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Rice producer enrollment and retention in a USDA regional conservation partnership program in the southern United States

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Abstract: Private lands conservation is critical to maintain available and quality natural resources in agriculture-dominated landscapes. Financial capital and technical assistance incentives are a primary tool to recruit and retain voluntary participation in private lands conservation programs and, subsequently, to induce persistence of innovative conservation practices. Fundamental to program success is to evaluate how, why, and to what extent incentives and program characteristics motivate participation and persistence. This study draws on diffusion of innovations' attributes of innovation as our conceptual and interpretive framework to qualitatively explore and describe program participation and persistence of on-farm water, nutrient, and wildlife habitat management practices among a cohort of rice (*Oryza sativa* L.) producers enrolled in the Rice Stewardship Program (RSP) in the southern United States. A total of 50 interviews were conducted between January of 2019 and July of 2019 in Arkansas, Louisiana, and Mississippi. Findings suggest the program's lack of complexity (practices were simple to enact) and relative advantage (practices were viewed as better than previous practices) were primary motivations that influenced initial and continued participation, as well as the persistence of specific practices. Compatibility with current on-farm practices and the observability of outcomes or benefits to program participation and its practices were reported consistently but as secondary motivations. Nutrient management practices were observed as having the highest potential persistence as these practices were perceived to be compatible, observable, and relatively advantageous, particularly in relation to the region's existing nutrient stewardship framework. As few evaluations of private lands conservation programs specific to rice agriculture exist, our findings offer practical insights for managers to consider program evaluation or design that is based on the established innovation attributes framework common to other agricultural contexts.

Key words: attributes of innovation—conservation programs—nutrient management—program evaluation—rice agriculture—water conservation

Managing agriculture-dominated landscapes through private lands conservation programs is a critical tool to maintain the availability and quality of natural resources like water, soil, nutrients, and wildlife habitat. In the United States, private lands conservation programs often use financial incentives—both monetary (e.g., payments and capital) and nonmonetary (e.g., tax credits and technical assistance)—to recruit, enroll, and retain agricultural producers (Langpap 2006). A primary goal of incentives is to introduce and sustain practices that lessen environmental impacts at the landscape level, i.e., to facilitate the persistence of the program's practices. A requisite goal is also then to provide participants with evidence that the incentivized practices are efficient and beneficial, beyond the initial incentives that were provided, thus, increasing the likelihood that conservation practices will be adopted as standard on-farm practices (Christensen and Norris 1983; Prokopy et al. 2008; Baumgart-Getz et al. 2012).

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Financial capital and technical assistance are two common incentives used to grow and sustain program participation and practice persistence (Claassen and Ribaudo 2006). Financial capital is a common monetary incentive that helps producers offset costs associated with new practice implementation, which is known as a primary barrier to program enrollment and conservation practice adoption (Reimer and Prokopy 2014; Swann and Richards 2016). While intuitive, financial capital can remove barriers associated with the costs of practices that require program participants to use new technology or infrastructure they would not otherwise (Rodriguez et al. 2009). Alternatively, technical assistance provides professional guidance to learn, implement, and understand new practices or production methods (Swann and Richards 2016). Providing technical assistance can eliminate barriers associated with understanding how a practice benefits operations, production, or seeing alternative advantages that may be outside the scope and initial benefits of certain practices (Rodriguez et al. 2009). However, even when these incentives are available to off-set startup costs or facilitate learning, long-term maintenance costs encumbered by producers or budgets that constrain programs from providing long-term technical assistance staff can negatively affect the likelihood producers will continue a practice once incentives expire (Liu et al. 2018).

Both program providers and participants recognize that the financial capital and technical assistance a program can provide are finite, and at some point, will expire. Therefore, a growing area of research has sought to identify and explain motivations of program participation and practice persistence beyond the initial capital and assistance, particularly when incentives are unavailable or when participants near contract expiration. If certain aspects of a program do not meet

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the demands, objectives, or expectations of producers, nor the objectives of the program or its partners, its viability is tenuous. From a program design and success perspective, evaluation is an essential component (Stem et al. 2005; Ferraro and Pattanayak 2006; Vandever et al. 2021). Program evaluation is necessary to gain a systematic and empirical understanding of what motivates or inhibits participation and persistence when financial capital and technical assistance incentives expire (Jackson-Smith et al. 2010). Likewise, evaluation is warranted to identify disconnects between participants, deliverables, administrators, and partners. In these regards, interactive formative evaluation to identify potential and actual influences on the progress and effectiveness of implementation are appropriate (Tessmer 1997; Owen 2007).

This paper uses the attributes of innovation (Rogers 2003) as a conceptual and interpretive framework to evaluate program participation and practice persistence. Literature on voluntary program participation and practice persistence derives from various agricultural and conservation contexts but is limited in its extent. A review by Dayer et al. (2017) acknowledged that although participation in conservation programs is well-studied, few studies focus their evaluations to understand whether and why landowners decided to persist with practices after incentives. Moreover, the literature tends to be skewed toward wheat (*Triticum aestivum* L.) and corn (*Zea mays* L.) agricultural regions, with few examples from rice (*Oryza sativa* L.) agriculture in the southern United States.

Attributes of Innovation. Several models, theories, and frameworks have been used to explain landowner decision-making in the context of voluntary adoption and continuation of conservation practices, particularly in agricultural settings where incentives are common. Among these, Rogers' (2003) diffusion of innovations framework is arguably the most established and supported. Within the framework, the attributes of innovation comprise a five-factor model of expected influences on the adoption of innovative practices (Hubbard and Sandman 2007). Those attributes are relative advantage, compatibility, complexity, observability, and trialability (table 1).

Table 1

Attributes of innovation and definitions from Rogers (2003).

Attribute	Definition
Relative advantage	... the degree to which an innovation appears to be better than the idea that any other alternatives the potential adopter might have, measured in terms of economics, convenience, satisfaction, and social prestige.
Compatibility	... the degree to which the innovation is seen as consistent with existing values, previous experiences, and needs of the user.
Complexity	... the degree in which the innovation is seen as difficult to understand or use.
Observability	... the degree in which the innovation or its results can be seen by others likely to adopt it. If potential adopters are unaware of the innovation or do not see it being used by their peers, they are less likely to adopt it themselves.
Trialability	... the degree in which the innovation can be experienced firsthand on a limited basis.

