



Survey of feedlot nutritionists gives insight on information-seeking behavior

Emma Rients,  Allison VanDerWal, Daniel Loy, Mary Reynolds, and Stephanie Hansen¹

Department of Animal Science, Iowa State University, Ames, IA 50011, USA

¹Corresponding author: slhansen@iastate.edu

ABSTRACT

Nutrition critically affects feedlot cattle health and growth, and ultimately cost of production. Feedlot producers rely on professionals such as nutritionists, extension educators, feed company representatives, and others to assist them in developing the best nutritional program for their operation. In turn, these professionals depend on feedlot nutrition research to drive decisions for their clients. A survey of feedlot professionals was conducted regarding how published resources are used. Surveys were included in the spring 2020 mailing to potential Plains Nutrition Council meeting attendees; 61 surveys were returned. The objective of this survey was to aid feedlot nutrition researchers to make more informed decisions when publishing new research to maximize impact on the feedlot industry. The survey asked 15 questions regarding the participant's career, professional organization memberships, frequency and intentions of using research, and ranking the importance of resources, peer-reviewed journals, and learning platforms. Survey respondents primarily served the Midwest and Plains regions (83.1%) with employment by feed companies (34.4%), private consulting firms (21.3%), other aspects of feedlot production (26.2%), or were self-employed (18%). Survey participants found great importance in peer-reviewed journals, though the relevance of peer-reviewed journals sometimes differed due to the professional age of respondents. The main strategies for accessing journals were via society memberships and through open access; utilizing open access publishing may increase the number of industry professionals reached. Looking to the future, we may see a shift in resources used by industry professionals due to the differences seen in preferences of early and late career survey participants, specifically increases in the use of technology-based platforms. These data may inform feedlot researchers on the information-seeking behaviors of feedlot professionals, such as the importance of publishing data in open access formats, allowing for greater impact through increased utilization of newly published research.

Key words: feedlot nutritionists, information seeking behavior, survey

INTRODUCTION

Researchers are constantly generating new information regarding nutritional strategies, technologies, and other timely strategies to improve feedlot cattle production and efficiency. It is important that this information reaches producers quickly if research advances are to be adopted by the industry. Feedlot managers may depend on a variety of professionals, including extension specialists, feed and health company representatives, independent consultants, and others, to learn about the latest research advances. Data regarding feedlot nutrition and management can be found in peer-reviewed journals, university-published reports, and extension materials. Accessing these materials may be through open access or behind a paywall. Additionally, feedlot professionals may prefer certain types of publications based on previous experience or training.

To the authors' knowledge, the information-seeking behavior of feedlot professionals has not previously been studied. Studies in other industries, such as specific fields of academia and medicine, suggest factors such as professional age and accessibility of documents determine how professionals acquire information in their field (Stinson and Mueller, 1980; Rupp-Serrano and Robbins, 2013). Understanding the information-seeking behavior of feedlot professionals may help feedlot researchers make better-informed decisions when publishing research to reach their intended audience.

Therefore, a survey of feedlot nutritionists was conducted to understand the information-seeking behavior of feedlot professionals. The objective of this survey was to determine where feedlot professionals are looking for feedlot research data to help nutrition researchers make more informed decisions when publishing new research to maximize impact on the feedlot industry.

MATERIALS AND METHODS

In consultation with the Iowa State University Institutional Review Board (IRB), it was determined this work was exempt from further IRB review.

Survey Distribution and Response

Paper surveys were included in the spring 2020 mailing to potential attendees ($n = 550$) of the Plains Nutrition Council Meeting. Surveys could be completed by hand and returned via United States Postal Service (USPS) or on an online survey platform (Qualtrics, Provo, UT). Survey response was 11%. Sixty-one completed, anonymous responses were received; 7 via the online survey platform and 54 handwritten responses.

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Survey Questions

The survey consisted of 15 questions regarding the participant's career and professional membership information (6 questions), frequency and intentions of using research (2 questions), and ranking of the importance of resources, peer-reviewed journals, and learning platforms (7 questions). Respondents were also given space to write in other resources they found valuable. For questions asking participants to rank a resource, peer-reviewed journal, or learning platform, a scale of 1 to 5 was used, with one being least important and five being most important. There was a difference in the wording describing these scales between the online and paper surveys that went unnoticed before distribution. The paper survey only had wording describing the numbers for the first and last number, as "not important" and "very important," respectively. The online survey used wording describing all numbers from 1 to 5, as "not important at all," "slightly important," "moderately important," "very important," and "extremely important," respectively. During analysis, ratings were used by value no matter the survey platform, due to the low percentage of responses via the online platform. A rating of 1 was considered "not important," 2 and 3 considered "slightly important," and 4 or 5 considered "very important."

