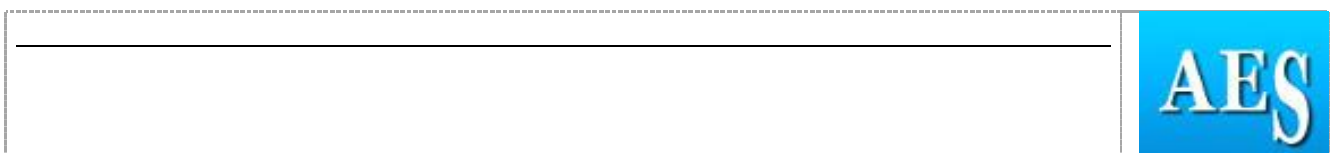# Extended Abstract
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Paper/Poster Title	Public acceptance of feed additives for methane emission reduction in dairy production

Abstract prepared for presentation at the 98th Annual Conference of The Agricultural Economics Society will be held at The University of Edinburgh, UK, 18th - 20th March 2024.

Abstract	200 words max

The reduction of methane emissions from livestock production is a prime issue on policy agendas worldwide. Methane from dairy cows accounts for about 50% of the climate emissions from dairy farms, and 1-2% of greenhouse gas emissions in the EU. Hence, governments are looking for solutions to reduce emissions without reducing food production. Understanding how the public views the adoption of natural and chemical feed additives for methane emission reduction is crucial for the acceptance of new feeding management practices. To this end, the European public response to novel feeding strategies (1) natural: supplementing the feed with algae or seaweed extracts, or plant-based oils or fats and 2) chemical: using 3-NOP feed additive) intended to reduce methane emissions from dairy cows were investigated. The analysis was based on econometric models and survey data with 3,220 participants from four EU member states (Finland, France, Poland and Ireland). The results indicated a significant difference in the acceptance between practices that use natural and chemical feed additives, with European citizens generally being more reluctant to use the latter. Additionally, the analysis showed a negative link between additional information and chemical feed additives. The findings have implications for encouraging broad acceptance of production schemes.

Keywords	Methane emissions, Dairy production, Feeding, Public perception, European Union
JEL Code	Q54, Q18, Q53, D83

Introduction	100 – 250 words

Enteric fermentation in ruminants is a major contributor to greenhouse gas emissions in agriculture, particularly methane. Methane from dairy cows accounts for about 50% of the climate emissions from dairy farms, and 1-2% of greenhouse gas emission in the EU. Given the global demand for ruminant products such as meat and milk, mitigating methane emissions is crucial. Various strategies, including the use of new feed additives, have been proposed to address the issue. For example, incorporating dietary fats, oils, or algae in the feed has demonstrated effectiveness in reducing methane emissions in numerous studies. Furthermore, chemical additives, like the recently approved 3-NOP (3-Nitrooxypropanol) in European Union (EU) member states, offer additional options to curb methane release from dairy cows.

Despite the potential environmental benefits, ethical concerns surround these practices. There is a growing unease among EU citizens regarding the safety and effectiveness of feed additives slated for the EU market. The public is concerned about impacts on animal health, human health, and the environment, emphasizing the importance of transparent and accurate product presentation.

In this study, the public's perceptions of innovative dairy cattle feeding practices and whether these perceptions are influenced by the provision of supplementary explanatory information were examined. Therefore, while accounting for a range of co-varying factors, the relationship between giving European citizens additional information and their willingness to accept novel feeding practices was tested. This information is necessary to formulate policies that are well-informed and successful.

Methodology	*100 – 250 words*

The main goal of our analysis was to explore the relationship between providing additional information to European citizens and their willingness to accept the following innovative feeding practices: i) the use of natural feed additives (i.e. supplementing the feed with algae or seaweed extracts, or plant-based oils or fats) to decrease methane emissions, and ii) the use of chemical feed additives (3-NOP) for the same purpose. The acceptance levels were evaluated in the survey through a 5-point Likert scale. Regression analysis was employed to control for covariates. The complete specification of estimated model is outlined below:

$$Public\ acceptance\ of\ innovative\ practices = \alpha_0 + \alpha_1 Level\ of\ information + \beta X + \varepsilon,$$

where the observed public acceptance of three different innovative practices involving the use of feed additives to reduce methane emissions is the dependent variable and α_1 is the main coefficient of interest, while X represents the control variables. These control variables comprised of socio-demographic characteristics of the participants and their perceptions and preferences that might be associated with the decision to support the use of innovative feeding practices. A series of robustness checks to validate the stability of findings were conducted.

Data used in this analysis were obtained from an online survey conducted in July 2023. The final sample consists of 3 220 citizens from four EU member states (Finland=813, France=803, Ireland=801 and Poland=803 responses).

Results	100 – 250 words

Participants were asked to assess the inclusion of three feed additives designed to reduce methane emissions, namely supplementing the feed with: (1) algae or seaweed extracts; (2) plant-based oils or fats; or (3) chemical additives to reduce dairy cow methane emissions. Public acceptance of these feeding practices was elicited using a 5-point Likert scale (from 1 = strongly disagree to 5 = strongly agree). On average, the public's acceptance of incorporating algae or seaweed extracts (mean of index = 3.09, sd = 1.57) was significantly higher (using a t-test) than the acceptance of adding plant-based oils or fats (mean = 2.98, sd = 1.55). In addition, the value of index measuring the public's acceptance of using chemical feed additive was significantly lower than that of both algae or seaweed extracts and plant-based oils or fats (mean = 2.17, sd = 1.41).

Regression analysis was used to examine the relationship between providing additional information to European citizens and their willingness to accept novel livestock practices. This analysis took into consideration a range of covariates that could potentially be correlated with the public's acceptance of novel practices aimed at reducing methane emissions.

The findings indicated a noteworthy aspect: offering more detailed information to participants during the evaluation of practices involving algae or seaweed extracts and plant-based oils or fats significantly reduced their acceptance. By contrast, when

participants were provided with more details regarding the use of chemical feed additive that aims to lowering enteric methane emissions, their acceptance of it increased. Finally, adding control variables did not affect the significance of these associations.

Discussion and Conclusion | *100 – 250 words*

We study the European public's response to innovative feeding strategies aimed at lowering dairy cow methane emissions. The results revealed a contrast in the acceptance levels between natural and chemical feed additives, with Europeans showing greater reluctance towards the latter.

The effect of providing additional information on the use of natural additives may seem counter-intuitive. However, studies have shown that providing people with more information about a particular issue can have an unintended effect — that is, additional information may make people more critical towards the issue. Moreover, the acceptance of natural interventions was already quite high, so there was little room to increase the acceptance rate. The initial negative perceptions of chemical additives were probably associated with concerns that people tend to have about chemical substances in general. Additional information provided about the measure seemed to change the public's opinion substantially. More comprehensive information helped the public to see the environmental benefits of reducing enteric methane emissions, hence better justifying the use of chemical feed additives and contributing to increased acceptance of their use. This highlights that it is crucial to communicate with citizens in a way that is clear, consistent, and supported by evidence.

The acceptance of policies by the public is a crucial aspect of promoting sustainable farming. Consequently, policymakers should take into account these findings when designing and communicating policies aimed at mitigating greenhouse gas emissions through feeding-related measures.