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Mini Review

The Effects of Cattle Methane Emissions on Sustainable Agriculture

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Abstract

Greenhouse gases (GHG) are gases in the atmosphere which capture solar radiation to warm the surface of the earth. Increased concentrations of GHGs can significantly warm the surface of the earth, cause "Greenhouse Effect" and change in climatic conditions. The primary agricultural source of greenhouse gases globally is cattle. Livestock animals including cattle generate about 14% of human-induced greenhouse gas emissions that affects climate [1,2]. The main greenhouse gas generated from cattle is methane (CH_4) and it is produced via enteric fermentation from cattle. Methane is part of the biogenic carbon cycle and stays in atmosphere for 12 years. This research report intends to investigate the effects of enteric CH_4 emissions from cattle and mitigating strategies to maintain agricultural sustainability.

Keywords: *Cattle; Greenhouse Gases; Methane Emission; Climate Change; Agriculture; Sustainability*

Introduction

Greenhouse gases (GHG) are gases in the atmosphere which capture solar radiation to warm the surface of the earth [3]. Without GHG, average daily surface temperature on earth would be about minus 2 degrees Fahrenheit rather than its current temperature of about 59 degrees Fahrenheit [4]. Thus, increased concentrations of GHGs can significantly warm the surface of the earth, cause "Greenhouse Effect" and also change in climatic conditions. This change affects many sectors including livestock (farm animals) and agriculture.

The major agricultural source of greenhouse gases is livestock animals. The livestock animals contributes 14.5% of greenhouse gas emissions globally [5] and plays a significant role in climate change and agricultural sustainability.

The main greenhouse gas generated from cattle is methane (CH_4) [6] and it is derived from atmospheric carbon, such as CO_2 and also 28 times more potent than carbon dioxide (CO_2). Furthermore, methane has a relatively short lifetime of 12 years compared to CO_2. After about 12 years, 80 to 89 percent of methane is removed by oxidation with hydroxyl radicals (OH), a process called hydroxyl oxidation [7].

Methane is produced from cattle through enteric fermentation process via belching [8] and it is part of a natural cycle which is known the biogenic carbon cycle [9]. The biogenic cycle centers on the ability of plants to absorb and separate carbon. Plants have the unique ability to remove carbon dioxide (CO_2) from the atmosphere and store that carbon into parts of the plants through photosynthesis. It is the fundamental process of this cycle [10].

Cattle consume plants that are high in cellulose and they digest the carbon that is deposited in cellulose. As a by-product of consuming cellulose, cattle belch out methane and the carbon separated by plants back into the atmosphere. After 10 to 12 years, that methane is broken down and converted back to CO_2. Once it is converted to CO_2, photosynthesis can be performed again and the carbon is fixed back into cellulose. After that, cattle can eat the plants and the cycle begins again.

Discussion

Cattle are considered as the largest contributors to total livestock industry GHG emissions [5].

It should be noted that, if a cattle herd emits the same amount of methane over 12 years, it means they are contributing to global warming for those 12 years. Thus, it is important to implement proper mitigation strategies such as forage digestibility, replacing silage type, feeding legumes, adding dietary supplements are some of the effective strategies to reducing methane emissions from cattle [11].

Conclusion

Implementing proper enteric methane reduction strategies associated with animal agriculture is one of the most important way and to understand potential roles of animal agriculture and fighting climate change.

In light of scientific studies, GHGs can be decreased by cattle implementing proper reduction strategies. Reducing methane emissions and carbon footprint contribute to transform carbon neutral industrial livestock operations in the future. Overall, further investigations needed to adjust climate-specific targets for sustainable agriculture worldwide.

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