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# Podcasts in Production: An Examination of Current and Best Practices for Agricultural and Natural Resource Podcast Producers

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# Podcasts in Production: An Examination of Current and Best Practices for Agricultural and Natural Resource Podcast Producers


## Abstract

Little research has been done on the production and use of podcasts in the fields of food, agriculture, natural resource, or human sciences (FANRHS). Currently, there is limited information for best practices on creating an effective FANRHS podcast to reach a target public audience. The purpose of this study was to examine existing practices and experiences of FANRHS podcast producers. The findings of this study will be of interest to organizations, institutions, and individuals who currently produce or are interested in producing an educational or science-based podcast. This study provided foundational information on podcast creation and maintenance. Future research should explore optimal podcast formats and content design to influence listeners' perception and knowledge level on FANRHS science topics.



## Keywords

science communication, adult learning, communication technology, podcasting, science education



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## Introduction

Due to the ease of access, many consumers have looked to various media outlets as a primary source for information on food systems (Holt & Cartmell, 2013). With the increasing popularity of new and mass media, more individuals have represented their company or product online or created a career by marketing products on new media (Pratt, 2000; Quesenberry, 2020; Rust & Oliver, 1994). Unfortunately, due to the ability to freely disseminate information, issues of mass distribution of misinformation, misrepresentation, and misuse have arisen (Caulfield, 2019). Vosoughi (2018) indicated that, due to the novel nature of false information, it can spread faster and farther than factually supported information. While the media has been known to occasionally misrepresent issues, media can also influence consumers' attitudes toward agricultural topics, draw on their past experiences, and provide information to counteract false claims (Ansari et al., 2018; Goodwin & Shoulders, 2013; Holt & Cartmell, 2013). Over the years, a close connection has been made between education and entertainment to increase motivation and stimulation for learners (Corona et al., 2013). Digital edutainment programs allow communicators to share educational information in a narrative format for listeners to connect to and gain knowledge (Singhal & Rogers, 1999; Madej, 2003).

Many individuals and organizations have begun to use podcasting for outreach, due to the medium's accessibility, availability, and low production and consumption costs (Fannin, 2006). Podcasts were originally coined as such because they were an iPod-generated broadcast. Apple made iPods available in 2001 as a portable MP3 player (Computer Hope, 2020). Unlike traditional radio, iPods did not require access to adequate reception to be used, and this made the audio portable and more easily accessible (Berry, 2006). In recent years, podcast producers have primarily utilized desktop computers, laptops, smartphones, and other technology to create and stream audio content (Lucking, et al., 2009). According to the 2021 Edison Research Report, 78% of the U.S. population is familiar with podcasts. In the United States, 28% of the population over the age of 12 listen to an average of eight podcasts per week (Edison Research and Triton Digital, 2021). Though the demographics of podcast listeners continue to diversify, the typical podcast listener remains an affluent, educated consumer (Edison Research and Triton Digital, 2017; Edison Research and Triton Digital, 2021).

Given the 12-54 age range of podcast listeners (Edison Research and Triton Digital, 2021), these listeners can be considered adult learners who participate in informal, self-regulated learning experiences via podcasts. Several subject matter experts and platforms within food, agricultural, natural resource, and human science (FANRHS) professions have taken advantage of the educational opportunities that podcasts provide and have chosen to use the medium to connect with their target audiences (Chivers et al., 2021; Opat, 2020). For the purpose of this study, FANRHS podcasts include specialties such as food science and food safety, consumer science, apiculture, agricultural education, and animal science. The podcasts were from various states throughout the U.S., differed in length, and varied in number of total episodes. These podcasts often include guest speakers in the form of subject matter experts who share information with a general public audience. FANRHS podcasts do not have their own category on podcasting applications, but they can often be found under the education, lifestyle, or health categories.

This research addresses two of the research priority areas outlined in the American Association for Agricultural Education Research Agenda (Roberts et al., 2016). The first priority this study informs is *Priority Area 2: New Technologies, Practices, and Product Adoption*

*Decisions*. This area included research on distance education technologies that include, but are not limited to, videos, websites and mobile devices. The second priority that this study informs is, *Research Priority 7: Addressing Complex Problems*. This priority includes research that examines the effectiveness of programs (both formal and nonformal) that address and prepare people to solve complex issues (Roberts et al., 2016).

## Purpose and Research Objectives

Several FANRHS podcasts were studied in this research, including podcasts hosted by individuals, universities, and industry organizations. Podcasts can be used as a tool for connecting with adult learners, and for creating agricultural content for formal, informal, and non-formal learning settings (Barnes et al., 2021; Dantas-Queiroz et al., 2018). The following research questions (RQ) guided this study:

RQ1: What are the demographics of FANRHS podcast producers?
RQ2: What equipment is used to create and sustain a FANRHS podcast?
RQ3: How do FANRHS podcast producers develop and maintain their platforms and programming?