Before survey distribution, questions were edited by the Center for Survey Statistics and Methodology at Iowa State University (Ames, IA).

Data Handling and Analysis

Handwritten and online survey responses were compiled and organized in Microsoft Excel (Microsoft, Redmond, WA). After initial organization, a codebook was created, and data were coded for analysis. Open text responses for membership and meeting attendance questions were coded if more than three participants indicated the same organization or meeting. Other open text responses were not coded. Data were sorted and analyzed in SAS 9.4 (SAS Institute, Cary, NC). Data were analyzed using PROC FREQ for the number of respondents within each question and as the percentage of responses for all survey participants and within professional age group. For main effects, data were analyzed using PROC SURVEYFREQ with chisq, the *F*-test statistics are reported. Percentage of a population was used for analysis within a population and used in PROC GENMOD. Data reported are percentages calculated in PROC FREQ. Statistical significance was designated as $P \leq 0.05$. Incomplete surveys and unanswered questions were not used in data analysis.

RESULTS AND DISCUSSION

Demographics

There were 61 survey responses and respondent demographics are shown in Table 1. The primary area of service for 88.5% of participants was the Midwest and Plains regions (Nebraska, Colorado, Iowa, South Dakota, North Dakota, Minnesota, Wisconsin, Illinois, Ohio, Indiana, Kansas, Texas, Oklahoma, and New Mexico), which is not surprising considering 83.1% of U.S. feedlots are in Texas, Nebraska, Kansas, Colorado, and Iowa (USDA, 2021). Participants' employment included 34.4% at a feed company, 21.3% at a private consulting firm, 18% were self-employed, and 26.2% indicated other or did not answer this question. Those indicating other employment also had the

Table 1. Demographic information of survey participants

	Count ¹	Percentage ²
Postal service responses	54	88.5
Online responses	7	11.5
Total	61	100
Employer		
Feed company	21	34.4
Private consulting firm	13	21.3
Other	13	21.3
Self employed	11	18
Feed company and private consulting firm	1	1.6
University	1	1.6
No response	1	1.6
Professional age		
1 to 15 years (early-career)	26	42.6
16 to 25 years (mid-career)	11	18
26+ years (late-career)	24	39.3
Highest degree		
Bachelor	1	1.6
Master	12	5.1
Ph.D. or other professional degree	48	78.7
Degree area		
Animal science	28	45.9
Nutrition	25	41
Nutrition and animal science	3	4.9
Other	5	8.2

¹The number of responses.

²The percent of responses.

opportunity to list their employment; responses included animal health companies, grain production companies, and in-house feedlot management.

Participants were asked to indicate their years of experience. Participants with 1 to 15 years of experience are referred to as early-career, consisting of 42.6% of survey respondents. Eighteen participants (29.5%) had 16 to 25 years of experience and are referred to as the mid-career population. The population referred to as late-career has 26 or more years of experience and makes up the remaining 24% of the survey population. All but one survey participant indicated having a graduate or other professional degree, with all but five participant's degrees being in animal science or nutrition.

To better understand the motives for seeking feedlot nutrition research results, we asked participants to indicate if they primarily were actively looking for new science or troubleshooting a problem. These responses were evenly split, with 45.9% indicating "actively looking for new science" and 44.3% indicating "troubleshooting a problem," with 9.8% of participants choosing both.

Preferences of Resource Type

Feedlot industry professionals have many resources available to learn about advances in feedlot nutrition. We asked participants to rank the importance of university research reports, extension factsheets, magazine articles, peer-reviewed articles, peers and coworkers, and direct contact with

researchers (e.g., calling an expert directly with an inquiry). Rankings of these resources are shown in Table 2.

