Research Article ISSN: 2770-2928

International Journal of Agriculture and Technology

Mobilizing a Collective Response: Farmer Awareness of the Giant African Snail (Achatina fulica) and its Impacts on Trinidad Agriculture

Tracy C. Larkin[1]*, James R. Lindner[2], Joseph J. Molnar[3], Christopher A. Clemons[4] and Jason D. McKibben[5]

[1]*Department of Curriculum and Teaching, College of Education, 5032 Haley Center, Auburn University, Alabama, USA.*

[2]*Department of Curriculum and Teaching, College of Education, 5058 Haley Center, Auburn University, Alabama, USA.*

[3]*Department of Agricultural Economics and Rural Sociology, College of Agriculture, 301 Comer Hall, Auburn University, Alabama, USA.*

[4]*Department of Curriculum and Teaching, College of Education, 5070 Haley Center, Auburn University, Alabama, USA.*

[5]*Department of Curriculum and Teaching, College of Education, 5060 Haley Center, Auburn University, Alabama, USA.*

***Correspondence:**
Tracy Larkin, Department of Curriculum and Teaching, College of Education, 5032 Haley Center, Auburn University, Alabama, USA, Phone: 1-347-481-9057.

Received: 02 Sep 2024; **Accepted:** 04 Oct 2024; **Published:** 11 Oct 2024

Citation: Larkin TC, Lindner JR, Molnar JJ, et al. Mobilizing a Collective Response: Farmer Awareness of the Giant African Snail (Achatina fulica) and its Impacts on Trinidad Agriculture. Int J Agriculture Technology. 2024; 4(4): 1-11.

ABSTRACT

This study used Rogers' Diffusion of Innovation Theory theoretical framework to explain the adoption of the eradication methods of the Giant African Snail (Achatina fulica) by farmers in Trinidad and Tobago. The purpose of this study was to understand the influence of selected factors on the adoption of eradication methods/programs for the Giant African Snail (GAS) by farmers. A cross-sectional design was used for this study. Analytical and descriptive analyses were conducted, including frequencies, percentages, means, standard deviations, and correlations. Results show that the majority of farmers (56.8%) were in the confirmation stage when it came to the eradication of GAS. Overall, farmers strongly agreed that they had a relative advantage over the eradication methods and the eradication methods were compatible and not complex. Farmers neither agreed nor disagreed that the eradication methods of GAS were observable and trialable. There were significant relationships between farmers' farming status and trialability, and between farmers' level of education and relative advantage and trialability.

Keywords

Diffusion of Innovation Theory, Eradication methods, Giant African Snail (*Achatina fulica*).

Introduction

The Giant African Snail (*Achatina fulica*) continues to be a nuisance to farmers and members of the public, devouring at least 500 different plant species and having the capability of wreaking structural havoc on plaster and stucco infrastructure [1]. They can cause eosinophilic meningitis disease which is a major health concern and that also destroys farmers' crops [1,2]. Even, after the Ministry of Agriculture, Land and Marine Affairs brought awareness to the farming community and general public about the Giant African Snail (GAS), the issue of how to respond to the invasion still arises [2]. There are many challenges in the adoption and diffusion of eradication methods for GAS. The adoption of an innovation depends on the perception and performance of the innovation [3]. Another concern according to [4] is the disciplinary words and terms used in eradication educational programs which adopters may not be familiar with.

After years of bringing awareness to the farming community and general public about the GAS, the issue of invasion still persists. In an effort to further eradication/ awareness, The Ministry of Agriculture, Land, and Fisheries ran The GAS Sensitization Campaign, an experimental project from January 16 to February 2, 2023, for three (3) weeks [5]. This was done due to the additional funding provided by the Ministry of Finance specifically for the eradication of the GAS. The Minister of Finance allocated TT $3 million (US $442,480) in the 2022/2023 budget towards funding projects and grants. In the deliverance of his budget speech, he stated "I propose to allocate an additional $3 million to the Ministry of Agriculture, Land and Fisheries in our fight against these destructive pests for marketing and awareness campaigns, training of staff and agricultural supply materials."- Minister of Finance Colm Imbert [6]. With TT $3 million (US $442,480) budgeted toward funding projects and grants, the GAS Sensitization Campaign has been introduced to encourage citizens to partake in eradication methods. As farmers are the main stakeholders due to crop loss, their perceptions were the main focus of this study. Therefore, the purpose of this study is to understand the influence of selected factors on the adoption of eradication methods/ programs for the GAS by farmers.

Literature Review and Theoretical Framework

Rogers [7] Theory on Diffusion of Innovation is a well-known theoretical framework for explaining how new ideas, products, and technologies are adopted by individuals and organizations. Everett Rogers created the theory in the 1960s, and it has since been widely applied in a variety of industries, including marketing, medicine, education, and technology. The diffusion process is predicated on the notion that embracing new ideas is a social process involving communication between various social groupings [8] noted that adoption of agricultural innovations is directly ties to ease in communicating an innovation to a targeted audience [7] identified the following five crucial steps in the diffusion process; knowledge, persuasion, decision, implementation, and confirmation. Li and Harder adapted Rogers' stages in the innovation-decision process to include no knowledge at the beginning of the process [7,9,10].

No knowledge is the first stage in the diffusion process and is when people do not know about the innovation [9,10]. Knowledge is when people become aware of the new innovation and start to gather information about it. Persuasion is people having some knowledge about the innovation and they need convincing that it is worth adopting. In the decision stage, people decide whether to adopt the innovation or not. This decision is influenced by various factors, such as perceived relative advantage, compatibility, complexity, trialability, and observability. After people decide to adopt the innovation, they need to put it into practice and implement the innovation by learning how to use the innovation, overcoming any challenges or obstacles, and integrating it into their existing routines and practices. The final stage in the diffusion process is confirmation where people evaluate their decision to adopt the innovation and decide whether to continue using it or not [7]. Additionally, Rogers characteristics of innovation distinguished specific characteristics of innovation [7].

