SOCIAL SCIENCE RESEARCH ON FACTORS INFLUENCING FARMERS' ATTITUDES TOWARD THE ADOPTION OF ROTATIONAL GRAZING IN VIRGINIA

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https://ext.vt.edu/agriculture/graze-300.html

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INTRODUCTION

The purpose of the research presented in this report is to evaluate various factors that influence farmers' attitudes toward different forms of grazing management practices—specifically, the adoption of rotational grazing. Findings of this study provide information to extension agents and decision makers around Virginia to highlight opportunities for training regarding grazing management techniques, as well as to inform different approaches to developing effective messaging and educational materials. General questions addressed in this report include:

i) What are farmers' current grazing management practices?

ii) What challenges do farmers face in adopting rotational grazing?

iii) What are the key factors influencing farmers' attitudes toward changing grazing management practices (e.g., economic, environmental, cultural, information sources)?

iv) From what sources do farmers obtain their information about grazing practices?

1. METHODOLOGY

1.1 Interviews with Farmers and Review of Literature

To begin, our project team met with the Graze 300 team which was comprised of Virginia Cooperative Extension (VCE) agents, VCE Forage Specialists, and livestock producers in Virginia that already practice rotational grazing. Next, we organized conversations with a few Virginia beef farmers that were practicing rotational grazing. Through these sessions, we not only learned about the topic itself but about the terminology and language of the field. Through convenience and snowball sampling amongst our grant team, we were able to schedule and conduct interviews with six producers from across the state of Virginia who are using rotational grazing.

Conducted during the summer of 2021, these semi-structured interviews ranged between thirty and ninety minutes in duration. The age of the participants was between 36-68, all were male, and all had raised cattle in Virginia. Three interviews were conducted via Zoom and three were conducted via phone. Every participant had taken part in a government cost-share program to make changes to their operations. About half of the participants were engaged in another form of agricultural production such as farming, raising other types of livestock, or offering horse riding lessons on their land. Every participant not only supported rotational grazing but also practiced and implemented it on their own farms. Through these interviews, it was apparent that

there were two major categories of reasons that farmers may struggle with when considering adopting rotational grazing practices—physical and social barriers.

After concluding the interviews with farmers that are already invested in and practicing rotational grazing techniques, we conducted a literature review of research regarding the barriers farmers experience when they want to use rotational grazing practices. In addition to what we learned during our conversations with farmers, we garnered a better understanding of the physical and other tangible barriers—such as access to shade and water—that farmers may struggle to overcome.

The existing literature outlines the physical barriers to rotational grazing, like access to shade/water (Wang 2020; Wang et al. 2020; Winsten et al. 2011); time/cost of paddock fence installation and management (Wang et al. 2020; Winsten et al. 2011); size of operation versus access to land (Winsten et al. 2011); as well as social barriers like opinions of neighbors and the politicization of environmentalism (Nelson et al. 2014). Most of the physical/tangible barriers and farmers' perceptions about the difficulty of those barriers have not changed in roughly thirty years, and future research should focus on social and psychological barriers to rotational grazing (Ranjan et al. 2019).

Nelson (2014) found that farmers with weak social ties to the "traditional farming community" were more likely to experiment with and implement rotational grazing practices. Through that process, they then develop strong ties with other rotational graziers who help facilitate knowledge and offer social support and develop social capital within the community. During the interviews conducted for this project, one younger farmer mentioned that he was able to start his farming operation with rotational grazing methods because he was a first-generation farmer and therefore not "confined" by family and tradition. This provides an example of the weak social ties that Nelson (2014) was referring to. This social aspect of rotational grazing versus "traditional" farming was present in each of the interviews and demonstrates the need for further research into social reasons farmers may or may not choose rotational grazing methods.

1.2 Survey Instrument Development

The literature review not only provided context, but also examples of previous surveys, questions, and categorization of barriers (Ibrahim, Pattanaik, and Cornish 2019; Nelson et al. 2014; Wang 2020; Wang et al. 2020; Winsten et al. 2011). As a team, based on our own research questions, we decided which questions to use on the survey for this project. After the development of a draft survey, it was sent to the larger Graze 300 team of farmers, Extension agents and Specialists for review. Their comments and concerns were implemented into what became the final draft of the survey instrument.