## Conceptual Framework

The conceptual framework for this exploratory study included concepts from the Technology Acceptance Model (TAM) and Social Cognitive Theory (SCT). In this study, TAM framed how podcast producers decided to approach using the medium, and SCT can provide a framework for how podcast producers learn to use this technology and engage with their listeners and learners.

### Technology Acceptance Model

Davis' (1989) TAM determined that the two factors that influence the acceptance of a digital or informational system are its perceived usefulness and perceived ease of use. Then in 2000, Davis & Venkatesh, expanded this model to TAM2 which also accounted for the influence of social influence and cognitive instrumental process, such as the relevancy and results, on the acceptance of new technology by users. Podcasting technology has already been identified as easy to use (Fannin, 2006), and its increase in popularity has incorporated it as a social norm for audio content production.

### Social Cognitive Theory

SCT is based on the work of Albert Bandura (1991) and explains how an individuals' actions and motivations are internally influenced. SCT describes a two-pathway approach to communication (direct and social) and examines the factors of communication that can affect opinions and actions (Bandura, 2001). Bandura (1991) explained that individuals can often adjust their goals based on different forms of feedback. Self-regulated learning (SRL) is a tenant of SCT that describes the relationship between goal setting, self-efficacy, and reflection. There are several components that contribute to self-regulation, including self-observation, motivation,

personally developed standards, and incentives (Bandura, 1991). Many components of self-regulated learning also hold true for self-directed learning (Theunissen & Stubbé, 2014).

## Literature Review

### Science Communication and Podcasts

Science information is traditionally shared via scientific journals (Quintana & Heathers, 2021). Knowledge about academia and academic topics is often less accessible, given that much of it is shared in face-to-face formats at conferences or through mentoring (Hoffman, 2021; Quintana & Heathers, 2021). Other knowledge of scientific or academic etiquette regarding research and the publication process is also difficult to come by unless connected to an academic or scientific community (Quintana & Heathers, 2021; Dantas-Queiroz et al., 2018). Podcasts make information more broadly and readily available to all and are ideal for asynchronous learning since they do not require visual attention (Fannin, 2006; Quintana & Heathers, 2021). Podcasting has become a flexible format for sharing science knowledge in beginning online discussions about science (Birch & Weitkamp, 2010). Dantas-Queiroz et al. (2018) presented podcasts as a way to create trust filled relationships with listeners and therefore more effective science communication. The ease of creating and distributing podcasts will allow all scientists (not just the most infamous) to share their research and join conversations related to science education and policy (Quintana & Heathers, 2021). In another study, it was found that podcasting can allow for a more representational community of experts to share their work and for more scientists to speak on science topics without censorship (Mulki & Ormsby, 2022).

### Podcasts and Podcasting in Education

Podcasting has become a popular and fast-growing form of portable audio content (Shim et al., 2007). Podcasts offer a flexible listening format that can be accessed from anywhere. Reddit users identified several places and times when they commonly listen to podcasts, including while driving, exercising, working a boring job, doing yard work, or cooking (Hennig, 2017). Podcasting first arose as a recognized communication medium in 2005, but its use and practice became further solidified in 2015 when Apple first offered a podcast listening service on its devices (Bottomely, 2015). Independent podcast producers are often educated individuals over the age of 30 who are motivated by factors such as community, feedback, and personal improvement (Markman & Sawyer, 2014). When evaluating podcasting in education, podcasts have been shown to be exceptionally effective when connecting with distance learners (Shim et al., 2007).

### Podcasting in FANRHS Education

Fannin (2006) identified podcasting as a useful tool due to the ease of production, low production costs, and the ability to distribute information to hard-to-reach audiences such as rural communities and farmers. FANRHS podcasts have been used as a tool for agricultural educators and communicators. The following are some examples of FANRHS podcasts and the audiences they were created to reach. The podcast Owl Pellets includes Tips for Ag Teachers and is a podcast that targets agricultural education professionals who share relevant research and advice

(Beattie et al., 2020). The From Urban to Ag podcast targets consumers from non-agricultural backgrounds and facilitates conversations with scientists and subject matter experts (Beattie et al., 2020). The Wedgeworth Leadership institute's podcast targets stakeholders and alumni from their program and shares leadership development research highlights (Beattie et al., 2020).

Podcast usage within FANRHS has varied greatly. As of 2007, 12 land-grant universities used podcasting as part of their extension programming (Xie & Gu, 2007). These land-grant based podcasts covered topics such as gardening information, 4-H program information, wildlife, dairy, and crops (Xie & Gu, 2007). Podcasting provides an opportunity for educators, communicators and extension professionals to cater their programs to a diverse set of learning styles, skill levels, learning environments, and topics, all while building stronger relationships with their learners (Chester et al., 2011; Edirisingha et al., 2007; Fernandez et al., 2009; Xie & Gu, 2007).

As the use of podcasts for science communication rises (Dantas-Queiroz et al., 2018), more information is needed to help guide the effective production and distribution of FANRHS podcasts. Science podcasts provide an opportunity to share science knowledge, the scientific process, and is an opportunity for more voices to be heard on science topics (Quintana & Heathers, 2021; Frische, 2018). To date little research has examined the development, maintenance, and growth of FANRHS podcasts.

