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First-year hemp farmers' motives and resources to cultivate hemp

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Abstract

Recent legislative changes have opened new avenues of hemp production for farmers seeking to diversify their operations. With the availability of these opportunities comes the need to better understand the decision making processes of new hemp growers. The purpose of this study was to explore what motivated first-year hemp farmers to grow hemp and to better understand the resources they utilized for decision-making. Fifteen farmers engaged in one-on-one interviews, which were analyzed using qualitative research methods. Three dis-

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tinct themes emerged that undergirded farmer motivations to grow hemp: personal characteristics, identified advantages of hemp as a crop, and trialability and compatibility. Additionally, four themes were central to the resources new hemp farmers sought out: grower networks, digital media, government-based resources, and print media. The findings of this study align with components of Rogers' Diffusion of Innovation Theory and recent research related to hemp and hemp-based products. Based on these findings, we recommend developing and expanding educational resources for those interested in entering hemp production to aid in their decision-making process and assist them as they navigate their entry into hemp cultivation.

Keywords
alternative crops, cannabidiol, cannabis, diffusion of innovations, farmer behavior, hemp, hemp adoption

Introduction and Literature Review

Hemp, a nonpsychoactive form of cannabis grown for industrial and consumable uses, is an agricultural crop that has maintained a global presence throughout history and has provided significant contributions to human development. In the early U.S., hemp was an important agricultural commodity used to produce ship cordage, rigging, and sails (Fike et al., 2020). However, hemp production soon waned due to competing fiber production and technology development (Jenkins, 2016). Although the production of hemp made a brief resurgence in the U.S. during World War II (Small & Marcus, 2002), the crop's association with marijuana and resulting federal regulation and public stigma toward cannabis undermined hemp's potential in the mid- to late 20th century (Cherney & Small, 2016).

All forms of cannabis were made federally illegal in the U.S. with the passage of the Comprehensive Drug Abuse Prevention and Control Act of 1970 (Duppong, 2009). The act did not differentiate between hemp and marijuana, and hemp remained federally illegal for nearly 50 years. During this period, investments in hemp research and development almost entirely halted due to the plant's Schedule 1 Controlled Substance status. Investments in hemp research remained sparse until the signing of the 2014 farm bill, which allowed institutions and state departments of agriculture to apply for permits to conduct pilot hemp research programs (Johnson, 2018). Hemp and marijuana were further established as distinct forms of cannabis when the 2018 farm bill removed hemp as a Schedule 1 Drug. The federally legal status of hemp soon prompted state departments of agriculture to form hemp cultivation and processing regulations under the direction of the U.S. Department of Agriculture (USDA).

Federal law in the U.S. differentiates forms of cannabis based on the content of Delta-9-tetrahydrocannabinol (THC), the principal psychoactive compound that produces a euphoric effect when consumed. Cannabis with a THC content of no more than 0.3% on a dry-weight basis is classified as hemp and is currently legal both federally and at the state level in all U.S. states (Hemp Industry Daily, 2021; Johnson, 2018). The characteristics of hemp cultivation vary by three primary targeted products: fiber, grain, and cannabinoids (Colclasure & Rothenberger, 2021).

Hemp production for fiber or grain is generally like that of other agronomic crops: producers in large-scale operations use mechanical farm implements to plant and harvest the crop. Hemp varieties grown for fiber typically grow fast and tall and are composed of quality yet variable bast fibers found in the outer portion of the stalk (Riddle et al., 2019). Products made from hemp fiber include a wide range of textiles, absorbents (e.g., animal bedding), composite reinforcements, and construction materials (e.g., hempcrete) (Malabadi et al., 2023; Riddle et al., 2019; Shahzad, 2012). Varieties of hemp grown for grain are traditionally shorter in stature and produce compact clusters of achenes—simple, dry fruits containing seeds (Small & Marcus, 2002). The hemp seeds can be used whole or processed into hempseed oil, which is used for human and animal consumption as well as in personal care products, biofuels, and industrial solvents (Burton et al., 2022). According to the U.S. *National Hemp Report* (USDA, 2022), in 2021 hemp was grown for grain on approximately 8,200 acres (3,318 hectares) and was valued at nearly US$6 mil-

lion. Hemp was grown for fiber on 12,700 acres (5,140 hectares) and valued at US$41.4 million (USDA, 2022).

