DESCRIPTION FOR THE GENERAL PUBLIC

Project title: The role of biologically active substances of Paulownia CLON IN VITRO in the methanogenesis and biohydrogenation regulation in ruminants

In order to mitigate enteric methane production from anthropogenic sources, including ruminants, and to the increased demand for animal products with health promoting properties, methods of effective mitigation of methanogenesis (process of methane production) and biohydrogenation (process of health promoting agents formation) are required.

It was proved that flavonoids served with the diet, thanks to antimicrobial properties, might modulate rumen processes in animals. **The aim of the planned research is to determine the complete set of small-molecule metabolites (such as metabolic intermediates and secondary metabolites) to be found within a biological sample, such as a leaves, flowers, fruits and twigs of Paulownia CLON IN VITRO 112® and to determine their effect on qualitative and quantitative changes of rumen microbial populations responsible for methanogenesis and biohydrogenation processes in dairy cows.** The overriding aim of the project is to mitigate enteric methane production and biohydrogenation of unsaturated fatty acids in the rumen environment. The point is that rumen methane production decreases energy density of the diet that can be utilized by the animal and, consequently, comprises the source of environmental pollution. While as the effect of biohydrogenation of unsaturated fatty acids, when stopped at initial stages, conjugated isomers of proven biological activity are formed. Unsaturated fatty acids, including conjugated isomers, formed in the rumen, mammary gland, and tissues, which are ultimately present in milk and meat, offer potential benefits for human health. Paulownia CLON IN VITRO 112® called climate control plant - is extremely useful for the improvement of air quality and preserving the environment. Paulownia, due to relatively high nitrogen content, has been shown as potential source of plant material that can be used as fodder or fertilizer. Based on initial chemical analysis, it can be stated that Paulownia CLON IN VITRO 112® as a rich source of flavonoids that may be effective in modulation of rumen microbial populations and hence may be used as dietary component for ruminants. Not only does Paulownia deliver good wood quality and a high potential to be extremely effective in improving both air quality and protecting the environment, but also we predict that the cultivation of Paulownia would provide a significant increase of green biomass. In order for this to be successful, methods for green biomass must be properly developed and utilized. Biomass, because of the positive properties, may be extremely effective in modulating rumen processes and consequently, decrease environmental pollution by decreasing high oxygen production, high CO_2, and H_2 utilization; additionally, it will improve the quality of both milk and meat fatty acids.

Based on the information mentioned above, this study will be carried out to test the hypothesis that flavonoids of Paulownia CLON IN VITRO 112® have effects on energy metabolism, methane production, and biohydrogenation in the rumen of dairy cows. Determination of the effect of flavonoid-containing Paulownia leaves on both rumen hydrogen pathways and microbial populations will be evaluated in order to establish the optimum dose of these leaves for inclusion in the ruminant diets. Short and long term *in vitro* techniques will be used to verify the research idea as well as one confirming *in vivo* experiment using cannulated dairy cows will be performed. In order to better understanding of the mechanisms responsible for the above mentioned processes, the quality and quantity of biologically active compounds will be determined in dried and fresh Paulownia leaves and extracts.

Additionally to strengthen the evaluation process of determining the biological activity of Paulownia CLON IN VITRO 112® the following will also be investigated: the haemostatic properties and oxidative stress of both blood platelets and plasma protein, the antibacterial and antifungal activity against *Staphylococcus aureus* and *Candida sp*., and to some degree, the cytotoxicity analysis of tested material to normal and human cancer cells *in vitro*.