Peer-reviewed journals and university research reports were highly valued by this community, with no participants ranking them as not important. For peer-reviewed journals, 88.3% of participants indicated they were very important and 11.7% indicated slightly important. University research reports were also highly valued by participants, with 67.2% indicating very important and 32.8% ranking slightly important. Both peer-reviewed journal articles and university research reports provide detailed data and research studies. These resources have many similarities regarding content; however, university research reports are published by the university, often more quickly than journal articles, and the review process may differ between institutions. These resources may also be considered particularly valuable by feedlot professionals because of the review process. Both resources allow industry professionals to gather data quickly and determine if the information may be helpful to the feedlot producers they serve. In other studies of information-seeking behavior, specifically within faculty of education and health

sciences, peer-reviewed journals are also of high importance (Rupp-Serrano and Robbins, 2013; De Groote et al., 2014; Inman et al., 2019). The current survey participants have a similar education level to those in faculty positions, with almost all survey participants having a graduate or professional degree. Peer-reviewed publications and university research reports may be familiar because participants most likely have published their own research during their education or if involved in research in their current role. Peer-reviewed journal articles may be easier to access as well, leading to the increase in “very important” rankings due to better indexing and many articles from various institutions being published in the same journals. University research reports may be more poorly indexed resulting in more difficulty and time needed to find information through these sources.

It is also clear that contact with peers, coworkers, and researchers (e.g., emailing or calling a university professional directly) is another important resource to feedlot industry professionals. For peers and coworkers as a resource, 78.8% of participants indicated very important, 19.6% indicated

Table 2. Respondents' rating of resources, peer reviewed journals, journal access, and learning platform types

	Percent of responses				P-value
	Respondent count ¹	Not important ²	Slightly important ³	Very important ⁴	
Resource					
Peer reviewed journals	60	0.0	11.7	88.3	0.01
Peers and coworkers	61	1.6	19.6	78.8	0.01
University research report	61	0.0	32.8	67.2	0.01
Directly contact researcher	61	3.3	34.4	62.3	0.01
Extension factsheets	61	13.1	62.3	24.6	0.01
Magazine articles	61	29.5	65.6	4.9	0.01
Peer reviewed journals					
Journal of Animal Science	60	0.0	15.0	85.0	0.01
Journal of Dairy Science	58	17.2	43.1	39.7	0.04
Translational Animal Science	55	30.9	34.5	34.5	0.93
Animal Feed Science and Technology	58	15.5	53.4	31.0	0.01
Canadian Journal of Animal Science	56	25.0	46.4	25.6	0.11
Journal of Nutrition	55	14.5	67.3	18.2	0.01
Animal	50	36.0	52.0	12.0	0.01
Livestock Science	54	37.0	54.9	11.1	0.01
Journal access					
Open access	60	5.0	13.3	81.7	0.01
Membership/subscription	60	10.0	40.0	50.0	0.01
Learning platforms					
In person meetings	60	3.3	15.0	81.6	0.01
Continuing education program	60	18.3	40.0	41.7	0.05
Webinars	61	11.5	49.2	39.3	0.01
Meetings with continuing education credits	61	26.2	45.9	27.9	0.12
Home study	60	33.3	40.0	26.7	0.45
Short course	60	23.3	51.7	25.0	0.01
Formal certification program	60	40.0	50.0	10.0	0.01

¹The number of participants who answered the question in the survey.

²Percentage of participants indicating 1 on a scale of 1 to 5.

³Percentage of participants indicating 2 or 3 on a scale of 1 to 5.

⁴Percentage of participants indicating 4 or 5 on a scale of 1 to 5.

slightly important, and 1.6% indicated not important. For direct contact with a researcher, 62.3% indicated very important, 34.4% indicated slightly important and 3.3% indicated not important. Because contact with peers, coworkers, and researchers is important to this group, it may also be assumed that relationships built during the sharing of information are also important. These relationships may make the knowledge shared between peers, coworkers, and researchers considered more trustworthy, like peer-reviewed journal articles and university research reports.

The final two categories of resources, extension factsheets and magazine articles, had the lowest percentage of very important ratings, with 24.6% and 4.9% for extension factsheets and magazine articles, respectively. There were 62.3% and 65.6% of slightly important ratings, respectively. While these categories are not ranked as highly among survey participants, these resources are a starting point to learn about a new topic but may not provide the data and detail feedlot professionals need to make informed decisions for their clients. In addition, these may be resources professionals write themselves or can use with producers to help them better understand a topic without overwhelming them with data.

Feedlot professionals may use the National Academies of Sciences, Engineering, and Medicine Nutrient Requirements of Beef Cattle (NASEM, 2016) as a reference for developing and implementing nutritional programs for beef cattle. Our survey asked participants to indicate the importance of the beef cattle nutrient requirements book (NASEM, 2016 or earlier editions; Table 3). For using this resource to “understanding nutrient requirements,” responses included 78.3% as very important, 20% slightly important, and 1.7% not important. As it relates to “learning or teaching general ruminant nutrition information,” participants ranked this resource as very important (60%), or slightly important (31.7%), with 8.3% selecting not important. The beef cattle nutrient guidelines synthesize data from many studies and sources to make general recommendations on how to feed and manage today’s cattle. This survey indicates these guidelines are highly valued by feedlot professionals, and future revised editions of the book will be important to optimizing feedlot cattle production in the United States.

