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A Perplexing Process: Understanding How Agricultural Producers Process Best Management Practice Information

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Abstract
Best management practices (BMPs) are suggested practices that help agricultural producers optimize production while reducing pollution, soil erosion, and other environmental impacts. Many audiences, including scientists and policy makers, have expressed disappointment at the current level of BMP use. Elaboration likelihood model (ELM) is used to understand how people process messages. ELM states that people can process messages either centrally or peripherally. This study sought to understand how producers processed information related to BMP adoption in grazing systems. Researchers conducted qualitative, in-depth interviews with 42 beef-cattle producers in Kansas and Oklahoma. It was found producers process information both centrally and peripherally, more specifically through past experiences and visual observations. This study suggests that when promoting BMPs, communicators should use visual cues to help producers process information. More importantly communicators should utilize strategies that encourage producers to reflect on past experiences to promote central processing.

Keywords
elaboration likelihood model, best management practices, grazing

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Drought affected regions of Kansas and Oklahoma from 2011 to 2014. In 2010, most of the United States experienced near normal conditions with no presence of drought in Kansas or Oklahoma. Parts of Oklahoma and Kansas were beginning to experience abnormal dryness, moderate drought, and even severe drought in 2011. In 2012, that trend continued and cattle inventory was down in Kansas by 25% (Voorhis, 2012). The next few years, 2013 and 2014, proved to be the most severe for Oklahoma and Kansas as well as most of the Great Plains. Drought continued in some areas of Kansas and Oklahoma in 2015 (Folger & Cody, 2014; Rippey, 2015).

Policymakers and scientists have expressed frustration at the level of best management practice (BMP) adoption (Pannell et al. 2006). BMPs are practices agricultural producers can voluntarily adopt to better manage resources and mitigate environmental pollution (Paudel, Gauthier, Westra, & Hall, 2008). Proper management practices for grazing lands can increase forage production, reduce soil erosion, and increase resiliency (Alonge & Martin, 1995; Ohlenbusch & Jones, 2002).

The resiliency of grazing systems is particularly important due to climate change. The Southern Great Plains is not only particularly susceptible to climate change, but also highly dependent upon the economic contributions of the grazing industry ("Climate risks in the Southern Plains," n.d.). Effectively communicating the BMPs for grazing could increase the adoption of BMPs thereby lessening this effect. Practices are based on scientific evidence and application, recommended by scientists and/or government entities, and are targeted to reach a specific objective while optimizing producers' resources (BMP, 2018; EPA 1993). Depending on the specific context of the BMP, it may be monitored through a government agency, scientific research, or state associations and institutions (EPA, 1993; Welsch, Ryder, & Post, 2007). Though these practices can mean an initial cost, implementation can be economically beneficial in the long run (Boyer et al., 2004). BMPs are designed to reduce water pollutants and conserve soil while improving or maintaining productive land use (Sanders, Wegenhoft, & Del Vecchio, 2002).

According to the 2012 census of agriculture, there were 22.1 million acres of grazing lands in Oklahoma (2014). Permanent pastureland in Oklahoma accounted for over 56% (19.45 million acres) of total land use as of 2012 (2012 census of agriculture, 2014). Grazing lands in Kansas were equal to 16.2 million acres and permanent pastures accounted for one-third of Kansas land area (15.5 million acres) (2012 census of agriculture, 2014). In 2011 alone, drought resulted in more than $1.6 billion lost from the agricultural sector in Oklahoma with over $6.6 million of loss in the livestock sector (Wessler, 2011). More recently, more than 66% of Kansas and 73% of Oklahoma have been plagued by drought (Fuchs, 2018). Many different sources have worked to promote the adoption of BMPs by producers such as extension, Natural Resource Conservation Services (NRCS), soil conservation districts, and private industry. The lack of adoption paired with potential benefits for producers may point to communication challenges between agricultural producers and scientists, policy makers, extension, NRCS, and conservation districts.

