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Medicinal forage and herbal diets: a new approach to sustainable farming

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ABSTRACT

Medicinal and aromatic plants have long been used in traditional medicine, for preparing food or feeding livestock as well as during religious ceremonies and to manufacture cosmetics. The concept of “medicinal forage” refers to plants that provide both nutrition and medicinal benefits to animals, forage crops containing active compounds or secondary metabolites, as well as the method of intercropping medicinal plants with forage crops. Aromatic plants, herbs and their derivatives such as essential oils have been studied in the literature for their potential application to replace antibiotics in ruminant diets. In the research world, scientists are examining natural plant compounds like tannins, saponins and essential oils which could become part of alternative applications for antibiotics. Herbal diets can reduce, and sometimes negate the disease incidence in animals; increase reproductive health of livestock and sustainable weight gain. The economic benefits are typically decreased veterinary expenses, higher profits because of a lower cost to production ratio and the premium consumers will pay for organic products. The inclusion of medicinal forage and herbs in the diet can be used as a tool to increase animal welfare and productivity but also brings agriculture towards sustainability through animals raised organically by associating different species.

KEYWORDS: Medicinal forage, Herbal diets, Livestock feeding, Sustainable farming

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INTRODUCTION

Due to the rise in demand for sustainable and health-conscious agricultural practices, as well as concerns about proper livestock rearing procedures, the use of medicinal forage and herbal diets has garnered renewed interest on a worldwide scale. The abundant literature supported by both traditional practices and modern science that explores the use of these natural dietary supplements makes it clear that this source presents a promising alternative to conventional feed additives. Plants used for dietary supplements are often referred to as medicinal forage; they consist of herbs or edible plants known worldwide for their nutritive and therapeutic properties, which can positively influence the health and productivity of farm animals (Salobir *et al.*, 2012).

The term medicinal forage may include feeding animals with medicinal plants that have nutritional value; forages containing secondary metabolites or active principles used in animal health and crop protection (for example, essential oils); intercropping, which involves a perennial system of plantation during natural area regenerative systems associated production management processes to maximize benefits from both the animal feeding needs as well as human uses. Animal nutrition is one of the most critical factors in animal health, and organic products must

be used within agricultural systems that contain organically produced materials (Yu *et al.*, 2018; Åkerfeldt *et al.*, 2021).

This review attempts to provide comprehensive insight into the various benefits of feeding medicinal forages to animal diets from nutritional, health, and economic standpoints. Looking at the most popular foraged medicinal plants and discovering projects that are working with them around the world offers a way to understand how nature can help improve current agricultural practices. Finally, comparative studies with herbal diets against conventional ones may explore their extended effects on animal health along with productivity (Åkerfeldt *et al.*, 2021).

Recently, farmers, researchers, and policymakers have shown an increased interest in more sustainable forms of livestock feeding. People are interested in decreasing our dependence on synthetic additives, reducing the environmental footprint, and promoting animal welfare. Therefore, to utilize herbal-based feed for livestock purposes and to handle its constraints along with solutions is very important through a sustainable agriculture lens (Yu *et al.*, 2018). For thousands of years, medicinal and aromatic plants and herbs have been utilized in traditional medicine as well as for food preparation, preservation, animal husbandry, religious observances, and cosmetic practices. The medicinal plants are successfully used in healthcare treatment

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to promote improvement in both the health state and productivity of animals. The use of natural medicines is more cost-effective, easier, and prolonged compared to synthetic drugs and pharmaceuticals (Sreekeesoon & Mahomoodally, 2014).

Several studies have indicated the possible substitution of antibiotics with aromatic plants and herbs, including essential oils in ruminant nutrition (Greathead, 2003; Gallois *et al.*, 2009; Reddy *et al.*, 2020; Kuralkar & Kuralkar, 2021; Leal *et al.*, 2023; Alem, 2024; Parkunan *et al.*, 2024). Natural plant-based alternatives to in-feed antibiotics, which may include tannins and saponins as well as essential oils (Gallois *et al.*, 2009) have also been closely screened. According to Greathead (2003), plant secondary metabolites are underutilized natural resources in conventional animal production systems. These are the different effects of feeding botanicals and herbs to livestock. These include, but are not limited to, the release of digestive secretions, immune stimulation, antibacterial, antiviral, inflammatory activity, and antioxidant status under food intake-associated benefits (Wallace *et al.*, 2002).