Relative Advantage

This attribute describes how the innovation is viewed in relation to competing options. It reveals the degree to which people think the innovation offers better advantages and benefits compared to current practices [7]. People are more inclined to adopt an invention when there is a perceived increase in performance, reduction in risk or other benefits from the innovation [11]. Study, perceptions of relative advantage and trialability imply that Extension officers found SMS to be a more advantageous communication tool than other options, and they also had good experiences experimenting with SMS to connect with farmers.

Compatibility

Compatibility is the degree to which an innovation is viewed as being suitable with the values, experiences, and requirements of potential adopters. An innovation is more likely to be embraced if it fits in well with current beliefs, values, and practices [7]. Individual preferences, societal structures, and cultural conventions can all have an impact on perceived compatibility.

Observability

This term describes how visible an innovation and its outcomes are to other people. It refers to the extent to which potential adopters may quickly see the results or advantages of embracing the innovation [7]. When an innovation's outcomes are clearly apparent or obvious, this might facilitate the decision to adopt it.

Complexity

Complexity is the perceived difficulty or complexity of comprehending and using an invention. Adoption may be hampered if an innovation is viewed as difficult. Innovations are more likely to be embraced if they are simple to comprehend, apply, and incorporate into current procedures [7]. The apparent complexity of the innovation can be decreased by simplifying it or by offering support and training [12]. stated that the major factor in staff acceptance of the process innovation resulting from Lean Systems Thinking was the animated computer simulation's mix of trialability and observability.

Trialability

Trialability describes people's willingness to experiment with new ideas on a small scale. It illustrates the extent to which prospective adopters can test out the innovation before committing fully [7]. The possibility of adoption rises when an innovation is testable, allowing people to evaluate its advantages and compatibility in a low risk setting. A study by illustrates that trialability was shown to be the most important factor influencing a foreign language school's adoption of the Internet as a teaching tool [13].

Purpose and Objectives

The purpose of this study was to understand the influence of selected factors on the adoption of eradication methods/programs for the GAS by farmers.

The objectives for this study are:

1. Determine farmers' stages in the innovation-decision process,

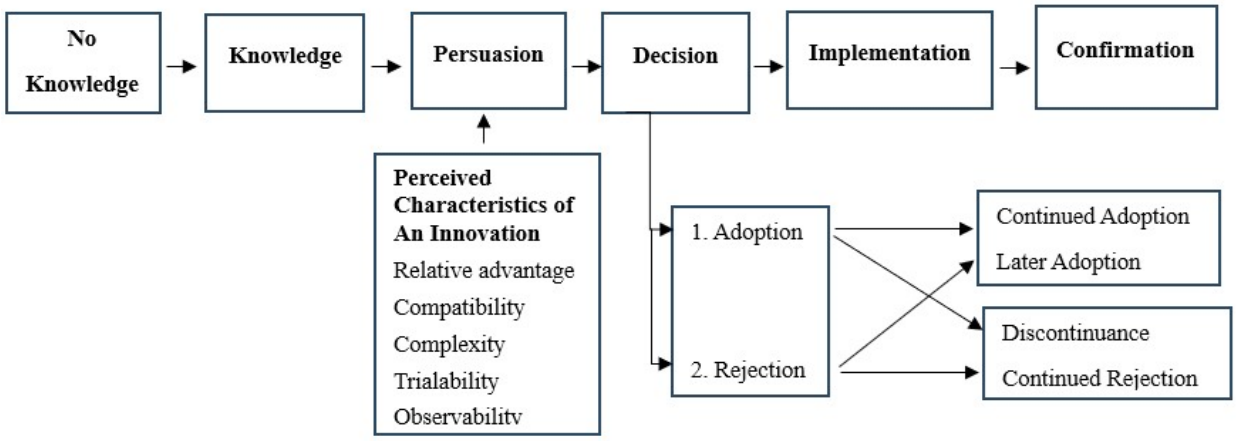

Figure 1: Theoretical Framework for the Innovation Decision Process. Adopted from Rogers [7].

based on Li's and Harder's adaptation of Rogers stages in the innovation-decision process (no knowledge, knowledge, persuasion, decision, implementation, and confirmation) [7,9,10].

2. Determine farmers' perceptions of eradication methods/ programs for the GAS based on Rogers' characteristics of an innovation (relative advantage, compatibility, observability, complexity, and trialability) [7].
3. Describe the relationships between farmers' selected personal characteristics and their perceptions of eradication methods/ programs for the GAS.

Methods

Sample

Participants (n=53) are farmers from Trinidad. There are approximately 23 000 registered farmers and 35,000 farmers in general in Trinidad and Tobago [14]. Farmers located at two major Trinidad farmers' markets and a farmers' county office were approached to be interviewed. The Macoya Market is located in the northern region of Trinidad and Tobago while the Debe market is located in the southern region. County Caroni Office is located in the central region of Trinidad and Tobago. The number of registered farmers at the nine (9) farmers markets excluding Debe Market is 400. Non-probability convenience sampling was used to select and recruit respondents. Given the sampling technique used, external reliability of the study is a concern and caution and was warranted against generalizing the findings beyond the study participants [14].

Data Collection

Farmers were relayed an oral administered questionnaire, and the information was recorded immediately on questionnaires. Data collection was conducted from August 2nd to August 17th August 2023. Some of the respondents (n=9) were not able to complete the survey due to time constraints and therefore some of the questionnaires could not be used. Out of 53 questionnaires, 44 were available for analysis. All information was documented on survey instruments and then entered into the Statistical Package for the Social Sciences (SPSS) 29. After completion, the data was analyzed, and results were documented.