Further examining the importance of resources, we examined participant rankings when divided into professional age populations, reflecting how many years of feedlot consulting experience a participant indicated. There was

professional age by resource rank interactions for all resources except peer-reviewed journals and directly contacting a researcher (age \times rank $P \geq 0.41$; Table 4). These resources were already highly ranked and are important to all professional age populations.

Other highly ranked resources with professional age interactions were university research reports and peers and coworkers (age \times rank $P = 0.01$). All professional age groups highly ranked university research reports. However, the mid and early-career professionals emphasized their importance, with a greater percentage of the populations ranking extremely important compared to late-career. Peers and coworkers were also highly ranked overall, with only early-career indicating any response in the not important category. This may reflect a more developed network of resources for mid and late-career professionals compared with early-career.

For extension factsheets, slightly important was the most common response for all ages, but early and mid-career groups had a lesser percentage indicate not important compared to the late-career professionals ($P = 0.01$). Similarly, for magazine articles, the early career professionals have a lesser percentage indicating not important ($P = 0.01$). Early and mid-career professionals may find these more general resources more important because they are still learning some feedlot nutrition basics. In contrast, late-career professionals most likely do not see the need for these resources as their experience allows for expertise that may surpass the information in the articles and factsheets.

There was a professional age by rank interaction for using the beef cattle requirements guide as a learning or teaching tool where more early career professionals indicated very important compared to late-career individuals ($P = 0.01$). There were tendencies for an interaction between age and importance for using the beef nutrients guide for understanding nutrient requirement where all age groups had the largest percentage indicate very important, and with slight differences in the percentages for slightly important and not important categories ($P = 0.07$). The slight differences in how populations use NASEM could indicate professionals in early and mid-career are continuing to seek information on the standards in management and requirements, while the more experienced population may already feel comfortable with their grasp of information in this book, or they may have private information they consider more accurate than the current beef cattle nutrients guide.

Table 3. Percentage of survey participants rank the use of National Recommendations for Beef Cattle (NASEM 2016 or earlier versions)

	Percentage of responses			P-value
	Not important ¹	Slightly important ²	Very important ³	
To understand nutrient requirement(s)	1.7	20.0	78.3	0.01
For learning or teaching general information	8.3	31.7	60.0	0.01

¹Percentage of participants indicating 1 on a scale of 1 to 5.

²Percentage of participants indicating 2 or 3 on a scale of 1 to 5.

³Percentage of participants indicating 4 or 5 on a scale of 1 to 5.

Preferences of Peer-Reviewed Journals

Participants were asked to rank common animal science journals on their importance for accessing beef nutrition information (Table 2). The Journal of Animal Science was highly ranked, with 85% of participants indicating very important and the remaining 15% indicating slightly important. Other journals ranked with very, and slightly important ratings, respectively, include Journal of Dairy Science (39.7%, 43.1%), Translational Animal Science (34.5%, 34.5%), Animal Feed Science and Technology (31%, 53.4%), Canadian Journal of Animal Science (25.6%, 46.4%), Journal of Nutrition (18.2%, 67.3%), and Animal and Livestock Science (11.1%, 54.9%). These journals overall had fewer very important ratings and many slightly important ratings, indicating survey participants may use a variety of journals. However, the Journal of Animal Science