1.3 Survey Distribution

Distribution of the survey was a major concern of the Extension agents involved with the Graze 300 team. Using the knowledge and first-hand experience they had in the field with our potential population, we decided to use both online and paper survey formats and gathered data employing a convenience sample approach. We utilized Qualtrics for our online survey and as our survey data repository. The Qualtrics version had conditional sets of questions—some that were for farmers using rotational grazing (defined as individuals who reported they fed hay less than 120 days per year) and separate questions for farmers that were not (continuous graziers, who reported feeding hay 120 per year or more). Because of those conditional questions in the online format and our team's desire to keep length to a minimum to facilitate higher completion rates, we also used two versions of paper surveys: one for farmers already using rotational grazing methods and one for non-users. To keep the survey short enough to fit on the front and back of one page, the paper survey did not include questions regarding farm size and structure. On average, surveys took approximately 8-10 minutes to complete.

As Extension agents collected paper surveys, they were mailed to the graduate and undergraduate students on the team for processing (entering data into Excel, checking for validity, and loading into Qualtrics). Extension agents and others on the team distributed the survey through their Extension meetings, trainings, conferences (e.g., the Virginia Forage and Grassland Council Winter Conferences), and email listservs. Paper surveys were administered at these events as well. Participants were given the option to fill out a paper survey in person or to take the link to the Qualtrics survey for completion. We collected survey data from October 2021 through the end of March 2022, yielding 535 completed surveys—411 online surveys and 124 paper surveys. Farmers practicing continuous grazing accounted for 206 surveys and 329 surveys were from farmers practicing rotational grazing.[1]

2. ANALYSIS & DISCUSSION

2.1 Demographics

The average participant in this survey was a 57-year-old white male. As expected, most of our sample was both white (90%) and male (74%). Our sample was taken in Virginia, which, like many states, has a history of white, male land ownership. This is present in our sample. Approximately 1 percent of our sample self-reported as Black and 2.2 percent self-reported as Native American. Approximately one-quarter of the sample identified as female. Statistical

[1] Note: There are likely more rotational grazing farmers in our convenience sample than in the general population of Virginia producers, given that participants in Extension events and Virginia Forage and Grassland Council meetings are more likely on the leading edge of deploying better land management practices.

comparisons between continuous and rotational grazing farmers revealed no significant differences in age, gender, and ethnicity.

We asked participants about their familial relationship to farming: 36 percent of participants were first generation farmers—meaning they are the first in their family to engage in the practice of farming. They likely do not have the generational traditions, knowledge, or expectations around farming like those who come from families that have engaged in farming across multiple generations. Conversely, 34 percent of our sample were more than third generation farmers, whose families have engaged in farming practices for at least four or more generations of children. 70 percent of our sample fell into these two categories—first time or long-time farmers. The rest of the sample were second- or third-generation farmers. However, there were no statistically significant differences between those who practiced rotational grazing and those who practiced continuous grazing. Further, respondents, whether rotational or continuous grazing practitioners, had been farming an average of 21 years.