Instrument

The questionnaire was adapted from Harder's, study on the diffusion of eXtension among the Cooperative Extension agents in the state of Texas and modified for this study [10]. The instrument was divided into four sections; 1) characteristics impacting the diffusion of the eradication methods of the GAS, 2) potential barriers to the diffusion of the eradication methods of the GAS, 3) the adoption of eradication methods, and 4) characteristics/ demographics of farmers. Section one was based on the characteristics impacting the diffusion of eradication methods of the GAS. Questions include the level of participation in the eradication methods for the GAS and the perceived attributes of eradication methods of GAS. For level of participation, Harder's, presented that the first stage includes no knowledge which was added to Rogers' theory of the decision-process and the innovation [7,10]. After no knowledge there is knowledge, persuasion, decision, implementation, and confirmation. The perceived attributes of an innovation were categorized into five groups by Rogers [7]. They are relative advantage, compatibility, observability, trialability, and complexity. The five characteristics of eradication methods were organized into a set of Likert-type items with a five-point rating system from 1 to 5 with 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree.

The degree to which a farmer agreed with a certain item indicated how favorable they thought the innovation's feature was. Because of this, the genuine limits of the scale anchors 1 = Strongly Disagree (range 1 - 1.5), 2 = Disagree (range 1.51 - 2.5), 3 = Neither Agree nor Disagree (range 2.51 - 3.5), 4 = Agree (range 3.51 - 4.5), 5 = Strongly Agree (range 4.51 - 5), were used to interpret the overall construct mean for each innovation characteristic in relation to farmers perceived agreement [15].

Section two was based on the possible barriers to the diffusion of eradication methods of the GAS. Questions include potential barriers to the diffusion of eradication methods of the GAS. Studies by Harder, and stated five barriers to adoption of innovation [10,16]. These are concerns about time, concerns about incentives, financial concerns, planning concerns and technology concerns. Perceived barriers of the eradication methods were rated on a scale

from 1 to 5 with 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree.

The degree to which a farmer agreed with a certain item indicated their agreement on these perceived barriers. Because of this, the genuine limits of the scale anchors 1 = Strongly Disagree (range 1 - 1.5), 2 = Disagree (range 1.51 - 2.5), 3 = Neither Agree nor Disagree (range 2.51 - 3.5), 4 = Agree (range 3.51 - 4.5), 5 = Strongly Agree (range 4.51 - 5), were used to interpret the overall construct mean for each perceived barrier in relation to farmers agreement [16].

Section three looked at the adoption of eradication methods. Varying questions about the awareness of eradication methods along with how information is dispersed to the general public were asked. In section four selected characteristics of farmers were obtained, including age, gender, level of education, farming status, and farm location.

A panel of experts, including professors from Auburn University's Department of Curriculum and Teaching and an extension officer from Trinidad and Tobago's Ministry of Agriculture's Extension Training and Information Services, evaluated the content validity of the instrument. Several statements were changed and adjusted in order to survey farmers and improve the likelihood of obtaining accurate and trustworthy findings. In order to determine internal consistency or reliability, the data was measured using Cronbach's alpha coefficient.

Cronbach alphas were determined for internal consistency with data from the survey. Relative Advantage = 0.63, Compatibility = 0.69, Complexity = 0.96, Observability= 0.81, and Trialability = 0.45.

The original α level for trialability was 0.39 and therefore one item was deleted. Reliability levels ≥.80 were considered acceptable (Harder, 2007) but Taber, (2018) interpretation of calculated alpha values are as follows: excellent (0.93–0.94), strong (0.91–0.93), reliable (0.84–0.90), robust(0.81), fairly high (0.76–0.95), high (0.73–0.95), good (0.71–0.91), relatively high (0.70–0.77), slightly low (0.68), reasonable (0.67–0.87), adequate (0.64–0.85), moderate (0.61–0.65), satisfactory (0.58–0.97), acceptable (0.45–0.98), sufficient (0.45–0.96), not satisfactory (0.4–0.55) and low (0.11).

Analysis and Measures

Descriptive statistics, such as means, standard deviation, and frequencies, as well as inferential statistics were used in Statistical Package for Social Science (SPSS) version 29 to analyze the data. Inferential statistics compare the treatment groups and draw conclusions about the wider population of subjects based on measures taken from the experiment's sample of subjects [17]. Age, gender, education, agricultural status, and farm location were the study's independent factors. Stages in the innovation-decision process, relative advantage, compatibility, complexity, trialability and observability were the dependent factors for the study.

Based on Rogers' Diffusion of Innovations theory, this study examined farmers attributes of the eradication methods for the GAS as an innovation [7]. The five characteristics of eradication methods were organized into a set of Likert-type items with a five-point rating system: five items for relative advantage, four for complexity, four for compatibility, four for trialability, and four for observability. Perceived attributes of the eradication methods were rated on a scale from 1 to 5 with 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree.

The degree to which a farmer agreed with a certain item indicated how favorable they thought the innovation's feature was. Because of this, the genuine limits of the scale anchors
1 = Strongly Disagree (range 1 - 1.5), 2 = Disagree (range 1.51 - 2.5), 3 = Neither Agree nor Disagree (range 2.51 - 3.5), 4 = Agree (range 3.51 - 4.5), 5 = Strongly Agree (range 4.51 - 5), were used to interpret the overall construct mean for each innovation characteristic in relation to farmers perceived favorability [15].

The data were analyzed using Pearson's correlation, frequency tables, correlation tests, ordinal regression and ordinary least squares regression. The degree of correlation, assessed on an interval scale between two variables is indicated by the Pearson's r correlation [18].

Results

Objective 1: Stages in the innovation-decision process

Determine farmers' stages in the innovation-decision process, based on Li's and Harder's adaptation of Rogers' stages in the innovation-decision process (no knowledge, knowledge, persuasion, decision, implementation, and confirmation) [7,9,10]. Among the forty-four respondents, there were not any respondents that had "no knowledge" about the eradication methods of the GAS. Seven respondents (15.9%) were in the stage "knowledge" stage and there were no respondents in the "persuasion" stage. There were also no respondents in the "decision" stage. Twelve respondents (27.3) were in the "implementation" stage of using eradication methods of the GAS while twenty-five respondents (56.8) were in the "confirmation" stage. All forty-four respondents answered this question.