Hemp grown for cannabinoids, such as cannabidiol (CBD), is sometimes referred to as floral hemp and is more characteristic of a horticultural crop than an agronomic crop. Production typically targets hemp flower because cannabinoids are most concentrated in the trichomes found on the flowers of female plants (Livingston et al., 2020). Floral hemp production can be labor intensive and have high input costs; however, as a specialty crop, it is more lucrative than hemp grown for fiber or grain (Moore, 2020). Floral hemp can be propagated by seed or vegetative clones and grown outdoors or in controlled environments (USDA, 2022). Many varieties have been selectively bred to produce desired cannabinoid concentrations, including minor cannabinoids such as cannabigerol (CBG). The market for the primary hemp-derived cannabinoid, CBD, has emerged in the health and wellness sector. Although clinical research on CBD is still in its infancy, emerging research has suggested that CBD may be beneficial in alleviating the symptoms of insomnia (Ranum et al., 2023), reducing stress and anxiety (Lookfong et al., 2023), and modulating inflammation (Pagano et al., 2023), among other medical uses (White, 2019). Hemp-derived cannabinoids are primarily sold in health and wellness products for human and pet consumption (Alvarenga et al., 2023; Wheeler et al., 2020) and cosmetic products (Jeong et al., 2019). The 2021 U.S. market for floral hemp far outweighed hemp grown for grain or fiber, with floral hemp making up US$687 million of the US$824 million total hemp value (USDA, 2022).

In addition to economic value, proponents of hemp postulate that the crop contributes to a myriad of environmental and social benefits. Hemp can be used to diversify farming operations (Dingha et al., 2019), improving sustainability by reducing pests and enhancing soil quality (Kremen & Miles, 2012). Hemp grown for fiber or grain can be compatible with the large-scale, yearly crop rotational systems typical of the Midwest and Great Plains regions of the U.S. (Tenkorang, 2016). The deep root system of hemp can also improve soil aeration, reduce erosion, and enhance soil organic matter (Nath, 2022). Additionally, field trials have demonstrated hemp's ability to remove contaminants from the soil (Golia et al., 2023). Many hemp products can be considered eco-friendly and thereby support a green economy (Karche & Singh, 2019).

Despite the potential benefits of hemp and hemp products, a multitude of challenges has threatened the ability of hemp to reemerge as a mainstream agricultural commodity.

Researchers have found that the public has a limited ability to differentiate between the properties of hemp and marijuana, often defining hemp as a plant that causes euphoric effects when consumed (Colclasure et al., 2021; Rampold et al., 2021). When these misattributions exist, individuals who have a negative perception of marijuana likely have a similar perception of hemp (Rampold et al., 2021). However, the public has become more accepting of marijuana in recent years despite differences in acceptance by political ideologies (Chiu et al., 2022; Denham, 2019). As of May 2024, marijuana for recreational or medical use remained illegal in only 13 states (Breen & Johnston, 2024), including in Nebraska, where lawmakers have voiced opposition to all forms of cannabis (Young, 2019).

The rapidly changing and sometimes ambiguous laws on cannabis production and processing may hinder hemp cultivation (Dingha et al., 2019). Additionally, regulatory approval of chemical controls (e.g., synthetic pesticide options) to be used on hemp is lagging due to how recently hemp has been legalized, thus leaving farmers with limited chemical pest control options (Wortmann, 2020). Similarly, Barker (2020) posited that the future of the hemp industry depends on the development of appropriate infrastructure (e.g., equipment, processing facilities, lending), which is currently lacking. Lastly, unclear guidance and a lack of available resources may deter farmers from adopting hemp (Adesina et al., 2020).

After the federal legalization of hemp in the U.S., state governments soon enacted programs allowing farmers to grow hemp. Like in many states, farmers in Nebraska actively decided to seek hemp cultivation permits. In 2020, the first year that the Nebraska Hemp Farming Act was fully

implemented, 84 farmers were granted approval for hemp cultivation (Nebraska Department of Agriculture, 2020). In this study, we sought to explore the lived experiences of those farmers, paying particular attention to what motivated them to cultivate hemp and the resources they used to inform their cultivation. In doing so, we used Rogers' (2003) diffusion of innovation theory to situate our investigation.

The hemp industry in the U.S. entails a storied history, from being a foundational crop in colonial America to being a plant discouraged by the government. Although the successful reemergence of the hemp industry may strengthen environmental, economic, and human health, the advancement of the industry will depend on many factors. One factor is the willingness of U.S. farmers to grow the newly legal crop. The purpose of this study was to explore what motivated first-year hemp farmers to make the decision to grow hemp. Additionally, we sought to explore the types of resources these farmers used to make important decisions in their hemp farming operations. The results from this exploratory research can be used to inform policymakers, university extension, agricultural educators, and agricultural communicators who work with farmers interested in resilient and sustainable agricultural systems. The two overarching research questions that guided this study were:

(1) What motivated farmers to cultivate hemp?
(2) What resources did first-year hemp farmers utilize to inform their cultivation of hemp?

Research Methods

Hemp cultivation became legal in Nebraska in 2020 for all farmers obtaining state-granted hemp cultivation permits. All farmers obtaining legal permits in 2020 served as the population for our study. The Nebraska Department of Agriculture's website was used to identify publicly available names and addresses of all farmers who held state hemp cultivation permits. We used these names and addresses to compile a sampling frame that consisted of all Nebraska hemp cultivation permit holders (N = 84; Nebraska Department of Agriculture, 2020).

Due to the exploratory nature of our research and the relatively small number of farmers who received hemp permits, we opted to use qualitative methods to best answer our research questions. Specifically, we conducted in-depth, one-on-one interviews (Kafle, 2013). We used this approach to elicit thick and rich data to describe first-year hemp farmers' motives and resources used to grow hemp.

