Introduction

The way society consumes information has changed drastically, and the agricultural industry is fighting to remain a part of the media landscape. The gradual death of print news and the rise of young adults' social media (SM) consumption (Twenge et al., 2019) begs the question of how pro-agriculture voices successfully communicate scientific agricultural topics to young adults. With extremist activist voices on Instagram gripping the attention of young adult SM users, opposing voices of influence sharing scientific and pro-agriculture messages seem to be missing. Cultivating additional agricultural Social Media influencers (SMIs) on Instagram could allow agricultural communicators to share accurate scientific agricultural information with young adult users. The following sections will delve into the relevant literature around social media communication in general and in the agricultural space, the methodology used to address the question at hand, the results of the current study, and recommendations for future research.

Literature Review

Influence and Social Media Influencers

Social Media Influencers, or SMIs, are characterized as "individuals who, through producing original content that publicly displays their expertise and/or taste, have amassed a large network of followers and are regarded as trusted tastemakers and experts" (Scholz, 2021 p. 512). Interestingly, SMIs seem to have more influence on the average consumer than traditional celebrity endorsements, largely because those same consumers find SMIs more relevant (Audrezet et al., 2018), more accessible, and with higher levels of credibility than their celebrity counterparts, so much so that SMI-generated content was found to be much more effective than studio shot content (Ki & Kim, 2019; De Veirman et al., 2017). All these factors, put together, result in SMI messages being viewed as more trustworthy than those communicated via celebrity endorsers (Willemsen et al., 2011).

While research continues to examine the specifics of how and why SMIs are so effective (Eisman & Wonh, 2023), much of the previous research has relied on the theory of parasocial relationships to help explain the effectiveness of SMIs (Scholz, 2021). These one-sided relationships are defined by the consumer developing a feeling of familiarity or even having a friendship with a specific media figure (Horton & Wohl, 1956; Scholz, 2021). Thus, the consumer sees a specific media figure (in this case, an SMI) as a source of trusted and authentic information (Scholz, 2021). This ideology seems to fit well within the Social Cognitive Theory, which helps to explain how individuals form opinions, attitudes, and behaviors (Specht et al., 2020; Bandura, 1986). According to Social Cognitive Theory, humans learn from their environment, process information, retain said information, and then apply it later (Specht et al., 2020). Thus, SMIs fill the role of the environment as a trusted and authentic source of information that is then retained and applied via purchasing behaviors, attitudes, and opinions.

Current Difficulties with Communicating Agriculture Science

As a result of the United States (U.S.) shifting from rural to urban lifestyles over the last century, the public has a lack of understanding when it comes to agricultural sciences. In

response, various organizations have sought to communicate agricultural-related information, which can sometimes be complex and heavy with technical terms and scientific content. Further complicating the issues is how communication happens within the scientific community. Scientists devotedly follow the scientific method, leading to what some would perceive as dull, technical, and meticulous methods of explaining their findings (Sand-Jensen, 2007). While these intentionally objective techniques are necessary for communications within the scientific community, they may not be nearly as effective as they could be when shared with a non-scientific population. In response to this communication gap, SMIs may be an effective tool for agriculture to effectively communicate with a broader population that is not well versed or interested in technical, science "heavy" content.

Media Source Changes, Polarity of Agricultural Stories in Media, and Agricultural Communication Efforts

Using data collected over the last 30 years, Twenge et al. (2019) studied trends in media source usage of adolescents in the United States. The results of this work indicated significant increases in digital media usage, with 12th graders doubling the amount of time they reported using the internet between 2006 and 2016. Another comparison between 12th graders in 2008 and 2016 demonstrated a contrast of 52% reporting they visited SM sites "almost every day" in 2008, jumping to 82% in 2016. In a study conducted by Howard et al. (2017) looking at the effects of SM on university students' beef industry perceptions, they found that their participants reported a range of 0-23 hours of specifically Instagram usage alone in a week.