Table 1: Farmers' current stage in the Innovation Decision Process of the eradication methods of GAS. Trinidad Farmers, 2023.

	Description	*f*	%
No Knowledge	I had never heard of eradication methods for the GAS before reading the description provided in this questionnaire	0	0
Knowledge	I understand its purpose and techniques but have not decided whether or not I like or dislike the eradication methods	7	15.9
Persuasion	I have decided that I like or dislike the eradication methods for the GAS	0	0
Decision	I have decided that I will or will not use eradication methods for the GAS	0	0
Implementation	I am using eradication methods for GAS	12	27.3
Confirmation	I have used eradication methods for the GAS long enough to evaluate whether these eradication methods will be part of my future in farming	25	56.8
Total		44	100

Effect of GAS on Farmers

Table 2 shows the effects of the GAS on farmers livelihood and wellbeing. Twenty-one farmers stated that their crops were damaged and there was an increase in the cost of production due to the presence of the GAS on their farms. Seven farmers stated that there was an increase in the use of resources to manage, very costly, and an increased risk of losses and time consuming when managing the GAS. Two farmers stated that the GAS barely affected and another two stated that they had to postpone farming for a period of time. One farmer each were not able to use organic waste or believe that insect growth regulator should be implemented to stop the reproduction of the GAS.

Table 2: The Effects of the GAS on Farmers, Trinidad Farmers, 2023.

How GAS has Affected Farmers	*f*	%
Crops/seedlings damaged/destroyed. Increased cost of production.	21	47.8
Increased use of resources to manage, costly, increased risk of losses and time consuming	7	15.9
The GAS has barely affected me	2	4.5
Postponed farming for a period of time due to the GAS	2	4.5
Farmer not able to use organic waste from other areas due to fear of the GAS being transported to their farm.	1	2.3
Insect growth regulator should be implemented to stop the reproduction of the GAS	1	2.3
N/A	10	22.8
Total	44	100

Objective 2: Characteristics of an Innovation

Determine farmers' perceptions of eradication methods/programs for the GAS based on Rogers' characteristics of an innovation (relative advantage, compatibility, observability, complexity, and trialability) [7].

The second objective was to characterize how farmers perceived the eradication methods of the GAS based on Rogers' characteristics of an innovation. The likert type scale used is as follows: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree. The summated range of the mean responses being utilized are: 1 = Strongly Disagree (range 1 - 1.5), 2 = Disagree (range 1.51 - 2.5), 3 = Neither Agree nor Disagree (range 2.51 - 3.5), 4 = Agree (range 3.51 - 4.5), 5 = Strongly Agree (range 4.51 - 5), [7,15].

Relative Advantage

Five statements were used to gauge the perceived relative advantage of using eradication methods for the GAS. In table 3, respondents tended to agree with the statements, "Economic profitability is an advantage of using eradication methods for the GAS (M = 3.59, SD = 1.19), a decrease in some kind of distress is an advantage of using eradication methods for the GAS (M = 3.93, SD = 0.87), saving time and/or effort is an advantage of using eradication methods for the GAS, (M = 3.64, SD = 1.14) and the benefits of using eradication methods for the GAS are immediate and that is an advantage of using these methods (M = 4.07, SD = 1.13)." They tended to neither agree nor disagree with the statement "low initial cost is an advantage of using eradication methods for the GAS" (M = 2.82, SD = 1.30). Overall, there was agreement that there is a relative advantage to using eradication methods for the GAS (M = 3.61, SD = 1.13).

Compatibility

Four statements were used to gauge the perceived compatibility of using eradication methods for the GAS. Table 4 displays the frequencies, percentages, means and standard deviations for each item. Respondents inclined to agree with the statements, "the eradication methods for the GAS will keep farmers safe from diseases (M = 3.84, SD = 1.22), and the eradication methods for the GAS are a suitable way for farmers to increase their production yield (M = 4.11, SD = 0.87)".

They strongly agree with the statement, "my vision for the future of agriculture includes the continued use of eradication methods for the GAS" (M = 4.55, SD = 0.63). Farmers neither agree or disagree that the use of eradication methods for the GAS is compatible with previously introduction ideas e.g. management, mitigation and control (M = 3.45, SD = 0.73). Overall, farmers agreed that there is compatibility when it comes to adoption of the eradication methods for the GAS (M = 3.99, SD = 0.86).

Complexity

Four statements were used to gauge the perceived complexity of using eradication methods for the GAS. Table 5 displays the frequencies, percentages, means and standard deviations for each item. Respondents tended to agree with all statements. "Information given on eradication methods for the GAS is easily understandable, (M = 4.45, SD = 0.88), Eradication methods for the GAS seem simple, (M = 4.41, SD = 0.95), Eradication methods for the GAS seem easy to exercise, (M = 4.32, SD = 0.96), Eradication methods for the GAS can be conducted with little to no mistakes, (M = 4.34, SD = 0.94)". Overall, farmers agreed that there is complexity when it comes to adoption of the eradication methods for the GAS (M = 4.38, SD = 0.93).

Trialability

Three statements were used to gauge the perceived trialability of using eradication methods for the GAS. Table 6 displays the frequencies, percentages, means and standard deviations for each item. Respondents tended to agree with the statement, "I can test eradication methods for the GAS with no obligation for continued use of these methods in the future (M = 4.20, SD = 0.93). They neither agree nor disagree with the statements "I can use eradication methods for the GAS without providing new materials for it (M = 2.86, SD = 1.13) and there are mechanisms that enable the users to easily try the eradication methods for the GAS (M = 3.39, SD = 0.87)". Overall, farmers neither agree nor disagree that trialability helps in adoption of the eradication methods for the GAS (M = 3.48, SD = 0.98).