Many studies have examined why producers choose to adopt BMPs (Prokopy, Floress, Klotthor-Weinkauf, & Baumgart-Getz, 2008; Rahelizatovo & Gillespie, 2003, 2004). These studies examined the motivations of producers who adopt practices (Greiner, Patterson, & Miller, 2009), factors that influenced the adoption of practices in stocker-cattle operations (Johnson et al., 2010), BMP adoption among Louisiana dairy producers (Paudel et al., 2008), adoption of cow-calf BMPs in Oklahoma (Ward, Vestal, Doye, & Lalman, 2008), and factors that influenced BMP

adoption in Louisiana sugarcane operations (Henning & Cardona, 2000). Though several studies have been done concerning the information sources producers use (Velandia et al., 2010; Vergot III, Israel, & Mayo, 2005*; Information Sources for Beef Cow/Calf Producers,* 1994), these studies didn't delve into the deeper meaning behind sources of information and did not examine how producers process information. However, all of these studies were outside of the scope of understanding the communication aspects of BMPs and failed to investigate the role of how producers process information associated with BMPs.

According to Gillespie, Kim, and Paudel (2007), a producer who hears about BMPs but still chooses not to implement them in his or her operation is an unexplained phenomenon. The present study seeks to understand how producers' decision to adopt BMPs connects to how they process information associated with BMPs. Understanding the choices that lead to the decisions can help communicators influence those choices (McKenzie-Mohr, 2011). The elaboration likelihood model (ELM) could help to understand why producers are not adopting BMPs by understanding how they process information. In ELM, messages can be processed either centrally or peripherally. Individuals have to work harder in order to centrally process information; central processing requires an individual to scrutinize an argument and all of its elements (Petty & Cacioppo, 1984). Central also requires that a person have the motivation and ability to think about the information (Kruglanski & Van Lange, 2012). For instance, a person who readily understands the context of a message or cares about its topic, will pay more attention and consider it carefully. If information is centrally processed, that information is more likely to be used. One of the best ways to motivate people to centrally process information is to make it personally relevant to them (Petty & Cacioppo, 1984) as people are more likely to be motivated to centrally process if they can see how it is relevant to their own lives (Sherif & Hovland, 1961).

When a message is peripherally processed, a person decides with very little processing of the information. Peripherally processed messages do not have personal relevance to the receiver or are of little interest to the receiver (Kruglanski & Van Lange, 2012). Peripheral processing is essential to making the vast number of daily decisions producers must make on his or her respective operation. Personal relevance is not presented in the literature related to BMPs; therefore, a gap exists in this area. Thus, it is important to determine awareness, perception, personal relevance, and processing of BMP information.

Literature Review

Understanding the way audiences process information has been an area of interest for many communications researchers. ELM is a model that seeks to understand how people process messages through cues. ELM has been used to understand how people make choices about new technology. For instance, if consumers cannot concretely understand a new technology, they rely on peripheral cues, i.e. other cues besides the strength of the arguments or ideas in the message, to make choices. Rather than scientific findings, consumers focused on easily remembered cues (Miller, Annou, & Wailes, 2003).

ELM can be used to make campaigns more relevant to consumers. In a study on local food, it was found that credible branding sources were essential to central processing. Moreover, it was found that locally grown and locally supported products were more relevant to consumers (Wilson et al., 2013). These kinds of findings can be applied not only to consumers but also to voters and producers.

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Industry Background

This study's focus is on the adoption of BMPs specific to grazing. The lack of adoption of grazing BMPs was most recently notable in the 2011-2014 drought.

In 2012, there were 16.2 million acres of grazing and pastureland in Kansas; beef cattle production is the main industry on these lands (*2012 census of agriculture*, 2014; Boyer et al., 2004). In the 2012 Agricultural Census, Kansas had 27,568 farms with cattle, totaling 7.46 million head and Oklahoma had 51,043 farms with cattle, totaling 4.24 million head. These cattle numbers were some of the lowest seen since 1951 ("U.S. Cattle Decline," 2013)The low population of cattle was due to the drought conditions described above. The drought negatively changed the quality and quantity of forage available for cattle production (Hurt, 2014).

