RED CLOVER – ASSESSMENT OF THE NUTRITIONAL POTENTIAL IN MANGALITA PIG FEED

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RESEARCH ARTICLE

Abstract
This study aims to evaluate the potential of red clover (Trifolium pratense L.) as a valuable ingredient in the diet of the Mangalita pig, a traditional breed valued for its superior meat quality. Known for its high protein, fiber and micronutrient content, red clover offers numerous nutritional benefits that can contribute to animal health and performance.
The research emphasizes the importance of using red clover as a sustainable component in animal nutrition, contributing not only to increas livestock performance, but also to promote ecological farming practices.

Key words: red clover, Mangalita pig, animal nutrition, zootechnical performance, feed, nutritional value.
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INTRODUCTION

The Mangalita pig, a native Romanian breed, is recognized for its ability to convert quality forage into high-quality meat and fat, rich in unsaturated fatty acids. This breed is known for its curly hair and high-quality meat, often compared to Kobe beef due to its high-fat content and rich flavor. Mangalita needs a carefully balanced diet to maintain its unique characteristics, such as intramuscular fat which contributes to the meat's marbling and taste.

The fat in Mangalitsa pork is particularly special. It has a high concentration of unsaturated fatty acids, including oleic acid, which not only enhances the meat's flavor but also makes it healthier than many other types of pork. The meat is rich in essential nutrients, such as B vitamins, iron, and healthy fats, which contribute to both its health benefits and culinary appeal.

Red clover (Trifolium pratense) is a perennial forage plant known for its high nutritional value and versatility in livestock systems. Belonging to the legume family, it is an important source of protein, fiber, vitamins and minerals, and is widely used in the diet of ruminants, but also of other species, such as pigs. Red clover has a remarkable adaptability to various soil and climate conditions, which makes it a popular choice on farms that prioritize natural and economical feeds.

The use of red clover in pig feeding, especially of traditional breeds such as Mangalitsa, has attracted attention due to its positive impact on meat quality. It becomes richer in healthy fats, more aromatic and with a superior texture, aspects highly appreciated in gourmet markets. At the same time, feeding red clover can contribute to reducing production costs, especially in regions where this plant is abundant.

This introduction aims to emphasize the importance of red clover as a valuable forage resource and to highlight how its integration into pig diets can support both the economic performance of farms and the demands of modern consumers for high-quality products obtained through sustainable methods.

MATERIAL AND METHOD

For this study, 10 Mangalita pigs were selected, divided into two groups: a control group (which receives a traditional grain ration) and an experimental group (where red clover represents 60% of the daily feed ration). The study lasted 150 days, monitoring feed

consumption, weight evolution and general health.

RESULTS AND DISCUSSIONS

Pig body growth is an essential parameter in evaluating the nutritional efficiency of a diet. In this study, we monitored the body development of Mangalita pigs fed a red clover diet compared to a control group fed conventional feed.

During the 150 days of the study, the pigs were weighed weekly to assess the evolution of body weight and growth rate. This monitoring was done under controlled conditions, ensuring that each group received equivalent amounts of feed (in proportion to initial body mass), so that the influence of red clover on growth could be accurately determined.

Samples of red clover were analyzed in specialized laboratories to determine the content of crude protein, fiber, carbohydrates, vitamins and minerals. The energy value and its potential to replace other feeds were also investigated.

Table 1

Chemical composition of red clover

Nutrient	Content
Crude protein	20%
Fiber	25%
Metabolic energy	11 MJ/kg
Vitamin A	2,000 UI/kg
Vitamin E	35 mg/kg

Red clover showed a high content of protein, fiber and essential vitamins, providing a complete feed source for the healthy development of Mangalita pigs. The crude protein in red clover helped increase muscle mass, and the fiber supported efficient digestion, improving the assimilation of other nutrients.

