



# Policy and Regulatory Frameworks Addressing Methane Emissions in Dairy Farming

Ali Ranjbaranghaleh

Poznań University of Life Sciences, Faculty of Veterinary Medicine and Animal Science, Poland

<https://orcid.org/0009-0008-4722-717X>

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**Abstract**— Currently, there are more than 1 billion cows in the world that produce more than 1.5 billion tons of milk annually. According to the increasing demand for milk consumption in the world, it is predicted that by 2028, the number of these cows will reach more than 1.5 billion. In addition to increasing global warming, animal husbandry plays a significant role in the production of greenhouse gases, including methane\*. Because each dairy cow can produce an average of 400 liters of methane per day. On the other hand, the production of methane in the rumen of animals causes an average loss of 6% of energy in animals\*\*. Therefore, in recent years, strategies and techniques to reduce methane emissions in animal husbandry have attracted the attention of governments, researchers, animal husbandry and environmentally conscious consumers.

**Keywords**— methane emission, animal production, agriculture, dairy farming

## I. OVERVIEW OF CURRENT POLICIES

The European Commission is one of the most important active regulators in the field of reducing methane emissions in animal husbandry. In October 2020, this commission presented its strategy to reduce methane emissions in livestock farming in Europe. In this regard, the European Commission has prepared a list of innovative ways to reduce methane in animal husbandry [3].

Also, in May 2024, the European Union approved a new EU Regulation on methane emissions reduction in the energy sector [4]. The Regulation was first proposed in December 2021 as part of the Fit-for-55 package, following the adoption of the EU Methane Strategy in 2020.

In addition, in different countries, policies, regulations and methods have been prepared and implemented in this regard. In general, the current policies regarding the reduction of methane emissions in animal husbandry are focused on several specific areas, the most important of which are the following:

### 1) Technology

Part of the implemented policies and regulations related to the reduction of methane emissions in animal husbandry is focused on effective and efficient technologies in this field.

One of the efficient technologies presented is the supplementation of organic, mineral and microbial feed additives. This technology can reduce rumen methanogenesis by changing the rumen microbial structure of animals. In this way, the amount of methane emissions will be reduced. However, the use of this technology may cause health and safety issues. Therefore, supplementation technology in practice cannot be a useful solution to reduce methane emissions in animal husbandry [5]. Nevertheless, the relevant regulations in many countries still allow the use of this technology.

### 2) Dietary factors

The focus of many regulations and policies related to reducing methane production in animal husbandry is on the addition of some food ingredients in animal nutrition. For example, new oil-based formulations containing bromoform and asparagopsis have been introduced as a dry feed additive to reduce intestinal methane emissions. In this regard, according to the existing regulations in this field, the amount of asparagopsis used in feeding cows should be 0.2% to 0.5% of their total daily diet. Also, the allowed consumption of bromoform for each animal is in the range of 0.4 to 1 mg/kg per day. In addition, the existing regulations for the efficient implementation of this methane

production reduction policy have also provided regulatory considerations for the safe use of bromoform to reduce methane in livestock. Mainly, these considerations govern the administration of a very low dose of the substance as well as the timing of its administration [6].

Moreover, feeding cows grains and fats, results in reduced methane formation. These food sources produce different digestion products during rumen fermentation. In fact, the products they make serve as a sink for some of the extra hydrogen molecules in a cow's rumen [7].

### 3) Nature-based solutions

Some existing regulations and policies to reduce methane in animal husbandry are based on solutions derived from nature. Trying to change some of the animals' natural behavior can reduce the amount of methane produced in animal husbandry. For example, studies have shown that longer rumination time reduces methane emissions. Therefore, one of the policies used to reduce methane is to increase propionate and decrease acetate and butyrate in the rumen, which can reduce the amount of hydrogen and, as a result, the amount of methane produced. The use of red seaweed can increase the rumination time in livestock and thus reduce the amount of methane production by 20%. The regulations related to this methane emission reduction policy also generally ensure that the red seaweeds used are disease-free. Also, the time and dosage of their use are also important issues in the relevant regulations [8].

The use of phytogetic products is another nature-based solution that can have an effect on the release of methane produced in animal husbandry by checking the intake and digestibility of nutrients by livestock. In fact, the use of phytogetic products has a negative effect on the consumption of nutrients and digestibility, and in this way it will also reduce the amount of methane emissions [9].

