Grape stems as a functional ingredient for rabbit feed




Food Waste Management & Waste Management in island & Isolated areas

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Winery sector

Generation ratio of grape stem is of 0.21 kg per 1 kg of processed grapes.

The only organic by-product from winemaking process that is disposed as a waste:

- Cost of management
- Environmental impact

Functional ingredient for animal feed would:

1) Reduce the environmental footprint by giving them a second life.
2) Improve its competitiveness by generating a new economic activity based on circular economy, reducing waste managing costs & enhancement of its environmental footprint, which new markets are increasingly demanding.

Grape stems

Literature (Gouvinhas et al, 2018)

- High **fibre content**: 21.5 % crude fibre
- High **phenolic content** (38 mgGAE / g) → biological and physiological effects [*antiallergenic, anti-inflammatory, antithrombotic, antioxidant, antimicrobial, and modulators of various enzyme systems*]

↓

Healthy effects on the organism

- Its phytochemical composition includes **flavan-3-ols** (mainly flavonoids and stilbenes)

↓

Significant antioxidant properties

→ The high polyphenol content, associated with the high fibre content (21.5 % crude fibre), makes it very interesting as a *new fibre-rich functional ingredient for animal feed*.

Rabbits culture

Rabbit farming → some **risk factors** → **diseases and high mortality rates**

- High population density in the hatcheries
- Presence of infectious and contagious agents
- Nutritional and water imbalance
- Early weaning or excessive lighting

→ High economic losses

Diseases with the highest incidence are → **digestive**, respiratory systems, skin conditions and behavioural disorders

→ **Medications** as a preventive treatment to minimize mortality rates

Rabbits culture

Several initiatives to **reduce the use of medicated feed** in livestock → Strong pressure on livestock activity to adapt to the new regulations

A new functional ingredient rich in fibre from grape stem would have:

1) An **immuno-stimulatory effect** on the animal which would lead to a decrease in mortality → minimize the risk associated with reducing the preventive use of antibiotics in the mortality rate of rabbit farming

2) An increasing the **competitiveness of the cuniculture sector** by complying with the law* in the responsible use of medicated feed, minimizing losses associated with rabbit mortality and the cost of medications

* [Regulation (EU) 2019/4 on the manufacture, placing on the market and use of medicated feed]

Innovative process

A sustainable technological solution for reusing grape stems as a new functional ingredient for cuniculture through the application of an innovative process for a secondary raw material procurement:

1. Step 1 - **Griding**

   It is of utmost importance to obtain an homogeneous intermediate product for the drying step.

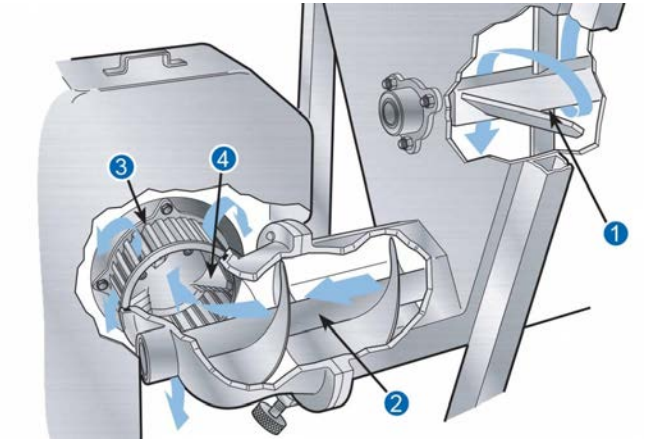
2. Step 2- **Flash Drying**

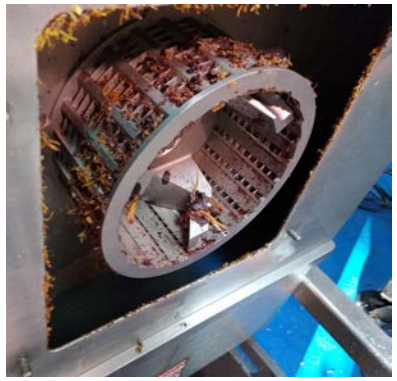
   Its high moisture content makes them rapidly get spoiled due to the microbial activity.

   The presence of high value temperature sensitive compounds involves the need of a non-aggressive drying process.

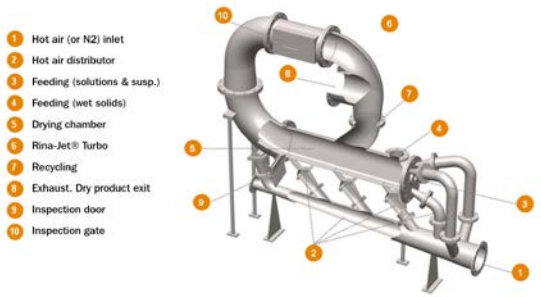
Step 1 Grinding

There are multiple options but we have selected one with 7 millimetre blades.





Step 2 Flash Drying



Initial moisture content of the grape stems was 70 %
Final target moisture content is < 10 %

Flash dryer technology → the most appropriate technology because it allows instant, self-regulating and continuous drying of wet solids.