Relative advantage can be perceived as reduced costs, time or effort saved, or improved task simplicity, which financial capital and technical assistance incentives may enhance. Compatibility can be perceived as how well a program's incentivized practices align with existing or intended on-farm practices, local, state, or federal regulations, or whether they align with an adopter's worldview or belief system. Complexity can be seen by adopters as how well a program is able to simplify practices or procedures, including incentivized practices and program bureaucracy, i.e., facilitating the implementation of new technology that remained elusive without technical assistance or that was too expensive without startup capital. Observability can manifest as an improved ability to monitor and respond to on-farm operations using innovative metering or sensor systems, being able to see direct financial benefits like reduced monthly costs or increased annual profits. Trialability is seen by adopters as the ability to use or experiment with, in situ, new practices at smaller scales or for limited time period without committing to a full investment in unproven technology.

While Roger's framework proposes the five attributes as distinct concepts, research has observed innovation attributes are not experienced or expressed as mutually exclusive. Moreover, a combination of attributes, but not necessarily all, tend to be active influences on adoption. For example, a meta-analysis by Tornatzky and Klein (1982) demonstrated that relative advantage, compatibility, and complexity had the most consistent significant relationship to adoption across multiple innovation domains; a related meta-analysis by Vagnani and Volpe (2017) identified relative advantage as the primary influencer. In the agricultural context, a systematic literature review of precision agriculture/farming adoption by Pathak et al. (2019) found relative advantage to be the only influential innovation attribute, while a review by Lee et al. (2021) found that relative advantage and compatibility were the two major factors in the same adoption setting. In alignment with the conclusions of Pathak et al. (2019), Batte and Arnholt (2003) observed that profit—viewed as an expression of relative advantage—was the major factor on the adoption of precision farming practices.

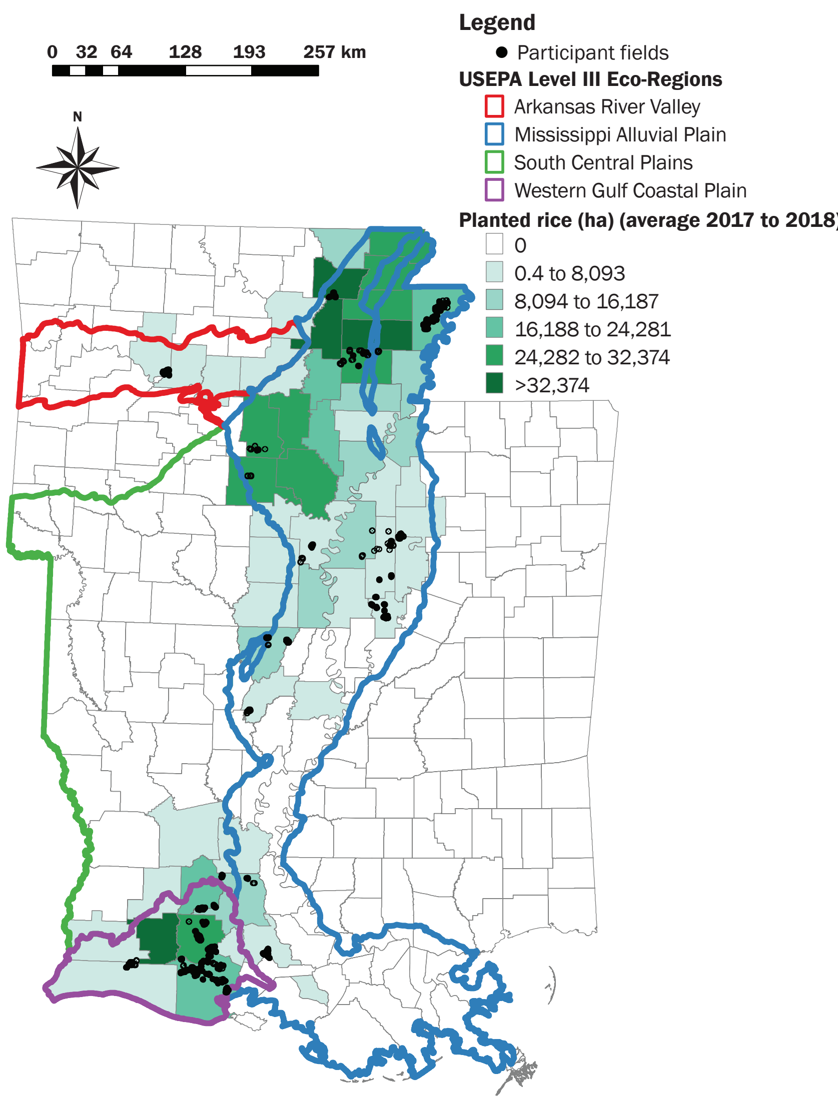
Cross-sectional studies have, likewise, observed significant contributions of one or a combination of the five innovation attributes in agriculture settings. For example, a qualitative study of Midwest farmers' decision to adopt best management practices reported relative advantage, observability, and compatibility as the most significant attributes (Reimer et al. 2012). Lamm et al. (2017) reported compatibility and complexity as the most influential attributes among nursery and greenhouse growers' adoption of practices to protect water quality. In the context of more mesic-hydric soil crops, a survey of Malaysian vegetable farmers found relative advantage, compatibility, and complexity to be most prominent (Tey et al. 2014). Specific to rice production, Arsil et al. (2022) reported relative advantage, compatibility, and complexity as essential factors for adoption among focus groups of Indonesian rice farmers. Similarly, Effendy (2020) recommended observability and complexity as the primary innovation attributes that lowland rice conservation programs in Indonesia could focus their retention and persistence efforts. To date, similar studies among US rice producers were not identified.

In general, the attributes of innovation are an established conceptual and interpretive framework to evaluate factors that influence program participation and practice persistence. Their influence does vary from context to context, but the presence of all attributes has been observed in agricultural settings and associated conservation or sustainability programs, with the predominance of relative advantage consistent across context. For example, the adoption and diffusion outcome prediction tool (ADOPT) is built on the theoretical underpinnings of relative advantage (Kuehne et al. 2017). However, in the context of rice agriculture, limited research has been conducted, both in the United States and globally. So, given the consistent research on and observed influence of the innovation attributes, we use them to qualitatively explore and describe program participation and practice persistence in the context of a rice agriculture conservation program in the southern United States.