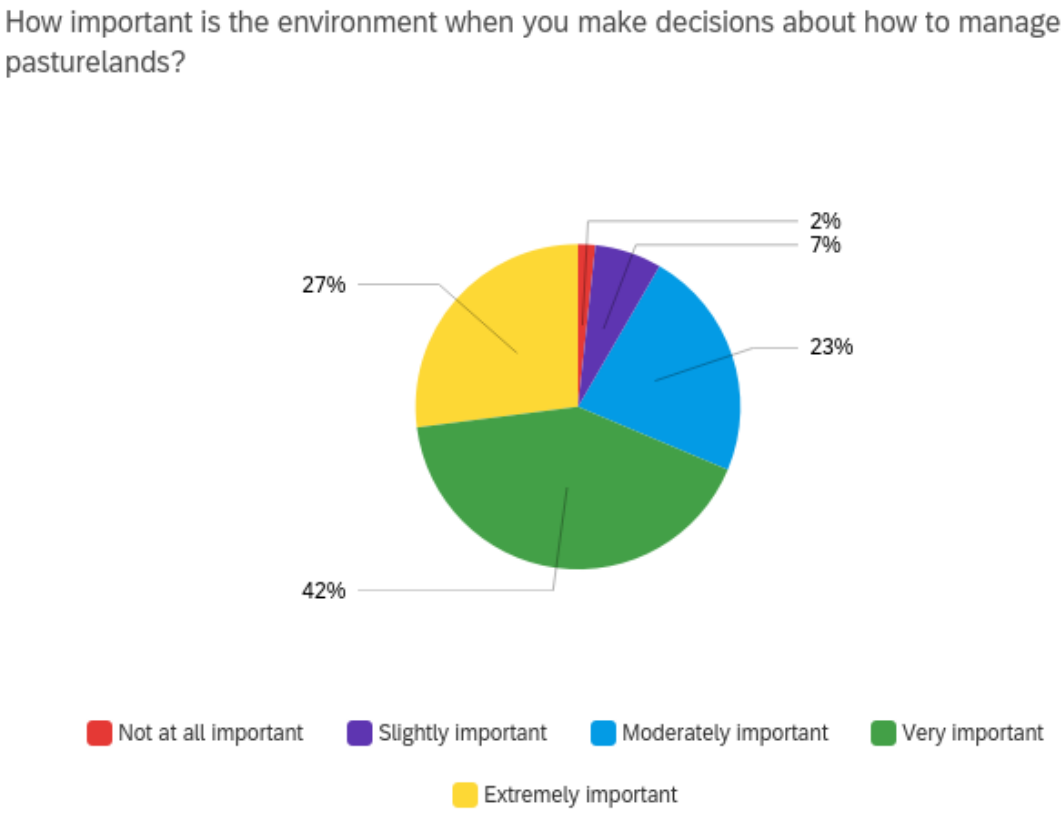
2.2 Additional Respondent Information

In our overall sample, respondents reported owning an average of 145 acres of grassland. Of that acreage, they used approximately 31 acres to produce hay. On average, respondents are renting/leasing approximately 93 acres and using around 30 of those rented/leased acres to produce hay. There were no significant differences between rotational grazing and continuous grazing practitioners regarding the amount of grassland owned and rented, but as expected, those who used rotational grazing devoted significantly less owned and leased acres to hay production. In our sample, nearly 93 percent of respondents are the primary operators on their farms.

Our respondents obtain their information from several different sources, but the top three reported channels of information were: Extension agents/specialists (23%); farm media such as magazines, monthly agricultural newspapers/publications (16%); and local soil and water conservation districts (14%). When asked, "*Prior to receiving this survey, had you heard about Graze 300?*" slightly more than one-half (53%) responded yes. Those who practiced rotational grazing might be expected to be more aware of Graze 300 than those who practice continuous grazing, but there were no statistical differences between the two groups.

When asked, "*How important is the environment when you make decisions about how to manage your pasturelands?"* more than two-thirds (69%) of respondents indicated that it was extremely important (27%) or very important (42%) (see Chart 1). Although our qualitative data indicated that those who used rotational grazing were more likely to place higher value on the environment than those who used continuous grazing, there were no statistical differences between the two groups on this issue.

Chart 1.
Importance of the Environment When Making Pastureland Management Decisions (N=462)