1. Low operating cost associated to this high thermal efficiency:
   The combination of the turbulence effect and reduced pressure with the high-speed movement of particles results in disintegrating and drying solid instantly. The target product is very rapidly broken in the drying chamber, its surface area increases significantly and, therefore, the required energy decreases considerably.

2. Suitable for temperature-sensitive products:
   Minimum heating of the solid during a short time of residence inside the dryer - fractions of a second - to maintain their nutritional value and safely (food security).

Ingredient value

Parameters	Unit	Value
Moisture	%	7.43
Ashes	%	6.28
Energy	KJ/100 g	1480
Protein	%	4.07
Carbohydrates	%	81.58
Neutral detergent fiber	%	40.81
Acid detergent fiber	%	40.81
Lignin acid detergent	%	19.72
Crude fat	%	0.64
Starch	%	4.90
Total sugars (expressed in glucose)	%	19.74
Total polyphenols	(g GAE kg^{-1})	24.3

Experimental diet

Iso-protein and isoenergetic diet was compared to commercial diet, used as a control.

Ingredients	Control diet (%)	Experimental diet (%)
Wheat Quarters	22.00	23.80
Sunflower BP	24.58	21.00
Black oats	10.00	19.40
Alfalfa	10.00	10.00
Sunflower husk	10.00	7.00
Grape stem	0.00	5.00
Maltese rootlets	5.00	5.00
Beet pulp	6.50	4.00
Barley	5.50	0.00
Cane molasses	3.00	2.50
Calcium Carbonate Hna 38.9	2.00	1.00
Salt	0.82	0.64
Lapin Engraissement 76 / 0.5	0.50	0.50
L-threonine	0.05	0.05
L-Lysine HCL	0.05	0.05
DL-Methionine	0.00	0.05

Growth trial

Feed efficiency trial was carried out with **120 rabbits** that were **randomly distributed in two groups** of 60 animals each. The two experimental batches were **balanced based on their live weight at birth**.

The test was run during the last **24 days** in which the effective implantation of the formulated feed with grape stems was carried out.

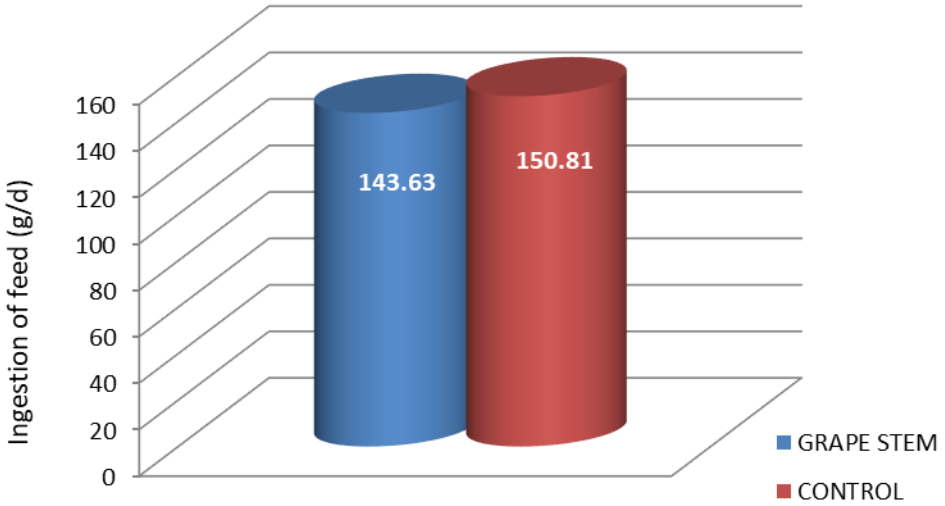
One of the lots received a **commercial control feed** and the other **the innovative feed with 5% grape stems** in its composition.

The handling of the feeding was the habitual one of the exploitations, but the quantity of feed offered and rejected in each cage was registered. These records were made weekly from weaning to slaughter.

The animals of each cage were **weighed in group at the beginning** and at the end of the bait, and **the mortality that could occur** is recorded.

Growth trial

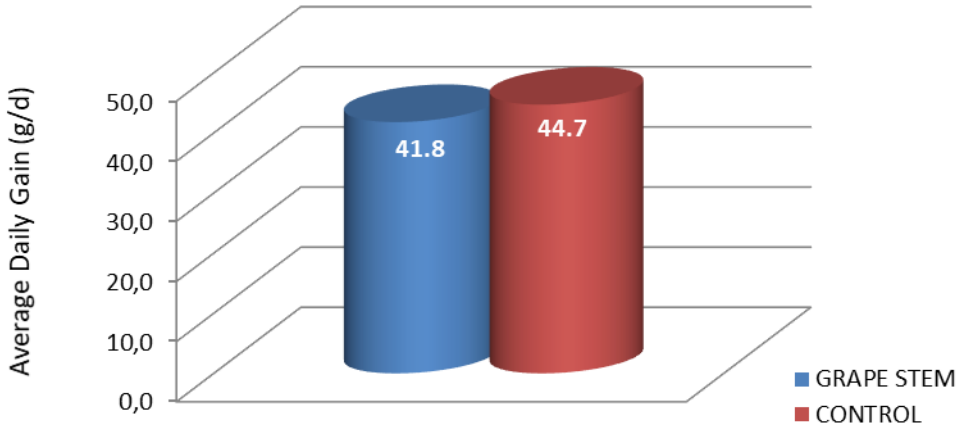
Daily ingestion of feed



The animals of the control group consumed more average feed than the rabbits of the control feed group (150.81 g / d vs. 143.63 g / d, respectively)