Our participant recruitment procedures entailed mailing all members of our sampling frame (N = 84) a letter requesting their participation in our research study. The individualized recruitment letters briefly introduced the researchers, described the purpose of the study, and offered potential participants a US$50 incentive to complete a one-hour interview with us. Fifteen of the 84 individuals responded and agreed to participate in the interviews, yielding an 18% response rate. We believed that 15 participants was an ideal sample size for our study, as qualitative research employing in-depth one-on-one interviews typically ranges between five and 50 participants (Dworkin, 2012). Additionally, we experienced data saturation as we approached interviewing approximately three-fourths of the participants, indicating that additional interviews would yield little to no new findings (Fusch & Ness, 2015).

We generated a semi-structured interview guide to facilitate the one-on-one interviews. The semi-structured interview guide contained five sections composed of 28 general questions and discussion points. However, the guide allowed the interviewers the flexibility to ask follow-up and probing questions to elicit the thick and rich data deemed valuable in qualitative research (Morse, 2015). We utilized the interview guide as part of a larger study; data obtained from approximately the first half of the guide served as the focus of this study. An external panel of experts reviewed the interview guide to improve face and content validity (Kerlinger, 1986). The panel consisted of a professor of chemistry and director of a cannabis studies program, an assistant professor of agricultural communications with experience in hemp research, and a professor of biology with expertise in cannabis biology. Additionally, we used an audit trail throughout the research process to improve trustworthiness (Lincoln & Guba, 1985).

We conducted individual interviews via Zoom to mitigate safety concerns associated with in-person interviews during the COVID-19 pandemic. Prior research has supported the use of remote interviews when in-person interviews are not feasible or practical (Cachia & Millward, 2011). During each interview, a second researcher was present to take detailed notes on the participant's audio and visual cues that would otherwise not be represented in transcriptions (Muswazi & Nhamo, 2013). Toward the conclusion of each interview, the moderator conducted member-checking by summarizing the main findings with each participant to ensure the accuracy and completeness of the data (Creswell, 2005; Lincoln & Guba, 1985). For accuracy, we recorded and transcribed all interviews.

We uploaded the transcriptions to NVivo, a software for qualitative coding, for data analysis. Two researchers worked together to code the data. As coding can be highly subjective, we attempted to bracket our biases in the coding process. One coder had an extensive background in hemp cultivation and held expertise in qualitative research. The second researcher was a novice qualitative researcher but held some prior knowledge of hemp cultivation. The two coders first established a codebook using deductive coding methods (Bingham & Witkowsky, 2022). The initial codebook contained codes aligning with Rogers' (2003) diffusion of innovation theory. Throughout the coding process, the researchers added emerging codes to the codebook that extended beyond the codes deriving from theory. The final codebook consisted of 20 codes, each with a definition and example passage.

The two coders then coded each transcript individually. After coding each transcript, the two coders met to discuss similarities and differences in coding until they agreed upon all codes found in each transcript. All passages for each code were then exported from NVivo for thematic analysis, where the two researchers again worked collaboratively to generate themes from the data that pertained to our research questions. We triangulated the findings between our thematic results, researcher notes, theoretical bases, and audit trails (Carter et al., 2014).

Results

Each of the 15 participating farmers completed a one-on-one, in-depth interview. Additionally, all farmers met the parameters of our research participants: (1) licensed hemp cultivator in Nebraska; (2) first-year hemp farmer in Nebraska; (3) above 18 years of age; and (4) provided voluntary informed consent as a research participant. We used pseudonyms in our findings in place of real names to protect participants' identities. Limited participant demographic and farm characteristics are illustrated in Table 1 to provide context for our participants' lived experiences.

Seven distinct themes emerged from our interviews with the 15 hemp farmer participants. Aligning with our first research question, "What motivated farmers to cultivate hemp?" the themes of personal characteristics, identified advantages of hemp as a crop, and trialability and compatibility emerged. The themes of grower networks, digital media, government-based resources, and print media provided answers to our second research question, "What resources did first-year hemp farmers utilize to inform hemp cultivation?" These findings are illustrated in Figure 1 and are described below.

Question 1: What Motivated Farmers to Cultivate Hemp?