2.3 Challenges/Barriers to Implementing Rotational Grazing Practices

The results for Question 11, "*How great of a challenge do you believe each of the following is in adopting rotational grazing?*" are presented in Table 1. These data reveal six moderate to significant challenges continuous grazing operators identify as barriers to adoption of rotational grazing practices: water source constraints (62%); amount of work to start rotational grazing (50%); lack of shade (42%); difficulty producing winter feed (41%); amount of work to use rotational grazing (38%); and not enough cost-share incentives (38%). Three significant and moderate challenges were identified by rotational grazing operators: amount of work to start rotational grazing (44%); water source constraints (41%); and lack of shade (38%). There was a statistical difference between the rotational and continuous grazing groups regarding difficulty in producing winter feed, yet more than one-fourth (26%) of the rotational grazing groups viewed this as a challenge. Issues of water source constraints, the lack of shade, the amount of work to start, and cost-share incentives are consistent with the literature (Ibrahim, Pattanaik, and Cornish 2019; Ranjan et al. 2019; Wang 2020; Wang et al. 2020; Winsten et al. 2011) as "technical or physical limitations" and have been viewed as challenges for nearly 30 years.

Although a majority of both groups did not view decreased profitability and uncertain outcomes as challenges, statistically significant differences were found between continuous and rotational grazing farmers. Closer examination indicates that more than one-third of the continuous grazing

group were in the neutral category on both indicators, suggesting that more outreach might be done to convince farmers who are 'on the fence' that such challenges can be overcome. Likewise, there was a statistical difference regarding 'information,' but the majority of both groups did not see a lack of information as a challenge.

There were statistically significant differences between the rotational and continuous grazing groups for issues of farm size—too big, too small, or too many, with the continuous grazing groups more likely to view these as challenges. A large majority of both groups did not view skepticism from other farmers, skepticism from family members, or the concerns of neighbors as serious challenges. However, statistical differences between the two groups were observed for the latter two variables.

Table 1. Perceived Challenges to Adopting Rotational Grazing Practices among Rotational and Continuous Grazing Farmers

Q11: How great of a challenge do you believe each of the following is in adopting rotational grazing?[1]	Not or somewhat a Challenge	Neutral	Significant or moderate challenge	Mean	T-Test Significance
Lack of information					
Continuous (n=179)	62%	26%	12%	2.0	
Rotational (n=276)	75%	12%	13%	1.8	.031
Decrease in profitability					
Continuous (n=180)	46%	35%	19%	2.5	
Rotational (n=277)	70%	21%	9%	1.8	<.001
Not enough cost-share incentives					
Continuous (n=182)	41%	21%	38%	2.9	
Rotational (n=277)	55%	21%	24%	2.4	<.001
Uncertain outcomes					
Continuous (n=179)	39%	40%	21%	2.7	
Rotational (n=274)	63%	20%	16%	2.2	<.001
Amount of work to start					
Continuous (n=184)	37%	13%	50%	3.2	
Rotational (n=276)	46%	10%	44%	2.9	.004
Amount of work to use					
Continuous (n=182)	41%	21%	38%	2.9	
Rotational (n=275)	62%	15%	22%	2.3	<.001
Using poly wire					
Continuous (n=175)	49%	26%	25%	2.5	
Rotational (n=273)	71%	16%	12%	1.9	<.001
Difficulty producing winter feed					
Continuous (n=183)	44%	15%	41%	2.9	
Rotational (n=280)	57%	17%	26%	2.4	<.001
Water source constraints					
Continuous (n=181)	31%	7%	62%	3.4	

Rotational (n=276)	52%	6%	41%	2.8	<.001
Lack of shade					
Continuous (n=181)	48%	10%	42%	2.8	
Rotational (n=277)	54%	8%	38%	2.7	.670
Weather/climate issues					
Continuous (n=180)	48%	32%	20%	2.5	
Rotational (n=277)	60%	16%	24%	2.4	.221
Farm too big					
Continuous (n=178)	62%	29%	9%	2.0	
Rotational (n=277)	80%	19%	1%	1.4	<.001
Farm too small					
Continuous (n=177)	50%	26%	24%	2.5	
Rotational (n=273)	70%	19%	12%	1.9	<.001
Multiple small farms					
Continuous (n=175)	46%	31%	22%	2.5	
Rotational (n=258)	61%	29%	10%	2.0	<.001
Leasing restrictions					
Continuous (n=176)	54%	29%	17%	2.2	
Rotational (n=263)	65%	24%	10%	1.9	.003
Not the primary operator					
Continuous (n=174)	67%	29%	4%	1.8	
Rotational (n=262)	68%	25%	6%	1.8	.907
Skepticism from other farmers					
Continuous (n=180)	73%	22%	6%	1.7	
Rotational (n=272)	78%	14%	7%	1.6	.796
Skepticism from family					
Continuous (n=180)	71%	18%	12%	1.8	
Rotational (n=271)	79%	14%	7%	1.6	.022
Worried what neighbors will think					
Continuous (n=182)	78%	16%	6%	1.6	
Rotational (n=273)	89%	10%	1%	1.3	.001