K-State Research and Extension and Oklahoma Cooperative Extension suggest the following BMPs for grazing: setting proper stocking rates, controlling grazing distribution, utilizing planned periodic rest, prescribed burning, weed and brush management, utilizing winter wheat, introduced grasses, and alternative forages, and managing fertility of grazing lands (Boyer et al., 2004; Hossain, Epplin, Horn, & Krenzer, 2004; Jia, Ramaswamy, Whitworth, Ohlenbusch, & Thiessen, 2003; Krenzer & Redfearn, 2005; Ohlenbusch & Harner, 2003; Ohlenbush & Hartnett, 2000; Redfearn, Rice, Bidwell, & Woods, 2005; Towne & Ohlenbusch, 1992; Weir et al., n.d.; *Wheat Production Handbook*, 1997). Livestock producers have based stocking rates on tradition, neighbors, guesses, or financial pressure (Ohlenbusch & Watson, 1994). Grazed forages are most productive when grazing pressures are matched to the grazing capacity of a pasture on a case-by-case basis and then adjusted for periods of stress, such as drought. Overuse of pasture for many years has resulted in reduced profitability and increased soil erosion (Ohlenbusch & Watson, 1994).

The push for adoption and dissemination of BMPs can be traced to the Dust Bowl. After this tragedy, producers and ranchers began to understand the importance of caring for the land for the future. On April 27, 1935, the Soil Conservation Service (SCS) was established as a branch of the USDA to provide financial incentives for producers to take unsuitable land out of crop production and help them return it to its natural state. The SCS also encouraged implementation of BMPs such as terraces, contour plowing, and crop rotation. The SCS was later renamed the Natural Resource Conservation Service (NRCS, n.d.). BMPs were determined by years of research to be not only effective, but a practical way to conserve soil, reduce water pollutants, and improve the productivity of agricultural lands (Sanders et al., 2002). The Extension system places agents or educators in each county to disseminate this information to constituents on a personal level. County agents have the unique advantage of becoming integrated into the community and establishing themselves as a trusted source. Each agent should be a skilled communicator (Rasmussen, 1989). Communication is of the utmost importance to make county Extension offices function. Extension agents use a variety of methods to communicate BMPs to producers like face-to-face communication, phone calls, email, fact sheets, web tools, and field days.

There were three predominate ecoregions in the study area: Flint Hills, Central Great Plains, and Southwestern Tablelands (Chapman et al., 2001; Woods et al., 2005). Table 1 describes the area, identifying factors, climate, and predominate plant types of each ecoregion in the study. The eastern part of Kansas and Oklahoma had higher amounts of precipitation than the western. As of 2012, in Oklahoma, the annual precipitation varied from 56 inches in the southeast to less than 16 in the northwest (Tyrl, Bidwell, Masters, Elmore, & Weir, 2012). In Kansas, the annual precipitation varied from 42 inches in the northeast to 16 inches in the southwest (Jia, Ramaswamy, Whitworth, Ohlenbusch, & Thiessen, 2003).

Table 1

Ecoregion descriptions

Ecoregion	Geographic Area	Identifying Factors	Annual Precipitation	Predominate Vegetation
Flint Hills	Eastern Kansas and north central Oklahoma	Rolling hills, limestone, rocky soils, and grazing lands	38 to 42 inches	Tallgrass prairie; Big bluestem, little bluestem, indiangrass, and switchgrass
Central Great Plains	Central Kansas and Oklahoma	Crop production, little topography, and deep fertile soils	22 to 38 inches	Mixed grass prairie; Big bluestem, indiangrass, blue grama, side-oats grama, western wheatgrass, switch grass, and Western ragweed
Southwestern Tablelands	Western quarter of Kansas and Panhandle of Oklahoma	Hills, canyons, plains, buttes, mesas, and terraces; limited row crop production, grazing, and rangeland	16 to 28 inches	Short grass prairie; Blue grama, buffalograss, western wheatgrass, and switch grass

Conceptual Framework

This qualitative study uses ELM as a conceptual framework to inform and guide the study. ELM has been used to inform qualitative studies that explore user motivations for specific behaviors (Wilson, Barnes, & Irani, 2013), as ELM seeks to understand how people process information. ELM is a model of attitudinal change (Cacioppo & Petty, 1984). In the context of this model, elaboration means "the extent to which people think about the issue-relevant arguments contained in a message" (Petty & Cacioppo, 1984, p. 128). A high level of elaboration likelihood occurs when motivations to process information related to a message are high; therefore, an ideal environment is created for information processing (Petty & Cacioppo, 1986). The higher the motivations, the more likely the information is processed.