Study Context. A majority of research on agricultural conservation incentives in the United States focuses on the Corn and Wheat Belts, with limited research on the rice growing region of the Lower Mississippi River Basin (LMRB) (figure 1). Within the LMRB rice region, production occurs on 607,000 million ha or approximately 2% of the Arkansas, Louisiana, and Mississippi (ArkLaMiss) landscape, annually (USDA NASS 2019). The 607,000 million ha area accounts for 12% of all agricultural area planted (USDA NASS 2018, 2019). Arkansas is the primary producer of rice in the United States, harvesting 46% of the entire US rice crop every year (USDA 2019). In total, the ArkLaMiss produces 67% of all US rice (USDA 2019). Similar to wheat and corn dominated agricultural regions, the LMRB region is subject to increasing concerns about water quantity, soil conservation, nutrient runoff, and wildlife habitat. Water quantity concerns revolve around the high demand for aquifer water to irrigate rice crops (Schrader 2008). Soil conservation and nutrient runoff concerns stems from the losses of an estimated 8.65 t soil ha^{-1} y^{-1} from agriculture fields (USDA 2007; USDA NASS 2018).

These concerns prompted the creation of the USA Rice-Ducks Unlimited Rice Stewardship Partnership (RSP) in 2013. The RSP was developed in collaboration with partners from USA Rice, Ducks Unlimited (DU), USDA Natural Resources Conservation Service (NRCS), and several corporate sponsors (e.g., Walmart Foundation and Nestlé Purina, among many others). The mission of the RSP is to address natural resource concerns of declining aquifer levels, water quality, and nutrient management while simultaneously providing valuable wildlife habitat, targeted mainly toward wintering waterfowl and other migratory birds. The RSP operates under the NRCS' Regional Conservation Partnership Program (RCPP) and its first cohort was primarily funded through the Environmental Quality Incentive Program (EQIP). Like other private lands conservation programs, RSP was designed to provide regional rice producers with financial and technical resources to incentivize conservation-centered agricultural practices. Financial incentives were paid out on a "by-practice" basis, meaning that a producer had to enroll in specific practices and either had to demonstrate installation of infrastructure or demonstrate practice use through reporting requirements (reporting irrigation times, rainfall, soil sample results, etc.) depending on which practices a producer selected to participate in. Technical assistance was

Figure 1
Study site map of general locations of producers in the Rice Stewardship Partnership in the Lower Mississippi River Basin overlaid with rice production (average hectares planted in 2017 to 2018) and with USEPA Level III Eco-Regions.



offered through RSP program staff who were located in each region and offered expertise in infrastructure installment and for practice implementation and interpretation.

Enrollment for the first cohort of participants began in 2015 and 2016, with contracts taking effect during the 2017 or 2018 growing seasons across 27 counties of the LMRB (figure 1). The program offered participants options to implement (1) irrigation water management (IWM) practices to reduce groundwater usage and increase irrigation efficiency, (2) nutrient management (NM) practices to encourage nutrient application efficiency, and (3) wildlife habitat management (WHM) practices to promote wetland habitat for migratory birds like waterfowl and shorebirds. For each IWM and NM, producers chose from three enrollment levels and WHM had one option for producers to flood harvested winter rice fields (table 2). Participants who enrolled in IWM selected from different practices (alternate wetting and drying [AWD] and recording weather/irrigation data), infrastructure (flow meters and irrigation pump automation), and innovative software (pipe hole selection and irrigation telemetry). Nutrient management practices included soil sampling, grid sampling, and variable rate nutrient applications. Practices in the NM were designed to address the 4Rs of nutrient stewardship framework (source, rate, time, and place) to lessen the impacts of runoff and optimize inputs. The WHM component included flooding postharvest winter agricultural fields for the purpose of providing habitat to wintering waterfowl, other migratory waterbirds, and local wildlife, and required producers to keep water control structures closed from harvest end dates in November through late January or February, depending on region.

In addition to the limited literature on motivations to voluntarily persist with practices after incentives, it is worth noting that the literature tends to focus on land retirement programs and quantitative approaches (Johnson et al. 1997; Moon and Cocklin 2011; Reimer and Prokopy 2014). While beneficial for examining relationships between easily quantified factors such as farm income, farm size, producer age, etc., quantitative approaches cannot fully capture a producer's motivations for participation and persistence. Evaluations of working lands conservation programs such as the EQIP and the RCPP require a focus on depth and meaning to adapt and improve the program given participants are actively working their lands for production and profit within the framework of the program and their contract. Studies that use qualitative approaches provide more robust descriptions of program and practice characteristics and how those are perceived by producers (Lincoln and Guba 1985; Owen 2007). Without a deeper understanding of what influences a private landowner's decision to participate in a program, continue in the program, or continue its promoted practices after incentives end, conservation programs will struggle to sustain their long-term goals and outcomes (James 2002; Dayer et al. 2017).

Table 2
Regional enrollment of rice producers who were a part of the first cohort of the Rice Stewardship Partnership Program in Arkansas, Louisiana, and Mississippi.

	Practice category and level						
	Irrigation water management			Nutrient management			Wildlife habitat
Region	Basic	Intermediate	Advanced	Basic	Enhanced	Precision	—
Arkansas	1	8	4	2	2	8	12
Mississippi	1	7	5	11	0	0	10
Northern Louisiana	5	0	0	3	0	1	4
Southern Louisiana	17	2	0	10	0	8	15
Total	24	17	9	26	2	17	41

Research Questions. The aim of this paper is to qualitatively explore and describe RSP participation and practice persistence using the attributes of innovation perspective as our conceptual and interpretive framework. Specifically, we focus our evaluation to understand (1) how RSP incentives initially recruited and retained participants and (2) what characteristics of the program or its practices influence persistence after incentives expire. Those are rephrased as the following two research questions:

1. What are the most salient attributes of innovation that influence program participation and retention (enrollment and reenrollment)?
2. What are the most salient attributes of innovation that influence practice persistence (the continuation of practices after RSP contract expiration)?