Some studies have shown the potential for positive changes in meat and meat products quality characteristics, either by changing the animal diet or by adding natural fibers such as vegetables, herbs, and spices, while eliminating fats and reducing saturated fatty acids, additives, etc. (Zhou *et al.*, 2023).

The purpose of this review is to summarize and provide an in-depth understanding of the effects, potentialities, and possibilities achieved with the application of medicinal forage plant diets, as well as practical usage-based data. This article, providing scientific research and case studies, will help farmers, veterinarians, and agriculturists enhance their livestock management without relying on antibiotics by natural means.

BENEFITS OF MEDICINAL FORAGE

Incorporating medicinal forage into the diet of livestock has received quite a lot of interest in recent years. This section delves into the multifaceted benefits that medicinal forage offers, encompassing nutritional advantages, health improvements, and economic benefits.

Nutritional Advantages

Medicinal forage plants are nutrient-dense and improve the general health of animals. In contrast to typical feeds, these are often rich in vitamins, minerals, and bioactives. This means that plants like alfalfa and clover serve not only as sources of protein but also bring with them an assortment of micronutrients such as calcium, magnesium, and zinc. These are essential minerals that serve a variety of functions in animals, such as maintaining bone health and contributing to metabolic activities and the immune system.

In addition, medicinal forage is often high in compounds termed phytochemicals - antioxidants as well as flavonoids and tannins - not normally present at appreciable levels in

non-medicinal feeds. Such compounds should, therefore, be able to make farm animals more nutrient-efficient and productive. Therefore, the diversity of the nutrient profile present in medicinal forage provides more than a healthy diet; it also supports animals' immune systems, hence their long-term health.

Cullen *et al.* (2005) conducted a study with the objective of evaluating nutrient digestibility, pig performance parameters (feed intake, weight gain), carcass measurements - as well as sensory characteristics of pork meat - by including garlic or rosemary extracts in the diet fed to pigs. When the growth performance and carcass traits of broilers in this study were relatively low weight gain, FI (feed intake), FCR (food conversion ratio) compared with reports by Zhang *et al.* on 140 meat ducks, namely, the addition of garlic reduced feed intake and improved weight gain, while rosemary did not have any significant effects (Cullen *et al.*, 2005). Similarly, rosemary leaf powder had no additive beneficial effect on either live body weight gains or quality characteristics at all sampling days up to processing day after feeding it alone for the entire growing period following part-contest feeds (Frankie *et al.*, 2009).

In Europe, there has been an implementation of the ban on non-therapeutic use of antibiotic growth promoters and control with respect to other drugs, which led to increased digestive disturbances together with mortality in rabbits. This, along with the rising trend for organic goods, has led to the search for plant-based alternatives. Thus, plants and plant extracts are influencing animal nutrition in the form of appetites, digestion stimulants, coloring agents, and antioxidants by being used as preventive agents or to control the pathological status (Frankie *et al.*, 2009).

Health Improvements

There are many health benefits derived from feeding livestock medicinal forage. One of the biggest pros is a boost to the immune system. The anti-inflammatory, antibacterial, and antiviral properties of these plants are due to the presence of bioactive compounds like saponins, alkaloids, or essential oils. Such natural compounds work to decrease disease and infection rates in animal populations, which will reduce the need for antibiotics that are otherwise synthesized. Some healthful forage can be used as medicinal forage and may stabilize the gut. For example, the use of herbs such as oregano or thyme in animal diets can support a proper gut microbiome. This, in turn, aids digestion and increases nutrient absorption, which ultimately results in more growth and weight gain for the livestock.

In addition, the presence of anti-parasitic properties in some medicinal plants aids in parasitism control by removing internal parasites and favoring improvements in animal health. Meanwhile, the extracts of many herbs and seeds are anti-inflammatory. These can include black pepper, cinnamon, mint, chamomile, marigold, and ginger extracts, to name just a few. Types of molecules possessing potent anti-inflammatory effects are flavonoids and terpenoids that have the ability to

inhibit inflammation-related metabolism of prostaglandins. In addition, quite a few bioactive compounds of herbs and spices have the potential to inhibit lipid peroxidation by scavenging free radicals or inducing antioxidant enzymes (Tipu *et al.*, 2006; Frankic *et al.*, 2009).