## Methods

This study was a piece of a larger, dissertation research project that examined FANRHS podcasts from the lens of listeners, guests, and producers. The research followed a mixed method approach to address the study's research questions and objectives. We chose to follow an explanatory sequential mixed methods design. This approach utilized online, cross-sectional survey questionnaires to collect quantitative data, followed by qualitative interviews to expand upon the quantitative findings (Creswell & Creswell, 2018). The FANRHS podcast producers recruited for this study were identified using various online lists and blog posts published by organizations such as the University of Florida, Animal Ag Alliance, Feedspot, and other blog-type lists of agriculture focused podcasts. From there, only podcasts that included contact information for the producer were used for the study (i.e., those which included the name of the producer in the description or included a website that housed contact information for the producer). A finalized list of 71 podcast producers were contacted via email in three waves. Wave A (consisted of 26 podcast producers) potential participants were sent the initial recruitment email in September 2021. Wave B (25 producers) was contacted a week after Wave A, and Wave C (21 producers) a week after Wave B. Each Wave of producers then received two reminder emails: one approximately 1-2 weeks after the initial contact, and a final email reminder approximately three weeks after the initial contact (Dillman, 2014). Given the small, niche sample for this study, results are not generalizable to larger populations outside this sample.

The producer-focused survey included a combination of multiple choice, free response, and Likert-type scales ranging from one (strongly disagree) to five (strongly agree). The survey was divided into two main blocks of questions. Block one included questions regarding the podcast production practices of producers. Block two collected an array of demographic information including location, age, level of education, and more. Descriptive statistics were used to answer RQs 1 and 2, and to examine the FANRHS podcast producer's: 1) podcast, 2) the

development and distribution of the podcast, and 3) producer demographics. Of the 71 producers who received the survey, 23 completed the survey in its entirety, resulting in a 32% response rate. At the end of the survey, participants were given the option to participate in a follow-up interview. A total of five participants also completed follow-up interviews. Semi-structured interviews with podcast producers included seven open ended questions that covered topics such as producers' motivations for beginning the podcasts, challenges and successes they experienced, resources used, and future goals for their podcast. Examples of questions included: Why did you start a podcast? And, where do you go when you have questions about podcasting? The interview protocol was drafted by the lead researcher then reviewed by the entire research team. Each interview lasted approximately one hour.

## Reliability and Validity

An online survey design was chosen for the study, due to the rapid response time, potential reach, and ease of distribution (Creswell & Creswell, 2018; Van Selm, et al., 2006). While there are many advantages to using an online survey, disadvantages include an additional need for assurance of confidentiality and combating survey fatigue (Van Selm, et al., 2006). Other threats to validity when conducting descriptive survey research include measurement error, sampling error, coverage error, and nonresponse error (Mertler, 2016).

To account for these threats to validity, the researcher used chain-referral sampling to advertise the survey in multiple online locations, in order to reach a broad audience and obtain diverse responses. Since a purposive sample was used to identify podcasts producers to participate in the study, and participants were required to self-identify due to their experiences with podcasts, the study sample did not theoretically represent the target population. Thus, the findings of the study could not be generalized beyond the study participants.

Several strategies were implemented to ensure validity and reliability of the data, including triangulation of data, rich descriptions, reflexivity statement, and peer debriefing. We collaboratively created the interview protocols for these studies. Once analyzed, the findings were cross-checked between coders. Results were reported using rich descriptions to accurately capture the participants' experiences.

## Analysis

The quantitative data were analyzed using Statistical Package for Social Sciences (SPSS). We then qualitatively coded the free response questions and codes were confirmed by another member of the research team. The free response submissions were very diverse and not easily quantifiable into specific codes or categories, therefore an excerpt of responses will be reported in the results.

The interview data were qualitatively coded using various tools. Sonix.ai software was used to transcribe the Zoom recorded interviews. The transcripts were then checked for accuracy (Creswell & Creswell, 2018). We analyzed the data following a constant comparison method (Glaser, 1965), then a second researcher conducted a peer debrief to confirm the codes identified. The peer debrief included two transcripts and their associated codes (one from a producer interview and one from a guest interview), to provide feedback, and in this case, confirmation of the codes. The constant comparison method involves regularly comparing newly emerged codes to existing codes to identify areas of similarity or difference (Glaser & Strauss, 1967). We used

three levels of coding: open, axial, and thematic. According to Williams and Moser (2019), the first level of coding is open coding and involves identifying various general concepts (child codes). Next, we used axial coding to group open codes in to categories guided by the research questions (parent codes) (Corbin & Strauss, 2015; Williams & Moser, 2019).

## Results

The following subsections report results in order of the initial RQs to which they correspond. The results are from both the Qualtrics survey and semi-structured interviews.