Theme 1: Personal Characteristics. When describing their individual backgrounds and motivations for growing hemp, most producers illustrated personal traits that aligned with the characteristics of innovators, as described by Rogers (2003). The idea of participating in the frontier of a new agricultural industry was appealing to many. Dan wanted to be a leader in the industry. He stated, "It was to be a part of something new," and discussed his enthusiasm for leading a "really exciting industry to be part of" that is comparable to the "Wild West." Similarly, Ted described his interest in innovation and stated, "I like to try anything new." Aaron described how trying new things was exciting for him, stating, "I know I get bored if I'm not trying something new on a semi-regular basis." For Max, the challenge of trying new things was appealing to him. He stated, "It's a challenge and

Table 1. Participant Demographics and Production Characteristics

Name	Age Range	Gender	Targeted Hemp Product	Farming Background	Interview Length [a]
Ryan	40-50	Male	CBD	Conventional corn and soybean and diversified agriculture	43
Jordan	60-70	Male	CBD	Conventional corn and soybean	41
Max	40-50	Male	CBD	Conventional corn, soybean, and wheat	34
Ted	70-80	Male	Grain	Conventional corn, soybean, and wheat	33
Lincoln	20-30	Male	CBD	New farmer	45
Kyle	40-50	Male	CBD	Entrepreneur and rancher	38
Dan	40-50	Male	Fiber, Grain, CBD	Diversified agriculture	46
Riley	40-50	Male	Grain	Diversified agriculture	37
Molly	30-40	Female	CBD	Conventional corn and soybean	56
Todd	50-60	Male	CBD	Agricultural research	37
Jasper	40-50	Male	Fiber, Grain, CBD	Agricultural research	39
Marley	20-30	Male	CBD	New farmer	37
Daryl	70-80	Male	CBD	Diversified horticulture	55
Aaron	50-60	Male	CBD, CBG	Organic agriculture	53
Jack	50-60	Male	CBD	Organic agriculture	27

[a] Interview length in minutes

stuff like that. I'm the type of personality that if someone says it can't be done, I'm going to try to do it anyway."

For these farmers, the idea of growing a crop that had not been legally grown in nearly half a century was part of the appeal to grow hemp rather than a hindrance. Todd discussed a desire "to experiment" and to provide data that can be used to help others. He stated, "The research side actually made it even a little more tempting because I like to try to do the research and figure out a better way to do it." Several farmers' existing operations and schemas that went beyond the region's conventional agricultural operations illustrated the desire to try new things, leading new advancements and challenging themselves to operate differently within agriculture. For example, Aaron saw an opportunity in organic agriculture and transitioned to an organic farming operation 25 years ago. When describing his family farm, he stated, "We've been very open to trying new crops, and because of that, we have an unusual store of information." Similarly, Ted mentioned growing popcorn, an unconventional crop in the region, in addition to his conventional corn and soy operation. Ryan described his family farm, where they have raised corn and soybeans on large acreage for 150 years. However, Ryan's drive to delve into new agricultural markets led him to add greenhouses to his farmstead around 15 years ago, where they have been growing fresh herbs for wholesale.

Theme 2: Identified Advantages of Hemp as a Crop. Farmers shared their beliefs that growing hemp had advantages over growing other crops. These beliefs served as motivating factors that influenced them to grow hemp. The main advantage of growing hemp, as perceived by nearly all our participants, was the economic potential of the crop. Most farmers described their beliefs that hemp could be a cash crop; however, most were cautiously optimistic. For example, Dan stated, "The gold rush is over. … I came in with pretty darn low expectations, but as far as financial incentives, I hope to transition into a full-time role with the hemp industry." For Max, who was growing hemp for cannabinoids, it was the opportunity to make a high profit on a small amount of acreage. He stated, "The high return on your investment is the biggest thing." Kyle, who was limited by the

Figure 1. Themes Pertaining to First-Year Hemp Farmers' Motives and Resources to Cultivate Hemp

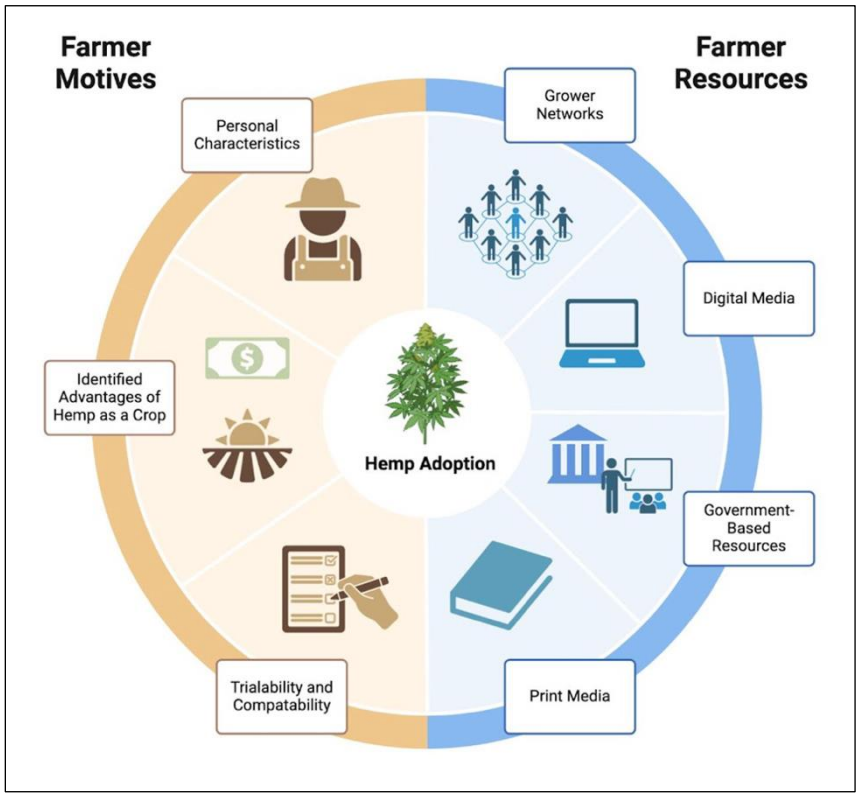

Figure created with BioRender.

acreage on his "small homestead," shared a similar sentiment. He asked himself, "What can I do with the amount of ground that I have that would be economically viable?"