Economic Benefits

The adoption of medicinal forage in livestock diets can also offer significant economic advantages. One of the primary economic benefits is the reduction in veterinary costs. With improved health and reduced disease incidence, the reliance on medical treatments and interventions diminishes, leading to cost savings for farmers. Additionally, the enhanced growth rates and productivity associated with better nutrition and health directly translate to increased profitability (Åkerfeldt *et al.*, 2021).

Another economic aspect to consider is the potential for premium pricing. Livestock products such as meat, milk, and eggs derived from animals fed medicinal forage can be marketed as organic or natural, appealing to health-conscious consumers willing to pay a premium. This market differentiation can provide farmers with a competitive edge and open up new revenue streams (Zhou *et al.*, 2023). Furthermore, the utilization of locally available medicinal forage plants can reduce feed costs. Instead of relying on expensive, imported feed, farmers can cultivate or forage these plants, leading to significant cost savings. This not only makes livestock farming more sustainable but also promotes the use of indigenous plant species, contributing to biodiversity and environmental conservation (Burt, 2004; Tipu *et al.*, 2006; Gallois *et al.*, 2009).

In summary, the benefits of incorporating medicinal forage into livestock diets are manifold, ranging from enhanced nutritional profiles and improved animal health to economic gains. These advantages make medicinal forage an attractive and sustainable option for modern livestock management.

LONG-TERM EFFECTS ON LIVESTOCK HEALTH AND PRODUCTIVITY

Long-term studies have begun to shed light on the sustained benefits of integrating medicinal forage into animal diets:

Improved Reproductive Health: Animals on herbal diets generally have optimal reproductive performance. In dairy cows, this includes alfalfa for better fertility rates and moringa, which enhances lactation and offspring viability in goats (Wallace, 2007; Benchaar *et al.*, 2008; Patra & Saxena, 2009).

There is a Holistic Weight Gain: Apart from that, you can achieve natural weight gain without indulging in synthetic additives-domestic wify. For example, animals fed moringa, compared to those on conventional diets, are able to reach market weight faster and more sustainably (Tassoul & Shaver, 2009).

Life-Length & Fecundity: In most cases, consuming medicinal forages extends the productive life of livestock. Furthermore, increased health and lower rates of disease will allow these animals to continue contributing to farm productivity over a longer period, thus maximizing return on investment (Windisch *et al.*, 2008; Artuso-Ponte *et al.*, 2020).

The integration of medicinal forage plants into livestock diets is an ideal strategy that possesses tremendous nutritional, health, and economic value. As a final note, farmers can improve the health and productivity of their livestock by leveraging region-specific varieties such as alfalfa, chicory, moringa, and plantain, etc. The subsequent section will discuss some practical applications for incorporating these herbal diets into animal management systems (Cowan, 1999; Hashemi & Davoodi, 2011; Palomares, 2022).

INTEGRATING HERBAL DIETS IN LIVESTOCK MANAGEMENT

The integration of herbal diets in livestock management is the most appropriate way to mix traditional knowledge and modern agricultural practices concerning both animal health, productivity increase, and economic sustainability. This section focuses on practical applications for using herbal diets, tracking health outcomes, and troubleshooting issues that may arise (Makkar, 2003; Manzanilla *et al.*, 2004; Cross *et al.*, 2007).

Feeding Strategies

Introduce the Addition of Herbs Gradually: Adding herbs to animal diets slowly allows time for animals to adjust to their new feed without digestive disturbances. It is recommended to approach this transition in a stepwise fashion, starting with small amounts and then increasing the medicinal forage content (Nelson & Satter, 1992; Tager & Krause, 2011).

Formulation of a Balanced Diet: It is crucial that the herbal diet is nutritionally well-rounded. This is achieved through the incorporation of medicinal plants with other feed substances required to meet the nutrient needs of animals. Dietary consultation with a veterinary nutritionist can provide guidance for diets that foster greater health and therefore productivity.

Seasonal Changes: The availability of medicinal forage can change with the seasons. Such fluctuations can be managed by preserving forage grown during the peak season as silage, to have a continuous supply throughout the year.

Wide Spectrum of Forage Sources: The simultaneous use of several medicinal plants may allow their combined actions to benefit health and prevent the evolution of resistance by providing a broad array of forages, which might avoid nutrient imbalances (Hanczakowska *et al.*, 2015).