There are seven postulates to the ELM (Petty & Cacioppo, 1986):

1. Seeking correctness: states that people want to hold correct attitudes; they want to be viewed as reputable.
2. Variations in elaboration: states that while people want to hold correct attitudes they did not want to think much about it.
3. Arguments, cues, and elaboration: states that variables, such as cues, influenced how much an attitude changed and in what direction.
4. Objective elaboration: states that objective processing is influenced by variables affecting motivations and the ability to process the message.
5. Elaboration versus cues: states the less motivation to interpret the message, the more important peripheral cues were to the argument and vice versa.

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6. Biased elaboration: states that biased processing could either have a negative or positive effect on the processing of the message.
7. Consequences of elaboration: states that attitude changes coming from central processing are far more likely to persist than attitude changes made from peripheral processing (Petty & Cacioppo, 1986).

The major tenets of ELM indicate people 1) attend to the appeal; 2) draw from memories to find relevant information, such as images and experiences; 3) examine the message provided to them with available memories and information they receive; 4) draw inferences about the validity of the message based upon the memories of the person; 5) complete an assessment of the message. If someone has a positive experience with past information related to the topic or message being communicated, it is far more likely they would process with a high elaboration likelihood, meaning information is more likely to be acted upon (Cacioppo & Petty, 1984). In relation to the current study, a producer who read BMP literature or heard messages related to BMP adoption might view the message similar to this: they listen, recall information from their own ranching practices going as far back as their childhood, consider the BMP information while the source is also considered, establish the validity of the source based on previous interactions, and finally decide if a BMP was worth adopting.

Central Processing

When information is centrally processed, the individual listens more intently and the individual is more likely to act upon the information. One of the best ways to motivate people to centrally process information is to make it personally relevant to them (Petty & Cacioppo, 1984). Messages can be made more personally relevant if examples from their own operations are used. The central route occurs when people are highly motivated and analyze arguments (Petty & Cacioppo, 1986).

Peripheral Processing

The peripheral route occurs when an individual has low motivation and ability to process. In the case of peripheral processing, the resulting attitude is determined by the cues in the persuasive context, either positive or negative. Peripheral persuasion occurs without an examination of the argument itself (Petty & Cacioppo, 1986). Peripheral processing can happen in a large group meeting of agricultural producers with generic examples and low application, and therefore low personal relevance.

Messaging Components According to ELM

Central and peripheral are not only ways of processing but parts of the message itself. Central components, for example, are argument quality and logic. Peripheral elements include source credibility and attractiveness of the medium on which the information is presented (Baldwin et al., 2004).

Peripheral arguments are almost instantly decided upon because a person automatically decides if they found the message to be attractive or not (Petty & Cacioppo, 1984). One way to sway attitudes is fluctuating the quality of the messages in a persuasive argument. However, arguments can be greatly affected by a peripheral cue that prevents or obscures argument processing (Petty & Cacioppo, 1986). Peripheral cues are things like the attractiveness of the presentation or document.

Purpose

The purpose of this study was to understand how agricultural producers process information related to BMPs in grazing systems. The specific research question guiding this study was:

RQ1: How do agricultural producers process information related to the adoption or non-adoption of grazing system BMPs?

Methods

In order to gain an in-depth understanding of producers' processing of information, a qualitative approach was used for this study. Researchers conducted 42 in-depth, semi-structured interviews with beef-cattle producers in southcentral Kansas and northcentral Oklahoma during the summer of 2015. A purposive sampling technique was used to obtain initial participants. Researchers contacted extension agents in Kansas and Oklahoma. Extension agents provided names of potential participants and researchers contacted them via telephone to complete the recruitment process. After the initial participants were interviewed, a snowball sampling method was used by asking participants if there was anyone else researchers should talk to that might have a different opinion. The protocol was approved by the university's institutional review board prior to data collection.

Before each face-to-face interview, participants signed consent forms in compliance with institutional review board policies. In order to address the research question of the study, researchers asked the following questions: (a) How did you come to use the practices you use in your operation?; (b) Can you tell me about the process that led you to use those practices?; and (c) When you make changes to your grazing practices, how is that done? Additional insights regarding the research question were gained through initial informational questions, probes, and the solicitation of additional comments and additions to the discussion at the end of the interview. Interviews lasted between 60 and 90 minutes and were audio recorded. The questioning route was reviewed by a panel of experts for face and content validity. During each interview, the interviewer and assistant interviewer both kept detailed field notes. An assistant interviewer is recommended to help with an accurate audit trail and to have another person intimately familiar with the data collection process if for some reason the main interviewer cannot continue (White, Oelke, & Friesen, 2012). Moreover, after each interview, the interviewer reviewed the answers of the participant to ensure accuracy, thus creating an audit trail. At the end of each interview, the interviewer recapped the discussion and asked if this was an accurate description of the discussion. This served as a member check, as done in previous qualitative studies (Rohling, Wandersee, Baker, & Tomlinson, 2016; Stebner, Ray, Becker, & Baker, 2015).

