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Review article

Probiotic yeasts in livestock sector

Ashima Vohra*, Poonam Syal, Anshu Madan

Department of Microbiology, Institute of Home Economics, University of Delhi, Hauz Khas, New Delhi, India

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ABSTRACT

The increase in livestock production systems has resulted in serious environmental impact due to emission of greenhouse gases and the possibility of transfer of zoonotic diseases to humans. Initially, antimicrobial drugs used as feed additives to overcome these challenges led to the emergence of resistant pathogens and have now been banned. The current trend in animal nutrition is to provide feed that meets nutritional needs, maintains healthy status and lowers the possibilities of infection. Probiotics have been described by many researchers to be an effective natural strategy towards improving an animal's health and performance. Probiotics are live microorganisms which confer health benefits on the host by modifying the intestinal microflora and probiotic yeasts have been used for decades as microbial feed additives. This review focuses on the positive influence of yeast supplementation in animal feed and some of the mechanisms by which these benefits are achieved have also been discussed.

Contents

* Corresponding author at: Department of Microbiology, Institute of Home Economics, University of Delhi, F–4 Hauz Khas, New Delhi 110016, India.
E-mail address: vohra_ashi@yahoo.co.in (A. Vohra).

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1. Introduction

The livestock sector is a highly dynamic and evolving system in response to rapidly increasing demand for livestock products (such as meat, milk, eggs and fish), largely driven by increasing human population growth, income growth and urbanization (Thornton, 2010). This increase in demand and the resulting livestock sector's vigorous growth has made current production systems challenging (Table 1).

According to FAO, livestock contributes directly or indirectly, about 9% of total anthropogenic carbon dioxide emissions, 37% of methane emissions and 65% of nitrous oxide emissions that are responsible for global warming (Fig. 1) (Steinfeld et al., 2006). Carbon dioxide emissions from the livestock sector are related to fossil fuel burning during production of fertilizer for feed production, the livestock production process, processing and transportation of refrigerated products. Methane emissions mostly occur as a part of the natural digestive process of animals (enteric fermentation) and manure management in livestock operations. Nitrous oxide emissions are associated with manure management; the application and deposition of manure. Indirect N_2O emissions from livestock production include emissions from fertilizer use for feed production, emissions from leguminous feed crops and emissions from aquatic sources following fertilizer application. These greenhouse gas emissions have affected the global climate significantly.

The use of antibiotics to increase the growth of animals rather than disease prevention is referred to as subtherapeutic antibiotic use. Studies have shown that administering low doses of antibiotics in livestock feed improves growth rate, reduces mortality and morbidity, and improves reproductive performance. It is estimated that over one-half of the antibiotics produced and sold in the United States is used as a feed additive (Cromwell, 2002). Since 1940s, antimicrobial drugs have been routinely administered in livestock production worldwide, to promote feed conversion efficiency and growth, with primary aim to reduce low-level infections in animals, improving the health and thus the production efficiency of the animal (Van den Bogaard and Stobberingh, 2000; Akinbowale et al., 2006; Lara-Flores, 2011). The antibiotic residue accumulated in animal products is considered to be harmful for human consumption since it can kill the beneficial microorganisms in the gastrointestinal tract. Also, the resulting excessive use of these agents has led to an increasing risk of transmission of resistant bacteria from animal products to humans and the subsequent horizontal and philandering flow of resistance genes to human pathogens leading to the evolution of antimicrobial resistant pathogens, thus making treatments less successful (SCAN 2003; FAO, 2005; Cabello, 2006; Sorum, 2006; WHO, 2006; Yousefian and Amiri, 2009). The more an antibiotic is used, the more likely are resistant populations to develop among pathogens. Therefore, the use of such antimicrobials has been questioned and the European Union and USA have implemented bans on, or restricted the use of antibiotics (Kesarcodi-Watson et al., 2008).

Ionophores (such as monensin, lasalocid, laidlomycin, salinomycin and narasin) are antimicrobial compounds that are commonly fed to ruminant animals to improve feed efficiency. These antimicrobials specifically target the ruminal bacterial population and alter the microbial ecology of the intestinal microbial consortium, resulting in increased carbon and nitro-

Table 1
Challenges associated with livestock production.

Effect of livestock on Land	Water	Climate change	Diseases transmitted from livestock to humans	Loss of biodiversity
The livestock sector is by far the world's largest anthropogenic users of land resources, with grazing land and cropland dedicated to the production of the feed representing almost 80% of all agricultural land. Expansion of grazing land for livestock is a key factor in deforestation and about 70% of all grazing land in dry areas is considered degraded, mostly Because of overgrazing, compactionand erosion attributable to livestock activity.	Livestock production also impacts heavily the world's water supply and accounts for about 8% of global water use, mainly for irrigation of feed crops. The livestock sector can harm water quality and is the largest sectoral source of water pollutants principally animal wastes, antibiotics, hormones, chemicals from tanneries, fertilizers and pesticides used for feed crops and sediments from eroded pastures. Poor manure management often contributes to pollution and eutrophication of surfacewaters,groundwater, coastal marine ecosystems and also to the accumulation of heavy metals in soils.	Livestock sector contributes to global climate change by emitting greenhouse gases (carbon dioxide,methane, nitrous oxide) either directly (e.g. from enteric fermentation)or indirectly (e.g. from feed production activities, deforestation to create new pasture etc.) It also generates almost two-thirds of anthropogenic ammonia,which contributes significantly to acid rain and acidification of ecosystems.	Zoonoses can be Transferred from animals to humans via bacteria, parasites, viruses and unconventional agents. The more common and serious zoonoses caused by infectious agents include salmonellosis, swineherds'disease caused by *Leptospira* sp.,brucellosis, Bovine Spongiform Encephalopathy (BSE),the variant Creutzfeldt-Jakob disease (vCJD), Rift Valley Fever (RVF), adult meningitis caused by *Streptococcus sius* and the influenza virus.	Increased livestock production and the resulting habitat change, climate change, overgrazing of land, water and environment pollution have caused loss of biodiversity of the species inhabiting the area other than the livestock, the surrounding species and even that of the livestock itself