Observability

Four statements were used to gauge the perceived observability of using eradication methods for the GAS. Table 7 displays the

Table 3: Responses of farmers by their perceptions about the relative advantage of using eradication methods for the GAS. Trinidad Farmers, 2023.

	Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree			
Relative Advantage	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	M	SD
Economic profitability is an advantage of using eradication methods for the GAS	2	4.5	7	15.9	10	22.7	13	29.5	12	27	3.59	1.19
Low initial cost is an advantage of using eradication methods for the GAS	4	9.1	21	47.7	6	13.6	5	11.4	8	18	2.82	1.30
A decrease in some kind of distress is an advantage of using eradication methods for the GAS	0	0	3	6.8	9	20.5	20	45.5	12	27	3.93	0.87
Saving time and/or effort is an advantage of using eradication methods for the GAS	1	2.3	8	18.2	9	20.5	14	31.8	12	27	3.64	1.14
The benefits of using eradication methods for the GAS are immediate and that is an advantage of using these methods	1	2.3	6	18.2	2	20.5	15	34.1	20	46	4.07	1.13
Total Average											3.61	1.13

Note: Overall M=3.61; SD=1.13, scale: 1=Strongly Disagree, 2=Disagree, 3=Neither Agree nor Disagree, 4=Agree, 5=Strongly Agree

Table 4: Responses of farmers by their perceptions about the compatibility of using eradication methods for the GAS. Trinidad Farmers, 2023.

	Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree			
Compatibility	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	M	SD
The eradication methods for the GAS will keep farmers safe from diseases	3	6.8	4	9.1	6	13.6	15	34.1	16	36	3.84	1.22
The use of eradication methods for the GAS is compatible with previously introduction ideas e.g. management, mitigation and control	1	2.1	2	4.5	18	40.9	22	50	1	2.3	3.45	0.73
The eradication methods for the GAS are a suitable way for farmers to increase their production yield	0	0	2	4.5	8	18.2	17	38.6	17	39	4.11	0.87
My vision for the future of agriculture includes the continued use of eradication methods for the GAS	0	0	0	0	3	6.8	14	31.8	27	61	4.55	0.63
Total Average											3.99	0.86

Note: Overall M=3.99; SD=0.86, scale: 1=Strongly Disagree, 2=Disagree, 3=Neither Agree nor Disagree, 4=Agree, 5=Strongly Agree.

Table 5: Responses of farmers by their perceptions about the complexity of using eradication methods for the GAS. Trinidad Farmers, 2023.

	Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree			
Complexity	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	M	SD
Information given on eradication methods for the GAS is easily understandable	1	2.3	1	2.3	2	4.5	13	29.5	27	61	4.45	0.88
Eradication methods for the GAS seem simple	1	2.3	2	2.3	2	4.5	12	27.3	27	61	4.41	0.95
Eradication methods for the GAS seem easy to exercise	1	2.3	1	2.3	6	13.6	11	25	25	57	4.32	0.96
Eradication methods for the GAS can be conducted with little to no mistakes	1	2.3	1	2.3	5	11.4	12	27.3	25	57	4.34	0.94
Total Average											4.38	0.93

Note: Overall M=4.38; SD=0.93, scale: 1=Strongly Disagree, 2=Disagree, 3=Neither Agree nor Disagree, 4=Agree, 5=Strongly Agree.

frequencies, percentages, means and standard deviations for each item. Respondents tended to neither agree nor disagree with all statements, "the eradication methods for the GAS are well publicized (M = 2.61, SD = 1.39), the use of eradication methods for the GAS is a highly visible program (M = 2.68, SD = 1.34), the results of eradication methods for the GAS are easily visible to potential users (M = 3.36, SD = 1.18) and the benefits of eradication methods for the GAS are easily visible to potential users (M = 3.50, SD = 1.09)". Overall, farmers neither agree nor disagree that observability helps in adoption of the eradication methods for the GAS (M = 3.04, SD = 1.25).

Objective 3: Relationships Between Personal Characteristics and Characteristics of an Innovation

Describe the relationships between farmers' selected personal characteristics and their perceptions of eradication methods/ programs for the GAS.

The third objective was to describe the relationships between farmers' selected personal characteristics and their perceptions

Table 6: Responses of farmers by their perceptions about the trialability of using eradication methods for the GAS. Trinidad Farmers, 2023.

	Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree			
Trialability	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	M	SD
I can test eradication methods for the GAS with no obligation for continued use of these methods in the future	0	0	3	6.8	6	13.6	14	31.8	21	48	4.20	0.93
I can use eradication methods for the GAS without providing new materials for it	1	2.3	23	52.3	6	13.6	9	20.5	5	11	2.86	1.13
There are mechanisms that enable the users to easily try the eradication methods for the GAS	1	2.3	3	6.8	23	52.3	12	27.3	5	11	3.39	0.87
Total Average											3.48	0.98

Note: Overall M=3.48; SD=0.98, scale: 1=Strongly Disagree, 2=Disagree, 3=Neither Agree nor Disagree, 4=Agree, 5=Strongly Agree.

Table 7: Responses of farmers by their perceptions about the observability of using eradication methods for the GAS. Trinidad Farmers, 2023.

	Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree			
Observability	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	M	SD
The eradication methods for the GAS are well publicized	11	25	15	34.1	3	6.8	10	22.7	5	11	2.61	1.39
The use of eradication methods for the GAS is a highly visible program	9	20.5	16	36.4	4	9.1	10	22.7	5	11	2.68	1.34
The results of eradication methods for the GAS are easily visible to potential users	3	6.8	10	22.7	5	11.4	20	45.5	6	14	3.36	1.18
The benefits of eradication methods for the GAS are easily visible to potential users	2	4.5	8	18.2	6	13.6	22	50	6	14	3.50	1.09
Total Average											3.04	1.25

Note: Overall M=3.04; SD=1.25, scale: 1=Strongly Disagree, 2=Disagree, 3=Neither Agree nor Disagree, 4=Agree, 5=Strongly Agree.

