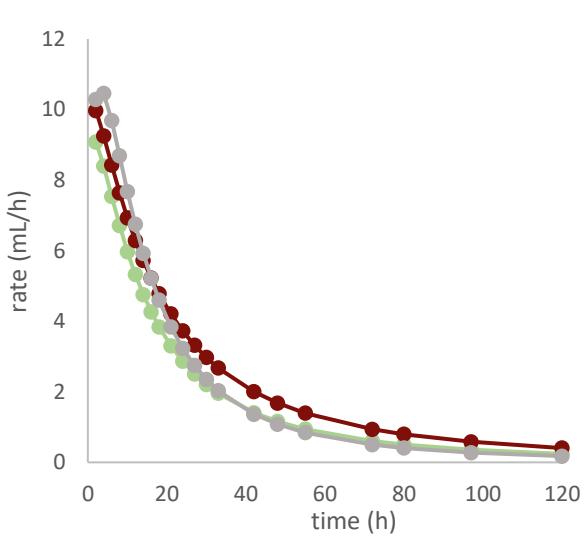


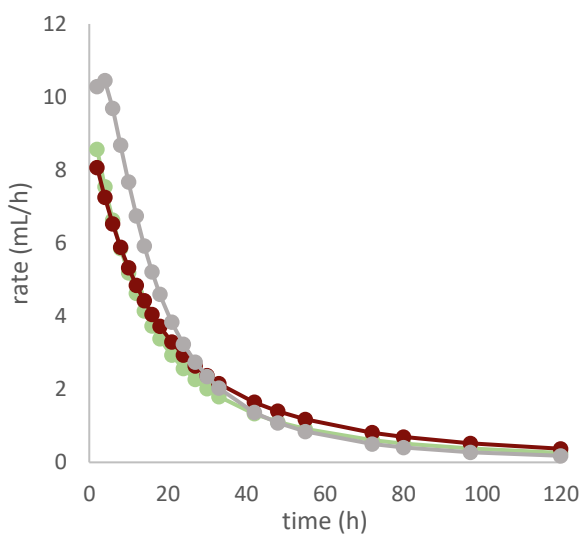
Cs/3/2

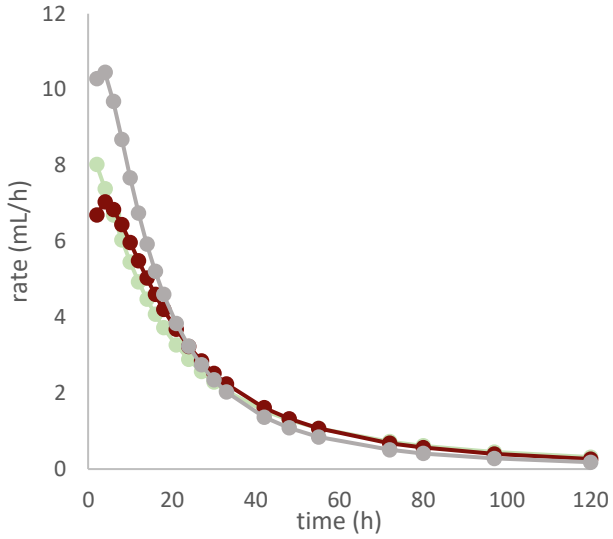


In vitro fermentation rate

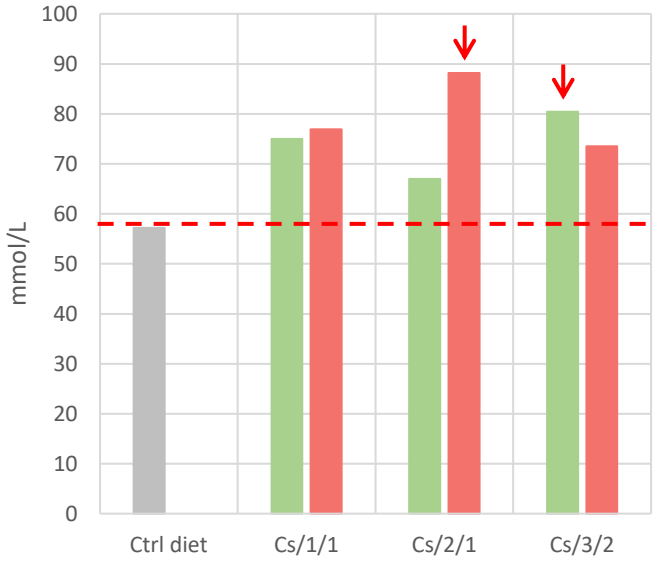
- Ctrl diet
- 50 mg
- 200 mg







Total VFA after 120h



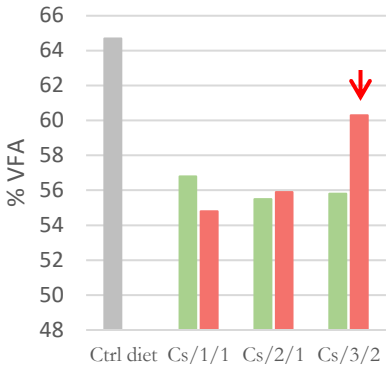
Ctrl diet
50 mg
200 mg