Materials and Methods

A census of the first RSP cohort was conducted to evaluate participants whose contracts expired in 2018. The first RSP cohort was comprised of 51 rice producers under 137 contracts and approximately 210,40 ha of private agriculture land. Contracts indicated that 100% of participants enacted some level of IWM (basic = 24, intermediate = 17, advanced = 9); 90% enacted NM (basic = 26, enhanced = 2, precision = 17), and 82% WHM (table 2). In total, 50 producers were interviewed (1 enrollee was indefinitely unavailable). Initial interviews were conducted opportunistically with participants from January to March of 2019; a second interview wave of remaining participants was conducted in June and July of 2019. Interviews began in southern Louisiana in late January to early February, followed by Mississippi and northern Louisiana in mid-late February, and finally in Arkansas from early to late March. Interviews were purposely scheduled south-to-north to limit interference with spring planting preparation and planting schedules. Interviews took place at mutually convenient locations that included farm offices (n = 22), barns or farm fields (n = 10), NRCS offices (n = 5), RSP vehicles (n = 4), and other locations (n = 9). Interviews were scheduled with assistance from RSP staff, and an RSP staff member was present at nearly all interviews. Interview length varied depending on responses provided by participants, and in some cases, those responses were limited to little information outside of standard "yes" and "no" answers, even when probed with follow up questions. Interview times ranged from 00:12:37 to 01:29:40 (hh:mm:ss) minutes with an average of 00:37:47. All interviews were conducted in-person and recorded using a digital recording device (Sony IC Recorder, ICD-UX560, Tokyo, Japan). Participants granted permission to record interview in accordance with protocols approved by the University of Arkansas at Monticello Institutional Review Board (#MSN-2/19).

The qualitative research design and semistructured interview method allowed for participants to openly express their experiences and for the emergence of personal narratives and viewpoints (Wilkinson et al. 2004). A "small q" research approach was applied, which is informed by both qualitative and quantitative research practices (Kidder and Fine 1987). The semistructured interview protocol focused primarily on questions specific to program participation and practice persistence while facilitating a free-flowing program evaluation conversation, and for questions to be asked in different orders (Bryman 2004; Turner III 2010). The development of the semistructured interview protocol was guided by the attributes of innovations to ask explicit questions about participants' motivations and program characteristics associated with RSP participation and IWM, NM, and WHM practices (Harvey-Jordan and Long 2001). Probes were included if a participant did not understand an initial question, did not explicitly answer a question, or the interviewer needed additional information for clarity and context (Turner III 2010). Due to the conversational style of the interview, questions were not necessarily asked in the same order for all participants, but all participants had the opportunity to answer all questions (Adams 2015). Project collaborators from USA Rice, DU, and NRCS provided feedback on the interview protocol (appendix 1 in supplemental material). Audio recordings were manually transcribed in a word processing program (La Pelle 2004). Transcription was completed verbatim and without explicit time limits to ensure precise reproduction of the audio file (Mergenthaler and Stinson 1992). To protect the anonymity of participants, personal identifiable information (PII) was redacted. All participants were assigned a random two-digit number associated with a single digit prefix to identify region (three digits total).

A deductive, theory-driven coding strategy was used to identify words, phrases, and other textual units within the defined categories of the attributes of innovation framework. Deductive coding is an efficient procedure to analyze data informed by an established theoretical framework and concepts (Patton 2002). An associated codebook, i.e., following a template approach, was developed as a reference to guide the coding process, organize segments of similar text, and help data interpretation (appendix B) (Crabtree and Miller 1999; Saldaña 2013). Content analysis was conducted to assess motivations of program participation (both enrollment and reenrollment) and practice persistence (IWM, NM, and WHM practices) that conform or relate to the attributes of innovation framework (Krippendorff 2004). Content analysis allows researchers to assess the content of text by translating the frequency of occurrence of certain symbols and meanings (i.e., language) into summaries, interpretations, and comparisons that assume the greater space and time a participant allocates to their expression and description, the greater significance and meaning associated (Starosta 1984). The first coding cycle was conducted to initially read interview transcripts and assign in vivo or descriptive codes that reflect participants reasoning or meaning; a second coding cycle was conducted to confirm, expand, or revise initial codes and to associate each code with program participation or a specific RSP practice. All analyses were conducted in HyperRESEARCH (version 4.0.3).

Results and Discussion

We begin with a quantitative summarization of the five attributes of innovation prevalence identified through deductive coding (table 3). In total, participants referred to relative advantage, compatibility, complexity, observability, or trialability a total of 688 times among the 50 interviews analyzed. Complexity and relative advantage were coded most commonly, followed by comparable rates between compatibility and observability, while aspects of trialability were expressed less often among participants.

Within each practice category, coded attributes showed similar trends; relative advantage, observability, and complexity were observed to have a similar proportion of codes within each practice category. Relative advantage was associated with 33% of codes referencing IWM practices, whereas complexity, or lack thereof (i.e., simplicity), was more evident among references to NM (29%) and WHM (31%) practices. Compatibility was most prevalent in reference to NM practices (40% of codes), as nearly all producers were already doing some level of NM on their own, usually associated with soil samples since that is common practice in modern agriculture.

Compatibility was only loosely associated with IWM practices, as RSP practices often encouraged producers to go above and beyond current irrigation methods. Because the IWM practices lacked compatibility, they may be less likely to persist after incentives end since practices that lack this attribute have been found to cause increased labor or financial inputs without the necessary return or advantages, similar to findings from Reimer et al. (2012). Complexity of a practice affects the ability to observe results, and subsequently, to judge whether it has a relative advantage of current or alternative practices. In IWM, complexity often referred to the difficulty of innovative practices, as the practices offered often challenged traditional irrigation methods by introducing practices like AWD, or the introduction of innovative tools such as flowmeters. Conversely, practices in NM and WHM were referred more to as relatively simple since NM practices were mostly outsourced to third party companies (in terms of soil samples); and for WHM, practices were as easy as installing boards in water control structures to manage water levels.

Observability, while certainly a factor in RSP practices, did not appear to be very prevalent in NM and WHM practices. This suggests practices in these categories

Table 3
Tabulated attributes of innovation as a percentage of codes among all interviews and the number of codes per participant.