Some farmers described growing hemp as an opportunity to diversify the types of crops in their operations. According to Jordan, he wanted "a crop that was a little more profitable to raise than corn and beans," and he just "hoped it would work out." Other farmers, like Molly, also mentioned using hemp to diversify their farming operations to improve economic sustainability. She stated, "We've been told time and time again we got to diversify. You know, corn and soybean prices are not great. It's not a great outlook for farmers to keep along that stream." Similarly, Riley said, "We need to find a substitute for growing soybeans," while Ryan added, "This is just another step for us to diversify our farm and create more opportunities for our kids."

Although the primary identified advantage of hemp over other crops was economic advantages, most farmers perceived additional advantages. Around half of the farmers mentioned aspects of hemp and hemp-based products that are environmentally favorable. Several farmers described a reduction in their use of pesticides. Molly stated, "You don't have to put chemicals on it, you don't have to put herbicide on it, so you're doing a favor to everybody by growing it." Dan also mentioned pesticide reduction, "I'm not using pesticides or herbicides, so I guess there's some benefit to that." Dan and Daryl also mentioned hemp's capacity to remove contaminates, such as "heavy metals," from the soil. However, both farmers described the capacity of hemp for phytoremediation as unsubstantial in their decision to grow hemp.

Several participants alluded to the environmentally favorable products made from hemp as a motivating factor for them to grow the crop. For example, Jordan said, "There are many things you can [make] from hemp that could help our environment" and mentioned green "insulation" and "construction materials." Other farmers also mentioned products from hemp, but as opposed to environmental health, they described advantages of the crop to support human health, and these perceived advantages made cultivating hemp an appealing avenue for them. Marley, who was growing hemp for cannabinoids, stated, "I'm growing CBD. It's a health supplement that people can use to better their lives, and that's really powerful, … so that is a lot of my motivation." Like Marley, Jordan also found the medical properties of hemp interesting and valuable. Jordan described wanting to eventually "grow certain varieties to do certain beneficial things, medicine-wise, once the genetics, science, and technology catch up with the industry."

Overall, all farmers believed in the potential of hemp to bring positive attributes to their farming operations, community, and the state. They specifically believed that hemp had a strong potential to improve economic, environmental, and human health. Jasper summarized such attributes by saying,

> We need to have something more regenerative and stable in the plant world that's healthier for not only the actual earth that it's being planted into but then, also all the byproducts that come from the plant and how those actually impact the environment and us. That's [my] motivation – to have a healthier culture.

Theme 3: Trialability and Compatibility. In addition to farmers identifying advantages of hemp, they also described two general characteristics of successfully adopted innovations that applied to hemp: trialability and compatibility. Nearly all participants explained that their first year growing hemp was more of a trial year, and they opted to grow the crop on a limited scale. Jordan stated that his first year was to "get [his] feet wet and get in there and grow some." Some farmers, like Molly, rationalized limiting production due to trusted advice from others. Molly mentioned, "One of those things that I was told right away, I kind of heeded toward, was 'it's a new crop, don't bite off more than you can chew.'" Kyle described his first year growing as essential to determine if the crop would be profitable. He mentioned, "Before a person makes a big leap, you're going to want to make sure you're doing something that is economically viable."

Farmers viewed the first year of production as an opportunity to experiment with crop varieties and growing conditions to learn more and to prepare them for the possibility of a larger operation in years to come. This view was illustrated by Marley when he said, "This year is a big learning experience and kind of like figuring out what the climate is like and what the environment in Nebraska is like and what [hemp] varieties grow good here." Ryan shared a similar sentiment: "I looked at this year being a strong research and development year for our company, learning the plant, learning timing … learning all the bumps in the road and figure out how to do it better in the second season." Dan said this year was to "make sure [he] was set up for next year to optimize [his] operation." He explained his focus this year was to "figure out what seeds, what varieties, and what genetics to pick."

All but two farmers were incorporating hemp into an existing farming operation. In doing so, these farmers described their perceptions of the compatibility of hemp with their prior operation. Ted, who also grows wheat, believed he could grow hemp for grain as a viable option to diversify his farm without significant disruption to his current operation. Ted stated:

> I thought I could start with the grain end of it because I'm a grain producer anyway, so if I got the grain drill that I use for wheat. … If you look at these real old grain drills, they've got a hemp setting right in there. You lift the lid, and it'll tell you a hemp setting, especially the ol' John Deere L13 grain drills… but anyway, I used the grain drill that I normally [use to] plant wheat.… It should be the same as growing wheat, as far as planting.

