

# Producer Concerns and Perceptions Regarding the Effect of Methane on Cattle Production and the Environment

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## Summary

*Knowledge of producer concerns and perceptions on methane production from cattle and its impact on the environment is unknown. Therefore, the objectives of this survey were to determine what producers know about methane production by cattle and to determine if different age groups, regions of Nebraska, and production size/type affects producer opinions on enteric methane production and climate change. Producers felt that methane production has little impact on animal performance but were not very confident in their knowledge. Most producers received information related to animal agriculture from veterinarians; therefore, veterinarians should continue to be a major target for extension efforts.*

## Introduction

Recently the environmental impact of beef cattle production and associated methane emissions has been a topic of interest. Methane is a greenhouse gas, with a global warming potential 25 times that of CO<sub>2</sub> (Livestock Science, 130:47–56). Ruminants account for 97% of the total methane produced by domesticated animals and 75% of the methane produced by ruminants is produced by cattle. Estimates suggest that 15–25% of the methane released into the atmosphere comes from domesticated ruminants (Tellus, 38B:271–284). The effect of livestock production on the environment is thought to be a topic that many producers overlook. However, with an increase in social media and popular press addressing climate change and methane issues, this may not be true. Therefore, the objective of this survey was to determine what producers know about methane production by cattle and how it affects the environment in addition to determining if producer age groups, regions of Nebraska, or production

size/type affects producer opinions on climate change and methane.

## Procedure

This survey was conducted by the Nebraska Agricultural Statistics Service who utilized their cow/calf and feedlot database from the 2007 census to determine operation size and the total number of operations in Nebraska. The feedlot operations were selected from the population for sampling first and were then removed from the sampling population prior to sampling beef cow operations. The sample was taken in this manner to eliminate duplication. This resulted in an overall sampling of 3337 randomly selected producers being surveyed.

The survey consisted of 24 multiple-choice and agree/disagree questions regarding the operation (area of Nebraska, operation size/type), producer (age, gender, years in production), and perceptions/knowledge about methane production and climate change. To analyze producer perceptions and knowledge about methane production and climate change, responses were coded numerically. Responses for the agree/disagree questions were coded on a 5-point Likert scale as 1 = Strongly Disagree to 5 = Strongly Agree. Responses for questions regarding confidence level were coded using a four point scale as 1 = “not at all confident”, 2 = “not very confident”, 3 = “somewhat confident” and 4 = “very confident”.

The surveys were first analyzed for completeness to determine if they were valid.

After the valid surveys were identified, they were analyzed using SPSS (IBM Corp; Armonk, NY). To determine if data were normally distributed the Kolmogorov-Smirnov test of normality was performed. Data were not normally distributed, so non-parametric tests were utilized for comparisons and correlations. The survey responses were grouped and analyzed for differences by area of Nebraska as marked by the producer (western, central and eastern) and age of producer (25–49, 50–59, 60–69 and 70+). A non-parametric correlation analysis was also performed to determine if producer responses to the question “I am concerned about climate change” were associated with how they responded to other questions in the survey.

## Results

Survey return rate was 22% with 725 surveys returned out of the 3337 sent out. Survey responses related to producer concerns about the effects of methane production by cattle on the environment and climate change were significantly different by area within the state of Nebraska (western, central and eastern; Table 1). Producers in western NE disagreed more based on the Likert scale ( $P < 0.05$ ) regarding concern about methane production on the environment compared to eastern NE, with responses of central NE producers being intermediate to western and eastern NE. Producers in western Nebraska also disagreed more based on the Likert scale ( $P < 0.05$ ) regarding concern about climate

Table 1. Concern about climate change by area of Nebraska

Question	Area of Nebraska		
	Western (n = 191)	Central (n = 373)	Eastern (n = 151)
I am concerned with the effects of methane production on the environment	2.30 ± 0.99 <sup>a</sup>	2.41 ± 1.0 <sup>ab</sup>	2.63 ± 0.95 <sup>b</sup>
I am concerned about climate change	2.55 ± 1.10 <sup>a</sup>	2.79 ± 1.20 <sup>b</sup>	2.86 ± 1.10 <sup>b</sup>

Note. Five point Likert scale was used with question with 1 = Strongly Disagree to 5 = Strongly Agree  
<sup>ab</sup>Values within the same row with unique superscripts differ  $P < 0.05$