The United States Department of Agriculture (USDA) reported that roughly 1% of the U.S. population is directly involved in producing food (USDA, 2017). Without knowledge or personal experience of the agricultural industry, the public largely relies on the media to provide them with agricultural-related information. Unfortunately, the media's coverage of the agricultural industry tends to focus on stories involving crises (Eyck, 2000). A disconnected population, combined with an inaccurate industry image produced by the media, has greatly impacted the general public's perception of agriculture (Holt & Cartmell, 2013).

The consequences of this negative agricultural media trend were demonstrated in a study conducted by Howard et al. (2017) regarding social media use and beef perceptions of college students. This study reflected the negative consequences of media events, such as the report by ABC News, which coined the term pink slime to describe lean, finely textured beef in 2012 (Greene, 2012). That negative coverage went on to propagate throughout media and had notable consequences, including the loss of over 600 jobs in three processing plants, the USDA's end to the use of lean finely textured beef in school lunches, and producers removing it from commercial sale (Greene, 2012). Howard et al. (2017) found that 78% of university student participants reported being negatively affected by information discovered on social media about pink slime. Among those student participants, 72% reported that their short-term (0-6 months) purchasing habits were negatively affected, and 56% of students reported that their long-term (6+ months) purchasing habits were affected due to the information that they received from social media regarding pink slime (Howard et al., 2017). The results of this study are significant because they indicate a direct correlation between negative messaging regarding animal protein on social media and the actual purchasing habits of young adults.

The need to determine the best route for communicating positive agricultural messages has been acknowledged for over a decade and was illustrated by Meyer et al. (2011) when they

stated that both agricultural researchers and professionals needed to explore new methods to help combat the negative impacts that media has had on the industry. Ruth-McSwain (2008) uncovered that the agricultural industry was not utilizing mass media to tell the story of agriculture, preferring instead to utilize outlets that only served populations already connected to agriculture while, at the same time, neglecting nonagricultural audiences and media. Ruth-McSwain (2008) concluded that the tendency for agricultural communications professionals to focus on more traditional media may contribute to why the agricultural industry has struggled to connect with nonagricultural audiences. More recently, research within the agricultural and extension domains has begun investigating how social media and SMIs impact content consumers. For example, Wallace et al. (2021) found that social media may be a valuable tool to help increase health communication outreach with underserved and underreached populations. Building on this idea, Sanders, Gibson, Byrd, Markosyan, and Lamm (2023) identified social media use in rural Georgia as being classified into three distinct clusters based on usage (low, medium, and high) with the effectiveness of the social media communication also being based on which cluster the user fell into. Investigators have also examined social media and SMIs on new and emerging topics such as cultured meat (Specht et al., 2020; Leite et al., 2024). Other work has centered on end-users trust in celebrities and TV Chefs, with Settle, Harvey, and Ruth (2023) finding that young mothers in the United States trusted TV chefs the most as a source of information regarding food safety and nutrition. These findings are particularly vexing in that Chefs have very little formal training regarding nutrition. Similarly, while chefs are typically trained in food safety, this training is largely regulated by topics such as cooking temperatures and holding times. To the authors' best knowledge, a lack of research addresses how SMIs impact a consumer's knowledge about specific agricultural products and processes. In order to address this gap in the research, the following purpose and research question are provided.

Purpose and Research Question

Considering the literature review provided, this study aims to measure the effectiveness of Social Media Influencers who communicate agricultural-related content to a nonagricultural audience. More specifically, the current study is focused on how effective the SMI methodology is when using Instagram-based content on young adults. Therefore, our research question is as follows: Do agricultural SMIs have the ability to increase and improve the perceived knowledge of nonagricultural young adult Instagram users in the industry?

Methodology

To address the proposed research question posed above, quantitative data were procured from both a pre-image and post-image survey, between which participants were shown example images from agricultural SMIs that have already been established on Instagram. Images included content surrounding genetically modified organisms (GMOs), hormone use in animal production, antibiotic use in animal production, organic farming practices, and the nutritional benefits of milk for human consumption.