1. Response categories were: 1= not a challenge; 2 = somewhat of a challenge; 3 = neutral; 4 = moderate challenge; 5 = significant challenge.

In open-ended responses on the survey, lack of rain/water were most often cited as critical challenges to implementing rotational grazing. The following quotes illustrate these points:

> *"[Rotational grazing] works well but you have to have rain."*

> *"I do use rotational grazing and it has worked but we need to tweak it in order that we cut down on hay being fed. I need some help figuring out how to make it more economical. The whole process is however determined by rain which we are sorely lacking."*

"It all depends on how much grass is available in the fall, rain has a lot to do with it."

"It's all fun and games till you have 9 months with less than 8" of rain. That's when rotational grazing starts to fall apart."

"The idea was very helpful to our practice, but lack of rain resulting in lack of pasture growth can cripple its success!"

"It is a challenge to practice rotational grazing on some of the strip-mined properties in our area because of weather and water supply."

Additional challenges to adopting rotational grazing are reflected in the following comments:

"Managed grazing is a great practice in my opinion. However, practices such as the 'Graze 300' initiative require very different management when compared directly to a traditionally managed herd. For many producers I see this initiative affecting them in decreasing their stocking rate or acquiring more grazing land. For operations such as mine, it is very challenging for a young farmer to find and obtain leases, so in turn I would have to decrease my stocking rate. This is fine in years of good production as the input costs would typically be lower if these practices would be implemented. However, in times of elevated or increased market prices I believe my operation would be more affected as having fewer head would mean being less profitable during these times. I understand there are pros and cons with everything, as feeding hay is one of the largest expenses a cattle operation can have. So, feeding less hay is always a good thing when it can be done but I would like to see more research on ways to improve these practices on an operation similar to mine where the effects can be seen without large changes to the operations herd size and finances."

"It's too expensive to put in permanent fencing and too much time and work to keep moving temporary fencing. Our acreage allows us to rotate through 4 pastures in summer and fall and 3 pastures in winter and spring. Let's face it, goats don't bring in enough money to justify huge inputs of money and labor."

"I always thought others would adopt this method because of profitability but that did not happen at scale. Seems there are other more important reasons for the slow rate of adoption."

"We already rotate on a very small scale but lack the infrastructure to make more intense mob grazing a reality due to water constraints and additional fence charger needs for multiple poly fences over multiple farm leases."

"Finding that balance between stocking rates and pasture health [is a challenge]."

"This is an excellent practice. However, the cost of fencing is so much higher than the paid per foot by the government its cost makes it prohibitive for most farmers."

"[I] used it more when [I was] young. . . . [it] ties you up almost every day. . . . [its] not possible anymore."

"It works, but I don't have manpower time to participate."

"I tried rotational grazing years ago. Fenced off some spring streams, constructed water troughs and etc. Now the fences have fallen down. It would cost me 1/2 the farm to replace the fences. I am too old to maintain the grazing and rotating the cattle. I do try and keep some of the land free from grazing in the summer to save for fall pasture. If I had 100 acres of nice flat land I would rotate. But my land us up hill, down hill. Fencing and water restricts me."

"Horse breeders have different considerations than other livestock. I have foals every year. I have horses that need training. The ONE key thing I have learned in farming is to SAVE LABOR. Why? Because it is very difficult to hire help and you need to be able to do it yourself. Rotational grazing is great, but it is time consuming and laborious. Luckily me for me, I do not want rich pastures so what I sacrifice not rotating is fine. You need to figure out how to make rotational grazing simpler to manage and less labor intensive."

