A NEEDS ASSESSMENT OF OPERATIONAL AND PRODUCTION PRACTICES OF MONTANA BEEF PRODCUERS

by

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ABSTRACT

Montana State University Extension provides educational programming for beef producers across the state of Montana. To develop programming opportunities for beef producers in Montana, Extension agents must first identify their needs. To determine the needs of beef producers in Montana, needs assessments should be conducted periodically. The purpose of this study was to explore Montana beef producers' operational and production practices and preferences for educational programming.

This study used a descriptive research design. The study utilized a web-based survey for data collection and was distributed to participants utilizing email to examine the characteristics of Montana beef producers. The survey was delivered to county Extension agents employed by Montana State University, agents forwarded the survey information to beef producers located in their counties. Descriptive statistics were used to analyze the data. The study identified barriers to attending programming were timing of programming and scheduled dates. The preference of program delivery was identified to be traditional 1–2-hour meetings with applicable research, reading materials, and tools to take home. The data indicated Montana beef producers want education focused on cattle marketing, range management, and virtual fencing. It was also identified that producers utilize pocket-sized books to collect herd level data and most often collecting data on pregnancy rate. Respondents indicated they do not collect herd level data on liver and blood, fecal, and not harvested feedstuffs. When adopting new operational practices, the data declared cost to be a major concern to producers and their biggest daily concern to be cow/calf management.

It was recommended for Extension agents to focus programming efforts to provide tools for producers to use on their operations. These tools should include tools to assist with cattle marketing, range management and accounting software. It was recommended for MontGuides to be developed for herd health, reproduction, and sampling of distinct types of feedstuffs and bodily fluid

CHAPTER ONE

INTRODUCTION

Background and Setting

The United States beef industry is rapidly evolving and changing. The number of people that work in the industry has drastically changed since 1862 when the first Morill Act was passed. In 1862, more than 50% of the U.S. population lived in a rural area and approximately 30% worked in farming (Garst and McCawley, 2015). Today, approximately 10% of the population is employed in agriculture and only 1.2% work directly on the farm ("Ag and Food Sectors", 2024). Technology, policy, practices, and consumer pressures have also changed drastically. The need for improved productivity and sustainability has increased with the expansion of population and food safety concerns ("Colleges of Agriculture", 1997). The changes producers face includes climate adaptation; changes in technology including wireless internet and the uses of drones to help manage livestock; animal husbandry methods; changes in calving conflicts; and antibiotic control measures (Roubal, 2017). When producers face challenges, they rely on University Extension to educate them on these changes. Extension agents serve as the facilitator between farmers/ranchers and scientists (Cash, 2001). Agents commonly utilize needs assessments to determine the needs of constituents to develop educational programming. The most recent statewide educational needs assessment of beef producers was conducted by Montana State University Extension (MSUE) on integrated ranch management practices in 1996 (Knerr, 1996). For MSUE to effectively meet the needs of beef

producers in Montana, periodic needs assessments should be conducted to determine the needs of producers to develop appropriate programming opportunities.

The Cooperative Extension system is the link between local citizens and the land grant university in each state. The land grant university is the institution designated by Congress to receive the benefits of the passing of the Morill Acts ("Land-Grant University FAQ", n.d.). The passing of the Smith-Lever Act in 1914 created Cooperative Extension. This act provided federal support for extension services ("Land-Grant University FAQ", n.d). Montana State University (MSU) is the land grant institution along with six 1994 tribal land-grant colleges. In 1887, the Hatch Act was passed to provide funding for agricultural experiment stations. Montana has seven agricultural research stations across the state. These stations research crop and animal production methods, market growth opportunities, pest management, and environmental quality issues ("About MAES", n.d.)

Currently, Montana State University Extension has 94 Extension agents and 26 specialists that serve in 56 counties and seven reservations ("Across Generations, Across Montana", n.d.). The agents and specialists work together to identify the needs of constituents. They partner to create resources that will help solve the problems of Montana citizens. Public educational resources created by MSUE specialists and agents are MontGuides, research-based publications containing current information and concise formats on a variety of topics. While there are 259 guides available, approximately only 15 relate to cattle production. Agriculture is the number one industry in Montana and beef production heavily contributes to the state economy (USDA-NASS, 2023). Montana has over 2,160,000 beef cattle and ranks 12th in the nation for beef cattle production (USDA-NASS, 2023). As such, there is a continuous need for educational

programming on beef production. Montana State University Extension has conducted limited assessments of beef producers' educational needs. In 2008, a survey was conducted to determine management practices between producers who were Beef Quality Assurance (BQA) certified and those that were not (Duffey et al., 2008). The survey also investigated where educational efforts should be focused, but the results were only utilized to inform educators about needs for BQA education (Duffey et al., 2008). In 1996, a needs assessment was conducted to assess the educational need for a statewide integrated ranch management (IRM) program (Knerr, 1996). The purpose was to identify the knowledge needed to improve Montana ranch resource management skills (Knerr, 1996). The study focused on integrated ranch management practices but did not assess program delivery or communication preferences of Montana beef producers. Therefore, the needs of Montana beef producers are currently unknown in a formal context.

Need assessments are utilized by Extension professionals to identify the needs of their constituents to build educational programming. The assessments provide information on the past, current, and future needs of learning. Colorado State University and University of Idaho have conducted beef producer needs assessments in the past five years. The University of Idaho used a Delphi model to gather data from a limited size group of knowledgeable industry professionals (Roubal, 2017). Colorado State University utilized a 31-question survey and a sample of producers from the Colorado cattlemen's association and Colorado livestock association (Dideriksen, 2018). The important findings of these studies can be examined by MSUE. However, each state has their own specific needs as beef production changes from state to state.

Creswell and Poth (2018) conducted a study focused on determining the gaps of knowledge in operational and production practices for beef producers in Montana. Montana beef

producers' operations vary greatly from each other, so this research revealed multiple needs. According to the Social Cognitive Theory (LaMorte, 2019), past experiences influence future behavior, expectations, and engagement. Therefore, this study examined any relationships between past educational experiences and expectations of Extension programming. The study also revealed preferred operational and production practices for this audience. Determining the needs of Montana beef producers will help inform extension professionals for future programming.

Purpose of the Study

The purpose of this study was to explore Montana beef producers' operational and production practices and preferences for educational programming.

Objectives of the Study

1. Describe Montana beef producers' educational programming preferences.
2. Describe Montana beef producers' preferences for operational and production practices.

Limitations of the Study

The survey did not address income levels, financial information, and did not gather any information about acreage. The study only included beef producers who had an email on file with their county Extension office. Therefore, results cannot be generalized to all Montana beef cattle producers.

Assumptions

It was assumed Montana beef producers have preferences for delivery of educational programs. It was also assumed that if resources are developed based on these preferences, participants will use the resources and attend Extension educational programs. Finally, it was assumed beef producers were willing to participate in the survey and answered the questions honestly and accurately.

Definition of Terms

To structure the content and further define the purpose of this study, the following terms were given specific definitions.

1. Beef Producer: Any person who raises, breeds, grows, or purchases cattle or calves for beef production ("Beef Producer Definition", n.d.).
2. Seedstock: Breeding cattle typically registered with a breed association and are considered genetic suppliers with documented pedigrees ("Beef Cattle Seedstock Marketing", n.d.).
3. Commercial: Cattle that are not registered and may be crossbred ("Beef Cattle Seedstock Marketing", n.d.)
4. Registered: Cattle with documented pedigrees that are registered with a breed association ("Beef Cattle Seedstock Marketing", n.d.).
5. Cow-Calf: producing a breed specifically for breeding cows to bulls to produce weaned calves ("Cow & Calf", n.d.).

6. Beef Quality Assurance: A national and state program that promotes the use of best practices in animal husbandry record keeping and herd health ("What is BQA?", n.d.).
7. Needs Assessment: A process to identify challenges in education to better understand and address the challenges (Cuiccio & Husby-Slater, 2018).
8. Consumer: A person who consumes goods and/or services for their own use ("Cambridge Dictionary", n.d.).
9. Agriculture Experiment Station: Dedicated by the Hatch Act of 1887 to provide research for Cooperative Extension's resources and curriculum ("State Agricultural Experiment Stations", n.d.)
10. Packers: A person or company who purchases livestock for slaughter to ultimately manufacture and sell meat products to consumers ("Packer", n.d.)
11. Extension Agent: A person employed by the land-grant university to offer informal education and assistance in the areas of agriculture, natural resources, family consumer sciences, and youth development ("Extension Agent", n.d.).

CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter presents literature and theories pertaining to needs assessments conducted with beef producers for Extension programming. This chapter includes research on (1) Cooperative Extension, (2) needs assessments, (3) United States beef industry, (4) adult learners, and (5) Rogers Diffusion of Innovation theory.

Cooperative Extension

Agriculture was the lifeblood of many Americans in the late 1800's. Justin Morrill, a Vermont congressman recognized the need for agricultural education (Cross, 1999). In 1857, he introduced a bill in Congress called the land-grant bill to establish funds for institutions to teach agriculture, mechanical arts, and military tactics to the common people (Comer et al., 2006). The bill was signed in 1862 by President Lincoln (Comer et al., 2006). The 1862 Morrill Act created land-grant universities leading to the creation of Cooperative Extension. Public meetings were being held for farmers to learn new agricultural information for decades. Credit for the creation of the Cooperative Extension Service was given to Seaman Knapp for his work on organizing demonstrations on county farms and at home demonstrations (Comer et al., 2006). George Carver and Booker T. Washington used Knapp's foundation to begin a traveling demonstration for farmers. In 1914, the Smith-Lever Act was passed formalizing the Cooperative Extension Service (Comer et al., 2006). Cooperative Extension has since expanded from just providing

resources for agriculture program areas to now include family consumer science, community and economic development, and 4-H/positive youth development.

Cooperative Extension is responsible for being the connecting link between researchers and community members. Extension professionals have a responsibility to provide unbiased research-based information to constituents to improve their lives ("Meeting the Needs of Montanans", n.d.). Cooperative Extension has a historical basis of progressive educational theory (Zacharakis, 2008). This theory places the learner's needs first and creates educational programming based around those needs. John Dewey recommended three methods for teaching: "learn by doing, learning by integration, and learning through productive and creative activities" (Samkange & Samkange, 2013, p. 455). Many Extension professionals use the experiential model to help constituents solve problems (Torock, 2009). A model created by Joplin (1981) has five different phases in which the learner is responsible for their own learning: focus, action, support, feedback, and debrief. Each part of the process is equally important, and the learner will be grasping different concepts through each phase. It is the role of the Extension educator to provide a program that includes all phases (Torock, 2009). The learner brings past experiences to the learning opportunity that will influence the learning occurring during each phase. The resources educators use must continue to be adapted to be relevant with the changing times (Torock, 2009).

Montana State University Extension

The information that follows in this paragraph was produced in 1956 by Totaan when he described the history, evolution, and organization of Montana State University Extension. In 1911, Dr. W. J. Hartman was the first person employed for Extension work in Montana Dr.

Hartman quickly became aware of the need for instruction in home economics and hired three women to teach the subject. In 1913, counties received approval from the Montana legislature to begin appropriating money to employ agricultural agents. The appropriation allowed counties to appropriate $1,200 annually to a county agent. However, this money could not be appropriated unless 51% of the registered voters that were engaged in agriculture signed a petition. M. L. Wilson was hired as the first agricultural Extension agent of Montana and was assigned to Custer and Dawson counties. Fergus County is the only county in Montana that received the petition and hired Carl H. Patterson in May 1913. In 1917, Montana State legislature passed a law to remove the limit of $1200 and the need for the signed petition.