The participants were 855 individuals aged 18-30 from the United States who use social media regularly, and most were members of a nonagricultural audience. Participants were selected utilizing purposeful sampling that fit the previous description, and they were contacted and surveyed using Prolific. Study participation was voluntary, and participants could opt out at

any point if they desired to do so. The validity of this test was established using Prolific to distribute surveys to a purposeful sample population and to procure data from the results of the provided survey through Qualtrics (Version 2022, Provo, Utah, U.S.).

The survey consisted of demographic and Likert scale questions. Likert scales allow for the measurement of attitudes and opinions (Privitera & Ahlgrim-Delzell, 2019), and due to the focus of this study on the audience's perceived opinion of their knowledge, this data collection method was deemed appropriate. After completing the demographic sections, respondents were asked to complete a series of pre-image questions. In other words, the respondent's perception of their knowledge regarding genetically modified organisms (GMOs), hormone use in animal production, antibiotic use in animal production, organic farming practices, and the nutritional benefits of milk for human consumption were measured. The respondents were then exposed to a series of images and text from SMIs found on Instagram, providing pro-agricultural information related to the same topics (GMOs, hormone use in animal production, etc.). These images were embedded into the Qualtrics study, along with the supporting text, which is a part of the overall Instagram post. Respondents were forced to view both the image and the text before being able to proceed with the survey. After reviewing all the images and text (one image and any supporting text were provided for each of the five subject areas), the respondents were asked to complete the same questions about their perceived knowledge of the five topics listed above. All images and texts were taken from existing Instagram influencers and their associated posts. The data was then analyzed to determine any change in perceptions from the pre-image and post-image utilizing IBM SPSS (Version 28) to calculate descriptive statistics and within-subject data differences through paired samples t-tests (Privitera & Ahlgrim-Delzell, 2019). The alpha significance was set at 0.05 for statistical purposes. Independent variables included the two data sets collected, and the dependent variable consisted of the summation of the pre-image and post-image scores operationalized by converting the Likert scale values (very poor, poor, fair, good, and excellent) to numerals (1, 2, 3, 4, and 5). The sample consisted of 855 participants equally distributed across the United States. Of those participants, 50% were between the ages of 18-24 years old ($f = 430$) and 50% were between 25-30 years old ($f = 425$). Participant demographics also revealed that 87% identified themselves to be omnivores ($f = 744$), 6% pescatarian ($f = 48$), 4% vegetarian ($f = 33$), 2% vegan ($f = 20$) and 1% other ($f = 10$). Additionally, 73% reported having no connection to agriculture ($f = 648$), and 27% reported being connected to agriculture in some capacity ($f = 207$). When questioned about their SM use, Instagram was the most widely used among participants, with 98% reporting using Instagram ($f = 834$).

Results

Data was gathered regarding the research question regarding the ability of agricultural SMIs to impact participants' perceived knowledge based on examples of content relating to GMOs, hormone use in animal production, antibiotic use in animal production, organic farming practices, and the nutritional benefits of milk for human consumption.

Table 1

Descriptive Results of Participant Perceived Knowledge

Topic	Pre-image Post-Image	Reported Level of Understanding (%)				
		Very Poor	Poor	Fair	Good	Excellent
GMOs*	Pre	5	20	43	27	5
	Post	1	13	43	35	8
Hormones	Pre	9	36	36	16	3
	Post	3	23	45	25	4
Antibiotics	Pre	10	38	32	17	3
	Post	3	20	45	27	5
Organic	Pre	7	32	37	19	5
	Post	3	26	42	24	5
Benefits of milk	Pre	6	26	40	23	5
	Post	3	16	42	32	7

Note. Survey utilizing Prolific of 855 young adults and their perceived knowledge of topics prior to (pre) and after the viewing (post) of example Instagram content.
*Genetically modified organisms