"The most significant problem we experience with rotational grazing is a lack of appropriate shade for larger group. There is a need for a portable shade option which is cost effective and relatively easy to use and move."

"[Rotational grazing is a] serious challenge in our climate."

"[One challenge is] the lack of understanding and ability to quantify the local and extended benefits of rotational grazing MANAGEMENT! Example: Chesapeake Bay Program assigns less credit to proper grazing management applied than any other practice on grazed lands! Time to get ducks in a row and deliver facts through research and application."

Participants were given the opportunity to expand upon these challenges in an open text box. Review of those comments suggests that land presents a significant barrier—having enough acreage and owning those acres to make structural improvements through government cost-share

programs. Many farmers are interested in rotational grazing but lease portions of their pastures or they cannot afford to buy land to expand grazing potential, as these quotes suggest:

> *"[I] definitely think it can work. [A] challenge is number of farms rented. Multiple landowners. Developing water sources in steep slope areas. Shade [is] an issue on some farms. Principal owners [are] more interested in machinery than grass management and hired help loves to run hay equipment."*

> *"I've been hesitant about rotational grazing and watering systems due to lack of ownership and amount of time and more management."*

2.4 Social Barriers to Rotational Grazing

Question 12 asked farmers who do not use rotational grazing why they have chosen not to do so by asking them to indicate their level of agreement or disagreement with a series of statements (see Table 2). This question focused on social aspects that may influence individual decision-making that came from the qualitative interviews with farmers who use rotational grazing as well as the literature (Nelson et al. 2014). First, a reliance on or preference for tradition was not as important as expected—52 percent of farmers disagreed that tradition is best. Rather than tradition, results suggest that some farmers choose not to implement rotational grazing methods because they prefer farming with machinery. Forty-four percent of participants reported they like operating their haying machinery; 43 percent indicated they get more done with machines; and 40 percent responded that they would rather drive than walk. As one respondent noted: *"Principal owner[s] [are] more interested in machinery than grass management and hired help loves to run hay equipment."* These results suggest that unwillingness to implement rotational grazing is more influenced by a desire to use machinery and a reliance on machinery than notions of "tradition." Future research should further explore these phenomena.

Table 2. Reasons for Not Adopting the Practice of Rotational Grazing among Continuous Grazing Practitioners

Q12: Below is a list of reasons you might have decided not to use rotational grazing:	Agree	Neutral	Disagree
Like operating hay machines (n = 177)	44%	30%	26%
Get more done with machines (n = 179)	43%	33%	24%
Rather drive a tractor than walk (n = 178)	40%	28%	32%
Wait and see how it works for others (n = 181)	34%	36%	30%
Traditional is still best (n = 181)	15%	33%	52%

2.5 Reasons to Use Rotational Grazing Practices

Question 13 was designed specifically for farmers already using rotational grazing (see Table 3). We asked them to indicate their level of agreement or disagreement with a series of statements about reasons they chose to use rotational grazing. The results are consistent with the literature (Ranjan et al. 2019; Wang 2020; Wang et al. 2020; Winsten et al. 2011)—respondents using rotational grazing indicated that it is better for their livestock (95%); better for the environment (90%); more cost-effective (87%); and that they enjoy walking the land (86%). More than one-half of these respondents cited less equipment costs (56%), less stress during hay season (53%), and being on the 'cutting edge' (50%) as reasons they practiced rotational grazing. Future studies should explore this relationship between environmentalism and agriculture, as well as the relationship between farmers, machinery, and exercise/physical activity.