### RQ1: Determine FANRHS Podcast Producer Demographics

The Qualtrics survey captured podcast producers' ($n$ = 22) various demographic information (Table 4-1). Twenty-two podcast producers completed the survey in its entirety, representing 21 unique podcasts in total. Of those 22 producers, 50% ($f$ = 11) were male, 90.9% ($f$ = 20) identified as white, and 63.7% ($f$ = 14) were between the ages of 25-38 (Table 1). All participants self-identified as part of the agriculture industry. When asked how long they have been in the agriculture industry, 27.3% ($f$ = 6) of participants indicated five years or less, 18.2% ($f$ = 4) said 6-10 years, and 54.5% ($f$ = 12) for 11+ years (Table 1). Participating producers were from 13 states, and one was international. Most participants were in Florida (13.6%, $f$ = 3) and Illinois (13.6%, $f$ = 3), followed by Texas (9.1%, $f$ = 2), New Jersey (9.1%, $f$ = 2), North Carolina (9.1%, $f$ = 2), and North Dakota (9.1%, $f$ = 2). Other states represented in the study included California, Oregon, Utah, South Dakota, Alabama, Indiana, and Minnesota. All respondents had some level of college education; 63.6% ($f$ = 14) indicted that some graduate school or advanced degree was their highest level of education, 18.2% ($f$ = 4) indicated a four-year degree, and 18.2% ($f$ = 4) had completed one to three years of college.

**Table 1**
*Demographics of Podcast Producer Survey Participants*

| Variable | | *f* | % |
|---|---|---|---|
| Gender | Male | 11 | 50 |
| | Female | 10 | 45.5 |
| | Gender non-conforming | 1 | 4.5 |
| Race | White | 20 | 90.9 |
| | Black or African American | 1 | 4.5 |
| | Asian | 1 | 4.5 |
| State/Territory | Alabama | 1 | 4.5 |
| | California | 1 | 4.5 |
| | Florida | 3 | 13.6 |
| | Illinois | 3 | 13.6 |
| | Indiana | 1 | 4.5 |
| | Minnesota | 1 | 4.5 |
| | New Jersey | 2 | 9.1 |
| | North Carolina | 2 | 9.1 |

| | | | |
|---|---|---|---|
| | North Dakota | 2 | 9.1 |
| | Oregon | 1 | 4.5 |
| | South Dakota | 1 | 4.5 |
| | Texas | 2 | 9.1 |
| | Utah | 1 | 4.5 |
| | Does not reside in the United States | 1 | 4.5 |
| Age range | 18-24 | 2 | 9.1 |
| | 25-31 | 6 | 27.3 |
| | 32-38 | 8 | 36.4 |
| | 39-45 | 2 | 9.1 |
| | 46-51 | 2 | 9.1 |
| | 52-58 | 1 | 4.5 |
| | 59+ | 1 | 4.5 |
| Level of education | One to Three years of college | 4 | 18.2 |
| | Four-year college degree | 4 | 18.2 |
| | Some graduate school or advanced degree | 14 | 63.6 |
| Self-identify as part of the food, agriculture, or natural resource industry | Yes | 22 | 100 |
| Years in this industry | 0-5 | 6 | 27.3 |
| | 6-10 | 4 | 18.2 |
| | 11+ | 12 | 54.5 |

**RQ2: Determine What Equipment was Used to Create and Sustain a FANRHS Podcast**

RQ2 aimed to determine the equipment participants used to produce their podcast. Based on the open-ended survey responses, podcasters used a vast array of mobile and stationary equipment ranging from a computer to Rode microphones, AKG P220 Vocal Condenser Microphones, and Audio Technica ATR2500x-USB Cardioid microphones. Participants used several different recording software modalities, including Zoom, Zencaster, and Anchor. The semi-structured interviews reaffirmed the survey results.

**RQ3: How do FANRHS Podcast Producers Develop and Maintain their Science Communication Platforms and Programming?**

To explore the development of these podcasts, the researcher asked the producers questions within the Qualtrics survey about the creation of their podcasts, identifying guest speakers, scheduling and logistics, editing, marketing, and more. The podcast producers participating in the survey covered an array of topics (Table 2). Over 50% of the podcasts discussed crops (59.1%, $f = 13$), animal agriculture (54.5%, $f = 12$), land management (59.1%, 13), sustainability (68.2%, $f = 15$), and natural resource management (54.5%, $f = 12$). Other topics discussed on the podcast included news (36.4%, $f = 8$), self-improvement (31.8%, $f = 7$), consumer science (36.4%, $f = 8$), policy (27.3%, $f = 6$), wildlife conservation (36.4%, $f = 8$), and urban agriculture (36.4%, $f = 8$) (Table 2). Fifty percent of respondents also identified other topics they covered on their podcasts, which included topics such as food safety, science

communication, veterinary medicine, and honeybee health. Producers developed their podcasts either for personal use (45.5%, *f* = 10) or for an organization (54.4%, *f* = 12) (Table 3).