Attribute	Percentage of total codes	Rate per participant
Relative advantage	29	4.0
Complexity	32	4.3
Compatibility	18	2.5
Observability	16	2.1
Trialability	6	0.8

may require additional support and technical assistance from program staff to see the accrued benefits for producers and the overall program. Emphasizing technical assistance may be beneficial in helping producers observe the effects of innovative practices from RSP and the impacts they may have to on-farm production (McCann et al. 2015). By demonstrating results and making them observable or recognizable to producers, this may subsequently lead to the relative advantage or complexity of a practice (Ploll et al. 2022). This finding may be indicative that revisions to staff practices, reporting procedures or documentation, or other communication indicators (e.g., utility bills) are needed to show that positive changes to on-farm production, efficiency, or expenditures are occurring.

Trialability was most coded in IWM (49% of trialability codes). Trialability was associated with practice in IWM for two reasons. First, because much of the infrastructure and technology associated with IWM practices in the RSP could be purchased and installed on a limited scale, and second, practices in NM and WHM are difficult in nature to implement on a small scale, as practices in these categories often have to be implemented across entire fields and sections. Purchasing tools like flow meters and moisture sensors may be easier to be "tested" on a small scale before producers take these tools to a larger scale or across the farm.

For program managers considering conservation program practices in the realm of IWM and NM, practices should be observable in a way that is perceived to be advantageous and should be relatively simple to implement (complexity). For NM and WHM, observability may be more difficult to directly see the advantages, so conservation program staff may need to provide more clarity on how practices could be directly and/or indirectly advantageous for producers. Trialability may be most applicable to IWM, as the tools used to monitor irrigation times, water levels, etc., may be easier to evaluate on a limited basis.

Program Participation. In addition to the more readily quantifiable results of content analysis, a deductive coding strategy also provides the opportunity to explore the depth and richness associated with each attribute of innovation. Here, we detail how innovation attributes were expressed by rice producers as reasons for their initial enrollment and potential reenrollment in the RSP (table 4).

When directly asked why they enrolled in the RSP, producers often talked through the multiple considerations that influence their decision-making process. Producers described their overall appreciation for the program and noted how the practices offered often aligned with their current on-farm practices, directions the farm was headed, and how it was important to them to have such a program. They also noted their overall satisfaction with the program and the improvements they made on their own farms, though they did also note a few things that made enrollment difficult, such as the flood dates of the WHM component or recording and reporting weather data for selected fields. In general, producers indicated that the financial assistance is what initially motivated their participation. Producers valued the financial assistance and its facilitative role in aiding producers to engage in innovative production methods. In terms of how financial assistance was characterized by producers, relative advantage was the most commonly coded innovation attribute. To a lesser degree, producers also expressed observability and compatibility, and brought up how the financial assistance allowed them to engage in practices that aligned with the general production directions of the farm. Similarly, producers talked about the financial assistance role in motivating them to engage in production methods that would, in turn, help them with expenses of another rice crop and increase their profitability.

Producers expressed relative advantage most frequently, which came through during discussions on why they enrolled in the program. Producers often noted the empowerment and motivation that the financial assistance gave them to complete on-farm projects that they had either already started or wanted to start. For one producer, the financial assistance that accompanied RSP enrollment was framed as giving them the ability to initiate alternative NM practices for which they did not have the initial startup funds to do so: "Well, I've always wanted to do it [nutrient management] but it's fairly expensive, but with the RCPP program and the cost-sharing, it makes it way more economical." Similar sentiment was expressed by another producer in the same LMRB subregion, who indicated they enrolled in RSP specifically because the financial assistance afforded them the opportunity to pursue new on-farm NM goals: "That's something that we had slowly been trying to do [nutrient management], and this process [the RSP] made it way more affordable to do so." Conservation programs like the RSP are one avenue to seek out and take advantage of to capture additional funds to scale up planned or aspirational projects. As one Arkansas producer said:

> Well, I've always been a little bit of an early adopter so a lot of these practices I was either thinking about planning on starting. It just gave me the incentive or the push to go ahead and implement it large scale.

Outside of the relative advantage, producers also noted the compatibility of the program, and how the program aligned with current ways of thinking, and with existing operations on the farm. For others, they may note the compatibility of practices, and then the observability of different practices. Most importantly, though, producers noted how both of these often contributed to the overall relative advantage of RSP practices and how they integrated into their operation. Concurrent with relative advantage, the financial assistance provided to further current or planned on-farm projects and the compatibility with current practices, projects, or conservation ideals was commonly expressed as a reason for enrollment. For instance, one producer specifically mentioned, "Well actually it was the income. Like, you know, they wanted to pay us to do it, so it was like, 'Hey, you can get paid to learn about your whole operation,' so it was a no brainer." For many producers, additional financial capital for on-farm projects is difficult. Securing capital for annual seed and nutrient applications is the primary focus each season, and many producers do not have the means to further invest in innovative practices or projects. For rice producers, additional capital is uncommon after general production expenses; thus, financial assistance is viewed as a means to implement or complete projects that mutually benefit and align a producer's and program's goals. These results highlight that a combination of RSP's financial assistance and conservation goals may motivate producers in multiple ways based on a predisposition to improve on-farm practices

Table 4

Rice producers expressed variation across the five attributes of innovation in reference to their motivations for program retention (enrollment and re-enrollment) and practice persistence.