The interviewer and assistant interviewer worked together to determine the level of adoption of BMPs for each producer. While making this determination, the adoption of rotational grazing, the use of alternative forages, introduced grasses, improved watering systems, and cover crops were considered. The practices producers were using were compared to the university recommended BMPs. High adopters used four or all five BMPs, medium adopters used two or three BMPs, and low adopters used one or none of the BMPs. The moderator and assistant moderator considered each producer and their practices in order to determine their level of adoption. In this study, there were 14 high adopters, 18 medium adopters, and 10 low adopters. Pseudonyms were assigned to each participant based on their adoption levels (Table 2). Pseudonyms that begin with an *H* were assigned to participants with a high level of adoption, *M*

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for participants with a medium level of adoption, and *L* for participants with a low level of adoption.

Table 2

Participants sorted by adoption level

Pseudonym	Level of BMP Adoption	EPA Ecoregion
Harry	High	Flint Hills
Harvey	High	Central Great Plains
Heath	High	Southwestern Tablelands
Henry	High	Flint Hills
Herbert	High	Central Great Plains
Holden	High	Central Great Plains
Horatio	High	Central Great Plains
Howard	High	Central Great Plains
Hugh	High	Southwestern Tablelands
Hugo	High	Central Great Plains
Hunter	High	Central Great Plains
Hurbert	High	Central Great Plains
Hutch	High	Central Great Plains
Hyde	High	Central Great Plains
Mac	Medium	Central Great Plains
Mace	Medium	Central Great Plains
Macon	Medium	Central Great Plains
Mark	Medium	Flint Hills
Martin	Medium	Southwestern Tablelands
Marshall	Medium	Central Great Plains
Mason	Medium	Southwestern Tablelands
Matthew	Medium	Southwestern Tablelands
Maurice	Medium	Central Great Plains
Max	Medium	Central Great Plains
Melvin	Medium	Central Great Plains
Michael	Medium	Southwestern Tablelands
Mickey	Medium	Central Great Plains
Miguel	Medium	Southwestern Tablelands
Miles	Medium	Central Great Plains
Mitchell	Medium	Central Great Plains
Monte	Medium	Central Great Plains
Murphy	Medium	Central Great Plains
Murray	Medium	Central Great Plains
Landon	Low	Central Great Plains
Larry	Low	Central Great Plains
Lawson	Low	Southwestern Tablelands
Levi	Low	Central Great Plains
Leonard	Low	Central Great Plains
Lewis	Low	Central Great Plains
Liam	Low	Flint Hills
Leonard	Low	Central Great Plains
Lorenzo	Low	Central Great Plains
Luke	Low	Flint Hills

A professional transcription service transcribed the audio recordings. Researchers reviewed the transcripts to confirm accuracy. Next, transcripts were analyzed for themes using Glaser's constant comparative method (Glaser, 1965) with Nvivo 10 to identify major themes and connections between groups. A concept was considered a theme if it was mentioned in at least half the interviews as done in previous agricultural communication research (Ray, Baker, & Settle, 2015).

As with all qualitative research, researcher subjectivity should be considered and established prior to the data analysis portion to help inform the researchers of potential bias and to provide a lens into the analysis for readers (Creswell, 2014, Guba & Lincoln, 1982). The lead researcher on this project has two degrees in agricultural communication and has a passion for the extension system. She may have a positive bias toward extension and agricultural producers. The secondary researcher has three degrees in agricultural communication and is familiar with production agriculture but did not grow up on a farm. As such, she may have a positive bias toward agriculture.