**Table 2**

*Topics podcast covers (n = 22)*

| Variable | | *f* | % |
|---|---|---|---|
| Podcast Topics | | | |
| | News | 8 | 36.4 |
| | Self-improvement | 7 | 31.8 |
| | Crops | 13 | 59.1 |
| | Animal Agriculture | 12 | 54.5 |
| | Land Management | 13 | 59.1 |
| | Sustainability | 15 | 68.2 |
| | Natural Resource Management | 12 | 54.5 |
| | Consumer Science | 8 | 36.4 |
| | Policy | 6 | 27.3 |
| | Wildlife Conservation | 8 | 36.4 |
| | Urban Agriculture | 8 | 36.4 |
| | Other | 11 | 50 |

**Table 3**

*Type of podcasts and years published*

| Variable | | *f* | % |
|---|---|---|---|
| Type of podcast | Personal | 10 | 45.5 |
| | Organizational | 12 | 54.4 |
| Years podcast has been published | 0-1 | 9 | 40.9 |
| | 2-5 | 10 | 45.5 |
| | 6+ | 3 | 13.6 |

At the time of the study, nineteen of the podcasts (86.4%) had been published and were available online for less than five years (Table 3). Twenty of the producers (90.9%) spent 0-10 hours per week producing their podcast (Table 4). While podcasts are often made available on several platforms, the most popular streaming platforms participants used were Apple Music (90.9%, *f* = 20), Spotify (72.7%, *f* = 16), and Google Play (68.2%, *f* = 15) (Table 5). To advertise their podcasts, sixteen producers used Facebook pages (72.7%), twelve used Twitter (54.5%), twelve used Instagram (54.5%), eight used custom websites (36.4%), 4 used LinkedIn (18.2%), three used other media (13.6%), two used Facebook Groups (9.1%), two used Clubhouse (9.1%), and one didn't use any social media platforms to advertise their podcast (4.5%) (Table 6). Other media included email listservs, or advertising their podcast on other's (e.g., their university's) platforms.

**Table 4**

*Time spent producing the podcast per week*

| Variable | *f* | % |
|---|---|---|

| | | | |
|---|---|---|---|
| Time spent per week producing the podcast (hours) | 0-5 | 14 | 63.6 |
| | 6-10 | 6 | 27.3 |
| | 10-20 | 1 | 4.5 |
| | 20-40 | 1 | 4.5 |

*Note:* The overlap of 10 and 20 hours means they could self-identify in either category

**Table 5**

*Podcast streaming platforms used by FANRHS podcast producers*

| Variable | | *f* | % |
|---|---|---|---|
| Podcast Streaming Platforms | | | |
| | Pandora | 4 | 18.2 |
| | Spotify | 16 | 72.7 |
| | Google Play | 15 | 68.2 |
| | Apple Music | 20 | 90.9 |
| | SoundCloud | 10 | 45.5 |
| | Anchor | 5 | 22.7 |
| | Amazon Music | 6 | 27.3 |
| | Other | 4 | 18.2 |

**Table 6**

*Social media platforms podcasters use to advertise their content*

| Variable | | *f* | % |
|---|---|---|---|
| Social Platform | | | |
| | Facebook Page | 16 | 72.7 |
| | Facebook Group | 2 | 9.1 |
| | Twitter | 12 | 54.5 |
| | Instagram | 12 | 54.5 |
| | Custom Website | 8 | 36.4 |
| | LinkedIn | 4 | 18.2 |
| | Clubhouse | 2 | 9.1 |
| | Other | 3 | 13.6 |
| | None | 1 | 4.5 |

Producers were able to further explain the development and production of their podcasts during the semi-structured interviews. Themes that arose from interview coding included: lack of podcasting/science communication training, target audience, guest preparation and logistics, motivation, future plans, challenges, characteristics of good podcasts, and benefits of podcasting.

***Agricultural podcasters often lack science communication training***

Four of the producers mentioned that they did not have any formal training in podcasting before starting their own program, and they used freely available online resources for guidance. For example, Producer 5 stated:

> As crazy as like I tell people, oftentimes, Google is not your best trusted source of information. I have used Google when learning how to kind of get started with this sort of thing. Yeah, it was a lot of, I guess, reading different tips that people would put together. And also, I'm an avid listener of podcasts myself. So, a lot of the podcasters that I listen to for fun, some of them have, like, this is how I podcast. So, I would listen to those and kind of take what I liked from each person and kind of try things out. But yeah, it was a lot of Googling: How do I do this? Or how do I find free music that I can include?

Many of the producers mentioned that the process of developing a podcast was based on trial and error, and often mimicked other established podcasts. When asked about how they learned to craft their podcast, Producer 4 explained that:

> It is just trial and error for us because it really is. The other thing I would say is, our research that we do is just listening to other podcasts because you'll be so surprised by, you know, like how they lay it out. Some people have an intro and then an outro, and some people do an intro and then, they talk briefly by themselves about the guests and then, they go into the—I mean, there's so many different ways. And just listening to other podcasts, I think, helped us craft what we wanted ours to look like, and it's ever changing.