In Montana, Extension has three points of funding.

1. Federal Allotment: The federal government under the Smith lever act appropriated $10,000 per year (Totaan, 1956). The appropriation of funds is created from three mechanisms of funding (Thomson, 1984).
2. The Montana Legislature: Funds are allotted to match the federal allotment to support Extension work (Totaan, 1956).
3. Montana Counties: The counties provide funds for the operation of the county office and contribute funds towards the agent's salary ("MSU Extension Valley County", n.d.).

Montana Extension has an Executive Director who has a supervisory role over the state Extension program ("MSU Extension Organizational Chart", n.d.). The state of Montana, specifically MSUE, is divided into three districts: Western, Central, and Eastern. Totaan (1956) explained all three regions have a regional department head whose role is to provide supervision and support to the county agents in their respective region The county agents are to determine the

needs and interests of their communities and plan educational programming to address those needs. Lastly, MSUE has subject-matter specialists who are employed under different departments within Montana State University. Totaan (1956) specified the role of the subject-matter specialist is to collaborate with agents to provide expertise in their area of specialization. The state director, regional directors, county agents, and subject-matter specialists work together to serve the needs of the people of Montana.

Needs Assessments

As extension agents, the needs of the constituents served are constantly changing. Agents formally and informally determine these needs. A formal approach to determine needs is to conduct a needs assessment among constituents. According to Donaldson and Franck (n.d.), to understand the needs of the people, an assessment should be conducted periodically. Needs assessments can be completed using a variety of techniques (Carter and Bealieu, 1992). One technique, focus groups, utilizes group discussions that occur in person. The main characteristic of focus groups is for the researcher to observe how participants interact with each other and to collect data on the interaction (McCawley, 2009). Other techniques are working groups and interviews, which can be conducted in person or using technology (McCawley, 2009). The final needs assessment technique that was utilized for this study was surveys. The survey technique can utilize written or oral questionnaires. Both types have their advantages and disadvantages. Written surveys can be distributed through mail, e-mail, or social media and are often non-intrusive to the subjects (McClelland, 1994). They are often low cost, can collect a large number of responses, allow for anonymity, and produce data that is easy to summarize and report (McCawley, 2009). The disadvantages of written surveys are they limit depth of answers as the

researcher cannot receive insights beyond the specific questions asked. Oral surveys are advantageous because they have a very high rate of returns, a large number of people can be reached at low cost, and they are not strongly biased (McCawley, 2009). However, the disadvantages to oral surveys are participants may want to tell personal stories, too many choices or categories may be difficult for the respondent to remember, and answers to open-ended questions are hard to record and analyze (McCawley, 2009). Written and oral surveys both have the disadvantage that interaction between participants does not occur (McCawley, 2009).

Roubal (2017) completed a needs assessment for the University of Idaho Extension using a Delphi-model with three rounds of surveys distributed using Qualtrics. Through this needs assessment, Roubal identified multiple different programming recommendations for the University of Idaho Extension. The results were programming recommendations such as "ranching on public lands" and "returning young people to the industry" (Roubal, 2017, p. 46). Other key issues identified were marketing commodities, financial management, animal nutrition and welfare, water management, managing wildfires, adapting to a consolidating industry, and utilizing technology.

Another needs assessment was conducted in Colorado in 2018 by Sarah M. Dideriksen. The study utilized a 31-question survey along with 21 key informant interviews. The study explored multiple factors that influence Colorado beef producer educational priorities and preferences. The study identified producers' shifts in need due to ranching succession, an external factor. An internal factor identified was the volatility of cattle markets that influences producers to diversify their operations. Lastly, the study identified producers being concerned about regulations and availability of land due to urban development. The study did not identify

certain program areas that should be developed; however, beef producers preferred formats for educational programming were identified as field days, full day seminars or workshops with expert speakers, websites, online resources, fee for service consulting, and virtual conferences (Dideriksen, 2018, p. 54). The study also identified structural elements that should be provided during educational programs such as tools to take home and use, hands on demonstrations, critical research, and reading materials.

Beef Industry in the United States

As of January 1, 2024, the cattle inventory in the United States was 87.2 million head of cattle and calves and beef cow numbers were down 2% from 2023 with 28.2 million head in the U.S. (USDA-NASS, 2024). In the United States, cattle production is one of the most important agricultural industries with total sales over $89 million dollars (USDA-NASS, 2022). The cattle inventory is distributed across the nation but the top ten cattle producing states by inventory are: Texas, Nebraska, Missouri, Oklahoma, South Dakota, Montana, Kansas, Kentucky, Florida, and Iowa (“Cattle Industry”, 2015). In 2012, the top five states accounted for 38% of the total inventory (“Cattle Industry”, 2015). Additionally, there were a total of 732,123 cow-calf operations (U.S. Census Bureau, 2022). The majority of producers are between the ages of 55 to 64 years old, and the average age of all producers is 58.1 years of age (U.S. Census Bureau, 2022). The U.S. beef cattle industry is split into two sectors: cow calf operations and cattle feeding (“Cattle & Beef”, 2023). In cow calf operations, the producers’ main goal is to raise and maintain beef cows for raising calves. The cow is typically maintained on pasture not suitable for crop production. As the calves reach between three to seven months of age, the producer must determine which calves will be retained in the herd and which will be sold into the feeding

system or the final stage of cattle production, feedlots. Calves are fed at feedlots for approximately 90 to 300 days until they reach a harvest weight ("Sector at a Glance", 2023). Feedlots are primarily located in the Great Plains but can also be found in the regions of the Corn Belt, Southwest, and Pacific Northwest ("Sector at a Glance"', 2023). In 2021, approximately 98% of all cattle and calves were located on cow-calf operations in Montana (USDA-NASS, 2021).

Montana Beef Industry and Practices

In 2023, the total value of agricultural production was $6.22 billion and total value of animals, products, and production was at $1.9 million (USDA-NASS, 2023). Montana is home to 2.1 million head of cattle with a total value of $3.2 million (USDA-NASS, 2023). According to the USDA-NASS (2022), Montana had a total of 46,327 producers with 10,360 between the ages of 55 to 64 years old. The top ten counties with largest inventories of cattle and calves were in the following descending order: Beaverhead, Fergus, Yellowstone, Rosebud, Carter, Powder River, Big Horn, Carbon, and Philips (USDA-NASS, 2023).

The beef industry is a continuously evolving industry. The industry faces challenges ranging from labor shortage to government regulations and is one of the most complex and complicated markets (Fischer et al., 2021). For more than 100 years, market competitiveness has been a concern for beef cattle producers. Nationally, the beef industry is controlled by four major meatpacking plants: JBS USA, Cargill, Tyson Foods, and Marfrig (previously National Beef) (Yu, 2021). The concentration of the meat processing sector is a major concern for producers; however, there are increasingly more policy efforts to support small to mid-sized packers

(Lubben, 2022). Due to this concentration of packers, there are concerns about market transparency and fair trade (Lubben, 2022).

Agriculture is a target for many environmentalists who support increased regulations and conservation incentives as priorities for policymakers (Johnson, 2023). One of these critical issues is the traceability of cattle. Country of origin labeling (COOL) has been a topic for over 30 years with stakeholders as it as it relates to cattle market competitiveness and the ability to trace cattle through the production chain (Lubben, 2022). Other concerns with traceability are the labeling of proteins, animal health, and biosecurity issues. As demand for beef increases, questions about trade regulations, agreements, and promotion efforts between U.S. and its major trading partners are growing (Lubben, 2022). New technologies, such as virtual fencing, smart ear tags, and water tank monitoring systems, continue to be invented, while old technologies, such as antibiotics, become more regulated (Love, 2023; Van Emon, n.d.). Finally, taxes are a concern for beef producers who want to protect and preserve their assets for the next generation (Lubben, 2022). These are some of the main issues facing the beef cattle industry that are broad reaching and can influence management decisions.

Adult Learners

Adults have different expectations and requirements for learning when compared to youth. Knowles (1980) suggests adults bring personal experiences to learning opportunities that children lack. Andragogy was introduced by Malcolm Knowles in the early 1970s and can be simply identified as adult learning (Knowles, 1980). Adults are more self-directed and want to learn information that is relevant to their lives. Educators of adult education need to base programming on the learner's experiences and interests (Ota et al., 2006). The educator needs to

remember the adult audience will bring diverse knowledge and experiences and each individual perspective can be an educational opportunity for the entire group (Johnson et al., 2008).

Adult learners have unique educational needs as well. Knowles (1980) identified the six assumptions of adult learning: (1) need to know, (2) self-concept, (3) prior experience, (4) readiness to learn, (5) learning orientation, and (6) motivation to learn. The first assumption, “need to know”, means adults need to know what is in it for them and the value of learning for their lives (Bouchrika, 2022). The next assumption of "self-concept” refers to adults as independent learners that prefer choices in their educational opportunities. The third assumption of “prior experience” is an important assumption to consider when planning programs. Adults bring life experiences to the situation and should have an opportunity to share these experiences as they can support the class discussion (Caruso, 2021). The assumption of “readiness to learn” can best be defined as the desire to relate content to real life situations (Ota et al., 2006). The “orientation to learning” assumption also relates to real-life application of information to solve everyday problems (Ota et al., 2006). Lastly, “motivation to learn”, requires adults to be motivated both internally and externally to fully participate in the learning experience.

Adult learners often are not required to attend educational programming. They do, however, face different barriers that can influence participation in programs. According to Smith (1998, 2010), there are three types of barriers that adult learners face: situational, institutional, and dispositional of barriers. The situational barriers include financial resources and lack of time due to other responsibilities (Smith, 1998, 2010). Institutional barriers include time commitments related to scheduling and location of programming and lack of relevancy (Smith, 1998, 2010). Lastly, dispositional barriers relate to the attitude and motivation of the learner (Smith, 1998,

2010). More specifically, Dideriksen (2018) identified the major barrier for agricultural producers to attend programs was dates. As such, location, date, time, expense, and relevancy should be priority considerations when planning extension programs.

Theoretical Framework: Roger's Diffusion of Innovation Theory

Roger's theory of innovation "is an idea, thing, procedure, or system that is perceived to be new by whomever is adopting it" (Lundblad, 2003, p. 52). Diffusion is defined by Rogers (2003) as communication of a new idea or innovation within a social system through different channels. When a message contains a new idea, communication between participants is essential for adopters to reach a mutual understanding (Rogers, 2003). The communication that occurs during diffusion is a two-way process. There are several cycles of information exchanged between the client and the change agent prior to adoption. Additionally, a lack of uncertainty usually follows a new idea being presented. This uncertainty is often due to educators not providing an adequate amount of information or structure (Rogers, 2003). To reduce uncertainty, more information must be presented about the new idea to consider its consequences and impact.

Diffusion of innovations has four elements that influence the decision to adopt a new idea are innovation, communication, time, and social system. An innovation is described by Rogers (2003) as a perceived new idea, practice, or object to members of a social system. The newness of the idea is not measured by time, but by the reaction of the individual. "Newness" of an innovation may be expressed in terms of knowledge, persuasion, or a decision to adopt (Rogers, 2003). Innovations may not be desirable for all when situations differ. The rate at which an innovation is adopted can be explained by the attributes of innovation: relative advantage, compatibility, complexity, trialability, and observability. Relative advantage is the degree to

which adopters find an innovation to be more favorable than the current idea. Compatibility is the degree to which the new idea is incompatible or inconsistent with potential adopters' values, past experiences, and needs. Complexity is the degree to which an innovation is too complicated for adopters to understand or use. Trial ability is the degree to which an innovation has less uncertainty, and an individual can learn by doing. Observability is the degree to which individuals can see the results of the innovation and its visible results (Rogers, 2003). The last step of diffusion is the message of the new idea being communicated via communication channel from one individual to another (Rogers, 2003). It is connecting an individual with knowledge about the innovation to an individual who does not have this knowledge.