Table 4. Respondents' rating of resource types within professional age group

Percentage of career group									P-values		
Early-career ¹			Mid-career ¹			Late-career ¹			Age	Rank	Age × rank
Not important ²	Slightly important ³	Very important ⁴	Not important ²	Slightly important ³	Very important ⁴	Not important ²	Slightly important ³	Very important ⁴			
Peer reviewed journals											
0.0	11.5	88.5	0.0	9.1	90.9	0.0	13.0	87.0	0.79	0.01	0.67
Peers and coworkers											
3.9 ^c	11.5 ^c	84.6 ^a	0.0 ^c	9.1 ^c	90.9 ^a	0.0 ^c	33.3 ^b	66.7 ^a	0.73	0.01	0.01
University research reports											
0.0 ^c	26.9 ^d	73.1 ^{ab}	0.0 ^c	12.1 ^d	81.8 ^a	0.0 ^c	45.8 ^c	54.2 ^{bc}	0.99	0.01	0.01
Directly contact a researcher											
3.9	38.5	57.7	0.0	27.3	72.7	4.2	33.3	62.5	0.83	0.01	0.41
Extension factsheet											
7.7 ^d	61.5 ^{ab}	30.8 ^c	0.0 ^d	81.8 ^a	18.2 ^c	25.0 ^c	54.3 ^b	20.8 ^c	0.36	0.01	0.01
Magazine articles											
11.5 ^c	80.8 ^a	7.7 ^c	45.5 ^b	45.5 ^b	9.1 ^c	41.7 ^b	58.3 ^{ab}	0.0 ^c	0.25	0.01	0.01
Use of NASEM (2016 or earlier editions)											
For learning or teaching											
0.0 ^d	30.8 ^b	69.2 ^a	20.0 ^c	10.0 ^c	70.0 ^a	12.5 ^c	41.7 ^b	45.8 ^b	0.61	0.01	0.01
For understanding a nutrient requirement											
0.0 ^z	19.2 ^y	80.8 ^x	0.0 ^z	10.0 ^{yz}	90.0 ^x	4.2 ^z	25.0 ^y	70.8 ^x	0.66	0.01	0.07

¹Early-career: 1–15 years of experience; Mid-career: 16–25 years of experience; Late-career: 26+ years of experience.

²Percentage of participants indicating 1 on a scale of 1 to 5.

³Percentage of participants indicating 2 or 3 on a scale of 1 to 5.

⁴Percentage of participants indicating 4 or 5 on a scale of 1 to 5.

^{a,b,c}Within row, means with unlike superscripts differ $P < 0.05$.

^{x,y,z}Within row, means with unlike superscripts differ $0.1 \leq P < 0.05$.

is the main source of peer-reviewed journals for feedlot industry professionals.

One journal was omitted from the paper copy of the survey due to a printing error. Applied Animal Science, formerly Professional Animal Scientist, was included in the online survey, where 83.3% ranked it as a very important journal. Eleven written survey participants also included Applied Animal Science as a journal they regularly use.

We further examined how professional age interacts with journal preference, with all journals offered in the survey having a professional age by rank interaction (Table 5; $P \leq 0.02$). Overall, early-career professionals ranked journals higher than mid and late-career professionals, especially for journals that have been publishing regularly for fewer years. For example, Translational Animal Science was first published in 2017, and 41.7 and 45.8% of the early-career population ranked it as slightly or very important, respectively. The mid-career population also had high percentages indicate slightly important (50%) and very important (20%) for Translational Animal Science. However, the late-career professionals mostly found it to be not important (52.4%), with 19 and 28.6% indicating slightly and very important, respectively.

Similarly, Animal was first published in 2007 and 62.5 and 16.7% of the early-career population found it slightly or very important, respectively. Mid-career also had a large percentage indicate slightly important (50%). However, the late-career professionals largely indicated Animal was not important (55.6%), and only one participant in this professional age group indicated very important. These interactions may be a function of the experience each of these age groupings

has had with peer-reviewed journals. Late career professionals may have been trained in an era where journals were physically printed and available with a subscription, potentially leading them to use more established journals in their search for feedlot research. Early-career professionals may have been trained in a period with wider journal access via the internet and open access journals. They have had access to a greater variety of journals for their entire career and may have less loyalty to a specific journal.

With the advent of many new animal science journals in recent years and the expansion of opportunities for academics to publish their research as open access (meaning freely available to anyone, regardless of subscription status) we asked participants to rank the importance of open access or traditional subscription-based journal access. There was a preference for open access, with 81.7 and 13.3% ranking very and slightly important, respectively and 5% indicating it was not important. Subscription or membership-based access were ranked as very (50%) and slightly important (40%). Open access article publishing charges vary widely (Solomon and Björk, 2012), and funding these article processing charges is considered a major barrier to open access publishing (Dallmeier-Tiessen et al., 2011). It is estimated at least 28% of scholarly literature is published open access (Piwowar et al., 2018). Today, almost any physical journal is also published online, with some journals available only in an online format. Both resources are important to feedlot professionals, but there is a preference for open access. Open access journals have also had a greater citation impact than traditional access journal articles (Kousha and

Table 5. Respondents' rating of peer reviewed journals and journal access within professional age group