Growth trial

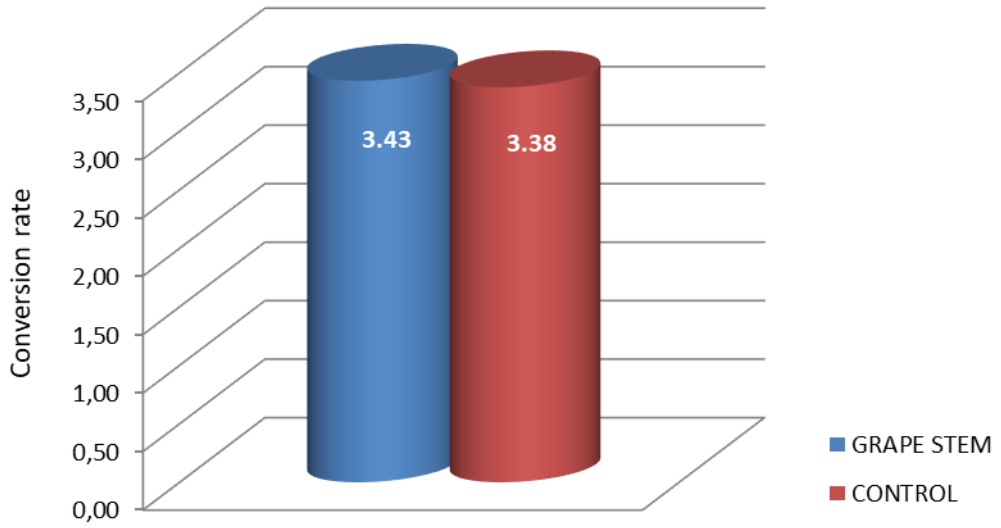
Average daily gain



A higher average daily gain was observed in the animals of the control group than in those with 5 % of grape stem flour (44.7 g / d vs. 41.8 g / d, respectively)

Growth trial

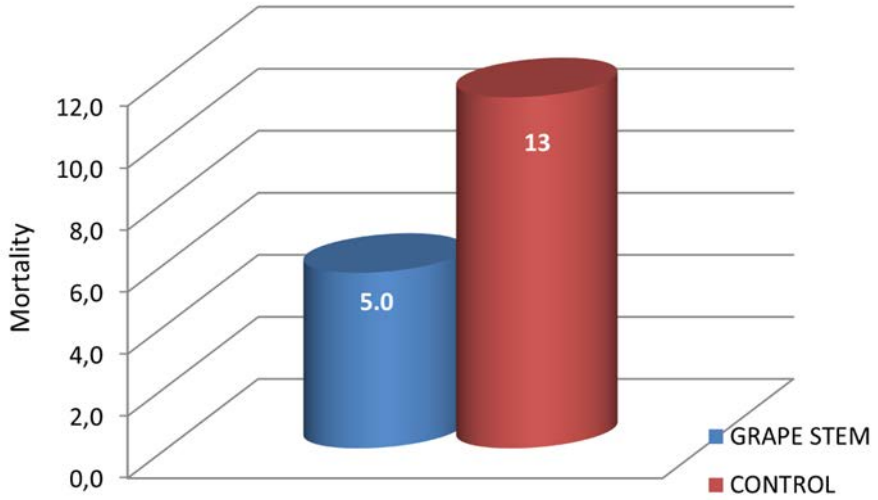
Conversion rate



The conversion rate of the grape stem group was slightly higher than one of the control group (3.43 vs. 3.38 for the 5 % of grape stem group and the control group respectively)

Growth trial

Mortality



A tendency to decrease the mortality of individuals fed with experimental diet with respect to control was observed.

Growth trial

Conclusions

Based on the data of the daily feed intake, the **palatability** of the experimental diet is adequate and does not affect feed intake.

The average daily gain data and the conversion rates conclude that, in terms of nutritional efficiency, the **inclusion of 5% of grape stem in the diets do not involve differences in the nutritional value of the diets** and **does not significantly affect the fattening of rabbits**.

Mortality is higher in rabbits fed with the commercial diet; therefore, there is **a slight tendency to immune stimulation of animals fed with grape stem-based diet.**

Conclusions

Grape stem stands as a potential functional ingredient for cuniculture due to:

1. Their **availability in Europe**
2. Their **nutritional characteristics** and the **results obtained in the growing trials**.
3. Their use would have an **immuno-stimulatory effect on the animal** which would lead to a decrease in mortality.
4. Their recovery would **reduce the environmental footprint of the wine sector**, while generating a new economic activity based on circular economy.

Thank you!

Any question?

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