Individuals may choose to evaluate innovations on peers' experiences rather than scientific studies (Rogers, 2003). This interpersonal communication is a vital process to diffusion of innovations. Time is the third element of the innovation decision process and includes how an individual gains knowledge of the innovation, forms an attitude about whether to adopt or reject, decides to implement the idea, and lastly, confirms the decision (Rogers, 2003).

The process can be refined into five steps: knowledge, persuasion, decision, implementation, and confirmation (Rogers, 2003). Knowledge is obtained when an individual is introduced to an innovation and gains an understanding of its functions. Persuasion is when an individual builds an attitude towards the innovation which can be favorable or unfavorable. Decision occurs when the innovation is accepted or rejected by the individual. Implementation is simply the innovation being implemented by the individual. Lastly, confirmation occurs when the individual looks for confirmation in the innovation (Rogers, 2003).

A social system is a group of individuals that are interrelated and have a goal of solving a common problem (Rogers, 2003). In a social system, diffusion occurs but is affected in several ways. Within the social system, opinion leaders and change agents affect the rate of diffusion (Rogers, 2003). In the system, peers often communicate with each other most. Opinion leaders develop as those who adopt the innovation first or are early adopters and will promote the idea throughout the system (Scott & McGuire, 2017). Change leaders often make the most of opinion leaders to the promote the idea. There are five categories of adopters: (1) innovators, (2) early adopters, (3) early majority, (4) late majority, and (5) laggards (Rogers, 2003). Innovators are the first to adopt an innovation and are considered risk takers. They are often outside of the social structure. An innovator is open to absorbing any financial losses and can understand scientific knowledge and manage uncertainties (Rogers, 2003). Early adopters are respected by their peers and commonly utilized by change agents to diffuse the idea. The uncertainty of an innovation is decreased when an early adopter adopts the idea. After the idea is proposed potential adopters will look too early adopters for advice (Rogers, 2003). The next group of adopters, early adopters, make up one third of the adopters and require time to research and think about the idea before adoption. Even after the additional thought process, early adopters are still considered an above average member of the system. The next group in the system, early majority are an important part of the diffusion process by connecting their peers (Rogers, 2003). They often have scarce resources financially, so the uncertainty of an idea must be mostly removed before adoption. The late majority often feel pressure from their peers to adopt the innovation. The final adopters in the system are categorized as laggards. This group of adopters can be classified as suspicious. They are suspicious of change agents, opinionated leaders, and mostly suspicious of

innovations. Resources are extremely limited, which makes them extremely cautious to adopt new ideas. They need to be confident that the innovation will not fail before adoption (Rogers, 2003).

Each category and adoption process has distinct characteristics. The first category of early adopters usually is more literate due to formal education that ultimately leads to a higher social status within a system (Rogers, 2003). The socioeconomic status of early adopters is generally higher than later adopters. In personality variables, early adopters favor attitudes towards change, can cope with uncertainties and risks and have an appreciation for education and science (Rogers, 2003).

Lastly, communication behaviors differ between early and late adopters. Early adopters are generally more active in a social system by seeking communication with their peers, communicating with change agents, and engaging in media channels and information seeking (Rogers, 2003). Socioeconomic status, personality variables, and communication behavior are important in differentiating between early and late adopters.

Characteristics of Adoption Categories in Agricultural Producers

Agricultural producers typically possess characteristics that will often categorize them into an adoption category. The number of years of formal education is usually higher in the early adopter categories (Rogers, 1961). Rogers (1961) found the relationship to be significant at the 1% level between producers' education level and their Adoption-of-Farm-Practice scores. According to Rogers (1961), younger farmers are often categorized as innovators and early adopters; size of farm operation influences adoption category; and innovators generally operate larger farms and laggards operate smaller farms. The relationship with the county Extension

agent was also examined in this study and it was found that early adopters had more contact and knew their county extension agent personally, while innovators had less of a relationship. In a study conducted by Cagle (2014), education level, gross annual income, and age were found to not have a statistically significant effect on adopter category classification. However, an ANOVA determined there to be a relationship between age and laggards and early majorities.

CHAPTER THREE

METHODOLOGY

This chapter describes the methodology that was used in this study. The research design, population, instrumentation, data collection procedures, and analysis are described.

Purpose and Research Objectives

The purpose of this study was to explore Montana beef producers' operational and production practices and preferences for educational programming.

The objectives of this study were to:

1. Describe Montana beef producers' educational programming preferences.
2. Describe Montana beef producers' preferences for operational and production practices.

Research Design

A quantitative design was utilized for this study. Quantitative research methods are utilized by researchers to represent data numerically and have a common goal of creating accurate and reliable data that the researcher can use for statistical analysis (Goertzen, 2017). Researchers completing quantitative research are examining ongoing situations to provide an explanation of the situation. They are also attempting to establish relationships and explain causal relationships (Mertler, 2016). Objectivity is important in order to generalize the findings to the larger population.

For this study, survey methodology was chosen as descriptive research design. The purpose of a descriptive research design is to explore phenomenon to gain new insights and

knowledge (Kramer, 1985). Survey research has a purpose of obtaining information by utilizing questionnaires to collect information from a population (Ponto, 2015). Survey research can be conducted through quantitative, qualitative, or a mixed-methods studies (Ponto, 2015). Researchers conducting survey research deploy a questionnaire to a sample population as it is usually not feasible to reach an entire population. There are three different types of surveys: descriptive, cross-sectional, and longitudinal. The sample in a descriptive study will be described by the researcher at the current point in time (Mertler, 2019). A cross-sectional survey examines the characteristics of several samples at the same point in time. Lastly, a longitudinal study is a group of individuals studied at different points in times. Survey research has a variety of data collection modes, including web-based, face-to-face, or online options (Diem, 2002).

This study utilized a web-based survey for data collection. A web-based survey is distributed to potential respondents via e-mail with a URL to complete the survey. The advantages of utilizing e-mail to distribute surveys are that time of distribution is reduced, response times and rates are assumed to increase, and the cost of mailing is eliminated (McCelland, 1994). However, online surveys do have limitations including participation rate, reliability of opinion expressed, and sampling issues (Nayak & Narayan, 2019). High response rate will decrease the chance of nonresponse error (Wiseman, 2003). Nonresponse error is a type of error that occurs in survey research due to individuals in a sample not responding to the survey creating a lack of response (Ponto, 2015). To reduce nonresponse error in this study, the researcher utilized QualtricsXM as the program designs a survey that is user-friendly. The researcher also sent follow-up emails in attempts to decrease nonresponse error as recommended

by Dillman et al. (2014). The web-based survey was a descriptive research questionnaire examining the characteristics of Montana beef producers at the same point in time.

Dillmans's Total Design Method (TDM) was integrated into the design of this study. Dillman's TDM utilizes a social exchange theory explaining when a person trusts the individual who is making the request, they are more likely to comply especially when the result of complying outweighs the cost (Dillman et al., 2014). An initial e-mail was sent on November 15th, 2023, to all county Extension agents employed by Montana State University requesting for them to forward the survey information to their beef producers residing in their county (Appendix A). With the request emails being sent by Montana State University employees, the intent was to build trust and help increase response rates among participants (Dillman et al., 2014). Also included in the e-mail was an informed consent form approved by MSU Institutional Review Board on November 14, 2023. This method encouraged the participants to know the survey can be trusted (Dillman et al., 2014). The communication in the initial e-mail also included information on how the survey results will be used. A follow up email was sent on December 1st, 2023, to Extension agents employed by Montana State University requesting them to forward the survey information to their beef producer residing in their county to encourage more responses (Appendix B). The follow up email also thanked those who responded and requested for those that haven't responded to complete the survey. Incentives were utilized to increase response rates. The first incentive was for a pair of tickets to the spring 2024 Livestock Nutrition Conference hosted by Montana State University. The second incentive was for membership into the Montana State University Beef Mineral Program. In contrast to Dillman's design, a pre notification e-mail was not sent to participants (Dillman et al., 2014).

Data Collection

The target population for this study was beef producers across the state of Montana. The sample was Montana beef producers that have utilized Extension services and are on a county extension distribution list. A beef producer is defined as an adult that is directly involved in beef cattle production by raising, breeding, growing, and purchasing cattle ("Beef Producer Definition", n.d.). The sample was obtained from extension agent list-servs. The respondents received an informational e-mail explaining the purpose of the study and a link to the Qualtrics XM survey. Demographics collected included county, location, education, level, type of operation, and size of operation. The questions explored current production practices, including current technology use, herd level performance, and collecting/utilizing samples of different feedstuffs and/or bodily fluids. Respondents were also asked to rank the importance of several topics and their importance of those topics to their individual operations. Finally, the questionnaire asked about barriers to attending educational programs.

Procedure

The web-based survey was utilized to gather information about Montana beef producers' operational and production practices including their educational needs, preferred communication methods, and preferred method of educational program delivery. To ensure voluntary participation, consent language was included at the beginning of the survey explicitly stating the participants will remain anonymous and the survey was voluntary (Appendix C). Once participants read the statement, they were able to make a choice if they wanted to complete the survey or not. If they did, this served as consent in place of a traditional signed consent form.

The informed consent statement, questionnaire, and the research application were approved by the IRB on November 14th, 2023 (Appendix D).

The survey consisted of three sections of questions (Appendix E) with a mixture of multiple choice, Likert, and matrix questions. The first section collected information about educational program barriers and preferences consisting of five Likert scale questions. The second section collected information about the beef producer's operation practices, the likelihood of attending educational programming, questions about their current production practices, including current technology use, measuring herd level performance, and collecting/utilizing samples. The section also addressed Rogers Diffusion of Innovation theory relating to producers' adoption of new operational practices. The survey also included questions related to barriers to attending educational programs and how they prefer these programs to be presented. The last section of the survey collected demographics of the respondents.

Pilot Study

The researcher conducted a pilot of the proposed study. The participants of the study included Meagher County beef producers that have attended beef cattle programming in Meagher County hosted by MSU Extension. These seven beef cattle producers were asked to complete the online survey period in addition to answering the pilot study questions, the participants were given an opportunity to make recommendations to the online survey instrument. A Cronbach's alpha test was conducted, and the value was $\alpha=0.923$ which is deemed acceptable.

Data Analysis

Descriptive statistics were used to summarize the collected data. Convergence is one type of evidence to demonstrate validity in a study (Heale & Twycross, 2015). Convergence occurs when an instrument is measuring similar concepts to another instrument (Heale & Twycross, 2015). This study was developed using similar concepts as the needs assessment conducted in by Dideriksen (2018). The data was analyzed to determine the needs, preferred communication method, and preferred program delivery method of the respondents. The data page collected information on personal and operational demographics. Frequencies were used to analyze patterns in the data. Operation type and size were also analyzed to further define the sample population.

CHAPTER FOUR

RESULTS

The purpose of this study was to explore Montana beef producers' operational and production practices and preferences for educational programming.

The objectives of this study were to:

1. Describe Montana beef producers' educational programming preferences.
2. Describe Montana beef producers' preferences for operational and production practices.

Demographics

For this study, participants were asked a series of personal and operational demographic questions. The questions related to gender, age, education level, size of operation, type of operation, and their role on the ranch. Respondents were also asked to identify in which county they were located so the researcher could sort them into three regions: East, Central, and West.