On average, participants exposed to content from agricultural SMIs sharing information about GMOs demonstrated greater perceived knowledge about GMOs ($M = 3.36$, $SE = .03$) than they did prior to being exposed to content ($M = 3.08$, $SE = .03$). This difference, -0.27, BCa *95%* CI [-.32, -.22], was significant, $t(846) = -11.21$, $p < .001$, and represented an effect of $d = 0.39$. Participants, when exposed to the agricultural SMI content about hormone use in animal production, indicated greater perceived knowledge about such hormone use ($M = 3.06$, $SE = .03$) than they did prior to exposure to said content ($M = 2.70$, $SE = .03$). The difference, -0.36, BCa *95%* CI [-.42, -.30], was significant, $t(846) = -12.27$, $p < .001$. It represented an effect of $d = 0.42$. Additionally, the results from participants when exposed to content from agricultural SMIs about antibiotic use in animal production resulted in greater perceived knowledge about antibiotic use ($M = 3.09$, $SE = .03$) than participants did prior to exposure to the content ($M = 2.65$, $SE = .03$). The difference of, -0.45, BCa *95%* CI [-.51, -.39], was significant, $t(846) = -14.53$, $p < .001$, and represented an effect of $d = 0.50$. Results of participants exposed to content from agricultural SMIs regarding organic farming practices indicated a greater perceived knowledge regarding organic farming ($M = 3.01$, $SE = .03$) than participants indicated prior to exposure to the provided SMI content ($M = 2.84$, $SE = .03$). Differences between the two groups, -0.16, BCa *95%* CI [-.22, -.11], was significant, $t(846) = -6.20$, $p < .001$, and represented an effect of $d = 0.21$. Lastly, data results revealed that when exposed to content from agricultural SMIs regarding the nutritional benefits of milk for human consumption, participants reported greater perceived knowledge of the subject ($M = 3.23$, $SE = .03$) than the same participants did prior to exposure to said content ($M = 2.95$, $SE = .03$). These final differences, -.28, BCa *95%* CI [-.33, -.22], were significant, $t(846) = -9.94$, $p < .001$, and represented an effect of $d = 0.34$. Even though all results were proven to be statistically significant, effect sizes ranged from weak to moderate effect ($d = 0.2$ to $d = 0.5$) according to classifications outlined by Cohen (1988).

Table 2

Paired Samples t-test Results

Pair	Topic	Mean difference	Std. deviation	Std. error mean	95% Confidence interval of the difference		t	df	Significance
					Lower	Upper			
Pair 1	GMOs* pre GMOs* post	-.27	.70	.02	-.32	-.22	-11.21	846	*p* < .001
Pair 2	Hormones pre Hormones post	-.36	.85	.03	-.42	-.30	-12.27	846	*p* < .001
Pair 3	Antibiotics pre Antibiotics post	-.45	.90	.03	-.51	-.39	-14.53	846	*p* < .001
Pair 4	Organic pre Organic post	-.16	.77	.03	-.22	-.11	-6.20	846	*p* < .001
Pair 5	Benefits of milk pre Benefits of milk post	-.28	.81	.03	-.33	-.22	-9.94	846	*p* < .001

Note. Survey utilizing Prolific of 855 young adults and their perceived knowledge of topics prior to (pre) and after the viewing (post) of example Instagram content. The abbreviation "Std." means "standard." *Genetically modified organisms

Discussion

The results of this study indicated significant differences between all pre-image and post-image knowledge results, indicating that agricultural SMIs can influence and inform young adult Instagram users. These results are promising, especially considering how many people use social media today. According to the Pew Research Center, about half of U.S. adults use Instagram (Pew Research Center Social Media Fact Sheet, January 31, 2024). Perhaps even more revealing for the future of agriculture communication, the same publications show that 78% of adults aged 18-29 currently use Instagram, which is only surpassed by YouTube regarding market penetration within the same age group. The current study findings align with previous research, which has also supported the ability of SMIs to impact consumer attitudes and behaviors (Leite et al., 2024), who found that SMIs impacted self-reported purchasing behavior towards cultured meat.