Percentage of career group									P-values		
Early-career ¹			Mid-career ¹			Late-career ¹			Age	Rank	Age × rank
Not important ²	Slightly important ³	Very important ⁴	Not important ²	Slightly important ³	Very important ⁴	Not important ²	Slightly important ³	Very important ⁴			
Journal of Animal Science											
0.0 ^e	4.0 ^d	96.0 ^a	0.0 ^e	9.1 ^d	90.9 ^{ab}	0.0 ^e	29.2 ^c	70.8 ^b	0.99	0.01	0.01
Journal of Dairy Science											
0.0 ^d	52.0 ^a	48.0 ^{ab}	20.0 ^c	30.0 ^c	50.0 ^{ab}	34.8 ^b	39.1 ^{ab}	26.1 ^c	0.72	0.66	0.01
Translational Animal Science											
12.5 ^c	41.7 ^{ab}	45.8 ^a	30 ^{bc}	50.0 ^a	20.0 ^c	52.4 ^a	19.0 ^c	28.6 ^{bc}	0.89	0.32	0.01
Animal Feed Science and Technology											
3.9 ^d	65.4 ^a	30.8 ^{bc}	22.2 ^c	44.4 ^{ab}	33.3 ^c	26.1 ^c	43.5 ^b	30.4 ^{bc}	0.05	0.01	0.01
Canadian Journal of Animal Science											
4.2 ^e	58.3 ^a	37.5 ^b	44.4 ^{ab}	22.2 ^c	33.3 ^{bc}	39.1 ^b	14.5 ^d	17.4 ^c	0.10	0.01	0.01
Journal of Nutrition											
8.0 ^c	72.0 ^a	20.0 ^b	11.1 ^c	66.7 ^a	22.2 ^b	23.8 ^b	61.9 ^a	14.3 ^c	0.56	0.01	0.02
Animal											
20.8 ^c	62.5 ^a	16.7 ^c	37.5 ^b	50.0 ^a	12.5 ^{cd}	55.6 ^{ab}	38.9 ^b	5.6 ^d	0.49	0.01	0.01
Livestock Science											
16.7 ^{bc}	75.0 ^a	8.3 ^c	22.2 ^b	55.6 ^a	22.2 ^b	66.7 ^a	23.8 ^b	9.5 ^c	0.18	0.01	0.01
Type of Journal Access											
Traditional Access											
16.0 ^b	24.0 ^b	60.0 ^a	0.0 ^b	54.5 ^a	45.5 ^a	8.3 ^b	50.0 ^a	41.7 ^a	0.69	0.18	0.01
Open Access											
12.0	12.0	76.0	0.0	9.1	90.9	0.0	16.7	83.3	0.62	0.01	0.47

¹Early-career: 1–15 years of experience; Mid-career: 16–25 years of experience; Late-career: 26+ years of experience.

²Percentage of participants indicating 1 on a scale of 1 to 5.

³Percentage of participants indicating 2 or 3 on a scale of 1 to 5.

⁴Percentage of participants indicating 4 or 5 on a scale of 1 to 5.

^{a,b,c} Within row, means with unlike superscripts differ $P < 0.05$.

^{x,y,z} Within row, means with unlike superscripts differ $0.1 \leq P < 0.05$.

Abdoli, 2010). With a greater citation impact, the article is more likely to reach a larger audience more quickly. New technologies and feeding strategies published via open access may be implemented sooner, significantly impacting the feedlot industry.

There was an age by rank interaction ($P = 0.01$) for the importance of traditionally accessed journal articles where all age groups found these articles very important, but early-career professionals had a greater percentage of not important and slightly important ratings compared to mid and late-career professionals. There was no age by rank interaction ($P = 0.47$) for open access, further showing it is especially important to all professional age groups.

Preferences of Learning Platforms

Survey participants were asked to rank the importance of in-person meetings, continuing education programs, webinars, meetings with continuing education credits, home study programs, short courses, and formal certification programs (Table 2). Ranked highest among these resources were in-person meetings, with 81.6 and 15% indicating very important and slightly important, respectively. Other highly ranked platforms included continuing education programs and webinars. Other platforms may still have importance within the industry but are not considered as crucial as

in-person meetings, continuing education programs, and webinars.

Once again, we were interested in examining differences in importance ratings based on professional age. There was no interaction for professional age and rank for home study programs and in-person meetings (Table 6; $P \geq 0.38$). There was an interaction between professional age and rankings for the importance of webinars ($P = 0.01$), where in general, early and mid-career professionals were more favorable toward webinars than late-career. A study of early and late-career professionals from various industries found both populations perceived younger generations or early-career professionals as more comfortable with technology-based training, such as webinars (Urlick, 2017). This study also found late-career interviewees were more comfortable with on-the-job training than instructor-led training (Urlick, 2017). This could explain the slight differences in continuing education programs where late-career professionals rank this platform more important than early and mid-career professionals ($P = 0.01$). Continuing education programs, similar to meetings, are potentially more hands-on and preferred by late-career professionals (age × rank $P = 0.01$). In years to come, researchers may see a difference in how communication with professionals occurs as the late-career population retires and technology becomes even more important in communicating with feedlot nutritionists.