Table 8: Pearson and Kendall Tau-b Correlations between Age and Characteristics of an Innovation. Trinidad Farmers, 2023.

	Pearson \ Kendall Tau-b Correlations					
	1	2	3	4	5	6
1. Age	1	0.117	-0.075	0.048	-0.01	0.055
2. Relative Advantage	0.012	1	.400**	0.048	0.269	0.119
3. Compatibility	-0.075	.311**	1	.305*	0.262	0.155
4. Complexity	0.045	0.135	.329**	1	-0.018	0.242
5. Trialability	0.005	0.175	0.13	0.089	1	0.114
6. Observability	0.024	0.042	0.145	0.112	0.13	1

*Correlation is significant at the 0.05 level
**Correlation is significant at the 0.01 level

Table 9: Pearson and Kendall Tau-b Correlations between Gender and Characteristics of an Innovation. Trinidad Farmers, 2023.

	Pearson \ Kendall Tau-b Correlations					
	1	2	3	4	5	6
1. Female	1	-0.2	-0.123	-0.173	0.282	0.01
2. Relative Advantage	-0.19	1	.400**	0.048	0.269	0.119
3. Compatibility	-0.117	.311**	1	.305*	0.262	0.155
4. Complexity	-0.268	0.135	.329**	1	-0.018	0.242
5. Trialability	0.192	0.175	0.13	0.089	1	0.114
6. Observability	0.023	0.042	0.145	0.112	0.13	1

*Correlation is significant at the 0.05 level

Table 10: Pearson and Kendall Tau-b Correlations between Level of Education and Characteristics of an Innovation. Trinidad Farmers, 2023.

	Pearson \ Kendall Tau-b Correlations					
	1	2	3	4	5	6
1. Level of Education	1	.341*	0.256	-0.084	.413**	0.139
2. Relative Advantage	.234*	1	.400**	0.048	0.269	0.119
3. Compatibility	0.193	.311**	1	.305*	0.262	0.155
4. Complexity	-0.097	0.135	.329**	1	-0.018	0.242
5. Trialability	.436**	0.175	0.13	0.089	1	0.114
6. Observability	0.15	0.042	0.145	0.112	0.13	1

*Correlation is significant at the 0.05 level
**Correlation is significant at the 0.01 level

of eradication methods/programs for the GAS based on Rogers characteristics of an innovation and selected participants' personal characteristics including age, gender, level of education, farming status. Farmers' perceptions of eradication methods were described based on the following characteristics of an innovation: relative advantage, compatibility, observability, complexity, and trialability [7].

Pearson's correlation and Kendall Tau- b were used to show the relationships between selected personal characteristics and the characteristics of an innovation. Both Pearson and Kendall Tau-b were used due to the small sample size and for comparison.

Age

Table 8 displays the correlations between age and characteristics of an innovation.

Pearson: There were no significant relationships between the age of respondents and the five characteristics of an innovation. All associations were low or negligible.

Kendall Tau-b: There were no significant relationships between the age of respondents and the five characteristics of an innovation. All associations were low or negligible.

Gender

Table 9 displays the correlations between gender and characteristics of an innovation.

Pearson: There were no significant relationships between the gender of respondents and the five characteristics of an innovation. All associations were low or negligible.

Kendall Tau-b: There were no significant relationships between the gender of respondents and the five characteristics of an innovation. All associations were low or negligible.

Due to the dichotomous variables (male = 1 and female = 2), then its stands that gender for this analysis is female.

Level of Education

Table 10 displays the correlations between level of education and characteristics of an innovation.

Pearson: There was a significant, moderate positive relationship between respondents' highest level of education and relative advantage, $r\,(44) = .341$, $p < .05$, and highest level of education, and trialability, $r\,(44) = .413$, $p < .05$. No other significant relationships were found for compatibility, complexity, and observability.

Kendall Tau-b: There was a significant, moderate positive relationship between respondents' level of education and relative advantage, $tb\,(44) = .234$, $p < .05$, level of education, and trialability, $tb\ (44) = .436$, $p < .05$. No other significant relationships were found for compatibility, complexity, and observability.

Farming Status

Table 11 displays the correlations between farming status and characteristics of an innovation.

Pearson: There was a significant, moderate positive relationship between respondents' farming status and trialability, $r\ (44) = .33$, $p < .05$. No other significant relationships were found for relative advantage, compatibility, complexity, and observability. All associations were low.

Kendall Tau-b: There was a significant, moderate positive relationship between respondents' farming status and trialability, $tb\ (44) = .316$, $p < .05$. No other significant relationships were found for relative advantage, compatibility, complexity, and observability. All associations were low.

Due to the dichotomous variables (full-time farmer = 1 and part-time farmer = 2), then its stands that farming status for this analysis is part time.

Table 11: Pearson and Kendall Tau-b Correlations between Farming Status and Characteristics of an Innovation. Trinidad Farmers, 2023.

	Pearson \ Kendall Tau-b Correlations					
	1	2	3	4	5	6
1. Part-time farmer	1	0.108	-0.115	-0.213	.330*	0.181
2. Relative Advantage	0.032	1	.400**	0.048	0.269	0.119
3. Compatibility	-0.113	.311**	1	.305*	0.262	0.155
4. Complexity	-0.148	0.135	.329**	1	-0.018	0.242
5. Trialability	.316*	0.175	0.13	0.089	1	0.114
6. Observability	0.135	0.042	0.145	0.112	0.13	1

*Correlation is significant at the 0.05 level

**Correlation is significant at the 0.01 level

Regression of Eradication Prevention Perceptions

Table 12 displays an Ordinary Least Squares (OLS) regression of eradication prevention perceptions on selected farmers.