One producer did mention taking an online course for podcasting to help with the continuation of his podcast. Producer 2 said: "I went through John Lee Dumas, *Entrepreneurs on Fire* free podcast course." But other producers did not invest in any formal training programs before developing a podcast.

### *Academic institutions can better support agricultural podcast producers' efforts to share scientific research with their audiences*

Respondents generally agreed that there was some value to academic outputs (i.e., research articles, Extension publications, workshops, etc.), but that they were not always easily accessible to practitioners. Producer 1, a high school agriculture educator and cohost of an agriculture podcast, said, "I think there's some universities that do a really good job of getting research out, but I think it doesn't hurt to see more of that happen." When asked about their perceived value of academic outputs, several producers mentioned numerous ways in which academic communication researchers can better support their efforts. Producer 2 mentioned how academic researchers can be proactive in sharing relevant information with practitioners:

> I think just as far as what they can do, how they can be a part, you know, finding avenues of communication to let podcasters know what they've got going on, and, I don't know. There are lots of podcasts, Facebook groups, you know, that they could get a part of or even niche down and find agricultural podcast Facebook

> groups that they could become a part of. And they could say, “Here's some interesting research,” you know, or reach out to networks.

Producer 2 went on to mention how researchers can alleviate some of the challenges podcast producers have identifying future guests and topics. He advised podcasters to, “Reach out to the podcasting networks and say, ‘Here's the research that we've got that we would like to talk about, and here's a person that could do it,’ you know?”

Finally, producers noted the frequent use of the term “doing research” by public audiences who may not understand the process of research. Producer 1 said, “I think it's important for people to also be informed about how to do proper research and let that drive what they're going to feel about things, even if they're not going to find the right answer that they're looking for.” Though podcast producers often described that they had no formal training in science communication or podcast production, there was a general interest for resources and relationships with institutional personnel.

***FANRHS podcast producers take several steps to prepare guests for podcast interviews***

Producers reported that they typically had some level of contact with their guests before recording a podcast interview. When asked about their process for preparing guests for their interview recording sessions, producers explained that they usually contact prospective guests via email or occasionally have guests reach out to them. For the pre-interview email content, producers discussed items such as scheduling, recording technology, developing a discussion outline, and additional resources. Another recommendation producers mentioned was to start building a relationship with guests by personalizing correspondence to that individual. Producer 5 explained their strategy for reaching out to potential guests via email:

> I usually schedule, you know, I send them like an invite on Microsoft or whatever and that sort of thing. But then, when it comes to inviting people that I know on Instagram, I usually have a copy and paste spiel that I know kind of like equates everybody with who I am because they probably don't know who I am. Introduces me. I'm a grad student. This is what I do with my podcast, but then, I make it personal.

After identifying and contacting a potential guest, many podcast producers shared a list of questions with their guests so that they could prepare in advance. Producer 2 said, “If they ask for questions, I will provide them with questions, but I try to have just a conversation about the topic. And even when I do give them a list of questions, there's maybe enough questions there to fill the half the time that we're looking to fill in.” Often, producers will also request that guests provide additional resources to support the episode. This can include biographies, recent publications, or lesson plans. When discussing the sharing of additional resources, Producer 1 said:

> I think the resources part is really important for our listeners. I listen to some podcasts that are ag teacher specific. They don't share resources. And that's kind of a downside because they might be talking about this really cool lab or lesson that they do, but if you don't have that lesson plan, it's really hard to implement

> just from listening to it. And we've gotten a lot of really great feedback that having those resources available.

The purpose of many of the preparation strategies and logistics was to decrease ambiguity and make podcast guests feel more comfortable being interviewed. Producer 4 commented on other strategies they use to make their guests feel comfortable and to be willing to be on the podcast: "We let them know that we only record the audio, and we let them know when we're going to be posting their episode. We like to make sure they know when we're posting the episode because we want their time to feel valued."

A final tactic producers used to alleviate any concern for guests was to give them the option to re-record or omit any portions of the interview where the guest felt uncomfortable. As Producer 5 explained:

> I always give people the option kind of like, I'm like, 'Hey, if there's anything later on that you change your mind about talking about sort of thing, just let me know and we can either rerecord or take out, that sort of thing.' Yeah, but I don't think I've ever had anyone actually say, 'Hey, can I listen to it before you post?' So yeah, I don't think most of the people I interview, they're like, I don't really want to listen to myself talk after this. Is that OK? And I'm like, that's totally fine.

Overall, producers described the following pre-production logistics and planning such as pre-interview meetings, sharing of questions, and collecting resources, to put podcast guests at ease and prepare them for a successful interview.