Overall, the survey had a response rate of 14%, 57 out of 405 respondents (N=57) answered demographic questions about gender, age, and educational level. For gender, 56% (*n*=32) of respondents were male, 42% (*n*=24) were female, and two percent (*n*=1) preferred not to answer. Regarding age, 35% (*n*=20) were under the age of 44 years old, and 64.9% (*n*=37) were 45 years age or older. All respondents had at the minimum a high school diploma; however, 42% (n=24) of respondents had a bachelor's degree.

Operation size varied with the majority reporting an operation with less than 200 head of cattle, 54.54% (*n*=30), 27.27% (*n*=15) of respondents have an operation with between 201 and 400 head of cattle, and 18.18% (*n*=10) of respondents have an operation with more than 401

head of cattle. In total, this survey represented approximately 14,700 head of beef cattle. In general, 80% (*n*=44) of respondents' primary operation type was commercial cow-calf. The main roles reported on the ranch were ranch manager and owner, 52% (*n*=29), closely followed by ranch mangers with partial ownership at 38% (*n*=21). The greatest number of responses came from the Western region of Montana with 41.8% (*n*=23), followed by the central region at 36.4% *(n*=20), and the eastern region at 21.8% (*n*=12). In this study the western region represented approximately 5,500 head of cattle, the central region represented 6,000 head of cattle, and the eastern region represented 3,300 head of cattle.

Table 1. Demographic characteristics of Montana beef producers from Montana needs assessment.

Category		*n*	%
Gender (n=57)			
	Male	32	56
	Female	24	42
	Preferred Not to Answer	1	2
Age (n=57)			
	18-24	0	0
	25-34	3	5
	35-44	17	30
	45-54	10	18
	55-64	14	25
	65-74	12	21
	75+	1	2
Education Level (n=57)			
	GED	0	0
	High School	5	9
	Some College	11	19
	Associate degree	4	7
	Bachelor's Degree	24	42
	Master's Degree	12	21
	Doctorate Degree	1	2
Size of Operation (n=55)			
	0-100	15	27

Table 1 continued.

Category		*n*	%
	101-200	15	27
	201-300	8	15
	301-400	7	13
	401-500	4	7
	500+	6	11
Primary Type of Operation (n=55)			
	Commercial Cow-Calf	44	80
	Seedstock Cow-Calf	10	18
	Stocker/Backgrounder	0	0
	Feedlot/Finisher	1	2
Indicate your role on the ranch (n=56)			
	Ranch manager and owner	29	52
	Ranch manager and partial owner	21	38
	Ranch manager, but not owner	1	2
	Ranch manager with absentee owner	1	2
	Other	4	7
What county are you located in? (n=55)			
	Western Region	23	41.8
	Central Region	20	36.4
	Eastern Region	12	21.8

Research Objective 1: Determine Montana Beef Producers Educational Programming Preferences.

Factors important to beef producers when attending educational programming are reported in Table 2. Overall, respondents indicated that applicable research was the most important factor when attending educational programming about ranching and/or the beef cattle industry. Approximately, 64% (*n*=41) of respondents indicated applicable research as very

important and 28.13% (*n*=18) as extremely important. Another 15% (*n*=10) of respondents specified reading materials as extremely important and 58.46% (*n*=38) as a very important factor when attending educational programming about ranching and/or the beef cattle industry. Tools to take home and use were reported by 26.98% (*n*=17) of respondents as extremely important and by 47.62% (*n*=30) as very important. Hands-on demonstrations at educational programming were rated extremely important by 26.56% (*n*=17) of respondents, 37.50% (*n*=24) as very important, and 34.38% (*n*=22) as slightly important. When asked about the importance of networking opportunities at beef educational programs, only 10.77% (*n*=7) of respondents indicated the factor as extremely important, 49.23% (*n*=32) as very important, 35.38% (*n*=23) as slightly important and 4.62% (*n*=3) as not at all important. Furthermore, 45.31% (*n*=29) of respondents declared the factor of mentoring as a slightly important factor and 35.94% (*n*=23) as very important factor when attending beef educational programming.

Table 2. Importance of each factor when attending an educational program about ranching and/or the beef cattle industry.

Factors	Not at all important		Slightly important		Very important		Extremely important		N
	n	%	n	%	n	%	n	%	
Applicable research	0	0	5	7.81	41	64.06	18	28.13	64
Tools to take home & use	1	1.59	15	23.81	30	47.62	17	26.98	63
Hands-on demonstrations	1	1.56	22	34.38	24	37.50	17	26.56	64
Reading materials/hands outs	2	3.08	15	23.08	38	58.46	10	15.38	65
Networking opportunities	3	4.62	23	35.38	32	49.23	7	10.77	65
Mentoring	9	14.06	29	45.31	23	35.94	3	4.69	64

Means and standard deviations were also calculated for the above statements to determine the factors of importance to beef producers when attending educational programming about ranching and/or the beef industry (Table 3). The top two factors were applicable research (M=3.2, SD=0.56) and tools to take home and use (M=3.00, SD=0.76). The bottom two factors were reading materials/hand-outs of materials (M=2.86, SD=0.7) and mentoring (M=2.31, SD=0.77).

Table 3. Importance of each factor when attending an educational program about ranching and/or the beef cattle industry.

Factor	Mean	SD	Variance	N
Applicable research	3.2	0.56	0.32	64
Tools to take home & use	3	0.76	0.57	63
Hands-on demonstrations	2.89	0.81	0.66	64
Reading materials/hands outs	2.86	0.7	0.49	65
Networking opportunities	2.66	0.73	0.53	65
Mentoring	2.31	0.77	0.59	64

Note. Minimum = 1 and Maximum = 4

Respondents were asked about barriers to attending educational programs on beef cattle management. Major barriers were the timing of programming (*n*=22 or 33.85%) and scheduled dates (*n*=20 or 30.77%). Cost of programming was indicated by 35.94% (*n*=23) respondents to be somewhat of a barrier to attending educational programs on beef cattle management. Motivation to learn was not a barrier to attending programming, 35.94% (*n*=23) respondents declared no barrier, and 35.94% (*n*=23) of respondents declared it to be a low barrier Overall,

35% (n=23) of respondents indicated content to be a low barrier for attending an educational program.

Table 4. Factors that are barriers when attending an educational program on beef cattle management.

Barriers	No barrier		Low barrier		Somewhat barrier		Moderate barrier		Major barrier		Total
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	N
Timing of programming	1	1.54	3	4.62	12	18.46	27	41.54	22	33.85	65
Scheduled dates	1	1.54	6	9.23	15	23.08	23	35.38	20	30.77	65
Cost of programming	3	4.69	13	20.31	23	35.94	18	28.13	7	10.94	64
Content	7	10.94	23	35.94	13	20.31	17	26.56	4	6.25	64
Motivation to learn	23	35.94	23	35.94	10	15.63	8	12.50	0	0.00	64

Means and standard deviations were also calculated to determine the factors of importance for attending beef educational programming (Table 5). The top barrier that respondents indicated was timing of programming with a mean of 4.02 and standard deviation of 0.92. The factor of motivation to learn was the bottom barrier with a mean of 2.05 and standard deviation of 1.01.

Table 5. Factors that are barriers when attending an educational program on beef cattle management.

Factor	Mean	SD	Variance	N
Cost of programming	3.2	1.03	1.07	64
Timing of programming	4.02	0.92	0.85	65
Scheduled dates	3.85	1.01	1.02	65
Content	2.81	1.13	1.28	64
Motivation to learn	2.05	1.01	1.01	64

Note. Minimum = 1 and Maximum = 5

Respondents were asked about their preferences for program delivery to obtain new research and educational information about beef cattle management. One-to-two-hour meetings were preferred a great deal by 20.63% (*n*=13) of respondents and preferred a lot by 47.62% (*n*=30). In reference to field days, 12.70% (*n*=8) of respondents preferred field days a great deal, while 46.03% (*n*=29) preferred them a lot. Approximately 47% (*n*=30) of respondents slightly prefer websites and 38.10% (*n*=24) prefer websites a lot. When asked about on-line resources such as webinars, courses, and videos, 47.62% (*n*=24) of respondents prefer them a lot and 34.38% (*n*=22) slightly prefer them. Regional meetings were indicated as being preferred a lot by 39.68% (*n*=25) of respondents and by 46.0 % (n=29) of respondents. Over 52% (*n*=33) of respondents indicated they do not prefer meetings at MSU campus.

Table 6. Preference of program deliver to obtain new research and educational information about beef cattle management.

Program Delivery	Do not prefer		Prefer slightly		Prefer a lot		Prefer a great deal		Total
	n	%	*n*	%	*n*	%	*n*	%	N
Traditional 1–2-hour meetings	3	4.76	17	26.98	30	47.62	13	20.63	63
Field days, on-ranch demonstrations	4	6.35	22	34.92	29	46.03	8	12.70	63
Websites (Extension publications and electronic materials)	2	3.17	30	47.62	24	38.10	7	11.11	63
On-line resources (Webinars, courses, videos)	11	17.19	22	34.38	24	37.50	7	10.94	64
Regional meetings	6	9.52	29	46.03	25	39.68	3	4.76	63
1-on-1 consultations	11	17.46	28	44.44	21	33.33	3	4.76	63
Full day seminars	19	29.69	25	39.06	19	29.69	1	1.56	64
Virtual format webinars	21	33.33	22	34.92	16	25.40	4	6.35	63
Meetings at MSU campus	33	52.38	24	38.10	5	7.94	1	1.59	63

Means and standard deviations were also calculated to determine the program delivery preferences to obtain new research and educational information about beef cattle management (Table 7). The top three program delivery methods preferred were traditional 1–2-hour meetings (M=2.84, SD=0.8), field days, on-ranch demonstrations (M=2.65, SD=0.78), and websites (M=2.57, SD=0.78). The program delivery types that were the least preferred were meetings at MSU campus (M=1.59, SD=0.7), full day seminars (M=2.03, SD=0.81), and virtual format webinars (M=2.05, SD=0.92).

Table 7. Preference of program delivery to obtain new research and educational information about beef cattle management.

Program delivery	Mean	SD	Variance	N
Traditional 1–2-hour meetings	2.84	0.8	0.64	63
Field days, on-ranch demonstrations	2.65	0.78	0.61	63
Field days, on-ranch demonstrations	2.65	0.78	0.61	63
Websites (Extension publications and electronic materials)	2.57	0.73	0.53	63
On-line resources (Webinars, courses, videos)	2.42	0.9	0.81	64
Regional meetings	2.4	0.72	0.53	63
1-on-1 consultations	2.25	0.8	0.63	63
Virtual format webinars	2.05	0.92	0.84	63
Full day seminars	2.03	0.81	0.66	64
Meetings at MSU campus	1.59	0.7	0.5	63

Note. Minimum = 1 and Maximum = 4

Respondents were asked about potential attendance at business management skills programs. More than 75% of respondents indicated they would be extremely likely (*n*=15 or 25.42%) or somewhat likely (*n*=31 or 52.54%) to attend programming about cattle marketing. When asked about the likeliness to attend programming about input costs, 20.34% (*n*=12) of respondents declared they would be extremely likely to attend, and 50.85% (*n*=30) declared they would be somewhat likely to attend. Furthermore, approximately 65% of respondents indicated they would be extremely likely (*n*=16 or 27.59%) or somewhat likely (*n*=22 or 37.93%) to attend

programming about succession of their operation. Lastly, respondents declared they would be extremely unlikely (*n*=14 or 24.14%) or somewhat unlikely (*n*=18 or 31.03%) to attend programming about export markets (Table 8).

Table 8. Business management skill educational programs producers are likely to attend.