Red clover is a nutritionally rich forage, containing a high protein content ranging from 15% to 20%. This makes it an excellent source of essential amino acids such as lysine, methionine, and leucine, which are crucial for muscle development, immune system support, and overall growth in livestock. Its fiber content promotes healthy digestion by slowing the digestive process, enhancing nutrient absorption, and supporting gut health. This led to a more efficient conversion of food into body mass. Additionally, red clover provides significant levels of vitamins A and E. Vitamin A is vital for vision, immune function, and reproduction, while vitamin E acts as a powerful antioxidant, protecting cells from oxidative stress and promoting cardiovascular and muscle health and contributed to maintaining a healthy metabolism and the proper development of adipose and muscle tissue.

The mineral composition of red clover includes calcium, potassium, and magnesium. Calcium supports bone strength, blood clotting, and muscle function, while potassium regulates fluid balance, nerve signals, and muscle contractions. Magnesium plays a crucial role in energy production, protein synthesis, and overall nerve and muscle health.

Beyond its nutritional profile, red clover is rich in bioactive compounds, particularly isoflavones such as genistein, daidzein, biochanin A, and formononetin. These phytoestrogens mimic estrogen in the body and can influence metabolism, reproduction, and immunity. Isoflavones contribute to improved metabolic efficiency and enhanced immune response while also reducing inflammation and oxidative stress. Their antioxidant properties protect against cellular damage caused by free radicals, potentially enhancing tissue health and resilience. For pigs, this can mean not only better overall health but also improved meat quality, with enhanced fat stability and flavor preservation

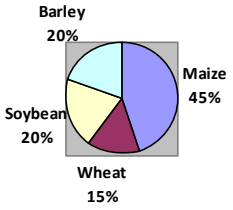

Figure 1 **Grain feed proportions**

The daily ration of piglets up to 50 kg fed with Grain is 3% of their weight, meaning approximately 1.5 kg of feed, and for piglets over 50 kg it is 5%, meaning 3-4 kg of feed.

The daily ration of piglets up to 50 kg fed with red clover is 4% of their weight, meaning approximately 2kg of feed, and for piglets over 50kg it is 7% of their weight, meaning 4-5 kg of feed.

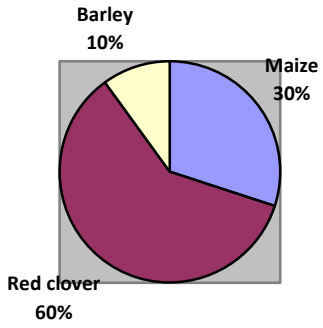

Figure 2 **Red clover feed proportions**

Table 2

Results compared between feeds

Time interval	Final Weight – Red Clover (kg)	Final weight – Traditional feed (kg)
Day 0-30	55	58
Day 30-60	68	74
Day 60-90	83	87
Day 90-120	92	95
Day 120-150	98	100

Analysis of the results

1. Body growth:

o The forage-fed group had faster growth during the first 90 days, indicating a greater efficiency of these forages in converting feed into muscle mass. On average, they grew 5-10 kg more than pigs fed red clover during the same time periods.

o In contrast, pigs fed red clover had a slower but sustained growth, with an evolution of about 0.5 kg per day in the first 60 days, gradually decreasing to 0.2 kg per day in the last 30 days.

2. Meat and fat quality:

o Pigs fed red clover had a higher fat quality, with a high content of unsaturated fatty acids (omega-3 and omega-6), due to the diet rich in fiber and natural nutrients. Their fat had a finer texture and a more appreciated flavor.

o Pigs fed concentrates had meat that was richer in muscle mass and lower in fat. However, their fat was denser and less appreciated for premium products.

Advantages of Grain Feeding

Accelerated Growth: Concentrated diets support a faster growth rate than green feed systems.

Nutritional Control: It is easier to monitor and adjust the intake of specific nutrients, such as protein, minerals and vitamins, depending on the growth stage.

Uniform Production: Animals grow at a predictable rate, which helps to meet marketing schedules.

Disadvantages of Grain Feeding

Meat Quality: Although the meat remains of superior quality, it may have less natural marbling and a less intense flavor compared to a diet based on natural forages, such as red clover.