The limitations associated with this study are those associated with all qualitative research. This data cannot be generalized to the general population (Creswell, 2014), but may be transferable to other similar cases. Because the audience researchers are concerned with are Kansas and Oklahoma cattle producers, the purposive and snowball sampling technique is the most appropriate choice for this endeavor (Creswell, 2014). Because Extension agents were used in the initial purposive sampling methods, this may result in some bias toward Extension in the data. Additionally, it was a limitation of this study that publicly available resources for concrete BMPs and steps for adopting these were not available from State Extension websites or contacts nor from other online resources. This made it difficult for researchers to compare the practices implemented by producers in the study and BMPs recommended by Extension.

Results

When producers were asked about the adoption of BMPs for their operation, two major themes emerged related to how producers process information: (a) reflection on past experiences and (b) visual observations. When asked about how they determined stocking rates and other essential management decisions, producers were quick to mention visual observation and past experiences as main determinants. It is clear producers processed information visually and valued their own experience at a higher level than research or new sources of information.

Reflection on Past Experiences

Producers reflected on previous experiences to make choices about the future, suggesting that they were using central processing. These experiences were sometimes personal, that of family, or community members. Twenty-six producers mentioned past experiences as an important factor when making decisions.

Personal experience.

Miles found that first-hand knowledge of his land is beneficial to him. "Just based on the past history and experience as much as anything because you learn pretty well what…kind of rates you can stock around here." Learning from experience was a valuable tool for Macon, "I've been here 48 years, I know it. I played on it as a kid, horse-backed it all my life and I know historic stocking rates like I said most of this country that we have I know."

Mitchell also benefited from a personal knowledge of his operation, “It’s all in my head. I mean, history of the pasture…I just know from experience.” Holden put his learning opportunities simply, “Some are just from good old-fashioned experience.”

Several producers cited personal trial and error as the thing that drove a lot of their choices. "You do a little bit of it, saw that it worked, and then kind of expanded," said Mickey. Macon also learned from "many years of trial and error." Martin said that while he may not know everything, he knows enough to get by, "I can't go out there and tell you the species that are out there. But over years of experience, I understand what cows will eat and what they don't eat."

Historical experience of family.

Levi valued not only his experience but also that of his ancestors: "I guess just history, I guess from [what] my…grandpa did and my dad did, I do it. I mean that's just what we kind of have always done it. And that seems to work fairly well for us so."

Max also used his family’s knowledge to influence his practices, “We have been in the cattle business all my life, my grandparents, my parents, all their lives too…I started learning about cattle and grazing at a young age and we know how to make the best of it.”

Experience of community.

While producers drew from personal and family experience, there was a third source of experience producers drew from: collective community experience. Producers talked about using peers as information sources and tapping into the knowledge of older community members. Murray spoke about using these as resources. "We used what we saw on our own operation or our neighbors'. There are a lot of people we grew up around that mentored us and that was helpful." Macon stated older community members were some of the best sources around. "There is an old man around here, and he's a huge wealth of information, but he won't talk about it unless you ask. You've got to ask him. And a lot of people would benefit from just asking him."

Visual Observations

When producers were asked how they determined stocking rates, timed rotations, and generally made management choices such as fertilizing pasture and selecting cattle, 30 producers stated they made choices by visual observations. The use of visual observations in decision making, suggests producers use peripheral processing to make choices. Sometimes these observations were of cattle or manure but most often were of grass. Under the theme of producer processing information visually there were subthemes of: visual observations enable producers to set stocking rates, rotation timing is determined by visual observations, and general management decisions are influenced by visual observations.

Visual observations enable producers to set stocking rates.

Producers used visual observations to set proper stocking rates on their operations. Martin elaborated: "Well, I'm a visual person…If something doesn't look right, if something is too short, I pull them off. I'm no crop scientist [but] if it looks like it's stressed…I just come off of them [pastures]."

Levi also set stocking rates by looking at the available forage, “Based on the amount of forages that is out there, it’s kind of an eye, looking at it, just kind of telling.” Lewis did not approach setting stocking rates with a scientific approach, “We just keep an eye on it. We don’t get out and measure it with a tape measure, anything like that.” Another producer approached his grazing

operation with a similar philosophy, “Not everything has a formalized grazing plan…just keep an eye on your forage.”

Rotation timing is determined by visual observations.