Context	Attribute	Example quotation
Program participation	Relative advantage	"There again, when I started this, I mean I'm being as transparent as possible, it was all about the incentive payment, and then I realized that the incentivized payment was so much less than the water savings."; "Well I didn't really know what my expectations were at first, I just knew that, based on my history, that we saw a lot of benefit from previous programs. So I was just putting my faith in that. I thought that, you know, we've had a lot of luck with it in the past, let's try something new. You know, if it doesn't work for us then it doesn't work for us. And, you know, if we pick up something good along the way, if we learn something, then great. And we did."
	Compatibility	"Yeah, we were doing that to some degree before but yeah, like I said, we've got a few hunters in the family so we're going to continue to do it on some basis anyway. I'd say the program encourages you to do it on more acres."; "A lot of these things we were trying to implement, we may not have been implementing them all correctly at the time, and this kind of gave us a little bit better guide and let us know that hey, this is going to help on as you see now why we're trying to conserve our water."
	Complexity	"Right, but without a program like this it is not economical for a farmer to go out and put that in. I mean, by any means. Everybody sees the price of those things and their nose goes up and it just goes out the other ear because it's not even, not feasible at all without help."
	Observability	"It's all the above. I think the financial assistance is a hook, but then you, then once you understand it and it literally, [RSP staff] was with me for years before I understood this AWD and I'm not a dumb guy, but it just, I didn't get it, you know, you're just not going to really get it until you see it, but once you see it, it's like a lightbulb comes on and you just say 'Oh wow. This is pretty neat.'"
	Trialability	"…we had started doing on a small-scale basis because, you know, we did see the benefit of it, but it's become more common to do it now and because again, of the added funding and stuff it made it a little easier for us to be a little bit more aggressive about doing it, so no, it's a good thing."
Practice persistence	Relative advantage	"Well the most beneficial is this alternate wetting and drying, of all of the practices, that has the big, the largest dividends if you want to call it? Biggest return? It will pay the biggest return for years to come."; "You know, I don't know that it really saves you any money applying it, but it puts out the spots where you need it the most, you know, where you're getting the most return on what you're putting you're putting out."; "I have never done side inlet until I did this, and I would never go back the other direction."
	Compatibility	"That's something that we had been slowly trying to do and this process made it way more affordable to do."; "…you know, the AWD we've just implemented into our regular practice, we're doing it without even thinking about it."
	Complexity	"I don't want to stop doing things like the wildlife management and stuff that we're, I mean, I'm still doing some, but yeah it's just hard to, because I mean it takes, it literally takes paying somebody all winter to manage that water."; AWD really works for us because we can get our water on and off real quick."; "…but the wildlife flooding, it's hard to do that, it's hard to go out and flood thousands and thousands of acres without a monetary incentive."
	Observability	"Yeah it saves, like putting out unneeded inputs. It narrows down what we've got so then we can figure out what you need and apply only that, and you know, a lot of times in, you know, especially in past generations, you know, you just put a little bit of everything out there hoping that you've got it covered, but the way economics are now with farming you really can't afford to do that. You've got to be pretty specific about what you're spending your money on, so that's a good place to put it."; "…it's unbelievable how the wildlife has increased as a result of that rice, you know, the duck population, raccoons, you know, frogs, yeah."
	Trialability	"Yeah so, I don't have a rice acre that doesn't have it, and I'm even going to try this year, I bought me some soybean moisture sensors. I've never used them, thought I didn't need them, but if I was over watering an aquatic crop like rice, then chances are that I'm overwatering my beans."

Notes: RSP = Rice Stewardship Partnership. AWD = alternate wetting and drying.

when the necessary capital can be obtained. As one Arkansas producer said:

> We were already doing most of the stuff that the Rice Stewardship Program was trying to get people to do, and so really, for us, it was an opportunity to actually maybe finish some projects and kind of capitalize on getting rewarded for doing all the things that we were already doing so it was easier for us to transition into doing, you know.

For some, producers recognized or became aware of (observability) the opportunity that the RSP's financial assistance would provide to facilitate completion (compatibility) of ongoing, on-farm projects that help increase aspects of production. As the producer notes, the observability of funds and the compatibility of practices made this program desirable to enroll in; such was common amongst many producers within this first cohort of producers in this innovative RCPP for rice producers.

Practice Persistence. In the following section, we detail how the five attributes of innovation were expressed by rice producers as reasons for why they will or will not continue conservation practices (persistence) as part of their on-farm operations after their current RSP contract expires (table 4). We asked specifically about producers' intent to continue practices in IWM, NM, and WHM, and broke down participant responses within the attributes of innovation framework.

While producers initially enrolled for financial assistance that allowed them to make changes to how they manage their water, some others noted the accountability of enrolling into the program to become better environmental/agricultural stewards and believed they would become better all-around rice producers in the long-term. One such change mentioned by multiple participants was water pump automation and other technologies offered by the RSP to allow for off-site control of water pumps. In turn, this would allow producers to remotely control water levels, saving producers time from individually checking fields and turning on/off water pumps. This is especially useful in periods of rain, where natural irrigation may save producers from having to manually flood fields, and thus potentially reducing the time spent pumping, saving money and valuable groundwater. However, these remote pump automation devices are relatively expensive, and producers on a tight annual budget struggle to afford them. As one producer said:

> Without a program like this, it is not economical for a farmer to go out and put that in, I mean, by any means. Everybody sees the price of those things and their nose goes up and it just goes out the other ear because it's not even, not feasible at all without help.

Similar to participation, financial considerations were noted in discussion of practice implementation and persistence, but producers focused more on specific characteristics of practices or aspects of technical assistance to express positive or negative experiences. Given several RSP practices required a level of technological knowledge and proficiency, technical assistance was commonly discussed in reference to how it helped producers understand practices and see the benefits those practices had on their operations (relative advantage and observability). While some producers expressed initial barriers such as familiarity with or understanding the specifics of a certain practice (complexity), once producers saw benefits to their operation (relative advantage and observability), it led to learning and adoption. However, in many cases, this epiphany was not recognized without the assistance of RSP staff members. One producer specifically attributed technical assistance to their realization of the benefit and impact AWD provided. However, without technical assistance, the producer would have perceived the practice as burdensome and may not have persisted with it to conserve water:

> I think the financial assistance is a hook, but then once you need to understand it. [RSP staff member] was with me for years before I understood this whole AWD. And I'm not a dumb guy, but it just, I didn't get it, you know? You're not going to really get it until you see it, but once you see it, it's like a lightbulb comes on and you just say, "Oh wow, this is pretty neat."

In terms of optional NM practices offered by RSP, participants expressed consistently positive experience with these practices. Producers across all three states found NM to be the most advantageous RSP practice category and appeared to be the most accepted and retained practice. A common response amongst participants about NM is exemplified by the following quote: "And since then, we have done wall-to-wall nutrient management, and then we've got a twenty percent reduction on nitrogen and we're doing grid sampling on every acre, variable rate on every acre, you know, there's no doubt in my mind that it works." Among the attributes most commonly expressed, compatibility was most commonly associated with NM as nearly all producers in the region had either engaged in some extent of NM, or was compatible with beliefs or desires to engage in NM on their farm. When asked if the producer would continue NM after their contract expired, nearly all producers had a similar response: "Yeah, I was going to say, we grid sample, I grid sample every other year whether it's in the program or not." While only one specific example, the quote is exemplary of a vast majority of the RSPs first cohort who agreed that NM was widely compatible with existing operations. In addition to the compatibility, producers also identified the relative advantage of the NM practices. Grid sampling, for example, was widely viewed as beneficial among the first RSP cohort. Not only was the practice seen as widely compatible to integrate into current operations, it was also advantageous to observe where nutrient applications were unneeded or overused: "Yeah, I learned a lot about my fields doing the grid sampling. What fields needed it and where." This quote reinforces the belief that producers were able to recognize the benefits, or the relative advantage of engaging in NM practices such as annual soil samples, to manage nutrient applications.