Higher Costs: Purchasing grains and protein supplements can significantly increase production costs, especially in regions where they are not locally produced.

Sustainability: The system is less environmentally friendly than the use of green fodder and pastures, due to the dependence on external inputs and the environmental impact.

Advantages of Red Clover Feeding

Superior Meat Quality: Red clover improves meat marbling and contributes to a healthier fat profile, with an optimal balance between omega-3 and omega-6 fatty acids.

The complex flavors and delicate texture are highly valued in premium markets.

Natural Source of Nutrients: Rich in protein (15-20%), fiber, vitamins (A and E) and minerals (calcium, magnesium, potassium), red clover supports the health and natural growth of animals.

Isoflavones in red clover have antioxidant and immunostimulatory effects, reducing oxidative stress and the risk of disease.

Sustainability and low costs: Red clover is a hardy and affordable plant, reducing dependence on concentrated or imported feeds.

As a nitrogen-fixing plant, it improves soil fertility and contributes to organic farming practices.

Pig Health Benefits: High fiber content supports healthy digestion and efficient nutrient absorption.

Reduces the need for vitamin and mineral supplements, due to its rich natural composition.

Adaptability to extensive systems: Ideal for extensive or semi-extensive pig farms, where pigs can consume fresh clover directly from the pasture.

Disadvantages of Red Clover Feeding

Space and management requirements: Raising pigs with access to fresh clover requires dedicated pastures, which can be difficult for small farms.

Requires careful management of pasture rotation to prevent overgrazing and soil degradation.

Additional preparation: For use during winter periods or for more balanced rations, clover must be preserved (dried or ensiled), which involves additional labor and cost.

Table 3

Comparison with Red Clover Diet

Characteristic	Red Clover Diet	Cereal Diet
Meat quality	Intense flavor, superior marbling	Good, but less intense
Costs	Low (in areas with abundant clover)	Larger, thanks to cereals and supplements
Growth	Slower, but healthier	Faster and more predictable
Sustainability	High	Moderate
Adaptability	Requires access to pasture and green fodder	Easy to use in any system

CONCLUSIONS

Feeding Mangalita pigs with red clover offers multiple benefits for producers who want to prioritize meat quality, animal health, and the sustainability of the farming system. This feeding method has a significant impact on meat characteristics such as marbling, healthy fat profile, and unique flavor, which are essential for consumers in premium markets. In addition, red clover is a natural source of essential nutrients, including protein, vitamins, minerals, and bioactive compounds, which reduces the need for supplementing with expensive commercial feeds.

Beyond the direct benefits on pig health and growth, the use of red clover contributes to a more sustainable farming system. As a hardy perennial, clover improves soil fertility by fixing nitrogen, reducing the dependence on chemical fertilizers. It also promotes efficient pasture use, fitting perfectly into extensive or semi-extensive systems where Mangalitsa can express their natural behaviors, which contributes to animal welfare.

However, this method also has limitations. The growth rate of pigs fed exclusively on red clover is slower, which can extend the fattening period and, implicitly, increase operational costs in productivity-oriented farms. Also, the lower energy content of clover requires supplementation with grains or other feeds, especially during the finishing period, to ensure optimal accumulation of intramuscular fat. The seasonal availability of fresh clover can be a challenge, requiring preservation through methods such as ensiling or drying, which involve additional labor and resources.

To maximize the benefits of feeding red clover, producers should implement a mixed strategy, combining clover with other feed sources, such as energy-rich cereals. Such a hybrid approach would allow the preservation of the unique health and meat quality benefits of clover, while compensating for the shortcomings related to the growth rate and energy requirements of pigs.

Thus, the red clover diet represents a viable and desirable solution for farmers who want to produce high-quality meat in an ecologically and economically viable way. With proper planning and the integration of other nutritional sources, this feeding system can become a key component of a sustainable agricultural model, able to meet the demands of the modern market, increasingly oriented towards quality and environmentally friendly products.

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