The current study's findings are promising, especially considering previous research, which has highlighted the need to combat the negative impacts of media on the agricultural industry (Meyer et al., 2011). The findings of this study support the idea that SMIs can be a useful tool in this regard. Additionally, SMI provides the ability to react quickly to a breaking or new media report that contains false or non-fact-based information that could damage agriculture. While the information shared via traditional media outlets (TV, magazine articles, newspapers, etc.) can take weeks or even months to move from idea generation to publication, SMIs can generate and publish a story in minutes. This would allow the agricultural industry to counterbalance biased and factually incorrect stories in a rapid deployment model that may prevent incorrect information from gaining speed or becoming viral. The importance of

responding quickly, especially when SMIs make false or misleading claims, is perhaps best highlighted by the so-called "Pink Slime" (Lean, Finely Textured Beef) video created by celebrity Chef Jamie Oliver and the resulting fallout after the video went viral. The resulting news stories, primarily by ABC News, shocked the American public. While responses from Beef Products Inc. (BPI) and the American Meat Institute were deployed using mainstream media models, the damage, and most of the communication apparatus causing the damage, was firmly laid on a foundation using social media as the primary marketing channel.

For example, BPI ran a full-page ad in the Wall Street Journal, arguing against "the media's misinformation campaign." The results of this effort seemed to be counterproductive, with plants responsible for producing Lean, Finely Textured Beef (LFTB) closing, Wendy's running a marketing campaign based on the fact that they have never used "Pink Slime" and a study finding that 88% of US. Adults were aware of pink slime, with 76% being at least somewhat concerned, and Cargill saw an 80% drop in volume in its production of LFTB. All of this occurred AFTER the traditional media models were used to try and combat the discourse that was started and largely continued via social media platforms (Tanenbaum, 2012; American Meat Institute, 2012). These real-life examples seem to support a research study that showed that false news travels faster than true stories and is primarily driven by real humans and not bots (MIT News, 2018). Thus, the project at hand has identified that SMIs might represent a highly valuable tool for providing proactive, factual information distribution and a highly flexible, rapidly deployable reactive tool to combat, in real-time, false or misleading media content.

Limitations and Future Research

As is the case with all survey-based research, it is important to address the limitations of the current project. For starters, the researchers did their best to identify a sample that was as diverse as possible. However, the results of the current project will need further testing before they can be fully applied to any other population outside of the one examined in the current study. Future research may want to address the demographics of the current project, which was predominantly identified as female and Caucasian/white. Furthermore, the current study utilized a relatively simple research design, which applied a pre/post-test. Variables that were not controlled are many, including the gender of the SMIs and the gender of the respondents. Previous research has highlighted that female SMIs more strongly influenced women who consumed their content, while male consumers of the same content were not impacted similarly (Hudders & De Jans, 2022). Future research should address how the genders of both the content provider and the content consumer may impact the effectiveness of the message, especially in an agricultural context.

Future research should also seek to confirm the current study's findings across different social media platforms. The current project was limited to Instagram due to its relatively high level of market penetration. However, other social media platforms such as X and YouTube are also important avenues of communication in the modern digital media age. Future research may also wish to examine the differences in content length and how these differences may impact communication effectiveness—for example, a 10-minute YouTube video vs. the character limitations found on X. Finally, the current study did not address future behavioral intentions; only self-perceived knowledge. While self-perceived knowledge is important, the connection between knowledge and actual behavior is critically important, especially from an economic standpoint. Future research should address this gap and identify what factors, if any, of SMIs and

their related content may change consumers' shopping, spending, and consumption behaviors of related agricultural products.

Conclusion

Study results revealed that participants' perceived knowledge of agricultural topics prior to being shown example images of content from established agricultural SMIs on Instagram differed from their perceived knowledge after being shown the example images. From the results of this study, we can conclude that participants' viewing of the seven example images led to an increase in perceived knowledge on the five topic areas covered (genetically modified organisms, antibiotic and hormone use in animal production, organic farming practices, and the nutritional benefits of milk).

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