In terms of NM compatibility, this attribute was more common among producers in Arkansas and Mississippi, while southern Louisiana participants noted the relative advantage that NM had to on-farm operations. This is likely because Arkansas, Mississippi, and northern Louisiana have greater crop diversity options than the producers of southern Louisiana, and thus, may be less likely to be dependent on nutrient applications to help supplement growth and protection for crops. Complexity existed for southern Louisiana participants, as they often noted that timing for soil samples was problematic since the turnaround time from sample collection to nutrient applications was not conducive to their operation. As one participant stated, "Well, he's not even able, because if you soil sample now, you won't get it back in time to do any good, so he's just going to have to go off of, he's kept all of our old ones, and he can go off of that." This quote demonstrates the complexities in conducting annual soil samples. In years where soil samples are delayed or not taken at all, it can lead to issues in producers receiving results back in a timely manner for when and where nutrients need to be applied. In addition, not all producers are always pleased by the result of soil test and grid sampling efforts. In cases where producers were unsatisfied with NM results, it was often due to the suggested increased costs for nutrient applications (complexity). For example, this southern Louisiana participant said, "But you know, the soil samples almost never come back to where you can afford to put what the soil really needs." When this idea came up in conversation, almost always the producer followed up and mentioned how they could not afford the increased costs (complexity), and almost always the producer mentioned how they did not fully follow recommendations and apply the full suggestions based on soil samples, which they attributed to mistrust with agrichemical companies.

In addition, while the logic behind NM is to have producers limit the overuse of nutrient applications, many producers mentioned how NM helps optimize inputs. One producer said, "I think, how do I want to word this, I don't know if saving me money is, I don't know if it's saving me money, but I'm putting my money where I can make the most profit." While the initial reaction of RSP staff may be to help save input costs for producers, and thus save excess nutrient runoff, it appeared as if many producers shifted their focus more to how NM can help maximize profits through creating more uniform yield with the use of variable rate applications (relative advantage and observability).

Winter flooding was a common practice among rice producers as WHM before the RSP, as postharvest rice fields are critical to winter waterfowl populations in the region. As one producer said, "We've always been duck hunters, so usually something gets flooded for ducks every year." Nearly all RSP producers mentioned how they take advantage of partially flooded fields, zero grade fields to catch rainwater, or pump water onto their fields to provide waterfowl hunting opportunities for themselves, or in many cases, for hunting leases. Other producers also noted the additional advantage of winter weed suppression; that is, producers could save money on herbicide treatments by instead applying a winter flood to their fields to hold back growth of winter annuals:

> ... last year we noticed that the fields we held water on, when we did pull the water off and get ready to plant rice in them again, that the fields were clean because the water held the weed pressure back all fall, whereas the fields that didn't have it, it grew all the winter weeds; the grasses and the clovers and stuff like that, that came up.

However, not all producers saw advantages with flooding winter agricultural fields. Some producers claimed winter flooding interrupted spring field preparation and planting plans:

> They said that there's an incentive to flood your rice fields after season, but as my uncle said, "you can flood your duck holes and that's it," because we don't want those fields flooded in the spring where we can't get in to prep them.

Producers across the entire study area, though more prevalent in southern Louisiana, expressed concerns that spring rains could potentially prolong drainage and interfere with spring planting operations, therefore increasing the complexity and reducing the relative advantage or compatibility of WHM practices. Another concern was justifying the additional expense to flood winter fields (complexity). One producer explicitly stated how they simply cannot afford to flood additional acres without the financial assistance that was provided by the RSP: "Wildlife flooding, it's hard to do that, it's hard to go out and flood thousands and thousands of acres without a monetary incentive." Flooding fields for some producers may come naturally with winter rainfall. However, for those who cannot rely on winter rains, it causes an extra and unnecessary expense. From the outside looking in, and not envisioning practices from the perspective of a producer, it would seem flooding rice fields would be a simple ask:

> That some of these programs to flood for wildlife habitat, you can't see growers continue doing that because it's not just closing the drains. It's costing money. It's costing the grower money. When you flood those fields over the winter or early spring or late fall, you have a lot of aquatic weeds that get started and continue to grow all through the season. And you know, that's a cost that the farmers have to come up with and you either have to go back and work the fields, which we're not trying to do, or you have to put in a bunch of herbicides to kill some of these aquatic weeds that are very hard to kill, so expensive herbicides. So, if they want farmers to continue doing that, we need to have pretty much either rewards payment or incentive to keep doing it.

Discussion. The purpose of our study was to contextualize the perceptions of the RSP from the perspective of a rice producer in the southern United States. From our results, we learned that producers enrolled for reasons like those of other agricultural producers—the initial financial incentives (Hoard and Brewer 2006). We also found that the first cohort of RSP rice producers used the financial incentives strategically to invest in proven methods that could increase on-farm efficiency and save time, stress, and costs. Results from Ernst and Wallace (2008) had similar findings in that financial incentives are beneficial in gaining interest, but more importantly, provided the financial capabilities to engage in innovative production practices that were otherwise unobtainable. For program managers, it may be worth considering that financial assistance can be framed as something as other than a simple payment for compliance, but rather, financial empowerment that participants can use to invest in themselves and the long-term success of their on-farm operation. When framing conservation program participation, focus should be emphasized on how to achieve on-farm production goals that secondarily align with conservation program objectives. After commonalities are found between on-farm goals and conservation program goals, program staff should introduce the use of financial incentives and technical assistance to help producers achieve these dual outcomes.