50 mg

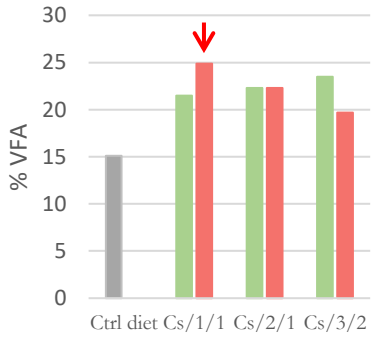
	Ctrl diet	Cs/1/1	Cs/2/1	Cs/3/2
pH	6.20	6.46	6.49	6.34
BCFA (%VFA)	7.42	3.95	3.08	2.56
A/P	4.27	2.64	2.50	2.38

200 mg

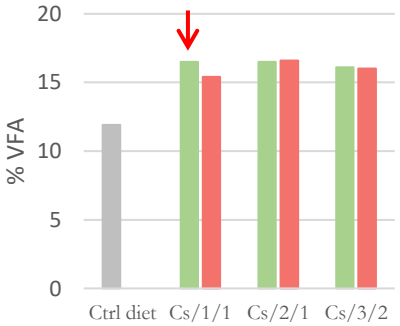
	Ctrl diet	Cs/1/1	Cs/2/1	Cs/3/2
pH	6.20	6.43	6.35	6.31
BCFA (%VFA)	7.42	3.80	3.28	3.09
A/P	4.27	2.20	2.50	3.06