Business Management Skills	Extremely unlikely		Somewhat unlikely		Neither likely nor unlikely		Somewhat likely		Extremely likely		Total
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	N
Cattle marketing	4	6.78	2	11.86	7	11.86	31	52.54	15	25.42	59
Succession of your operation	4	6.90	8	13.79	8	13.79	22	37.93	16	27.59	58
Input costs	3	5.08	6	13.56	8	13.56	30	50.85	12	20.34	59
Financing/budgeting	3	5.26	7	21.05	12	21.05	23	40.35	12	21.05	57
Direct to consumer marketing	8	13.56	7	27.12	16	27.12	16	27.12	12	20.34	59
Methods of managing market risk	7	11.86	9	18.64	11	18.64	27	45.76	5	8.47	59
Understanding business management principles	6	10.34	7	27.59	16	27.59	22	37.93	7	12.07	58
Goal setting for your operation	8	13.56	6	25.42	15	25.42	21	35.59	9	15.25	59
Export markets	14	24.14	18	25.86	15	25.86	9	15.52	2	3.45	58
Other	3	50.00	1	0.00	0	0.00	0	0.00	2	33.33	6

Means and standard deviations were also calculated to determine the likeliness to attend educational programming about business management skills (Table 9). The top three educational programs about business management skills that respondents declared they would be more likely to attend were cattle marketing (M=3.86, SD=1.05), input costs (M=3.71, SD=1.06), and succession of your operation (M=3.66, SD=1.21).The least preferred educational programs to

attend were export markets (M=2.43, SD=1.12), methods of managing market risk (M=3.24, SD=1.17), and understanding business management principles (M=3.29, SD=1.14).

Table 9. Business management skill educational programs producers are likely to attend.

	Mean	SD	Variance	N
Cattle marketing	3.86	1.05	1.1	59
Input costs	3.71	1.06	1.12	59
Succession of your operation	3.66	1.21	1.47	58
Financing/budgeting	3.6	1.11	1.22	57
Understanding business management principles	3.29	1.14	1.31	58
Goal setting for your operation	3.29	1.24	1.53	59
Direct to consumer marketing	3.29	1.29	1.66	59
Methods of managing market risk	3.24	1.17	1.37	59
Export markets	2.43	1.12	1.25	58
Other	2.5	1.8	3.25	6

Note. Minimum = 1 and Maximum = 5

Respondents were asked to indicate likeliness to attend programs about ranch management skills. Over 80% of respondents declared they would be extremely likely (*n*=24 or 40.68%) or somewhat likely (*n*=24 or 40.68%) to attend. The programs respondents were most likely to attend were herd health or reproduction. Regarding herd health, 33.90% (*n*=20) of respondents declared they would be extremely likely to attend, and 44.07% (*n*=3) declared they would be somewhat likely to attend. Furthermore, respondents indicated they would be more likely to attend programming about nutrition/supplementation with 27.12% (*n*=16) declaring

they would be extremely likely to attend, and 54.24% (*n*=32) would be somewhat likely to attend. Lastly, 23.33% (*n*=14) of respondents declared they would be extremely unlikely to attend educational programming about labor availability (Table 10).

Table 10. Ranch management skill educational programs producers are likely to attend.

Ranch Management Skills	Extremely unlikely		Somewhat unlikely		Neither likely nor unlikely		Somewhat likely		Extremely likely		Total
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	N
Range management	3	5.08	1	1.69	7	11.86	24	40.68	24	40.68	59
Nutrition/supplementation	0	0.00	3	5.08	8	13.56	32	54.24	16	27.12	59
Herd health	0	0.00	4	6.78	9	15.25	26	44.07	20	33.90	59
Reproduction	0	0.00	5	8.47	8	13.56	27	45.76	19	32.20	59
Genetic selection	6	10.00	4	6.67	13	21.67	23	38.33	14	23.33	60
Watering systems	4	6.90	7	12.07	11	18.97	23	39.66	13	22.41	58
Carcass information	7	11.67	8	13.33	20	33.33	17	28.33	8	13.33	60
Land/pasture availability	6	10.17	7	11.86	10	16.95	22	37.29	14	23.73	59
Pesticide use	9	15.25	8	13.56	21	35.59	11	18.64	10	16.95	59
Livestock transportation availability	8	13.56	11	18.64	23	38.98	15	25.42	2	3.39	59
Labor availability	14	23.33	14	23.33	12	20.00	15	25.00	5	8.33	60
Other	2	40.00	1	20.00	0	0.00	0	0.00	2	40.00	5

Means and standard deviations were also calculated to determine the likeliness of producers to attend educational programming about ranch management skills (Table 11). The top four educational programs about ranch management skills that respondents declared they would be more likely to attend were range management (M=4.1, SD=1.02), herd health (M=4.05,

SD=0.87), nutrition/supplementation (M=4.03, SD=0.78), and reproduction (M=4.02, SD=0.89). The least preferred educational programs to attend related to business management skills were labor availability (M=2.72, SD=1.29), livestock transportation availability (M=2.86, SD=1.05), pesticide use (M=3.08, SD=1.27), and carcass information (M=3.18, SD=1.18).

Table 11. Ranch management skill educational programs producers are likely to attend.

	Mean	SD	Variance	N
Herd health	4.05	0.87	0.76	59
Nutrition/supplementation	4.03	0.78	0.61	59
Reproduction	4.02	0.89	0.8	59
Watering systems	3.59	1.16	1.35	58
Genetic selection	3.58	1.2	1.44	60
Land/pasture availability	3.53	1.25	1.57	59
Carcass information	3.18	1.18	1.38	60
Pesticide use	3.08	1.27	1.6	59
Livestock transportation availability	2.86	1.05	1.1	59
Labor availability	2.72	1.29	1.67	60

Note. Minimum = 1 and Maximum = 5

Respondents were asked to indicate the likeliness to attend programming about technology practices. Thirty-one respondents (16.15%) indicated they would attend educational programming about virtual fencing, accounting software, and/or electronic cattle management. When asked about educational programming about drones, 15.63% (*n*=30) of respondents declared they would attend. Furthermore, 26 respondents (13.54%) indicated they would attend educational programming about feed systems and/or cameras. Lastly, 8.85% of respondents (*n*=17) declared they would attend programming about GPS tracking (Table 12).

Table 12. Respondent selection of technology practices respondents would attend educational programming on.

Technology practice	*n*	*%*
Virtual Fencing	31	16.15
Accounting software (e.g. Quick-Books)	31	16.15
Electronic cattle management	31	16.15
Drones	30	15.63
Feed system (e.g. Growsafe)	26	13.54
Cameras (e.g. calving barns)	23	13.54
GPS tracking	17	8.85

Research Objective 2: Determine Montana Beef Producers' Preferences for Operational and Production Practices.

Figure 1 shows the ranking of methods respondents use to collect herd level data. The top method reported were pocket-sized books (47.92%). More than 25% of respondents utilize a computer software program to collect herd level data. Another 14.58% of respondents collect herd level data on a smart phone app.

Figure 1. Methods used to collect herd level data.

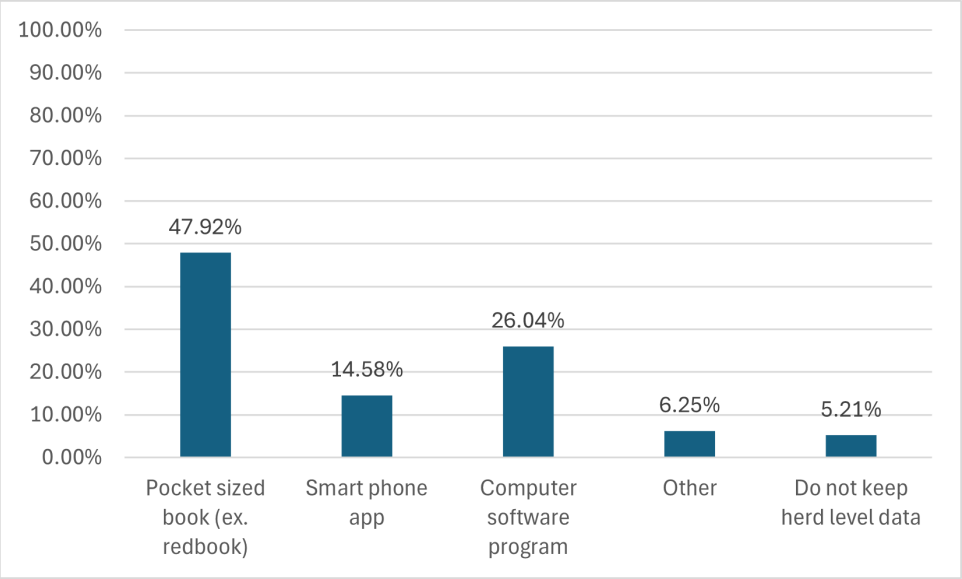


Table 13 reports the findings of how often respondents measure herd level performance data for different types of their operations. The majority of respondents always (*n*=49 or 79.03%) measure pregnancy rate in their herd. Approximately 85% of respondents either always (*n*=41 or 66.13%) or most of the time (*n*=10 or 16.13%) measure the bull to cow ratio of their herd. When asked about measuring the weaning weight of their herd, 66.13% (*n*=41) of respondents declared they always measure it and 16.13% (*n*=10) said they measure it most of the time. Additionally, more than 80% of respondents indicated they either always (*n*=38 or 61.29%) or most of the time (*n*=13 or 20.97%) measure their percentage calf crop. Lastly, 27.59% (*n*=16) of respondents never measure dystocia rate within their herd.

Table 13. How often respondents measure the following herd level performance data.

Herd level performance measure	Never		Sometimes		About half the time		Most of the time		Always		Total
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	N
Pregnancy rate	2	3.23	4	6.45	1	1.61	6	9.68	49	79.03	62
Bull:cow ratio	4	6.35	2	3.17	3	4.76	15	23.81	39	61.90	63
Weaning (sale) weight	7	11.29	3	4.84	1	1.61	10	16.13	41	66.13	62
Percent calf crop	2	3.23	6	9.68	3	4.84	13	20.97	38	61.29	62
Calving season distribution	11	17.74	4	6.45	4	6.45	7	11.29	36	58.06	62
Feed use and cost	4	6.45	5	8.06	6	9.68	13	20.97	34	54.84	62
Range conditions	6	9.68	4	6.45	8	12.90	12	19.35	32	51.61	62
Individual cow calving data	11	17.46	9	14.29	2	3.1	6	9.52	35	55.56	63
Grazing days per pasture	9	14.29	6	9.52	7	11.11	10	15.87	31	49.21	63
Body condition score	11	18.03	13	21.31	5	8.20	13	21.31	19	31.15	61
Dystocia rate	16	27.59	11	18.97	0	0.00	11	18.97	20	34.48	58
Other	2	33.33	0	0.00	1	16.67	2	33.33	1	16.67	6

Means and standard deviations were also calculated to determine how often respondents measure specific herd level data (Table 14). The top four areas respondents measure herd level performance data were pregnancy rate (M=4.55, SD=1.03), bull:cow ratio (M=4.32, SD=1.12), percent calf crop (M=4.27, SD=1.12), and weaning (sale) weight (M=4.21, SD=1.36). The least measured areas of herd level performance data were dystocia rate (M=3.14, SD=1.69), body

condition score (M=3.26, SD=1.52), individual cow calving data (M=3.71, SD=1.63), and grazing days per pasture (M=3.76, SD=1.49).

