

**Characteristics and Barriers Impacting the Eradication of an Invasive Species in Trinidad  
and Tobago: Case Study of the Giant African Snail (*Achatina fulica*)**

**A Three Paper Dissertation**

By

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A dissertation submitted to the Graduate Faculty of Auburn University  
in partial fulfillment of the requirements for the Degree of Doctor of Philosophy  
Auburn, Alabama  
December 9, 2023

Keywords: Giant African Snail (*Achatina fulica*), Diffusion of Innovation Theory, Technology  
Acceptance Model, perceived barriers, Mobile Money Transfer Services model,  
sociodemographic factors, level of participation, eradication methods.

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## Abstract

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 (*Achatina fulica*) by farmers. This study used Rogers, (2003) Diffusion of Innovation Theory theoretical framework, an adaptation of the Davis Technology Acceptance Model, and an adaptation of the Mobile Money Transfer Services (MMT's) model to explain factors that contribute to the adoption of the eradication methods of the Giant African Snail (GAS) by farmers in Trinidad and Tobago. A cross-sectional design was used for this study. Analytical and descriptive analysis was done and these included frequencies, percentages, means, standard deviations, correlations, and ordinal regression. 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 the eradication methods of GAS were not complex. Farmers agreed that they had a relative advantage over the eradication methods and the eradication methods were compatible and trailable. Farmers neither agreed nor disagreed that the eradication methods of GAS were observable. There were significant relationships between farmers' farming status and trialability, and between farmers' highest level of education and relative advantage; and trialability.

Farmers believed that concerns about incentives, financial concerns, and planning concerns were very strong barriers to eradication methods for the GAS. In general, farmers feel that time constraints pose a moderate barrier to GAS eradication methods. Farmers felt that concerns about technology were a strong barrier. There were significant relationships between farmers' gender and concerns about incentives and between farmers' gender and planning

concerns. Also, there were significant relationships between farmers' highest level of education and the potential barriers concerns about incentives, planning concerns, and technology concerns as well as between farmers' farming status and the potential barriers concerns about incentives, planning concerns, and technology concerns.

The majority of farmers in this study were males (68.2%) while (31.8%) were females. Thirteen respondents (29.5%) were ages 31- 40, 41- 50, and over the age of 50. Five respondents (11.4%) were under 30 years old. The majority of farmers were from Caroni County (29.5%) and most of the farmers (61.4%) were full-time farmers. Most farmers' (40.9%) level of education was secondary education while there was a substantial amount that had a bachelor's degree (22.8%). Farmers who have secondary education and a bachelor's degree were more likely to have a lower participation rate in eradication methods of GAS and full-time farmers were more likely to have a higher participation rate in the eradication methods of GAS.

## **Acknowledgements**

First and foremost, I would like to thank God for life, health, and strength to be able to complete this project because without him nothing is possible.

I would like to extend my deepest gratitude and thanks to my supervisor, Professor James Lindner, and my committee Members, Associate Professor Christopher Clemons, Assistant Professor Jason McKibben, and Dr. David Chapman for their guidance and support during this study. Special Thanks to Emeritus Professor, Dr. Molnar for his guidance and support and encouraging words. Thank you to Dr. Jeet Ramjattan, Mrs. Sarah Rangai, Mr. Rayber Bowen, Mr. Alpha Sennon, and Mr. Reggie Durgasingh for assisting in planning for data collection in Trinidad. Many thanks to all those who have supported me through this study and to the farmers who participated in the survey. Thanks to Professor George Flowers, Dean of Graduate School for assisting with funding for data collection. To my parents, Trevor and Lenore James, my brother, Richie James, and my niece Nkese James; thank you for your words of encouragement and continued support. Finally, I would like to express my gratitude to my husband Michael Larkin for his unwavering support, reassurance, and encouragement.

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## INTRODUCTION TO THE DISSERTATION

Invasive species can be defined as plants, animals, and other organisms that have been introduced by humans, either purposefully or unintentionally, outside of their native area and have since caused harm to the environment or human interests (Evans, 2003). Global invasions are occurring at an unprecedented rate thanks to expanding worldwide trade, improved transportation, and planned introductions. The local economy is also impacted by invasive alien *Achatina fulica*. More than 80 countries worldwide, primarily in tropical and subtropical areas, have reported the presence of the Giant African Snail (GAS). The GAS has evolved into a dangerous invasive species in Trinidad and Tobago and has had a considerable negative impact on horticulture, agriculture, and natural habitats. The GAS is an invasive species that has caused significant problems in many regions around the world, including Trinidad and Tobago. This species is native to East Africa, but has been introduced to other regions as a result of human activities such as the pet trade, horticulture, and the importation of contaminated foodstuffs (Ministry of Agriculture, 2023a).