Jordan believed incorporating hemp would "work well with corn and beans," citing the environmental benefits. However, Molly, who was growing hemp for cannabinoids, explained that this was not the case for her. She described challenges to growing hemp for CBD as a steep learning curve and very different from her current operation. She stated, "We have large equipment for cultivating corn and soybeans, so hemp cultivation has been a little bit more of a challenge as far as how do we get this into the ground and then what do we do as far as care for it when it comes up." Interestingly, several farmers growing hemp for cannabinoids mentioned hemp being compatible with their current operations because they were used to growing specialty crops. For example, Kyle described growing many specialty crops, such as tobacco and aronia, on his small "hobby farm." He described hemp as a crop that "checked all of the boxes" for his growing operation. Similarly, Ryan described the crop as compatible with his existing

operation, which ranges from conventional corn to fresh herbs.

Question 2: What Resources Did First-Year Hemp Farmers Utilize to Inform Hemp Cultivation?

Theme 1: Grower Networks. Nearly all the first-year hemp growers in our study built a network of trusted and knowledgeable individuals who served as a resource informing their hemp cultivation. Todd described his network as his primary resource: "I created a network of people that I talk to, and I think that's what is helping me more than anything right now." He continued by saying "I can call on individuals that have experience and some that don't, and we just talk about what we are seeing."

Hemp farmers formed these networks through many channels. Most hemp farmers started to build their network by attending seminars, workshops, or conferences. Several farmers, like Dan and Molly, mentioned joining the National Hemp Industry Association and taking advantage of knowledge exchanges through the organization. Jack discussed learning a lot through the Midwest Organic and Sustainable Education Services (MOSES) Organic Farming Conference, Ryan discussed attending the NoCo hemp exposition and conference, and Ted described attending the Midwest Hemp Forum. Ted elaborated on his experience by stating, "I went to seminars the last three years on hemp." He further explained how he found out-of-state conferences more beneficial, "I've been to seminars in Kansas. I've been to seminars in Colorado. I follow other states and what they are doing because they were ahead of Nebraska."

Some farmers would then use these contacts to reach out to others. Aaron summarized his experience by stating, "It was one of those cascade effects. One person met another person that allowed another person to be met. … We found some people that were very smart and knew a lot about the industry."

Uniquely, Marley, a young farmer, described finding his network through online chat groups. He described participating in Google Hangouts with experienced cannabis growers who were growing marijuana. Marley explained, "You could go and talk to them. … Just getting consensus on what problems they're having and how to avoid some of those problems. … At the end of the day, it's the same crop (marijuana and hemp) that we're growing."

Theme 2: Digital Media. Most farmers described searching the internet to find resources to inform their hemp operations, with Aaron stating that "Google was [his] honest friend." Farmers described finding a plethora of helpful information, yet a good portion of that information pertained to marijuana cultivation as opposed to hemp. Although Aaron stated that he found some helpful information online, some of the resources were produced by "backyard potheads," and while he took "tidbits of information from them," he found resources produced by larger operations more useful. Daryl described websites such as Grow Weed Easy and I Love Growing Marijuana as trusted resources for him. Several farmers described YouTube as being a primary resource. Jordan stated, "There are some good videos and everything on how to grow [cannabis] on YouTube, … and I just kept watching videos." Similarly, Marley got his start by watching YouTube videos. He stated, "I was always watching YouTube videos. That's where I got a lot of my information from … because there wasn't a lot of like set research or anything like that." He continued, "some people would just upload videos, like weekly, or daily, and you'd follow along with them." Jack described a similar experience of watching an online video of no-till, organic hemp production and telling himself, "that's the way I want to do it."

Theme 3: Government-Based Resources. Regarding laws and regulations for growing hemp in Nebraska, all participants stated they utilized the Nebraska Department of Agriculture website. Jasper summarized the sentiment, "As far as regulations go, we looked mostly to the Department of Agriculture." Some farmers found the information presented on the website straightforward, while others found it to be complex or incomplete. In these instances, farmers would reach out to the lead of the hemp program for the state for answers

to their questions or to assist them through the regulatory process.

Another commonly utilized government resource was Extension services provided by land-grant universities. The most mentioned modalities for these resources were online materials, in-person seminars, and field days. While only Riley described utilizing Nebraska's 1862 land-grant institution, the University of Nebraska-Lincoln, as a resource, other farmers mentioned utilizing materials from land-grant institutions in other states. For example, Jordan stated, "I was on a website for the University of Wisconsin. And there's a lot of universities now that are really getting with the idea of growing hemp." Furthermore, Jordan described his belief that the information from these universities was more credible than other resources. He stated, "I think [a] university, no matter where it's at, is probably more reliable source of information." Kyle stated, "Lots of different states had information on their state's [land-grant university] sites, meaning I could look at [the] University of Kentucky or the University of Kansas … [the] University of Washington … there was a lot of information out there." Dan similarly shared, "Wisconsin had a lot of good resources, the University of Wisconsin."