The R-Square (relative advantage) was 0.32. This means 32% of variance in the relative advantage of eradication methods can be accounted for by sociodemographic factors age, gender, education, and farming status. Based on the results it was shown that farmers who have a bachelor's degree were 0.67 times more likely to perceive that eradication methods had a relative advantage. Also, farmers who have a master's degree were 1.15 times more likely to perceive that eradication methods had a relative advantage.

The R-Square (complexity) was 0.11. This means 11% of variance in the complexity of eradication methods can be accounted for by sociodemographic factors age, gender, education, and farming status. Based on the results it was shown that farmers who were females were 0.23 times less likely to perceive that eradication methods were not complex.

The R-Square (trialability) was 0.39. This means 39% of variance in the trialability of eradication methods can be accounted for by sociodemographic factors age, gender, education, and farming status. Based on the results it was shown that farmers who have a bachelor's degree were 0.70 times more likely to perceive that eradication methods were trialable. Also, farmers who have a master's degree were 1.12 times more likely to perceive that eradication methods were trialable.

Discussion, Conclusion and Recommendations

The majority of farmers were in the later stages of the innovation-decision process, with 27.3% being in the "implementation" stage and 56.8% being in the "confirmation" stage. This suggests that a sizeable proportion of participants had either already implemented

Table 12: Regression of Eradication Prevention Perceptions on Selected Farmers Trinidad Farmers 2023.

	Standardized Beta Coefficient				
	Relative Advantage	**Compatibility**	**Complexity**	**Trialability**	**Observability**
(Constant)	2.95**	3.99**	4.38**	2.88**	2.19**
Age	0.01	0.00	0.01	0.01	0.02
Female	-0.44	-0.13	-0.23*	0.20	-0.35
Primary education	-0.05	0.15	-0.20	-0.12	-1.27
Trade school	0.30	0.56	0.37	0.01	-0.70
Associates degree	0.01	-0.07	0.22	0.37	0.49
Bachelor's degree	0.67*	0.41	-0.21	0.70*	0.42
Master's degree	1.15*	0.65	-0.41	1.12*	0.34
Part-time farmer	-0.18	-0.29	-0.21	-0.07	0.05
R^2	0.32	0.17	0.11	0.39	0.19
F-test	2.09	0.86	0.56	2.82*	1.04

*$p < .05$
**$p < .001$

or were presently utilizing eradication techniques. There were 15.9% of respondents who had knowledge of the eradication methods of the GAS but have not implemented these methods. This can be due to them not experiencing any issues of the GAS or they didn't want to use chemicals, or they have pets/animals that would be affected by some of the eradication methods [18]. The lack of respondents in the "decision" or "persuasion" phases, however, raises the possibility that these farmers' innovation-decision process is not linear. Many people may have jumped straight from awareness to implementation or confirmation possibly due to the urgency posed by the GAS. The absence of farmers in the "no knowledge" stage further demonstrates the effectiveness of awareness programs in educating people about the fundamentals of the eradication techniques.

Regarding the effect of GAS on farmers, the majority of farmers reported adverse impacts, such as crop damage and increased production costs, demonstrating the financial and time constraints GAS poses on agricultural output. This highlights the need for an efficient eradication method. Farmers usually saw utilizing GAS eradication methods as having a relative advantage in terms of innovation qualities, particularly in terms of economic profitability, reduced distress, time savings, and rapid advantages. This means farmers use or plan to use eradication methods of GAS because they see a relative advantage in using these methods. Perceptions of trialability and relative advantage in the Narine et al. [11] study suggest that Extension officers thought SMS was a better communication tool than other options and that they had positive experiences using SMS to interact with farmers. The "low initial cost" received less agreement, which would mean that some farmers are worried about the upfront costs of using these techniques. Regarding compatibility, farmers expressed agreement that the techniques match their future goals and increase production yield, but their opinions on how well the methods work with earlier pest management techniques were less unanimous.

Farmers perceived the eradication methods as less complex since they were simple to understand and execute with minimal mistakes, making the adoption process less overwhelming. There were demonstrations and workshops offered by the Ministry of Agriculture on how to use eradication methods for the GAS. Also, information was sent out to the public via flyers, advertisements, and social media to name a few. Regarding trialability, farmers expressed varying opinions. While they agreed that they may test methods without any obligation, they were unsure about the necessity of new materials or the accessibility of testing devices. This suggests there may be room for improvement in offering trial opportunities to farmers. Results from a study by Hsbollah and Idris [19] have demonstrated the significance of trialability, along with academic specialization, and relative advantages in determining adoption decisions prior to the introduction of new online technologies and instructional delivery in the field of education.

Observability was the weakest of the innovation characteristics, with farmers expressing neutrality toward the visibility and publicization of the GAS eradication methods. This may indicate that in order to highlight the benefits of these eradication methods and promote their greater adoption, further demonstration or communication initiatives are required. Hayes et al. [12] stated that the major factor in staff acceptance of the process innovation resulting from Lean Systems Thinking was the animated computer simulation's mix of trialability and observability. Some farmers believed that the Ministry of Agriculture did not adequately publicize the eradication methods. Those that had no support but were affected either gained information from other farmers are used trial and error methods to determine what methods would work to eradicate the GAS.

Some of the farmers who participated in the interviews said they were unaware of these programs and would utilize fellow farmers' knowledge or agro-chemical personnel on how to use eradication methods for GAS. This demonstrates that there is a gap between farmers and extension. There is a 1:600 ratio of extension officers to farmers [20]. An increase in participatory extension can assist in closing the gap between extension and farmers. Using participatory extension techniques can also help government agencies, non-governmental organizations, and other rural development-focused organizations increase the efficacy of their rural extension initiatives [20]. Narine et al. [11], in their study on extension officers use of

Information and Communications Technology (ICT's) stated that extension officers were able to meet farmers needs through the use of Short Messaging Service (SMS).