Acetic acid

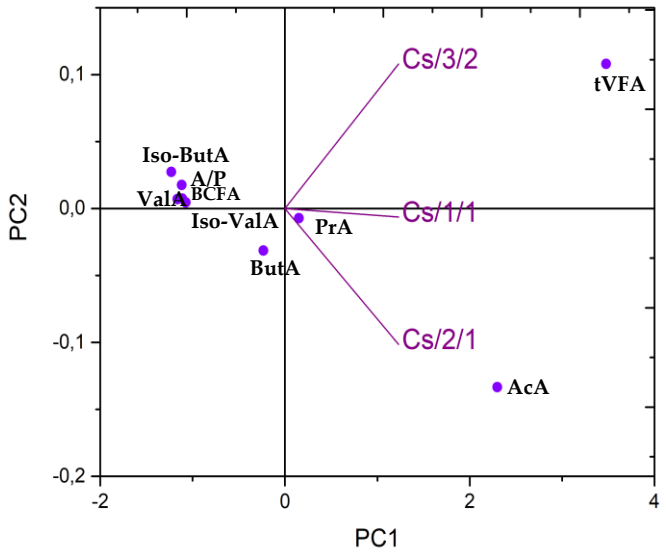


Propionic acid

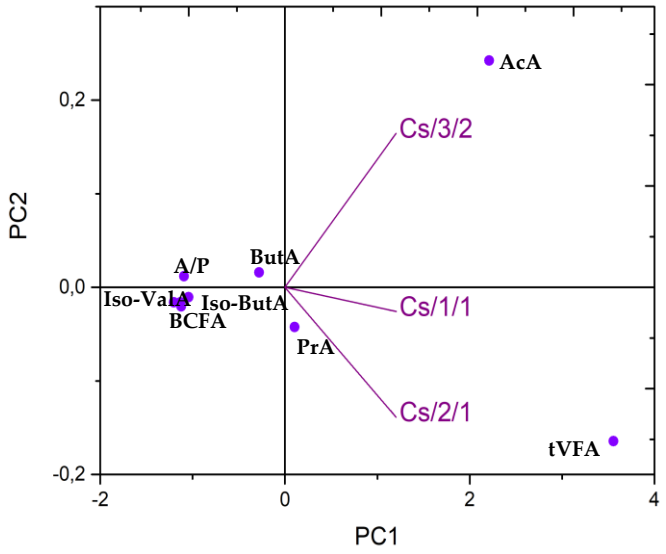


Butyric acid

50 mg



200 mg



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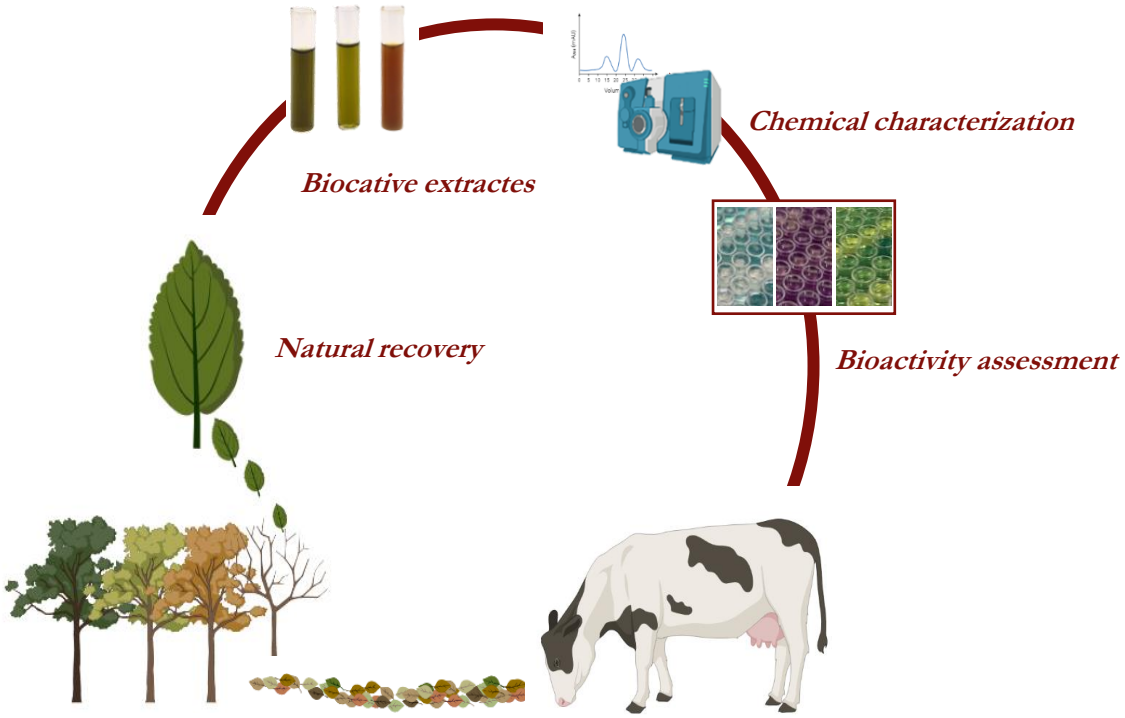
Conclusions

Chestnut leaves appear as a promising material affecting ruminal fermentation parameters and methanogenesis probably with effects on **ruminal microbiome.**

All tested fraction reduce the **CH_4 emission** after 24 h of incubation, mainly **Cs/2/1.**

The addition of **50 mg** of the **Cs/3/2** and **200 mg** of the **Cs/2/1** mainly increased the production of VFAs.

Acetic acid is decreased by all tested fractions whereas **propionic** and **butyric acid** are increased by **Cs/1/1** at 200 and 50 mg, respectively.



THANKS FOR YOUR ATTENTION

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