Monitoring Health Outcomes

To measure the effectiveness of this supplement, monitoring health outcomes is essential. The best ways to monitor your projects include:

Routine Health Assessments: These periodic health checks, through body condition scoring (assessing weight and BCS), tracking compliance rates with management practices to monitor the overall welfare status of animals (Kim *et al.*, 2009).

Productivity Indicators: Estimating milk yield, growth rates, reproductive performance, and feed conversion efficiency are valuable data points to understand different parameters of productivity during herbal diet feeding.

Detailed Health Records: Keeping detailed patient case records (recording disease incidence, recovery, and any changes in behavior or productivity) allows a farmer to identify trends and correlations with dietary changes (Wallace *et al.*, 2002; Tekippe *et al.*, 2013).

Feedback Loops: Establish feedback with local vets and nutritionists to continually refine what is being fed based on observed results or new science.

Challenges and Solutions

Though there are plenty of pros to incorporating botanical diets, doing so also comes with cons. Efficient handling of these issues is vital if medicinal forage is to be successfully integrated into ruminant management.

Awareness & Training: Ignorance or a lack of knowledge about plants and how to use them properly can deter customers from using medicinal crops. Training programs and resources on how to identify, grow, or even collect this medicinal forage should be made available to farmers.

Supply and Access: It can be difficult to provide continual, high-quality medicinal forage, especially in areas with few species that meet the criteria. Cultivation programs and supply chains are methods that can reduce these externalities.

Economic Concerns: Some farmers might find the cost of shifting to herbal diets to be an economic constraint. Therefore, highlighting the long-term economic benefits can boost investment in this sustainable practice (Zeng *et al.*, 2015).

Compliance Regulations: This is a necessary factor, and any medicinal plant used in foods for humans must be safe by regulations and guidelines. Farmers need to comply with the guidelines set by both local and international authorities to run their activities legally and safely.

Development of Research: Continuous research should be conducted to explore the complete prospects and optimal

feeding strategies with medicinal herbs. This innovation will require combinations of researchers, agricultural institutions with work experience on the ground, and farmers working together, protected by contracts specifying their duties.

In summary, the use of herbal diets for livestock constitutes alternative phytotherapeutic measures to increase animal well-being, productivity, and sustainability. My take-home message is that by using strategic feeding practices to control intake, monitoring responses in health, and proactively addressing challenges, farmers could utilize the benefits of medicinal forage as part of creating more resilient ecological systems on farms.

CONCLUSION

Medicinal forage and herbal diets alleviate a large number of benefits over conventional livestock management, stretching from nutrition to health purposes as well as economic benefits with environmental enforcement. The application of medicinal forage plants has significant and promising advantages in improving the health of livestock and productivity; thus, it leads toward a more sustainable agricultural system.

The nutritional benefits of medicinal forage can be supported by the abundant presence of crucial vitamins, micronutrients, and bioactive components in these varieties. These nutrients are very important since they help to strengthen the immune system of animals, thereby enhancing their ability to avoid illnesses; this positively influences well-being. There are significant health benefits, such as better digestion and far less dependence on chemical drugs to control parasites, as well as faster growth.

The use of medicinal forage can save farmers costs at the bio-economic level. Farmers are able to decrease operational costs since costly veterinary treatments and synthetic supplements will not be required. Additionally, producing higher-quality animal products (e.g., better meat/dairy) opens up even more market possibilities and the ability to charge a premium for them! The fact that these methods work in many regions around the world suggests versatility and adaptability across locales for medicinal forage. As reported in comparative studies, herbal diets compared to standard ones were able to improve several indicators such as animal health and the well-being of the host, productivity, or quality parameters. The lingering impacts on the health and productivity of livestock also underline that these benefits are not just short-term but long-lasting. Careful planning and execution are also necessary when integrating herbal diets into livestock management. The success of such an intervention hinges on effective feeding strategies, ongoing health outcomes monitoring, and the management challenges resulting from variations in forage quality (and associated seasonal availability). Challenges can be overcome and benefits optimized through solutions such as developing forage preservation techniques, breeding resilient varieties of

this valuable health-promoting resource, or farmer education programs.

In conclusion, medicinal forage and herbal animal diets seem to present a very interesting area for future livestock management. Adopting these practices on farms can promote the health and productivity of herds, bring economic rewards, and contribute to wider benefits for sustainable agriculture. More research and the design of this natural medicine feed will be needed to enhance more efficacious use and eventual public adoption.

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