In addition to stocking rates, producers who used rotational grazing used visual observations to time rotations. Hunter stated "Well, like when we rotate…I don't really go by the calendars so much. We're just kind of looking at it." Howard used to base his rotation on a calendar but now finds it easier to use observations, "I used to keep a calendar, but I don't anymore. I don't have a set plan. I just go out and look at my grass."

Herbert was very concerned about overgrazing; he ensured his grass resources were not abused by looking at the resource itself. “It’s more of how the pasture is looking; I mean with rainfall…or if they’re overgrazing and then we’ll move or rotate. So, it’s just more of a visual, nothing really scientific I guess, but just how it looks.” According to Monte the idea of managing grass was easily visually processed, “Just basically look at what’s out there and then move them accordingly.”

General management decisions are influenced by visual observations.

Many different choices were influenced by visual observations, from fertilizing to the selection of new cattle and everything in between. Macon talked about overall choices on his operation.

If you pay attention and look at your cows or your steers or your calves on your cows and looking at the grass, you ought to know something about what you have. If you don't, what the hell are you doing in the cattle business? You know, I mean seriously if you're not willing to pay attention why do have that much money borrowed?

Howard turned to observations of animal excrement to determine the health of his herd. “I mean I kind of look at the manure too [to assess the nutrition of the cattle], you know you can kind of tell.”

Liam used observations to make choices about when to fertilize grass, “You look at your grass and see what it looks like, whether it is healthy or not.” Monte also determined his fertilization timing by visual observation, “It’s pretty much all visual observation of the grass and the cattle [that determine] if we put on fertilizer.” Martin made choices about selecting cattle and supplementing their feed based on visual observations, “I pick out [buy] cattle by looking at them… If grass starts to get short, and I see it hurting I will start supplementing the cattle with other feed sources.”

Implications and Conclusions

The purpose of this study was to understand how producers process information related to the adoption of BMPs in grazing systems. The adoption of BMPs in grazing systems increases the resiliency of the producer's operations while maintaining economic viability and mitigating environmental impact (Paudel, Gauthier, Westra, & Hall, 2008). From the results, it can be inferred that producers used both central and peripheral routes of processing when processing information about BMPs. In the theme of “reflection on past experiences,” producers used the central route of processing to reflect upon experiences in order to make choices related to BMPs. In the theme of “visual observation” producers were processing peripherally by making quick decisions based on peripheral cues and not considering new information. It is of worth to note that many of the high-level adopters in the study opted for visual observations. This may be explained as efficiency

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related to experience or perhaps these BMPs have been used for so long that producers do not need to take the time to process centrally.

When investigating how producers processed information, the use of visual observation and past experiences were the most mentioned methods of information processing. Producers processed information regarding BMPs through the lens of past experiences of themselves, family, or peers, and visual observations. Past experiences were also a tool for processing information. When making choices associated with BMPs, producers often referenced past experiences. Producers knew the history of their land and its quality and used that information to make decisions. Producers visually assessed the health and vigor of their forage and made decisions based on those observations. Visual observation of cattle was used to assess the relative health of cattle and visual observations of manure were used to determine the quality of forage.

It should be noted that in the theme of "reflection on past experiences", where producers centrally processed information, the majority of responses came from high (n = 10) and medium-level (n = 14) adopters. Only one low adopter was included in the centrally processing theme. This may indicate agricultural producers are more likely to adopt grazing BMPs if they are centrally processing information, which aligns with ELM in that people are more likely to act upon information if it is centrally processed (Petty & Cacioppo, 1986). ELM states that if someone has a positive experience in the past, it is more likely that information related to that experience will be received positively and acted upon by the message recipient (Cacioppo & Petty, 1984). Because producers in this study used their past experiences to make choices, positive experiences would result in central processing and a higher likelihood of adoption. Central processing takes place when the listener attends to the message more intently and the information is more likely to be acted upon (Petty & Cacioppo, 1984). For example, producers who had positive experiences with rotational grazing on a small scale expanded to the rest of their operations. Negative experiences would have the opposite effect. For example, producers who had planted cover crops that failed were not planning on using that practice again; similar instances occurred for five producers.

Moreover, in the theme of “visual observation” producers’ adoption level was varied. This indicates peripherally processing is used by all producers when making decisions on BMPs. This also aligns with ELM in that all people make decisions peripherally at some point due to necessity and time limitations (Cacioppo & Petty, 1984). These decisions may be harder for communicators to influence.