**Table 2. Response based on age of producer**

Question	Producer Age			
	25–49 (n = 129)	50–59 (n = 251)	60–69 (n = 219)	70+ (n = 114)
Methane production impacts animal performance <sup>a</sup>	2.86 ± 0.99 <sup>e</sup>	2.72 ± 0.86 <sup>ef</sup>	2.66 ± 0.88 <sup>ef</sup>	2.47 ± 0.90 <sup>f</sup>
Cattle diet influences methane production <sup>a</sup>	3.64 ± 0.88 <sup>c</sup>	3.45 ± 0.91 <sup>ef</sup>	3.36 ± 0.89 <sup>f</sup>	2.93 ± 1.12 <sup>s</sup>
Concerned with the effects of methane production on the environment <sup>a</sup>	2.53 ± 1.00	2.50 ± 0.98	2.36 ± 1.02	2.30 ± 0.96
I am likely to adopt management practices that research has shown to improve animal performance <sup>a</sup>	3.67 ± 0.94 <sup>e</sup>	3.76 ± 0.96 <sup>e</sup>	3.66 ± 0.91 <sup>e</sup>	3.16 ± 1.12 <sup>f</sup>
I am concerned about climate change <sup>a</sup>	3.08 ± 1.12 <sup>c</sup>	2.82 ± 1.12 <sup>ef</sup>	2.59 ± 1.21 <sup>fg</sup>	2.44 ± 1.11 <sup>s</sup>
The industry should take steps to limit greenhouse gas emissions <sup>a</sup>	2.97 ± 1.03 <sup>c</sup>	2.78 ± 1.04 <sup>ef</sup>	2.61 ± 1.11 <sup>fg</sup>	2.45 ± 1.07 <sup>s</sup>
The government should take steps to limit greenhouse gas emissions <sup>a</sup>	2.19 ± 1.21	2.18 ± 1.1 <sup>e</sup>	2.10 ± 1.09	1.96 ± 1.09
Rank your perception of the impact cattle have on the environment <sup>b</sup>	4.14 ± 0.98 <sup>c</sup>	3.83 ± 1.17 <sup>c</sup>	3.74 ± 1.28 <sup>c</sup>	3.01 ± 1.62 <sup>f</sup>
Confidence in knowledge of methane production in cattle <sup>c</sup>	2.53 ± 0.73	2.51 ± 0.76	2.60 ± 0.82	2.74 ± 0.86
How often did you attend extension meetings in the past three years <sup>d</sup>	2.43 ± 1.51	2.48 ± 1.36	2.47 ± 1.45	2.37 ± 1.47

<sup>a</sup>Five point Likert scale was used with questions with 1 = Strongly Disagree to 5 = Strongly Agree  
<sup>b</sup>Five point scale was used with 1 = Negative Impact to 5 = Positive Impact  
<sup>c</sup>Four point scale was used with 1 = Not confident at all to 5 = Very Confident  
<sup>d</sup>Five point scale was used with 1 = Never attended a meeting to 5 = Attended a meeting more than five times  
<sup>e</sup>Values within rows with unique superscript differ  $P < 0.05$

change compared to both central and eastern NE.

Most producers either strongly disagreed to disagreed (39%) or were neutral (33%) with the statement “I am concerned about climate change”. Responses to questions on methane production by cattle and its effect on the environment, separated by age of producer are presented in Table 2. Younger producers were more neutral about the statement that methane production impacts animal performance ( $P < 0.05$ ) than older producers who were more likely to disagree with this statement. Eighty-four percent of the population sampled fell within the disagree/neutral category, suggesting that current research on methane production in beef cattle has not been well translated to producers. Younger producers agreed with the statement that

cattle diet influences methane production to a greater extent than older producers ( $P < 0.05$ ) who tended to slightly disagree with this statement.

Producers in the youngest three age groups tended to agree concerning the likelihood of adopting new management practices that research has shown to improve animal performance. Although approximately 60% of the entire sample agreed or strongly agreed with this statement; producers over 70 years of age were closer to neutral ( $P < 0.05$ ) compared to other age groups. This could potentially suggest that older producers are reluctant to adopt new management strategies for various reasons. The responses between producer age groups for the statement “government should take steps to limit greenhouse gas emissions” were not different ( $P > 0.05$ ).

About 63% of respondents disagreed or strongly disagreed with the statement that the government should take steps to limit greenhouse gas emissions, with another 25% neither agreeing nor disagreeing.

There was no difference between age groups for the statement “I am concerned about the effects of methane production on the environment” ( $P > 0.05$ ) with 50% selecting disagree or strongly disagree and 37% neither agreeing nor disagreeing to the statement, suggesting that producers are not very concerned about cattle methane production and its contribution to climate change. Younger producers were generally more neutral about the statement “I am concerned about climate change” than were older producers, with statistically significant differences ( $P < 0.05$ ) existing for producers in the youngest and oldest age categories. Producers under 70 years of age felt that cattle have a positive impact on the environment while producers older than 70 years of age were of the opinion that cattle have neither a positive nor negative impact ( $P < 0.05$ ). Across age groups, no significant differences were detected in producer confidence in their knowledge about methane production in cattle ( $P > 0.05$ ). Approximately 44% fell into the not at all to not very confident category, with 45% somewhat confident, and only 11% very confident. Given these low confidence levels regarding knowledge of methane production, this suggests a need for more education to be targeted in this area for producers.