Table 3. Reasons for Adopting Rotational Grazing among Current Practitioners

Q13: Reasons you may have decided to use rotational grazing	Agree	Neutral	Disagree
Better for livestock (n = 280)	95%	4%	1%
Better for the environment (n = 282)	90%	9%	1%
More cost-effective (n = 281)	87%	11%	2%
Enjoy walking the land (n = 281)	86%	11%	3%
Less equipment cost/maintenance (n = 281)	56%	23%	21%
Less stress during hay season (n = 279)	53%	38%	9%
"Cutting Edge" (n = 279)	50%	42%	8%
More time with family (n = 279)	38%	55%	7%
Never used another method (n = 277)	37%	25%	38%

Numerous survey responses highlighted what study participants see as the benefits of rotational grazing, as well as providing some useful insights/recommendations to Graze 300:

> *"I can't say enough good things about the practice! The only way to go for my farm! The soil has improved steadily since instituting rotation grazing. It really helps with many weed problems. Certainly not all. You need to live on or close to the property or be able to check it frequently. The deer are killing me and my polywire fences!"*

> *"[I] began rotational grazing in 1984 and grew to 42 paddocks with 250 ewes lambing at 160%. [I] converted to seasonal dairy in 1994 and milked up to 110 cows; it was highly profitable (around $1,000 net cash income on a 10 month season). Paid for the farm. [It is] designated a national demonstration site of sustainable ag practices."*

> *"We implemented rotational grazing starting in 2004 thanks to EQIP funding and have been very pleased with the results."*

"Rotational grazing is essential in pasture management. The soil quality and environmental stress placed on the land will affect the nutritional value to the animal."

"It does increase [the] number of cattle that we can own."

"[Rotational grazing is a] SUPER ENVIRONMENTAL CHOICE."

"I move my cows every day, but most farmers wouldn't take the time. [I] haven't fed hay in 15 years. In dry years, I supplement with feed. This is much cheaper, (and better quality), than hay and all the equipment and time associated with hay."

"Rotational/Managed grazing is critical to the health of our pastures and livestock. Financially it pays. It provides more nutritional grass, a longer grazing period, and reduced weed control costs. We also like to aerate pastures annually, and clip paddocks after moving cattle to next paddock. Finally, try not to over graze, leave 4-6" grass height when finished grazing a paddock. Try also to give pastures (paddocks) plenty of rest between grazing i.e.,. . . . 30 days plus gives best results. Rotational grazing works and shows the public we are good stewards of our land and animals."

"Our family has been rotational grazing for years before the industry embraced the idea. My great grandfather used this technique even though that wasn't what they called it. Their rationale was not to waste anything so the livestock would be allowed to forage over the crop fields as a way of cleaning up the field prior to turning the land up for its next crop (with the exception of crops not viable for livestock grazing). Times were hard and so my generation has grown up being educated to how things were then and how they were clever enough to rise above the issues and survive! . . . If we don't pass knowledge from past generations on to the future they will not be able to sustain their families. This applies to all areas of agriculture!"

"[I've] been rotational grazing for 20 years, have modified over the years. Presently have 16 paddocks average 4.4 acres, mainly fescue. We move 22 grown head (plus calves some of the year) every day year round. All have access to waterers. Despite the dry year we are not feeding hay regularly yet. It works for us."

"I think rotational grazing is awesome. I have seen a neighbor's pastures with grass from utilizing rotational grazing and I'm feeding hay. It's a no brainer!! A majority of my pasture is now under a solar lease and my pasture has several creeks which makes it very challenging. My pasture would be a continuous fence with creeks and a 4-acre pond. I fenced the cows out of the pond. Rotational grazing is the way to go, but I have obstacles such as creeks, pond, and smaller areas to graze."

"Rotational grazing is beneficial to cattle, pastures, and the environment. This practice helps in water quality, pasture/grass usage, and a more even distribution of nutrients back into the soil."

"There] is a multitude of other farms who have been practicing these techniques for years. . . . [M]aybe VCE and the other state agencies across the U.S. need to give credit where credit is due—better yet, get advice from some of these regenerative farmers who have already set the bar high."

3. IMPLICATIONS

The results of this survey reveal critical insights into perceptions about managed grazing practices. The data is important to a multitude of individuals and groups in which grassland management is relevant. It will be important to share this data with the stakeholders and to work collaboratively to address these issues.