***Many producers began their podcasts as personal projects, but some sought funding to support and grow their efforts***

While many of the producers created their podcast to serve as a personal project or service to their profession, some were aware of future or current opportunities to monetize their efforts. Producer 5 said, "This started out as a passion project for me. It wasn't anything I ever planned on monetizing, but people that do it and I'm like, 'That's good for y'all. That's awesome. Happy for you.'" One barrier to monetizing a participant identified was a level of ambiguity around what steps to take to secure sponsorships and the amount to charge for advertising. Producer 1 said:

> Yes, that's been the hardest part for us. It's like, how do we monetize it? Because, for example, the [conference] reached out to us and they said they wanted to do some advertising last summer on our podcast. So, they were like, 'What typically do you guys charge?' ...But that's one area that I don't really know how to explore because, we've never done it before. So, it would be really interesting to hear what other people do for theirs.

Producers mentioned numerous ways to monetize a podcast, including product advertisements, external partnerships, or advertising other related services. Producer 2 explained how their podcast exposure led them to event organizers who invited them to be a paid speaker:

> I think that part of monetizing a podcast can be putting yourself out there as a potential speaker in conferences and stuff like that. And so, I've done some solo episodes just to kind of show like, here, I can. I don't have to interview people. I can talk now in my own niche.

Producer 2 went on to explain other ways in which a podcast can be monetized:

> Right now, the monetization is happening kind of in an old paradigm, and that is just: People are paying for impressions, just like magazines, just like radio, just, you know. And I think that the true value of podcasting is drilling down and advertising to the niche of that podcast. If you're going to get paid by a vendor, the closer they are related to the people that you are trying to speak to with your podcast, the more they can afford to pay you for that. But I think that the main way that I've seen people monetize podcasts is: Having a product or service of their own to sell before they start the podcast and then using the podcast as a marketing tool for that, whether that's a speaking career, a book on financial services. You know, I think having something that they've already produced that they want to market is probably the main way that I've seen podcasts monetized successfully.

Many FANRHS podcast producers did not monetize their podcast at the time of the study, but they identified various methods for doing so, including paid advertisements within the podcast episodes, selling products, or creating merchandise.

***Positive feedback and additional benefits make producers want to continue their podcast***

All producers agreed that they plan to continue their podcast channels. When discussing future goals and reasons for continuing their efforts, many producers mentioned the responsibility they feel toward their listeners. Producer 5 said:

> I would say what motivates me is just knowing that people are listening. Sometimes, it feels like you just upload something and it's just like, 'Well, maybe someone's looking at it,' but when you actually get feedback back or, your numbers kind of validate the work you're doing, or you get emails like, 'Oh my gosh, your messages on Instagram, like, I really enjoyed this episode.' that sort of thing. That's always reassuring.

Producer 1 mentioned that they plan to continue hosting their podcast in an interview format, but that the format will present ongoing logistical challenges: "I would say our goals for the future are just to keep getting more guests there. Some of the challenges are to find relevant topics. We spend a lot of time researching like on different social media threads to see what people are looking for or what might be the hot topics. Additional benefits that producers found from podcasting were that podcasts can complement existing communication programs, allowing them to learn new information, and to help grow their network. As Producer 3, a university staff member with a background in education, communication, and natural sciences, explained:

> It's another way to kind of fulfill our mission, which is to engage the public and stakeholders in ag and natural resources. It's a little more casual, it's less formal, sometimes a bit more enjoyable and more fun than reading something.

Producers found many benefits to podcasting, including the opportunity for using a casual format to engage with stakeholders and public audiences. Producers also received positive feedback from listeners, which motivated them to continue producing content and growing their podcasts.

***Producing a FANRHS podcast presents various challenges including a lack of funds, limited time, and combating misinformation***

Producers identified several other challenges that they experienced while developing a podcast, including editing, time, and marketing. All producers mentioned at least one challenge, and all mentioned the hardship of audio editing. Producer 1 mentioned how a lack of time and financial resources restricts what they can do with the podcast: "You know, ideally, I would like to do editing with it, and I would like to have, you know, the fancy equipment, too." Producer 3 described similar struggles with time and resource management:

> Just starting it, building it was a challenge. Having it be a good return on investment, I think is a challenge as well, not putting too much time into where it's kind of like, you know, the amount of time you're putting in is not warranting the amount of listeners or followership you're getting. And also, having enough content in a timely manner. So, we're not rushing to stay on a timeline. I think staying on a timeline is a challenge in general with podcasting and really anything that you produce on a regular basis, for that matter.

The producers emphasized that editing and marketing a podcast take a substantial amount of time. They said their time was limited for podcast production, since all the producer interviewees also worked a full-time job on top of producing a podcast. Producer 4 said:

> So, challenges for sure is time. We both run the podcast and we both work full time jobs. I'm a new mom, you know. [Cohost], we're both doing our doctorates. So, the podcast takes time and where scheduling interviews and writing up, talking points and posting it, it all takes time. And so that's one of the major challenges is just finding that time to devote to it.

A final challenge producers mentioned was increasing the reach of their podcast. Producer 5 also identified how celebrity voices, while having higher influence, often lacked the expertise of science-based speakers. Producer 5 described how agricultural podcasts might compare and contrast to podcasts hosted by celebrities or public figures:

> I'm an avid podcast listener myself, so I have podcasts I listen to that have hundreds of thousands of listeners and followers, and I'm like, 'Wow, that's so cool.' But they're also public figures that do a different sort of topics, instead of agriculture and stuff like that.