Theme 4: Print Media. Approximately half of our participants recalled using some form of print media as a resource. Several farmers described finding information from magazines. For example, Dan mentioned that he subscribed to *Hemp Grower* magazine. Similarly, Jordan recounted learning more about hemp cultivation from farm magazines, such as *Successful Farming* and *Farm Journal*. Molly, Ryan, and Marley all described using the textbook, *The Cannabis Bible*, as one of their primary resources. Ryan explained, "One of the big resources that I got a lot of facts from is *The Cannabis Bible*. It talks about the differences on both plants (hemp and marijuana) and how that plant grows and how all of it comes together." Uniquely, Ryan also described "digging into old literature and books," particularly information "coming out of Europe."

Discussion

Our findings illustrate that the farmer characteristics in this study and their views toward hemp closely aligned to components of Rogers' (2003) diffusion of innovation theory. As described by Rogers (2003), innovators are the first individuals who adopt an innovation. These individuals have distinct personal characteristics that influence their motivation to adopt new agricultural practices and technologies (Hubbard & Sandmann, 2007). The farmers in our study had an ingrained desire to be change agents and leaders in a new agricultural industry. Furthermore, they were motivated by new challenges and viewed hemp cultivation as an appealing challenge they wanted to pursue. Exploring new opportunities was not limited to their pursuit of hemp cultivation. Most of our participants shared a history of exploring new agricultural opportunities and challenges, being entrepreneurs, risk-taking, and seeking new ways to manage their farms for the betterment of themselves, their families, and their community food systems. Prior research has identified similar traits in farmers who grow specialty crops, practice nonconventional agricultural methods (e.g., organic production), or employ climate-smart agricultural practices (Dingha et al., 2019; Kangogo et al., 2021; Padel, 2001; Rakesh et al., 2015)

Beyond the personal characteristics influencing the adoption of new technologies, individual attitudes toward the attributes of the technology influence the adoption of innovations (Rogers, 2003). Of these innovation attributes, we found that farmers perceived hemp to have relative advantages over other crops. Rogers (2003) describes the scholarly consensus that relative advantage is one of the strongest predictors of the adoption of an innovation. One of the most consistent participant viewpoints was the economic advantage of hemp as a motivation to cultivate the crop. Farmers believed they could make money from growing hemp, and thus it was a primary motive for their venture into the hemp industry. These findings align with Dingha et al. (2019), who surveyed potential hemp farmers in North Carolina and found that a viable hemp market was important for farmers to determine whether they would consider growing hemp.

Prior literature has illuminated the need for more crop diversification to improve agricultural sustainability (Paroda, 2022; Shah et al., 2021).

Farmers similarly acknowledged that they viewed hemp as impactful in this context. They sought to incorporate hemp as a means of crop diversification, primarily focused on diversification for economic sustainability. However, several farmers also described crop diversification as critical for improved environmental sustainability. Farmers described the ability of hemp to reduce the need for pesticides and improve soil conditions, which were found to be attributes of hemp described in scientific research (Golia et al., 2023; Nath, 2022). The farmers in our study described their belief that hemp provides tangible benefits to society, increasing their motivation to grow the crop. Farmers who were growing floral hemp for CBD believed that CBD was a beneficial health and wellness product. Although the claims of health benefits of CBD may be exaggerated in digital spaces (Merten et al., 2020), clinical research has shown there to be beneficial properties of CBD for medical uses (Lookfong et al., 2023; Pagano et al., 2023; Ranum et al., 2023; White, 2019).

The compatibility of a new crop, or its ability to be integrated within existing farming operations without significant disruption to operational characteristics, can influence wide-scale farmer adoption of the crop. Tenkorang (2016) described that hemp grown for fiber or grain is similar to the operational characteristics of other fiber and grain crops. These characteristics make hemp a potential crop for implementation in crop rotations with corn, soybeans, and wheat found in conventional large-scale operations in the Midwest and Great Plains regions of the U.S. (Tenkorang, 2016). Farmers in our study who were growing hemp for fiber or grain alluded to the compatibility of hemp with their current conventional farming operations. Conversely, the farmers growing hemp for cannabinoids found the crop to vary considerably from conventional agronomic crops. However, several of these farmers had experience growing specialty crops and found that floral hemp was compatible with their operations. This finding corroborates the suggestion of Hubbard and Sandmann (2007), who posited that farmers are more willing to adopt farming practices that they view as compatible with their existing operations. Neiden (2021) recommended that farmers who plan to enter the hemp industry should start on a small scale. Thus, trialability appears to be an important attribute for hemp adoption. The farmers in our study alluded to this, describing that their first year growing hemp was primarily for their own research and development in order to learn what works well for them and their operation.