For practices in IWM, producers perceived these to be relatively simple, compatible, and advantageous to integrate into their operations. However, many of the program practices are not affordable to implement and include barriers to long-term upkeep for many producers in our study, and possibly even in the broader LMRB region. Further, much of the infrastructure and technology available for IWM practices is expensive, and while producers wish to adopt and sustain progressive practices on their own, it is difficult to offset initial costs given their expense (relative disadvantage) without the financial assistance and despite recognizing the vital role water management and conservation plays in modern day agriculture (Atwell et al. 2009; Sattler and Nagel 2010).

Producers engaging in the RSP's NM found these practices to be advantageous as they were often observable, and changes to production costs and yield outputs were noticeable. Even when costs did not decrease or savings were not observed, producers noted how NM helped maximize profits through more uniform yields or enabled them to optimize nutrient applications, which is consistent with findings from Buckley et al. (2015). Producers specifically noted the compatibility of soil sampling, both by those who already engaged in a sample cycle and those who wanted to start the practice, similar to Carruthers and Vanclay (2012). These perceptions of compatibility are also consistent with results from Sattler and Nagel (2010) and Olson and Davenport (2017), which suggest the importance of NM and the role that conservation programs can play in addressing the issue of excess and optimum nutrient applications. Going forward, it would benefit the RSP and similar programs to hire an independent, third-party company (presumably one trusted by producers) to conduct soil samples. Moreover, if the goal is to facilitate producer's ability to optimize input efficiency, agricultural conservation programs should consider providing a graduated/tiered NM program to help offset any potential increased costs of NM, or provide incentives in cases where nutrient applications could be optimized.

Given the widespread negative repercussions and perceived uncertainty or inconvenience associated with winter flooding practices, the WHM may be less likely to be retained after financial incentives are no longer available (Brasher et al. 2019). The reality is that, without financial assistance, this practice of providing habitat is not widely common outside of traditional field lease agreements for waterfowl hunting (Zekor and Kaminski 1987; Denny et al. 2019). Outside of the complexities noted here, there were multiple producers who also noted the advantages that holding winter water could provide, such as the effectiveness it had in holding back winter weed pressures, which has been found to be effective, and subsequently saved producers the time and money to apply spring herbicides (Bridges and Anderson 1992; Manley et al. 2009; Sattler and Nagel 2010). This may be an alternative framing for conservation program staff to promote this practice as advantageous, as this may be more observable for producers, especially those located in more northern latitudes since coastal producers anecdotally noted how holding water on postharvest fields resulted in the growth of aquatic weeds.

For the RSP, many corporate industry partners have invested in this program, and thus, desirable outcomes from the administrative, economic, and marketing side include planning that producers will continue RSP practices. Efforts to make rice more sustainable and environmentally friendly is projected to be a win-win scenario for conservation and crop production, but if practices are not continued in the long-term, then the short-term production changes are virtually ineffective, and millions of dollars will be spent promoting practices that do not make sustainable, long-term conservation impacts. To facilitate more positive perceptions of RSP practices, especially in NM and WHM, flexibility attributes may be an important program design consideration to allow for producers to make slight adjustments that still address program outcomes while prioritizing on-farm production (Atwell et al. 2009; Mascia and Mills 2018).

Summary and Conclusions

The RSP's IWM practices were viewed by producers as advantageous and innovative, which encouraged them to implement these practices as a viable alternative and compatible with existing irrigation techniques. Producers initially were motivated to enroll because of financial incentives associated with water management but found they were gaining more than just financial assistance. Common IWM practices retained by producers were AWD and poly pipe, while others like rainfall tracking were not retained often. For NM, producers found practices to be compatible and advantageous. Initially, these were expected to be cost-saving practices that require less inputs; however, producers often noted that NM practices did not necessarily save money as much as they allowed producers to maximize where they put nutrients to create a more uniform crop. Continuing this practice for many producers seems natural but program managers should be mindful that, from the perspective of producers, fields do not need to be sampled and tested every year. Lastly, many producers found the wildlife habitat mostly compatible, as many producers are already flooding some of their winter rice fields for leased waterfowl hunting opportunities. For producers in southern Louisiana, if they are not leasing property for waterfowl hunting, then many producers flood for crawfish harvesting opportunities. From a program review perspective, expecting producers to continue WHM is tenuous, as many producers do not always have the financial capabilities to flood acres, especially those who feel the WHM impacts them on the back end when they are trying to prepare spring fields for planting.

When it comes to conservation focused practices offered by the USA Rice-Ducks Unlimited RSP in the first round of contracts, producers seemed to favor practices related to NM. This was largely due to the compatibility, observability, and advantageous nature of information sharing of the 4R's of NM (right source, right rate, right place, and right time) and for results of the grid sampling. However, caution must be used going forward that recommendations as a result of soil testing results do not exceed the producer's budget and the reality of increasing nutrient applications.

In summary, within a framework of water, nutrient, and wildlife habitat conservation, the RSP facilitated the adoption of several practices and infrastructure among rice producers that have a high probability of retention. In terms of the attributes of innovation that guided this study, producers noted the simplicity (complexity) of these practices and the ease of integration into existing on-farm production methods or thoughts (compatibility). Producers also expressed that many of the outcomes of IWM and NM practices were noticeable (observability) or provide a better result than current practices or infrastructure (relative advantage), which influenced their decision to continue practices beyond the program timeline. For the broader private lands conservation program development and evaluation field, our results should reinforce that an attributes of innovation framework is viable. However, an important caveat our findings demonstrate is that producers see or expect multiple attributes within a single practice. It is not enough to know or read that a new technique or piece of equipment will save money or time, it must be experienced, and a producer must recognize this for themselves to achieve greater adoption and persistence of practices. In addition, while trialability is a valuable component of Rogers' theory, startup and scale are important factors that can make it difficult to facilitate this attribute in practice. Because trialability uses a small-scale adoption approach, this cannot always be easily assimilated into agricultural settings since practices often have to be implemented at the field level. The attributes of innovation are one tool that natural resource managers should consider when designing conservation programs tailored for agricultural producers. Though the attributes may appear to contain very simplistic ways of thinking, these ways of thinking also pose a realistic and practical way of assimilating conservation practices into producers' operations. That said, as all producers go through the processes of changing perspectives and implementation of practices from conservation programs, there will be variability in timescale depending on operation size.

Supplemental Material

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