Farmers express high levels of environmental concern in managing their grassland, regardless of whether they use continuous or rotational grazing practices. Rotational graziers think their system is better for the environment and their animals, but all respondents value the environment. We need to recognize that continuous graziers care about the environment and their animals as well. Instead of viewing continuous graziers as lacking environmental concern, efforts can be made to further understand their views and build on them to advance the environmental advantages of rotational grazing.

There are three barriers that a large portion of both continuous and rotational graziers identified as a significant or moderate challenge. The first is the **amount of work required to start rotational grazing**. It will be necessary to better understand the type of work that is a challenge. For example, is it time expended with installation of infrastructure or installing portable wire or electric fence maintenance or simply the time expended in trial and error learning the entire system? It is further noteworthy that a lot of continuous graziers also rated **amount of work to use rotational grazing** as a challenge. Better understanding this barrier may lead to improved guidance, technology, and support to help farmers start rotational grazing.

A second barrier identified by both continuous and rotational graziers was lack of **shade**. There has been considerable work done to evaluate if shade is really needed for livestock, techniques for installing portable shade, and silvopasture. Nonetheless, farmers still perceive shade as a barrier. Perhaps a portion of silvopasture technology should be devoted to quick growth of shade trees. It is possible that many farmers might convert old-stand fescue fields to novel fescue to help reduce the heat stress of livestock. Perhaps there can be additional innovation, guidance, or support associated with portable or permanent shade for livestock. It is also possible that farmers also want "shade" (or some type of shelter) for winter weather extremes.

The final barrier identified by both continuous and rotational graziers was **water source constraints**. Sixty-two percent of continuous graziers perceive this as a constraint whereas a significantly lesser number (but still 41%) of rotational graziers said the same. There are a host of both cost share opportunities and alternative water system technologies available to farmers. It will be important to better understand what the barrier is. It is possible that most farmers do not want to participate in cost share programs or the cost and/or hassle of maintaining these water systems is a barrier. Perhaps it is the way water systems are designed that is the barrier. Maybe farmers want access to streams.

Getting more done with machinery, **rather drive than walk**, and **like using hay machinery** were top reasons for not adopting rotational grazing. This bears further investigation. If farmers just like to do something (e.g., making hay or driving vs. walking) that is a social factor that may be difficult to overcome. We speculate that further investigation might reveal the sheer physical labor needed to do the work associated with managed grazing (moving portable temporary fence, maintaining interior cross fence, and a host of other chores) may be a hidden barrier. Improving technology to reduce the physical labor needed to implement managed grazing may be needed. Some theorize the machinery used to bale hay and feed serves as training ground or a rite of passage for the next generation. Only 15 percent of the continuous graziers agreed with the statement "Traditional is still best." This suggests the rite-of-passage theory may not be true. However, only 52 percent of the respondents disagreed with that same statement. From this perspective, there is still a substantial portion of farmers who greatly value traditional ways.

Lack of profitability is often perceived as a barrier to adopting rotational grazing practices. More than one third of continuous graziers were neutral or "on the fence" about profitability and almost 20 percent believed it was a significant or moderate challenge. We need to understand more about these fence-riders and make efforts to better target information and messaging on the profitability margins related to rotational grazing practices.

We also found that several of the perceived challenges are related to **uncertain outcomes** associated with managed grazing, with 63 percent of rotational graziers saying this was not a challenge, whereas only 39 percent of continuous graziers reported this was not a challenge. A noteworthy portion of continuous graziers rated difficulty producing winter feed, amount of work to both start and maintain rotational grazing, and lack of shade as barriers. We speculate these barriers are part of the uncertainty. Sustaining livestock through extreme conditions (e.g., deep snow, ice/sleet, heat, cold, drought, animal disease, predators, access to hay, etc.) can override basic economic analysis. We need to better understand these uncertainties and possibly demonstrate risk management techniques that help farmers understand how to use managed grazing through these uncertainties.

This research survey also helps us to better understand areas which are "not a challenge" to managed grazing. This includes **size of farm**, **skepticism from family or neighbors**, **leasing restrictions, access to information,** and other factors. It will be important to shift educational effort, innovation, and incentive programs' focus to the larger challenges.

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