Extension meeting attendance was not different ( $P > 0.05$ ) across age groups with about 50% of producers attending one to three meetings in the past three years (Table 3). Even though the percent of producers never attending an extension meeting was higher than desired, 63% of producers attended at least one meeting in the past three years, which suggests some extension education is being provided to the majority of producers in Nebraska. Frequency of attending extension meetings was positively associated with likelihood to adopt management practices that research has shown to improve animal performance ( $P < 0.01$ ), perception that cattle diet influences methane production, ( $P < 0.05$ ), confidence in knowledge of methane production and management practices that impact methane production in cattle ( $P <$

**Table 3. Extension meeting attendance**

Number of extension meetings attended in past three years (% of producers within age category)	Producer Age			
	25-49 (n = 129)	50-59 (n = 251)	60-69 (n = 219)	70+ (n = 114)
Never	38.8	31.5	37.8	45.5
Once	23.3	25.9	18.0	8.2
Twice	11.6	17.5	18.0	23.6
Three Times	8.5	13.1	12.4	9.1
More than Three Times	17.8	12.0	13.8	13.6

**Table 4. Where producer obtain information about animal agriculture by age**

Where producers go for animal information (% of producers within age category)	Producer Age			
	25-49 (n = 129)	50-59 (n = 251)	60-69 (n = 219)	70+ (n = 114)
Federal Government	0.8	0.8	0.0	0.9
State Government	2.4	0.4	0.9	1.8
University of Nebraska	14.2	18.5	18.4	11.9
Veterinarian	51.2	43.0	43.8	52.3
Other	31.5	38.6	36.9	33.0

**Table 5. Correlations between the question “I am Concerned about climate change” and answers to other survey questions**

Positively Associated	R-value	Negatively Associated	R-value
Methane production impacts animal performance.* <sup>a</sup>	r = 0.294	On a scale from one to five, rank your perception of the impact cattle have on the environment. <sup>b</sup>	r = 0.154
Cattle diet influences methane production.* <sup>a</sup>	r = 0.197	Please indicate how confident you are in your knowledge of methane production of cattle.* <sup>c</sup>	r = 0.290
I am concerned with the effects of methane production on the environment.* <sup>a</sup>	r = 0.546	Please indicate how confident you are in your knowledge of management practices that impact methane production in cattle.* <sup>c</sup>	r = 0.274
I am likely to adopt management practices that research has shown improve animal performance.* <sup>a</sup>	r = 0.148	Please indicate how confident you are in your knowledge of climate change? <sup>*c</sup>	r = 0.310
I should take steps to limit greenhouse gas emissions.* <sup>a</sup>	r = 0.711	Which of the following describes your current age? <sup>*d</sup>	r = 0.181
The industry should take steps to limit greenhouse gas emissions.* <sup>a</sup>	r = 0.690		
The government should take steps to limit greenhouse gas emissions.* <sup>a</sup>	r = 0.564		

\*correlation is significant  $P < 0.01$

<sup>a</sup>Five point Likert scale was used with questions with 1 = Strongly Disagree to 5 = Strongly Agree

<sup>b</sup>Five point scale was used with 1 = Negative Impact to 5 = Positive Impact

<sup>c</sup>Four point scale was used with 1 = Not confident at all to 5 = Very Confident

<sup>d</sup>Age range options were 25 or younger, 26-29, 30-39, 40-49, 50-59, 60-69, 70-79 and 80 or older

0.01), and confidence in knowledge of climate change ( $P < 0.01$ ). These positive associations provide evidence that extension meeting attendance increased the knowledge level of producers, or at least producer perception of their knowledge level on methane production, cattle performance, and climate change.

About 45% of respondents, regardless of age, obtain information about animal agriculture from their veterinarian (Table 4), stressing the importance of sharing current research with veterinarians so they can pass it on to producers. The second most popular source of information fell into the “other” category (36%). If producers marked the other category, they were asked to comment on where they received their information. The other category consisted of magazines (n = 41) followed by consultants (n = 21), friends, family and neighbors (n = 8), feed companies/representatives (n = 6) and the internet (n = 5). The University of Nebraska-Lincoln (UNL) was responsible for getting information directly to about 16% of producers and state and federal government provided 2% of producers with information.

Correlations between how producers responded to the statement “I am concerned about climate change” and their responses to other questions in the survey are presented in Table 5. There was a positive association ( $r = 0.711$ ,  $P < 0.01$ ) between how producers answered if they were concerned about climate change and the question “I should take steps to limit greenhouse gas emissions”. This suggests that producers who were concerned about climate change were also likely to consider taking steps to limit greenhouse gas emissions and vice versa. There were also positive correlations ( $P < 0.01$ ) between concern about climate change and agreement that the industry ( $r = 0.690$ ) and government ( $r = 0.564$ ) should take steps to limit greenhouse gas emissions, as well as concern with the effects of methane on the environment ( $r = 0.546$ ). Producer age, however, was negatively associated ( $P < 0.01$ ) with being concerned about climate change ( $r = 0.181$ ) suggesting that older producers tend to be less concerned about climate change than younger producers. There were also negative associations ( $P < 0.01$ ) between producer confidence in their knowledge of methane production in cattle

and climate change ( $r > 0.29$ ). This suggests that producers who are unconcerned with climate change also tend to be confident in their knowledge about methane production and climate change.

The survey results show that methane production by cattle and climate change are not major concerns for producers. Producers feel methane production has little impact on animal performance but are not very confident in their knowledge on this subject suggesting universities and extension needs to find more effective methods of reaching producers with the results of current research. Most producers received

information related to animal agriculture from veterinarians; therefore, veterinarians should continue to be a major target for extension efforts

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