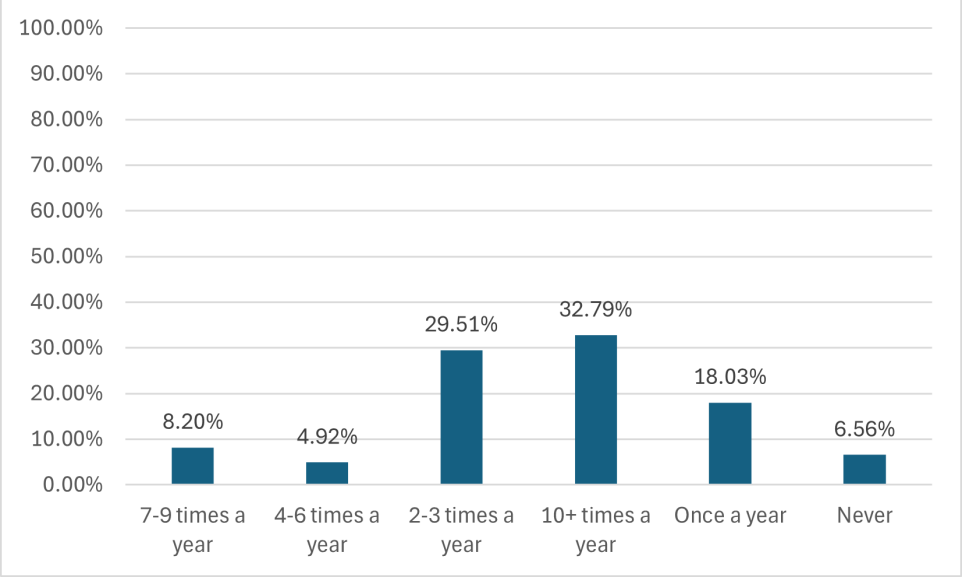
Table 14. How often respondents measure the following herd level performance data.

	Mean	SD	Variance	N
Pregnancy rate	4.55	1.03	1.05	62
Bull:cow ratio	4.32	1.12	1.26	63
Percent calf crop	4.27	1.12	1.26	62
Weaning (sale) weight	4.21	1.36	1.84	62
Feed use and cost	4.1	1.24	1.54	62
Range conditions	3.97	1.33	1.77	62
Calving season distribution	3.85	1.57	2.48	62
Grazing days per pasture	3.76	1.49	2.21	63
Individual cow calving data	3.71	1.63	2.65	63
Body condition score	3.26	1.52	2.32	61
Dystocia rate	3.14	1.69	2.84	58
Other	3	1.53	2.33	6

Note. Minimum = 1 and Maximum = 5

Respondents were asked to select how often they use performance data to make management decisions on their operations. As shown in figure 2, 32.79% use performance data 10 or more times in a year to make management decisions, 29.51% 2-3 times a year, and 18.03% once a year.

Figure 2. How often respondents utilize performance data to make decisions in a year.



Respondents were asked to indicate how often they collect and analyze samples at a commercial lab on an annual basis. Table 15 reported the means and standard deviations of the different types of samples. The top three samples collected and analyzed at a commercial laboratory on an annual basis were harvested forage (M=4.02, SD=3.42), soil (M=3.03, SD=2.66), and water (M=2.88, SD=3.3). The bottom three samples collected and analyzed at a commercial laboratory on an annual basis were liver and blood (M=0.94, SD=0.97), fecal (M=1.6, SD=1.65), and feed – not harvested (M=2.26, SD=2.81).

Table 15. Respondents indicated how often samples are collected and analyzed at a commercial lab on an annual basis.

	Mean	SD	Variance	N
Harvested forage	4.02	3.42	11.71	51
Soil	3.03	2.66	7.1	30
DNA	3	3.46	12	16
Water	2.88	3.3	10.91	25
Pasture	2.74	3.37	11.32	23
Feed - not harvested	2.26	2.81	7.9	27
Fecal	1.6	1.65	2.72	25
Liver & blood	0.95	0.97	0.95	20
Other	1.33	2.98	8.89	6

Note. Minimum = 1 and Maximum = 10

Respondents were asked to rank daily operation concerns on a scale of 1 to 10 with 1 being the most important and 10 being least important. Table 16 shows the means and standard deviations of daily concerns on respondents' operations. The top four daily operational concerns were cow/calf management (M=1.84, SD=1.30), nutritional management and costs (M=3.65, SD=1.8), ranch management (M=3.67, SD=2.26), and range management (M=4.58, SD=1.89).The bottom four daily operational concerns were succession (M=8.22, SD=2.54), federal/state leases (M=8.05, SD=1.88), private leases (M=7.24, SD=2.32), and bull management (M=6.02, SD=1.81).

Table 16. Concerns in the daily operation of respondents' ranches.

	Mean	SD	Variance	N
Succession	8.22	2.54	6.46	55
Federal/state leases	8.05	1.88	3.54	55
Private leases	7.24	2.32	5.38	55
Bull management	6.02	1.81	3.29	55
Marketing strategies	5.96	2.49	6.18	55
Labor management	5.84	2.45	5.99	55
Range management	4.58	1.89	3.59	55
Ranch management	3.67	2.26	5.09	55
Nutritional management and costs	3.65	1.8	3.24	55
Cow/calf management	1.84	1.3	1.7	55
Other	10.93	0.53	0.29	55

Note. Minimum = 1 and Maximum = 11

Table 17 shows how respondents ranked their concerns when adopting new operational practices. Thirty-four respondents (59.65%) declared they are very concerned about the cost to the producer when adopting new operational practices. Additionally, 78.95% of respondents indicated the reliability of technology makes them concerned (*n*=30 or 52.63%) or very concerned (*n*=15 or 26.32%) to adopt a new operational practice. Lastly, 22.81% (*n*=13) of respondents declared the confidentiality of information was not a concern when considering adopting new operational practices.

Table 17. Concern of respondents when adopting new operational practices.

Concerns	Not concerned		Somewhat concerned		Concerned		Very concerned		Total
	n	%	*n*	%	*n*	%	*n*	%	*N*
Cost to producer	0	0.00	4	7.02	19	33.33	34	59.65	57
Reliability of technology	0	0.00	12	21.05	30	52.63	15	26.32	57
Connectivity issues in rural areas	11	19.30	16	28.07	14	24.56	16	28.07	57
Liability to producer	7	12.28	12	21.05	30	52.63	8	14.04	57
Confidentiality of information	13	22.81	18	31.58	17	29.82	9	15.79	57
Risk of adopting	4	7.02	23	40.35	24	42.11	6	10.53	57
Other	2	100.00	0	0.00	0	0.00	0	0.00	2

Means and standard deviations were also calculated to determine the rate of concern of specific issues when adopting new operational practices (Table 18). The top two issues of concern when adopting new operation practices were cost to producer (M=3.53, SD=0.62) and reliability of technology (M=3.05, SD=0.69). The bottom two areas respondents measure herd level performance data were confidentiality of information (M=2.39, SD=1.00) and risk of adopting (M=2.56, SD=0.77).

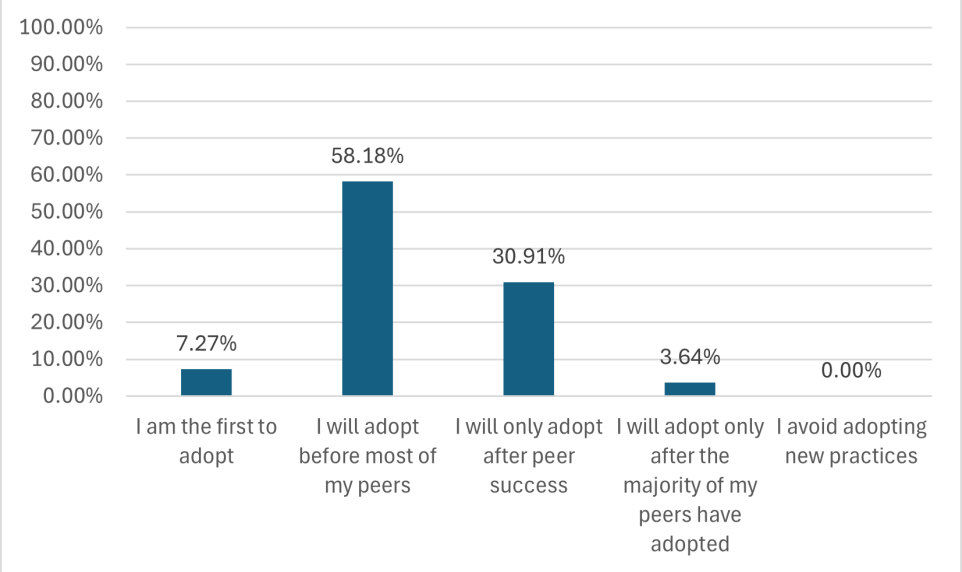
Table 18. Concern of respondents when adopting new operational practices.

	Mean	SD	Variance	N
Cost to producer	3.53	0.62	0.39	57
Reliability of technology	3.05	0.69	0.47	57
Liability to producer	2.68	0.86	0.74	57
Connectivity issues in rural areas	2.61	1.09	1.18	57
Risk of adopting	2.56	0.77	0.6	57
Confidentiality of information	2.39	1	1.01	57
Other	1	0	0	2

Note. Minimum = 1 and Maximum = 4

Respondents were asked to indicate when they adopt new operational practices compared to their peers. As shown in figure 3, 58.18% adopt new operational practices before most of their peers, 30.91% adopt only after peer success, and 7.27% are the first to adopt.

Figure 3. Adopt new operational practices compared to peers.



CHAPTER FIVE

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Introduction

The purpose of this study was to explore operational and production practices of Montana beef producers and their preference of educational programming to inform Montana Extension programming. To accomplish this purpose, two objectives were set: (1) determine Montana beef producers' educational programming preferences and (2) determine Montana beef producers' preferences for operational and production practices. With the quantitative analysis completed, this chapter reports conclusions about the study's objectives to provide future research recommendations along with practical considerations for Montana State University Extension programming efforts.

Summary of Findings

This study provided a description of Montana beef producers' educational programming preferences and their preferences for operational and production practices. Although these results are not generalizable to all Montana beef producers, Montana State University Extension agents and specialists can use the findings to inform their educational programming for Montana beef producers. The respondents of this study were producers that currently or have attended Extension programming, so the findings of this study can be tailored to those who are likely to attend educational programming hosted by Extension.

Research Objective One

Research objective one sought to investigate the educational programming preferences of Montana beef producers. Respondents were asked to identify important factors when attending educational programming, barriers to attending, and preferences of program delivery. Respondents were also asked how likely they are to attend different programming based on topics including business management topics, ranch management topics, and technological topics.

The top three factors important for attending educational programs were applicable research, reading materials, and tools to take home. A majority of participants indicated that timing of programming and scheduled dates were major barriers to attendance. These barriers can be classified as institutional barriers (Smith, 1998, 2010). Motivation to learn, a dispositional barrier, and content were not factors that hindered respondents from attending educational programming (Smith, 1998, 2010). As indicated by Knowles (1980), motivation to learn is an assumption of adult learning and educational needs of adults. Content can be related to a learner's readiness to learn, as defined by Ota et al. (2006) as the desire to relate content to real-life situations. The majority of respondents indicated their preferred program delivery method to be traditional 1–2-hour meetings. Traditional 1–2-hour meetings are educational meetings that have one or two speakers, each speaker typically presents one topic for one hour. Over half of respondents declared they do not prefer educational meetings to be hosted on the Montana State University campus.

Respondents were asked to declare topics of importance related to business management skills. The top three topics were cattle marketing, input costs, and succession of their operation.

Furthermore, respondents indicated they would not be likely to attend educational programming if the topics were export markets, methods of managing risk, or understanding business management principles.