When the researcher began collecting information regarding BMPs, the process was taxing and information was lacking. The information was difficult to find and once found, for the majority, was outdated. The information was often too vague to be widely applicable and recommendations were not concrete. Though vague information is suitable for a broad, state-wide approach, in actual practice and application it does not suffice. It is likely those documents and practices are processed peripherally; therefore, practices are less likely to be adopted.

Recommendations

Findings suggest producers processed information in a visual manner. Therefore, it could be beneficial to enhance producer learning experiences related to BMPs with additional visual elements. The present study did not collect data related to what these visual components could be. Future researchers and innovators could develop strategies for increasing visual learning experiences through traditional methods like enhanced field days or more advanced technological methods.

Providing networking-type events for producers, beyond the typical coffee shop talk, could provide a way to increase community collaboration and share experiences. This study found that producers draw on their own and peers' experience to make management decisions. If one could influence opinion leaders or influencer in these producer peer networks, a positive behavior change regarding grazing BMPs could be achieved.

Tailoring Extension publications to counties, regions, or ecoregions could make information more specific and relevant to producers. This increased relevancy could encourage the central processing of BMP recommendations by producers and possibly result in an increased adoption rate of BMPs. Extension publications should be updated and tailored. While many agents are likely tailoring materials, in the development of this study researchers found it difficult to identify concrete recommendations for specific practices to implement. This gap in information leads the researchers to recommend State Extension specialists develop overall publications and leave space for region-specific information to be integrated and updated regularly with prudent information in response to drought, flooding, or other timely events. While there is a need for vague, widely applicable information, it is likely those documents and recommendations are processed peripherally; therefore, practices are less likely to be adopted. Tailoring Extension publications to regions or ecoregions could help promote the central processing, resulting in the adoption of BMPs. These publications should be easier to find and have a place of prominence on each University's webpage. Extension agents should utilize these updated, personalized documents to start the personalized planning for producers.

Extension and researchers should clearly define the BMPs needed for each region or find ways to reach out to producers and personalize grazing management strategies to increase the resiliency of each operation. The majority of producers in this study were users of Extension. However, the majority of producers were not high-level adopters of BMPs. It can then be easily inferred that Extension agents may not be addressing grazing BMPs in a proper or effective format. This study found that although Extension is being used in the study area it is not being used to its fullest potential and improvements are possible. If producers do not understand what is suggested for their regions or operations, they cannot adopt BMPs. Communicating about BMPs in a way that make them relevant to the producer's own lives and operations could increase the likelihood of BMP information being centrally processed, and therefore, the BMPs being used.

This qualitative research represented the producers who were interviewed but similar research should be continued in other regions. Understanding the process and reasoning behind the decisions producers make is the best way to understand the choices themselves (Pannell et al., 2006). Understanding these choices can help communicators change those choices (McKenzie-Mohr, 2011). This research could also be expanded to different sectors of agriculture, such as row or specialty crop production.

It is recommended that communicators interested in increasing BMP adoption seek to develop messages that ask producers to reflect on information and past experiences on their operations or operations within their communities. These messages should be more effective based on the "reflection on past experiences" theme in this research and the higher level of adoption rates of producers in this theme. Future researcher evaluating what message elements encourage producers to reflect on past experiences would aid in strategic recommendations for developing reflective messaging. Communicators should be aware that because of barriers to adoption, like cost, time, and social constraints (King, Baker, & Tomlinson, 2017), producers may be resistant to these messages and a large investment in time may be needed increase message effectiveness. However, the importance of this type of communication is worth the investment in time.

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In order to change the way that BMPs are communicated, it must first be understood how these are currently communicated. In preparation for this study, BMPs were informally examined to create question routes and build literature review. The current study fills the void in literature related to producers' perceptions, implementation, and preferred communication for BMPs. It is recommended that future research examine further how state and local Extension communicate BMPs.

In conclusion, BMPs, while voluntary, are beneficial for producers to adopt in the long term, both economically and environmentally. Resiliency and sustainability are products of the proper implementation of BMPs (Alonge, & Martin, 1995). The resiliency of grazing systems is important in the face of a changing climate, especially in the Southern Great Plains ("Climate Risks in the Southern Plains", n. d.). While the BMPs have been well researched, the communication of BMPs is still under addressed, as represented by this study.

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