In addition to the above specific policies, there are also some general policies and regulations regarding the reduction of methane emissions in animal husbandry. These regulations generally emphasize policies such as cost-effectiveness, efficiency, compatibility with animal welfare standards, and adherence to existing and future environmental laws. Also, it is emphasized in these regulations that the strategies used should not endanger the health and well-being of dairy cows. In fact, the use of different strategies and methods is allowed on the condition that the mentioned items are taken into consideration. Some of the established regulations and policies regarding the reduction of methane emissions in animal husbandry have focused on sustainable development in the agricultural sector as the main goal [10].

In some countries such as Spain, the ruling policy regarding the production of methane gas in animal husbandry is to use

this gas instead of trying to reduce it. In fact, based on this policy, instead of applying different methods to reduce methane gas, the produced methane is used to provide fuel energy needed by livestock farms and farms [11].

## II. EFFECTIVENESS OF REGULATORY MEASURES

Adopting policies based on the use of new technologies to reduce the amount of methane produced in animal husbandry, although it has high efficiency, but it also faces challenges. One of the most important challenges is the relatively high cost of using some technologies and the possibility of creating negative and destructive effects on the health and hygiene of animals.

In addition, the use of policies based on changes in the diet of dairy cows or other livestock also faces risks. First, the error in determining the appropriate dose of additives in feeding livestock may cause them to be poisoned and endanger their health, or it may be ineffective in practice because it is less than the required level. Also, the effects of these additives may change with the change of season. For example, in reference [12], it has been shown that the effectiveness of additives is lower in autumn than in spring. Therefore, their effectiveness is variable and dependent on weather conditions.

Nutrition management strategies have the most effect in reducing greenhouse gases, but this effect is short-term.

The performance of some policies adopted to reduce methane production in animal husbandry is affected by environmental conditions such as air temperature and even the place where animals are kept. Therefore, they cannot be used as a comprehensive and unchanging solution for use in different conditions and in different countries [13]. Therefore, it cannot be ensured that the application of these policies can meet the requirements of international laws regarding the release of pollutants and the number of governments in this regard.

In many policies and methods based on ration supplementation, the efficiency of the methods is very low. For example, although supplementing the diet with fat can reduce the methane produced by cows, the reduction in the amount of methane produced in this method is a maximum of 9% [14].

The policy based on the use of seaweed can reduce the amount of methane production in animal husbandry by 70%. However, it is not possible to obtain this material in all the world. This reduces the effectiveness of adopting this policy in practice.

### III. RECOMMENDATIONS FOR POLICY IMPROVEMENTS

It seems that there is currently an important gap in regulating the allowed amount of methane production. On the other hand, forcing to reduce methane emissions without appropriate regulatory and policy measures is one of the other important challenges in this field. Therefore, providing a global standard for determining the permissible amount of methane production in different environmental conditions is necessary and important, which can improve the performance of plans to reduce emissions of pollutants such as methane.

Adopting fine and tax policies can be a good solution to reduce methane production in animal husbandry. In fact, if livestock farmers are forced to pay taxes or fines for producing and releasing methane, they will use appropriate strategies to reduce methane emissions.

Providing incentive policies and plans to reduce methane emissions can be very beneficial. The only downside is the cost, and it may be possible to create an income stream from other regulatory measures that seek to reduce greenhouse gas emissions.

The proposed Regulations would require monitoring three times per year to identify methane leaks in dairy farming recovery system equipment components. A methane leak is defined as a leak from an equipment component with a methane concentration of 500 parts per million volume (ppmv) or higher.

In adopting policies and developing regulations related to reducing methane emissions, two criteria of effectiveness and cost reduction should be considered as the main criteria.

It is suggested to establish rules and regulations regarding the improvement and breeding of ruminant animals. This can make it possible to compare different breeds of small and large livestock in terms of methane gas production potential and increase the number of bred livestock. In this way, the amount of methane production will decrease in the long term.

It is suggested to adopt policies to increase the nutritional value of low-quality livestock feed. In this way, by knowing the local potentials of different regions of the world, the quality of livestock rations can be improved in such a way that by inhibiting the methanogenic bacteria present in the rumen of livestock, the amount of methane gas emission can be minimized.

It is suggested to create regulations and policies regarding the production of vaccines for the modification of microorganisms in the rumen of animals. In this way, it is possible to reduce the amount of methane production by

supporting the establishment of bacteria and microorganisms in the rumen.

The amount of methane production in animal husbandry depends on environmental conditions such as temperature. Therefore, it is suggested to provide regulations regarding the provision of animal husbandry buildings and facilities with the aim of creating conditions to minimize the amount of methane production.

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