Table 6. Respondents' rating of types of learning platforms within professional age group

Percentage of response within age group									P-values		
Early-career ¹			Mid-career ¹			Late-career ¹			Age	Rank	Age × rank
Not important ²	Slightly important ³	Very important ⁴	Not important ²	Slightly important ³	Very important ⁴	Not important ²	Slightly important ³	Very important ⁴			
In person meeting											
0.0	11.5	88.5	0.0	18.2	81.8	8.7	17.4	73.9	0.63	0.01	0.50
Continuing education program											
23.1 ^d	46.2 ^{ab}	30.8 ^{bc}	27.3 ^{cd}	27.3 ^{cd}	45.5 ^{ab}	8.7 ^e	39.1 ^{abc}	52. ^a	0.39	0.01	0.01
Webinar											
7.7 ^c	46.2 ^{ab}	46.2 ^a	9.1 ^c	27.3 ^b	63.6 ^a	16.7 ^{bc}	62.5 ^a	20.8 ^b	0.80	0.01	0.01
Meeting with continuing education credits											
19.2 ^d	57.7 ^a	23.1 ^{cd}	36.4 ^b	45.5 ^{ab}	18.2 ^d	29.1 ^{bcd}	33.3 ^{bc}	37.5 ^b	0.73	0.01	0.01
Home study program											
32.0	36.0	32.0	36.4	36.4	27.3	33.3	45.8	20.8	0.94	0.02	0.38
Short course											
8.0 ^c	60.0 ^a	32.0 ^b	36.4 ^b	36.4 ^b	27.3 ^{bc}	33.3 ^b	50.0 ^{ab}	16.67 ^c	0.25	0.01	0.01
Formal certification program											
38.5 ^{ab}	50.0 ^{ab}	11.5 ^c	54.6 ^a	36.4 ^b	9.1 ^c	34.78 ^b	56.5 ^a	8.7 ^c	0.88	0.01	0.04

¹Early-career: 1–15 years of experience; Mid-career: 16–25 years of experience; Late-career: 26+ years of experience.

²Percentage of participants indicating 1 on a scale of 1 to 5.

³Percentage of participants indicating 2 or 3 on a scale of 1 to 5.

⁴Percentage of participants indicating 4 or 5 on a scale of 1 to 5.

^{a,b,c} Within row, means with unlike superscripts differ $P < 0.05$.

^{x,y,z} Within row, means with unlike superscripts differ $0.1 \leq P < 0.05$.

Table 7. Professional organization membership and meetings regularly attended by survey participants

Organization ¹	Count ²
ASAS	46
ARPAS	30
PNC	16
No response	7
ADSA	5
NCBA	4
TCFA	3
No membership	2
Meetings	
PNC	55
ASAS sectional	12
ASAS	9
Husker Nutrition Conference	7
No response	4
High Plains Nutrition	2
NCBA	2

¹American Society of Animal Science (ASAS); American Registry of Professional Animal Scientists (ARPAS); Plains Nutrition Council (PNC); American Dairy Science Association (ADSA); National Cattlemen's Beef Association (NCBA); Texas Cattle Feeder's Association (TCFA).

²Number of participants listing the organization they are members of or meeting they regularly attend.

Meeting Attendance and Professional Organization Membership

Participants were asked to list two meetings they regularly attend. Four participants did not list any meetings, and all

meetings may not be represented as some participants may regularly attend more than two meetings (Table 7). Meetings listed included Plains Nutritional Council (PNC), National American Society of Animal Science (ASAS), sectional ASAS, Husker Nutrition Conference, High Plains Nutrition, university, and regional conferences. Since the survey was sent to potential attendees of the PNC meeting, it is not surprising that 55 participants regularly attend PNC meetings. However, it is interesting to consider the low attendance at sectional and national ASAS meetings, with 12 and 9 participants reporting attendance, respectively, when 46 survey participants are ASAS members. Some comments on surveys may give insight on the reasoning behind decreased attendance at professional society meetings:

Schedules are tight, so it is best to find ways to learn via webinars or find meetings with good applied content that is covered in a short amount of time.

...costs of professional society meetings- cost/return has been declining for years.