Participants were also asked about the likelihood of attending educational programming when the topic was based on ranch management skills. The top four educational topics were range management, herd health, nutrition/supplementation, and reproduction. The data also revealed topics the respondents would not be likely to attend as labor availability, livestock transportation availability, pesticide use, and carcass information.

As technology continues to advance, the need for education on technological advances also. Respondents were asked to indicate what topics they would attend educational programming on for different technology practices. Thirty-one participants indicated they would attend educational programming on virtual fencing, accounting software, and electronic cattle management.

Research Objective Two

Research objective two sought to determine the preferences for operational and production practices. To determine this, the researched asked respondents about utilizing herd level data including what method they use to collect the data, how often performance data is measured, how often they utilize the data to make management decisions, and how often samples are collected and analyzed at a commercial lab. Approximately 50% of respondents identified the use of pocket-sized books to collect herd level data. Respondents indicated they collect data most often on pregnancy rate, bull:cow ratio, percent calf crop, and weaning (sale) weight. The least collected data were dystocia rate, body condition score, individual calving data, and grazing days

per pasture. More than 1/3 of participants utilize performance data 10 or more times per year to make management decisions. Another 1/3 of participants utilize performance data 2-3 times per year to make decisions for their operations. Respondents declared how often they analyzed different types of samples on an annual basis and the top three sample types were harvest forage, soil, and water. The samples collected and analyzed the least were liver and blood, fecal, and feed (not harvested). This data provides insights into the most and least common operational practices of Montana beef producers.

Research objective two also investigated the preferences of Montana beef producers operational and production practices by analyzing their daily operation concerns and concerns when adopting new operational practices. Respondents indicated their biggest daily concerns were cow/calf management, nutritional management, ranch management, and range management. The data also revealed the least important daily concerns as succession, federal/state leases, private leases, and bull management. Finally, approximately 60% of respondents declared themselves to be very concerned about the cost to the producer when adopting new operational practices but not concerned about confidentiality of information. A majority of respondents indicated they adopt new operational practices before most of their peers and could be identified as early adopters (Rogers, 2003). A small percentage of respondents could be classified as innovators due to being the first to adopt new operational practices.

Recommendations

Based on these conclusions, the researcher's recommendations for program development for Montana State University Extension agents and specialists are as follows. The first recommendation is to continue to plan traditional one-to-two-hour programs. These programs

have one or two speakers who educate about one topic within an hour time frame. The traditional program is currently the most utilized type of Extension programming across the state. The short time period of programming allows beef producers to not be absent from their operation for an entire day. These programs need to have applicable research integrated into the programming content and reading materials for producers to take home and use. The programs should also have tools that producers can use readily or apply to their operations with ease. An example of a tool to teach producers about cattle marketing and input costs, which were favored topics, is the Extension Cow-Calf Enterprise Budget spreadsheet created by University of Wisconsin-Madison ("Decision Tools and Software", n.d). This spreadsheet is a tool for producers to use annually for budgeting to make informed decisions on their operations. The spreadsheet also provides an insight into input costs by breaking down expenses into multiple categories including feedstuff, veterinary medicine, and pasture expenses. Regarding programming about ranch management topics specifically, educators should provide tools that producers could use to monitor their pastures. Monitoring rangelands can include monitoring stocking rates, range production, and the diversity of grass species in the pasture. An example of a tool that could be provided to producers is the South Dakota State University Extension Grazing Calculator. This tool allows producers to input information specific to the pasture to determine the stocking rate of the pasture (Ehlert, 2021). Finally for technology programming, an educational program about accounting software would be well attended by producers. The program should provide an overview of different types of software and allow producers the opportunity to try each software.

The researcher further recommends Montana State University Extension to focus programming in the areas declared by this study. For business management skill development,

programming topics should offer research and best management practices on cattle marketing, input costs, and succession of their operation. Programming efforts should be geared towards budget tools for producers that integrate cattle marketing and input costs. Templates producers could use for budgeting should be broken into different categories such as heifer development, bull investment, and feedlot costs. To develop these tools, Montana State University Extension Specialists could collaborate with Extension Economics. For ranch management skill development, programming should be focused in the areas of range management, herd health, nutrition/supplementation, and reproduction. Extension educators could collaborate with their local veterinarians to offer education on herd health and reproduction. For example, local veterinarians can be subject experts on vaccination protocols, parasites, and/or common diseases. Montana State University Extension should develop MontGuides related to herd health including but not limited to vaccine protocols and internal parasites. To develop resources related to reproduction, MontGuides regarding bull management prior to breeding season and artificial insemination protocols should be developed.

As technology continues to advance for farms and ranches, Extension educators should offer programming on virtual fencing, accounting software, and electronic cattle management. When Extension educators are providing education about technological advances, they should create programming to address the costs of the new innovations that could be integrated into producers' operations. The programming should also provide information on the reliability of the data to ease the concerns of producers. Precision agriculture specialists and MSU Extension Beef specialists could be options as educators for programming focused on technology. The researcher recommends educators to focus on the top four daily operational concerns. To address the

concern of cow/calf management, educators could provide programming about virtual fencing and GPS ear tags to track cattle movements. To educate about technology and nutritional management programming should be focused on feed systems and electronic cattle management. Producers were also concerned about ranch management and indicated they would be likely to attend programming about accounting software. Lastly, drones could be technological advancement producers are educated about for range management. These educational programs should be delivered in the form of traditional 1–2-hour meetings, field days, on-ranch demonstrations, or virtually on websites.

Results confirmed that it is important for Montana State University Extension to continue to educate beef producers about the benefits of utilizing sampling on their operations. They should specifically focus on the benefits of sampling liver and blood, fecal, and feed (not harvested) as these were the least analyzed samples indicated by this research. MontGuides could be created based on these different sample types and their benefits to production. The MontGuides should explain why gathering the sample is important, how to obtain the sample, where to send the sample, and how to analyze and utilize the results. To encourage adoption of these sampling practices, the educator needs to illustrate the benefits of sampling and highlight how the samples could improve their herd health and reproduction of their herd. It should be explained how utilizing sampling can improve overall herd health, cow/calf management, ranch management, and range management of their herd.

Future Research Recommendations

To continue to understand the educational needs of beef producers in Montana, periodic needs assessments should be conducted. Future research should be narrowed down to

specifically understand what topics producers want to learn about. Researchers should break needs assessment into categories of operational practices, business management, and technological advances.

Summary

The conclusions of this quantitative study identify Montana beef producers' operational and product practices and preferences for education programming. The study revealed barriers to attending educational programming are timing of programming and scheduled dates. Montana beef producers want education focused on cattle marketing, range management, and virtual fencing for technology practices. To collect herd level data, producers utilize pocket-sized books and herd level data collected most often is pregnancy rate. Producers do not often sample feedstuffs that are not harvest, liver and blood, or fecal. The researcher recommended Extension agents to focus programming efforts to provide tools for producers to use on their operations. These tools should include tools to assist with cattle marketing, range management and accounting software. It was also recommended for MontGuides to be developed for herd health, reproduction, and sampling of distinct types of feedstuffs and bodily fluids.

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APPENDICES

APPENDIX A

Initial Email

Greetings,

You are being asked to participate in a research study (IRB #2023-758) exploring the operation and production practices of Montana beef producers. The purpose of this study is to explore the operational and production practices of Montana beef producers and their preferences for educational programming to inform Montana Extension programming. The information obtained will benefit understanding and future programming needs for beef extension programs. This study is being led by Makayla Paul, a Graduate Student in the Department of Agricultural and Technology Education at Montana State University. The Faculty Advisor for this study is Dr. Shannon Arnold, Professor in the Department of Agricultural and Technology Education. You have been chosen to participate in this study because of interacting with Montana State University Extension as a beef producer.

At the end of the study, you can enter your email to be entered in a drawing for a pair of tickets to the 2024 Montana Nutrition Conference and Livestock Forum or a membership to the MSU Beef Cattle Nutrition Program. Winners will be notified by email.

If you have any questions or concerns, please contact Makayla Paul, (406)547-3042 or makayla.paul@montana.edu.

Survey Link: https://montana.qualtrics.com/jfe/form/SV_bykzcbrKGEP4L0a

Thank you for your participation in the survey. If you have any questions or concerns, please contact Makayla Paul, (406)547-3042 or makayla.paul@montana.edu.

APPENDIX B

Follow-up Email

Greetings,

You were recently contacted by your extension agent to participate in this research study. Thank you to those who have already completed the survey! If you have not had a chance to complete the survey, it will remain open until December 15, 2024, and we would greatly value your feedback. Please see the survey details below.

You are being asked to participate in a research study (IRB #2023-758) exploring the operation and production practices of Montana beef producers. The purpose of this study is to explore the operational and production practices of Montana beef producers and their preferences for educational programming to inform Montana Extension programming. The information obtained will benefit understanding and future programming needs for beef extension programs. This study is being led by Makayla Paul, a Graduate Student in the Department of Agricultural and Technology Education at Montana State University. The Faculty Advisors for this study are Dr. Shannon Arnold, Professor in the Department of Agricultural and Technology Education, and Dr. Megan VanEmon, MSU Extension Beef Cattle Specialist. You have been chosen to participate in this study because of your interactions with Montana State University Extension as a beef producer.

At the end of the study, you can submit your email to be entered into a drawing for a pair of free tickets to attend the 2024 Montana Nutrition Conference and Livestock Forum or a membership to the MSU Beef Cattle Nutrition Program. Winners will be notified by email.

APPENDIX C

Consent Statement

You are being asked to participate in a research study exploring Montana beef producers' adoption of operation and production practices. This may help us obtain a better understanding of the kinds of educational resources producers need to run their operations. You were chosen as a potential participant because of your involvement in previous MSU Extension programming. Your participation is voluntary. If you agree to participate, you will be asked to complete an online questionnaire. You can choose to answer or not answer any questions and/or you can stop at any time. Choosing to participate in this study will only require approximately 10 minutes of your time. If you agree to participate, your responses will be anonymous and confidential. At the end of the survey, you may enter your email addresses for a chance to win a drawing. Email addresses will be held confidential and not connected with an answer.

There are no foreseen risks associated with your participation in this study. The inconveniences are minimal and include the time required to complete the questionnaire. The results of this study will help educators and professionals develop more targeted educational materials and programming for producers. There is no cost to participate. You may stop or decline to participate at any time. All data will be kept confidential and available to the researcher only. Should you have any questions regarding the research, you may contact Makayla Paul at (406)547-3042 or email: makayla.paul@montana.edu. For questions or concerns about your rights as a human subject involved in this research you may contact Dr. Mark Quinn, Institutional Review Board Chairperson, at (406)994-4707 or email: mquinn@montana.edu.

By continuing this questionnaire, you give your voluntary informed consent to participate in this research.

APPENDIX D

IRB Approval

IRB Protocol #2023-758-EXEMPT APPROVED

NoReply@TOPAZTI.com <NoReply@TOPAZTI.com>
Tue 11/14/2023 2:30 PM

To:Arnold, Shannon <shannon.arnold@montana.edu>;Paul, Makayla <makayla.paul@montana.edu>;Beiswanger, Kelly <kelly.beiswanger@montana.edu>

External Sender

Hello Paul, Makayla,

Your protocol was reviewed by the IRB and has been approved.

PI: Paul, Makayla
Approval Date: 11/14/2023
Title: A Needs Assessment to Assess Operation and Production Practices of Montana Beef Producers

Protocol #: 2023-758-EXEMPT
Review Type: Amendment
Expiration Date: 6/5/2028

Work described under this protocol may now commence. The PI is responsible for ensuring that the protocol accurately describes research practices being conducted.