Beginning and experienced FANRHS podcast producers described experiencing several challenges, including lack of time, resources, and competing with better known celebrity individuals to share information.

## Conclusions

This study examined the demographics of FANRHS podcast producers and how they created and maintained their podcasts. RQ1 aimed to describe podcast producers' demographics, including their age, race, level of education, and the topics discussed in their podcasts. Results showed that podcast producers included individuals who had a personal podcast and those who created them for an organization or institution. The findings indicated that producers were evenly split between women and men, were typically white, middle-aged, with a high-level of education and that they had spent six or more years working in agriculture.

Topics covered in the FANRHS podcasts were varied, with a slight emphasis on animal agriculture, land management, and crop science. Other topics included personal interests, policy, and various agricultural and natural resource specific topics. RQ2 examined what types of hardware and software FANRHS podcast producers used. Findings showed that podcast producers used a variety of cost-effective hardware and software. Producers did not typically spend a large amount of time producing their podcast; generally, their production was within ten hours or less per week. For those who produced podcasts as part of their job, some of their production time was included as part of their work hours. Data from RQ2 reinforced the idea that podcasting is a relatively quick and easy medium to use for sharing agricultural content (Fannin, 2006).

An area of opportunity for podcast producers is to further develop a relationship between themselves and university personnel. Universities could better develop this relationship by directly sharing their research in social groups of agricultural communicators and serving as guest experts and providing testimonials. Better communication and outreach about the nature and process of science could be shared by combining the expert knowledge of university scientists, and the influence of existing podcasters.

When discussing how FANRHS podcast producers developed and maintained their podcast platforms, it was discovered that podcast producers largely lacked science communication training and were self-taught using Google or other podcast formats. This finding supported previous literature claiming that podcasts are easy and low-cost to create (Fannin, 2006). This also supports the growing body of literature of the need and opportunities for science communication training and workshops (Bankston & McDowell, 2018). Though there have been science communication training programs for scientists (Miller & Fahy, 2009), there has been less literature focused on the development and effect of industry level science communication training (Becerir & Peschke, 2019).

When working with guests, FANRHS podcast producers typically had an initial introduction (via phone or a short email), provided questions or topics that would be covered during the interview, and shared resources that might help the guest prepare. FANRHS podcasts to date are rarely monetized, but producers identified many opportunities for monetizing the platform, including promoting themselves as a speaker, selling merchandise, or advertising. Even with these opportunities available, producers identified a lack of funds as a challenge. Lack of funds can hinder producers' access to costly recording equipment, prevent outsourcing of podcast producing pieces, and limit the possibility of paid advertisements for their podcast

platform. Yet producers showed limited interest or concern for monetizing their podcasts. It is interesting to consider whether the lack of desire for podcast monetization might stem from the podcast hosts all having full-time jobs outside of their podcasting platforms, or having the podcast funded by their organization.

Without the monetization focus, podcast producers found other external motivations to continue their podcasts. Positive feedback from guests and listeners created a relationship between the producers and their audiences, which encouraged them to continue their communication efforts. The positive feedback was supported by previous literature depicting the benefits of two-way communication models.

The findings of this study have implications for more effective FANRHS science communications efforts from industry and university podcasts to share scientific knowledge, effect perceptions surrounding FANRHS issues, and increase awareness of FANRHS topics. The results of this study can help subject-matter experts, agricultural communicators, or Extension professionals in creating a podcast, enhancing an existing podcast, or designing professional development opportunities to support others in their science communication efforts.

## Recommendations

### Recommendations for Practice

When developing a podcast, producers should seek out training options, use online resources, or mimic practices of existing successful podcasts. If the podcast is not funded by an organization and additional resources are needed, producers should consider seeking advertisements, selling merchandise, or promoting themselves as a speaker. Producers should also reach out to potential guests via email and provide the objectives of the episode, a list of questions/topics, and share resources or examples of past podcast episodes to display the tone of the podcast. During the interview, podcast hosts can give a thorough introduction of the guest that explains their educational background and area of expertise to build credibility. After the episode, producers can opt to send the finished product to the interviewee.

### Recommendations for Future Research

It was interesting to note that some FANRHS podcast producers from the industry responded to the research recruitment email indicating their lack of interest in participating in the study, whereas others (many of which affiliated with universities) were eager. Future researchers should explore how to better incentivize participation in FANRHS podcast research and identify research focuses that would be deemed most useful to industry level podcasters. A challenge for this focus of research is identifying individuals within the population to recruit. A consolidated list of FANRHS podcasts would provide ease for purposive sampling and recruitment. Future research should continue to add depth to the literature on FANRHS podcast creation, mediation of science learning with podcast learners, opportunities for researchers to support podcast producers, and the relationship between agricultural science podcasts and consumers' science knowledge and attitudes towards science topics.

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