The relationship between personal characteristics and innovation perceptions revealed some notable trends. Higher educated farmers are more inclined to see the advantages of experimenting with new techniques, as seen by the positive correlation found between education level and views of relative advantage and trialability. Farming status (full-time vs. part-time) was also significantly associated to trialability, with part-time farmers more likely to regard the procedures as testable. Age and gender did not significantly correlate with innovation characteristics, indicating that farmers' opinions of GAS eradication techniques are not heavily influenced by these aspects.

The regression analysis revealed, sociodemographic variables explained 32% of the variance in trialability, 11% in complexity, and 32% in perceived relative advantage. Education level was a strong predictor of positive perceptions, with farmers holding bachelor's or master's degrees being more likely to perceive the methods as trialable and having a relative advantage. Ultimately, the attributes that Rogers identified as characteristics of an innovation offer a thorough framework for comprehending the processes of innovation adoption in society. These traits provide insight into the elements that affect people's decisions to adopt eradication methods for the GAS. This study highlights how GAS eradication methods are generally well-perceived among farmers, especially in terms of their relative advantage and compatibility with existing farming practices. It indicates that complexity is not a major barrier, and observability and trialability could be improved to foster greater adoption. Since education level has a significant impact on how people perceive things, training and informational campaigns should target less educated and part-time farmers in order to increase adoption rates. Increased public awareness and demonstration of these methods may help bridge the gap between awareness and broader implementation, ultimately improving the fight against the GAS.

References

1. Florida Department of Agriculture and Consumer Services, "Giant African Land Snail," Florida Department of Agriculture and Consumer Services. https://www.fdacs.gov/Agriculture-Industry/Pests-and-Diseases/Plant-Pests-and-Diseases/Invasive-Mollusks/Giant-African-Land-Snail.
2. Trinidad Express, "Invasion of giant African snails: Barrackpore farmers 'facing real disaster. Daily Express. https://trinidadexpress.com/features/local/invasion-of-giant-african-snails/article_d4412292-cef6-11eb-8b75-7f96855a157a.html
3. A KAbadi Ghadim, Pannell DJ. A conceptual framework of adoption of an agricultural innovation," Agricultural Economics. 1999; 21: 2.
4. Clemons CA, Heidenreich AE, Lindner JR. Assessing the Technical Expertise and Content Needs of Alabama Agriscience Teachers. J Agric Educ. 2018; 59: 87-99.
5. L. and F. Ministry of Agriculture, "Thank you for Participating – GAS Sensitization Campaign," Government of the Republic of Trinidad and Tobago. https://agriculture.gov.tt/media-releases/thank-you-for-participating-gas-sensitization-campaign/
6. Loop News, "Budget 2023: $3M to eradicate Giant African Snails," Loop. Accessed: Apr. 26, 2023. https://tt.loopnews.com/content/budget-2023-3m-eradicate-giant-african-snails.
7. Rogers EM, Diffusion of innovations, 5th Edition. New York: Free Press, 2003.
8. Strong R, Wynn JT, Lindner JR, et al. Evaluating Brazilian agriculturalists' IoT smart agriculture adoption barriers: Understanding stakeholder salience prior to launching an innovation," Sensors. 2022; 22: 18.
9. Li Y, Faculty perceptions about attributes and barriers impacting diffusion of Web-Based Distance Education (WBDE) at the China Agricultural University," Texas A&M University, College Station, 2004.
10. Harder AM. Characteristics and Barriers Impacting the Diffusion of E-Extension Among Texas Cooperative Extension County Extension Agents," Texas A&M University, College Station. 2007.
11. Narine L, Harder A, Roberts G. Extension Officers' Adoption of Modern Information Communication Technologies to Interact with Farmers of Trinidad," Journal of International Agricultural and Extension Education. 2019: 17-34.
12. Hayes KJ, Eljiz K, Dadich A, et al. Trialability, observability and risk reduction accelerating individual innovation adoption decisions. J Health Organ Manag. 2015; 29: 271-294.
13. Martins CBMJ, Steil AV, Todesco JL. Factors influencing the adoption of the Internet as a teaching tool at foreign language schools. Comput Educ. 2004; 42: 353-374.
14. Oxford Business Group, "Farm to table: Nirmalla Debysingh-Persad, CEO, National Agricultural Marketing and Development Corporation, on opportunities for investment and improving production chains," The Report: Trinidad and Tobago 2020. https://oxfordbusinessgroup.com/articles-interviews/farm-to-table-nirmalla-debysingh-persad-ceo-national-agricultural-marketing-and-development-corporation-on-opportunities-for-investment-and-improving-production-chains-interview
15. Lindner JR, Murphy TH, Briers GE. Handling Nonresponse in Social Research. J Agric Educ. 2001; 42: 43-53.
16. Lindner JR, Lindner N. Interpreting Likert type, summated, unidimensional, and attitudinal scales: I neither agree nor disagree, Likert or not. Advancements in Agricultural Development. 2024; 5: 152-163.
17. Benbaba A, Lindner J. Perceptions of barriers to learning management systems among teaching English to speakers of other languages teachers in Alabama and Mississippi. Q Rev Distance Educ. 2023. https://www.thefreelibrary.com/_/print/PrintArticle.aspx?id=766747010

18. Kuhar CW, "Experimental Design: Basic Concepts," in Encyclopedia of Animal Behavior. 2010; 693–695. https://www.sciencedirect.com/topics/medicine-and-dentistry/inferential-statistics#:~:text=Inferential%20statistics%20use%20measurements%20from,research%20design%20and%20sample%20characteristics.
19. Davis JA. Elementary survey analysis. United Kingdom: Prentice-Hall. 1971.
20. Hsbollah HM, Idris KM. E-learning adoption: The role of relative advantages, trialability and academic specialization. Campus-Wide Information Systems. 2009; 26: 54-70.