The prohibition of hemp cultivation in the U.S. from 1970 to the early 21st century significantly disrupted hemp research and development (Cherney & Small, 2016). This void in research and education likely caused a lack of resources on hemp cultivation for farmers to utilize. Dingha et al. (2019) found that a lack of knowledge and information about hemp was a factor that negatively impacted hemp adoption by potential hemp farmers in North Carolina. Interestingly, we found that farmers used a variety of resources to inform their hemp-growing operations. Among their primary resources was a robust personal network of other hemp farmers and hemp-related organizations. Participants discussed seeking out individuals through attending hemp conferences and expositions and utilizing this network to support their decision-making. Farmers often relied on each other to share information, resources, and personal experiences. Padel (2001) found that similar formal and informal farming networks were important to the distribution of information and the decision-making of farmers growing specialty crops or using niche production methods.

Although a lack of hemp production in recent years reduced its observability to U.S. farmers, an important attribute for adoption (Rogers, 2003), many of our farmer participants discussed online websites and videos as valuable resources to inform their hemp cultivation programs. This online modality allowed the participating farmers to observe aspects of hemp production that may have been difficult to access otherwise. Rust et al. (2022) described that more farmers are seeking information from online resources. Our findings show that the farmers in our study were using a variety of online resources, including online video-sharing platforms such as YouTube. Despite some farmers describing viewing online media specific to hemp cultivation, some farmers described using resources that were made to inform marijuana cultivation.

As farmers now have access to copious information online, including unverified information, farmers must decide what information to trust (Rust et al., 2022). Some participants questioned the trustworthiness of online resources they encountered from independent content creators, such as those produced by hobby marijuana growers. Farmers did seek information they perceived to be more trustworthy for growing hemp, including information produced through university Extension services. However, several of our participants described a lack of research-based resources for hemp growers produced by Extension services in their state. These farmers described finding information from Extension in states beyond Nebraska. While they believed this information to be both trustworthy and helpful, best practices in hemp production vary by differences in each state's economic, political, and environmental landscapes. This variability leads to a need for each state to develop educational resources for hemp farmers tailored to the unique conditions of their state and stakeholder needs. Ruth et al. (2022) recommended that Extension specialists and agricultural communicators in each state work with hemp growers and processors in the state to support the reemerging hemp industry. Additional hemp research and educational efforts, especially through the integration of existing hemp farmer networks, may be valuable to the success of the hemp industry.

Conclusions and Recommendations

The results of this study demonstrated that farmer characteristics and their perceptions of hemp influenced their decision to grow hemp. Based on the results of our qualitative study, we found that Nebraska hemp farmers exhibited characteristics aligning with Rogers' (2003) description of innovators. They saw themselves as change agents and disruptors to the agricultural industry, had a history of adopting new practices, and expressed excitement in seeking new challenges and opportunities for the betterment of themselves, their farming operations, and their communities. We believe these farmer characteristics are valuable to improve community food systems. Additionally, two of our participants became new farmers due to the desire to grow hemp. Thus, hemp can be a unique crop that encourages individuals to enter farming, and new farmer programs should be considered in the context of hemp.

Farmers also saw hemp as having a relative advantage over other crops, aligning with the diffusion of innovation theory (Rogers, 2003). Participants were motivated to grow hemp because they believed that hemp could increase the revenue of their farming operations over other crops. Although prior research has suggested that growing hemp can be a profitable endeavor (Khanal & Shah, 2024), we recommend that farmers be cautious due to uncertainty in hemp markets (Mark & Will, 2019; Sterns, 2019). As we found economic incentives to be the primary motive for farmers' adoption of hemp, extension-based educational programs to support profitable hemp operations can be valuable in supporting economic sustainability. These programs should be based on modeling from agricultural economists to project realistic profitability for farmers on a state-level basis (e.g., Moore, 2020). Due to the lack of hemp research, train-the-trainer programs or educator professional development on hemp may be necessary to guide such workforce and farming training programs in the cannabis industry (Colclasure et al., 2023).

Some farmers described a desire to increase the crop diversity of their farming operations to improve economic and environmental sustainability. Several farmers also believed hemp products would benefit human health and society. Farmers' attitudes toward the trialability and compatibility of hemp also influenced their decision to grow hemp. Participants described their first year growing hemp as a trial run and an important learning experience to inform their production decisions in future years.

The farmers in this study sought information from university Extension services to guide their decision-making in hemp production. However, these farmers were utilizing information from Extension services from states beyond their home state. We suggest that consideration should be given to the regional variations in growing hemp and therefore recommend that state Extension services create and disseminate cultivation resources specific to the regulations and environmental characteristics distinct to hemp in their state. Many of

the farmers in this study utilized online video resources to guide their hemp management decisions; therefore, we recommend that government support providers, such as Extension, explore the use of video resources to inform producers.

The characteristics of hemp cultivation vary state by state due to political, social, and geographical differences. We recommend that future studies explore hemp adoption in other states. Lastly, although the qualitative nature of our study provided valuable exploratory data on farmers' adoption of hemp, it does not lend itself to being generalizable to farmers beyond our study. Additional social science research should investigate the characteristics of hemp adoption from a quantitative methodology to provide generalizable data.

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