> Review Category designation determined by the IRB can be found in the final section of your protocol.
> IRB-stamped active Consent Forms are attached within your protocol where applicable.
> Any changes must be submitted via Amendment prior to implementation.
> Per the Common Rule, research only requires Interim (annual) Review by the IRB if 1) it was reviewed via Full Committee or 2) is regulated by the FDA.
> All research is subject to post approval monitoring.
> All protocol types must be renewed 5 years after approval.
> Inform the IRB once your research is complete so that the protocol may be inactivated.

Please contact your IRB Program Manager with any questions or if you are in need of assistance. Thank you for your diligence in the care of human subjects research participants.

Institutional Review Board for the Protection of Human Subjects | Office of Research Compliance | Montana State University

Access your protocol anytime at https://nam10.safelinks.protection.outlook.com/?url=https%3A%2F%2Fmontanaprod.topazti.net%2F%2FElements%3FemailLink%3D11%252c102%252c10615&data=05%7C01%7Cmakayla.paul%40montana.edu%7C7542eb5efd1f49819b5008dbe558e528%7C324aa97a03a644fc91e43846fbced113%7C0%7C0%7C638355942235378917%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=N68PzXR7N3xkiRtbi16VYnafHbHHCe%2FPBfYwxAfbEsg%3D&reserved=0.

APPENDIX E

Survey Instrument

Informed Consent

Q1. SUBJECT CONSENT FORM FOR PARTICIPATION IN HUMAN RESEARCH AT MONTANA STATE UNIVERSITY
Project Title: An Assessment to Assess Operation & Production Practices of Montana Beef Producers

You are being asked to participate in a research study exploring Montana beef producers' adoption of operation and production practices. This may help us obtain a better understanding of the kinds of educational resources producers need to run their operations. You were chosen as a potential participant because your involvement in previous MSU Extension programming.

Your participation is voluntary. If you agree to participate, you will be asked to complete an online questionnaire. You can choose to answer or not answer any questions and/or you can stop at any time. Choosing to participate in this study will only require approximately 10 minutes of your time. If you agree to participate, your responses will be anonymous and confidential. At the end of the survey, you may enter your email addresses for a chance to win a drawing. Email addresses will be held confidential and not connected with answer.

There are no foreseen risks associated with your participation in this study. Inconveniences are minimal and include the time required to complete the questionnaire. Results of this study will help educators and professionals develop more targeted educational materials and programming for producers. There are no costs to participate. You may stop or decline to participate at any time. All data will be kept confidential and available to the researcher only.

Should you have any questions regarding the research, you may contact Makayla Paul at (406)547-3042 or email: makayla.paul@montana.edu. For questions or concerns about your rights as a human subject involved in this research you may contact Dr. Mark Quinn, Institutional Review Board Chairperson, at (406)994-4707 or email: mquinn@montana.edu.

By continuing this questionnaire, you give your voluntary informed consent to participate in this research.

Educational Program Barriers & Preferences

Q2. Please indicate the importance of each factor when attending an educational program about ranching and/or the beef cattle industry.

	Not at all important	Slightly important	Very important	Extremely important
Applicable research	○	○	○	○
Hands-on demonstrations	○	○	○	○
Tools to take home and use	○	○	○	○
Networking opportunities	○	○	○	○

	Not at all important	Slightly important	Very important	Extremely important
Mentoring	○	○	○	○
Reading materials / hand-outs of materials presented	○	○	○	○

Q3. Please indicate how each factor may be a barrier to attending an educational program on beef cattle management.

	No Barrier	Low Barrier	Somewhat Barrier	Moderate Barrier	Major Barrier
Cost of programming	○	○	○	○	○
Timing of programming	○	○	○	○	○
Scheduled dates	○	○	○	○	○
Content	○	○	○	○	○
Motivation to learn	○	○	○	○	○

Q4. Please indicate your preference of program delivery to obtain new research and educational information about beef cattle management.

	Do not prefer	Prefer slightly	Prefer a lot	Prefer a great deal
Field days, on-ranch demonstrations	○	○	○	○
Websites (Extension publications and electronic materials)	○	○	○	○
Full day seminars	○	○	○	○
Traditional 1-2 hour meetings	○	○	○	○
On-line resources (Webinars, courses, videos)	○	○	○	○
Virtual format webinars	○	○	○	○
1-on-1 consultations	○	○	○	○
Regional meetings	○	○	○	○
Meetings at MSU campus	○	○	○	○

Q5. Please indicate how frequently you use the following media outlets.

	How often do you USE the following media outlets?			How often do you USE the following media outlets TO FIND educational information on beef topics?		
	Never	Occasionally (1 to 3 times weekly)	Frequently (greater than 4 times per week)	Never	Occasionally (1 to 3 times weekly)	Frequently (greater than 4 times per week)
Facebook	○	○	○	○	○	○

	Currently using	Planning to use	Interested in using	Not currently using/do not plan to use	Does not apply to my operation
Utilizing expected progeny differences (EPD) for replacement heifer selection	○	○	○	○	○
Pregnancy checking	○	○	○	○	○
Embryo Transfer	○	○	○	○	○
Artificial insemination	○	○	○	○	○
Obtaining carcass data from calves	○	○	○	○	○
Collecting body weight of calves on ranch	○	○	○	○	○
Collecting body weight of cows on ranch	○	○	○	○	○
Body condition scoring	○	○	○	○	○
Feed scales for diet accuracy	○	○	○	○	○
Vaccination of cattle	○	○	○	○	○
Antibiotic treatment of individual animals	○	○	○	○	○
Niche marketing (e.g. all-natural)	○	○	○	○	○

Q8. Of the following technology practices, please indicate which ones you use on your beef cattle operation.

	Never	Sometimes	About half the time	Most of the time	Always
Virtual fencing	○	○	○	○	○
Accounting software (e.g. Quick-Books)	○	○	○	○	○
Drones	○	○	○	○	○
Electronic cattle management system	○	○	○	○	○
GPS tracking	○	○	○	○	○
Feed system (e.g. Growsafe)	○	○	○	○	○
Cameras (e.g. calving barns)	○	○	○	○	○
Other	○	○	○	○	○

Q9. When considering the following technology practices, what educational programming would you attend?

- ☐ Virtual fencing
- ☐ Accounting software (e.g. Quick-Books)
- ☐ Drones

- [ ] Electronic cattle management system
- [ ] GPS Tracking
- [ ] Feed system (e.g. Growsafe)
- [ ] Cameras (e.g. calving barns)

Q10. What method do you use to collect herd level data?

- [ ] Pocket sized book (ex. redbook)
- [ ] Smart phone app, what app?
- [ ] Computer software program, what program?
- [ ] Other
- [ ] If you do not keep herd level data, please describe why not.

Q11. Select how often you measure the following herd level performance data.

	Never	Sometimes	About half the time	Most of the time	Always
Percent calf crop	○	○	○	○	○
Weaning (sale) weight	○	○	○	○	○
Bull:cow ratio	○	○	○	○	○
Dystocia rate	○	○	○	○	○
Grazing days per pasture	○	○	○	○	○
Pregnancy rate	○	○	○	○	○
Calving season distribution	○	○	○	○	○
Individual cow calving data	○	○	○	○	○
Body condition score	○	○	○	○	○
Range conditions	○	○	○	○	○
Feed use and cost	○	○	○	○	○
Other	○	○	○	○	○

Q12. How often do you use performance data to make management decisions?

- ○ Never

- ◯ Once a year
- ◯ 2-3 times a year
- ◯ 4-6 times a year
- ◯ 7-9 times a year
- ◯ 10+ times a year

Q13. Please indicate how often you collect the following samples and have them analyzed at a commercial lab on an annual basis.

	0	1	2	3	4	5	6	7	8	9	10	10+
Feed - not harvested												☐
Harvested forage												☐
Pasture												☐
Water												☐
Fecal												☐
Soil												☐
Liver & blood												☐
DNA												☐
Other												☐

Q14. Please rank the following concerns in the daily operation of your ranch with 1 being most important and 10 being least important.

- Cow/calf management

- Labor management
- Nutritional management and costs
- Marketing strategies
- Ranch management
- Range management
- Bull management
- Federal/state leases
- Private leases
- Succession
- Other

Q15. When considering business management skills, what educational programs are you more likely to attend?

	Extremely unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Extremely likely
Methods of managing market risk	○	○	○	○	○
Understanding business management principles	○	○	○	○	○
Goal setting for your operation	○	○	○	○	○
Input costs	○	○	○	○	○
Succession of your operation	○	○	○	○	○
Export markets	○	○	○	○	○
Direct to consumer marketing	○	○	○	○	○
Cattle marketing	○	○	○	○	○
Financing/budgeting	○	○	○	○	○
Other	○	○	○	○	○

Q16. When considering ranch management skills, what educational programs are you more likely to attend?

	Extremely unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Extremely likely
Herd health	○	○	○	○	○
Reproduction	○	○	○	○	○

	Extremely unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Extremely likely
Genetic selection	○	○	○	○	○
Nutrition/supplementation	○	○	○	○	○
Carcass information	○	○	○	○	○
Watering systems	○	○	○	○	○
Livestock transportation availability	○	○	○	○	○
Pesticide use	○	○	○	○	○
Labor availability	○	○	○	○	○
Land/pasture availability	○	○	○	○	○
Range management	○	○	○	○	○
Other _____	○	○	○	○	○

Q17. When it comes to adopting new operational practices,

- ○ I am the first to adopt
- ○ I will adopt before most of my peers
- ○ I will only adopt after peer success
- ○ I will adopt only after the majority of my peers have adopted
- ○ I avoid adopting new practices

Q18. What level of risk are you willing to accept when adopting new operational practices?

Q19. Please rate your concerns regarding the following issues when adopting new operational practices:

	Not concerned	Somewhat concerned	Concerned	Very concerned
Liability to producer	○	○	○	○
Cost to producer	○	○	○	○

	Not concerned	Somewhat concerned	Concerned	Very concerned
Reliability of technology	○	○	○	○
Confidentiality of information	○	○	○	○
Connectivity issues in rural areas	○	○	○	○
Risk of adopting	○	○	○	○
Other	○	○	○	○

Demographics

Q20. Please indicate your age.

- ○ 18-24
- ○ 25-34
- ○ 35-44
- ○ 45-54
- ○ 55-64
- ○ 65-74
- ○ 75+

Q21. Please Indicate your gender.

- ○ Male
- ○ Female
- ○ Non-binary / third gender
- ○ Prefer not to say

Q22. What is your highest level of education?

- ○ GED
- ○ High School Diploma
- ○ Some College
- ○ Associates Degree
- ○ Bachelors Degree
- ○ Masters Degree

- ◯ Doctorate
- ◯ None of the Above

Q23. Primary type of operation:

- ◯ Commercial cow-calf
- ◯ Seedstock cow-calf
- ◯ Stocker/backgrounder
- ◯ Feedlot/finisher

Q24. Size of Operation (in cow numbers):

- ◯ 0-100
- ◯ 101-200
- ◯ 201-300
- ◯ 301-400
- ◯ 401-500
- ◯ 500+

Q25. Indicate your role on the ranch:

- ◯ Ranch manager and owner
- ◯ Ranch manager and partial owner
- ◯ Ranch manager with an absentee owner
- ◯ Ranch manager, but not owner
- ◯ Other

Q26. What county are you located in?

Beaverhead
Big Horn
Blaine
Broadwater
Carbon
Carter
Cascade
Chouteau
Custer
Daniels

Q27. If you would like to be entered in a drawing for a pair of tickets to the 2024 MT Nutrition Conference and Livestock Forum or a membership to the MSU Beef Cattle Nutrition Program, please enter your email below.