Even though the population may be skewed because of who the survey was distributed to, it is interesting to consider the importance of shorter, more applied and feedlot-focused meetings like PNC to industry professionals instead of the longer and potentially less applied meetings like national and sectional ASAS, that also have a broader scope of animal research presented. With a large ASAS membership in survey participants and low meeting attendance, members must use their memberships for other things like journal access over meeting attendance. Considering the trend of preference toward open access articles and the probability that more research will continue to be published as open access, professional societies may need to find other niches that incentivize

Table 8. Frequency of visiting academic websites for beef nutrition information within the past 12 months

	Never	1 to 5 times	6 to 10 times	10+
Count ¹	2	14	17	28
Percentage ²	3.3	23	27.9	45.9

¹Number of participants who indicated each frequency option in the survey.

²Percentage of participants who indicated each frequency option in the survey.

continued membership for populations that are not attending meetings.

It is also interesting to consider how survey responses may have changed since responses were gathered in the spring of 2020, at the beginning or before the COVID-19 pandemic. Virtual meetings and webinar series increased tremendously to decrease face-to-face interactions during the pandemic. It is possible barriers for many technology-based platforms have been overcome since spring 2020. The importance of face-to-face learning platforms may have also increased, as we have seen the desire for these types of meetings increase after not having them for so long.

CONCLUSION

Because feedlot research aims to improve beef production, researchers must understand the information-seeking behaviors and channels most commonly used by industry professionals to make the greatest impact on the beef industry. In this survey, we observed the importance of detailed research records published in peer-reviewed journals and university research reports for this audience. In-person meetings and personal relationships are also essential resources for feedlot professionals. The results of this survey conclude that publishing research as open access is increasing in importance. As this likely increases the cost of publication, researchers may need to consider this when developing grant and research budgets.

It has also been noted that differences in information-seeking behavior of professionals exist within varying years of experience. As those with greater years of experience continue through their career and eventually retire, we may expect a change in the information-seeking behavior of professionals in the feedlot industry. Specifically, this may be a shift toward

more technology-based learning platforms and a greater variety of peer-reviewed journals.

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LITERATURE CITED

- Dallmeier-Tiessen, S., R. Darby, B. Goerner, J. Hypoelae, P. Igo-Kemenes, D. Kahn, S. Lambert, A. Lengenfelder, C. Leonard, S. Mele, et al. 2011. *Highlights from the SOAP project survey. What scientists think about Open Access Publishing*. Available from <http://arxiv.org/abs/1101.5260>
- De Groote, S. L., M. Shultz, and D. D. Blečić. 2014. Information-seeking behavior and the use of online resources: a snapshot of current health sciences faculty. *J. Med. Libr. Assoc.* 102:169–176. doi:10.3163/1536-5050.102.3.006.
- Inman, M., A. E. Blevins, E. Ketterman, and K. L. Young. 2019. Now tell us what you want: information-seeking habits of health sciences faculty. *Med. Ref. Serv. Q.* 38:131–142. doi:10.1080/02763869.2019.1588046.
- Kousha, K., and M. Abdoli. 2010. The citation impact of Open Access agricultural research: a comparison between OA and non-OA publications. *Online Inf. Rev.* 34:772–785. doi:10.1108/14684521011084618.
- National Academies of Sciences Engineering and Medicine. 2016. *Nutrient requirements of beef cattle: eighth revised edition*, 8th edn. The National Academies Press, Washington, DC.
- Piwovar, H., J. Priem, V. Larivière, J. P. Alperin, L. Matthias, B. Norlander, A. Farley, J. West, and S. Haustein. 2018. The state of OA: a large-scale analysis of the prevalence and impact of Open Access articles. *PeerJ*. 2018:1–23. doi:10.7717/peerj.4375.
- Rupp-Serrano, K., and S. Robbins. 2013. Information-seeking habits of education faculty. *Coll. Res. Libr.* 74:131–141. doi:10.5860/crl-322.
- Solomon, D., and B. C. Björk. 2012. A study of open access journals using article processing charges. *J. Am. Soc. Inf. Sci. Technol.* 64:1485–1495. doi:10.1002/asi.22673.
- Stinson, R., and D. A. Mueller. 1980. Survey of health professionals' information habits and needs conducted through personal interviews. *J. Am. Med. Assoc.* 243:140–143. doi:10.1001/jama.1980.03300280038025.
- Urick, M. 2017. Adapting training to meet the preferred learning styles of different generations. *Int. J. Train. Dev.* 21:53–59. doi:10.1111/ijtd.12093.
- USDA. 2021. Cattle on Feed.