Since its introduction to Trinidad and Tobago in the mid-twentieth century, the GAS has become a major agricultural and horticultural pest, causing direct damage to crops and landscapes and indirect damage through the transmission of diseases. The pest is a known carrier of plant infections, such as *Phytophthora* spp., which affects other crops like coffee, bananas, and papaya and causes black pod rot in cocoa. The snail has a high reproductive rate and is able to lay hundreds of eggs per year, which has enabled it to quickly establish populations in new areas (Shirpat, 2010). Additionally, the snail is highly adaptable and can survive in a wide range of habitats, from urban areas to rural farmland, making it difficult to control.

Farmers have faced a lot of issues over the years such as land tenancy issues, continued increases in the prices of chemical pesticides and agricultural equipment, and the loss of crops due to flooding and praedial larceny. The two main laws influencing the restricted operation of the land market are the "Agricultural Small Holdings Tenure Act" and the "Agricultural Contracts Act"(Jacque, 1998). While many prime agricultural lands in Trinidad and Tobago continue to be transformed into residential properties and industrial developments, small farmers have been fighting for secure land tenures and state assistance for agriculture for decades (Wilson, 2016). Many farmers rent their land from private landlords, state-owned companies such as Caroni (1975) Ltd., or the government. In the small farm sector, agricultural land rental is especially crucial (Driver & Prentice-Pierre, 2002).

The rising cost of inputs is one of the main problems farmers encounter and it can be decreased by lowering reliance on imported chemicals(Wynn et al., 2013). Also due to praedial larceny, this causes significant losses and a hefty expense of security, which has made some farmers give up on their entire business (Ganpat & Isaac, 2018). Praedial larceny is the theft of agricultural produce.

Farmers have been able to work through these challenges and provide food for the citizens of Trinidad and Tobago but now added to these issues is the invasion of the GAS which is detrimental to the agriculture sector.

### **Three papers**

1. Mobilizing a Collective Response: Farmer Awareness of the Giant African Snail (*Achatina fulica*) and its Impacts on Trinidad Agriculture
2. Potential Barriers to Farmers Eradicating the Giant African Snail (*Achatina fulica*)
3. Determinants of the Giant African Snail (*Achatina fulica*) Eradication Program Effectiveness: Farm and Personal Characteristics

## PAPER 1

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

#### **Abstract**

The GAS (*Achatina fulica*) continues to be a nuisance to farmers and members of the public and can cause eosinophilic meningitis disease which is a major health concern. In order to combat the GAS (GAS), a four-pronged strategy was adopted, including surveillance, snail collection and eradication, snail bait application, and public education. This study used Rogers, (2003) Diffusion of Innovation Theory theoretical framework to explain the adoption of the eradication methods of the GAS 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 GAS by farmers. A cross-sectional design was used for this study. Analytical and descriptive analysis was done and these included 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 the eradication methods of GAS were not complex. Farmers agreed that they had a relative advantage over the eradication methods and the eradication methods were compatible and trailable. Farmers neither agreed nor disagreed that the eradication methods of GAS were observable. There were significant relationships between farmers' farming status and trialability, and between farmers' level of education and relative advantage; and trialability.

Keywords: Giant African Snail (*Achatina fulica*), Diffusion of Innovation Theory, eradication methods.

## 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 (Florida Department of Agriculture and Consumer Services, 2023). They can cause eosinophilic meningitis disease which is a major health concern and that also destroys farmers' crops (Florida Department of Agriculture and Consumer Services, 2023; Trinidad Express, 2021). 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 and whether to respond to the invasion still arises. 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 (Abadi Ghadim & Pannell, 1999). Another concern according to Clemons et al., (2018) 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 (Ministry of Agriculture, 2023b). 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 (Loop News, 2022).

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, (2003) 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. Strong et al., (2022) noted that adoption of agricultural innovations is directly tied to ease in communicating an innovation to a targeted audience. Rogers (2003) identified the following five crucial steps in the diffusion process; knowledge, persuasion, decision, implementation, and confirmation. Li, (2004) and Harder (2007) adapted Rogers’ (2003) stages in the innovation-decision process to include no knowledge at the beginning of the process.

No knowledge is the first stage in the diffusion process and is when people do not know about the innovation (Li, 2004; Harder, 2007). 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 (Rogers, 2003). Additionally, Rogers (2003) characteristics of innovation distinguished specific characteristics of innovation.

**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 (Rogers, 2003). 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. In Narine et al., (2019) 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 (Rogers, 2003). 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 (Rogers, 2003). 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 (Rogers, 2003). The apparent complexity of the innovation can be decreased by simplifying it or by offering support and training. Hayes et al., (2015) 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 (Rogers, 2003). 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 Martins et al., (2004) 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.

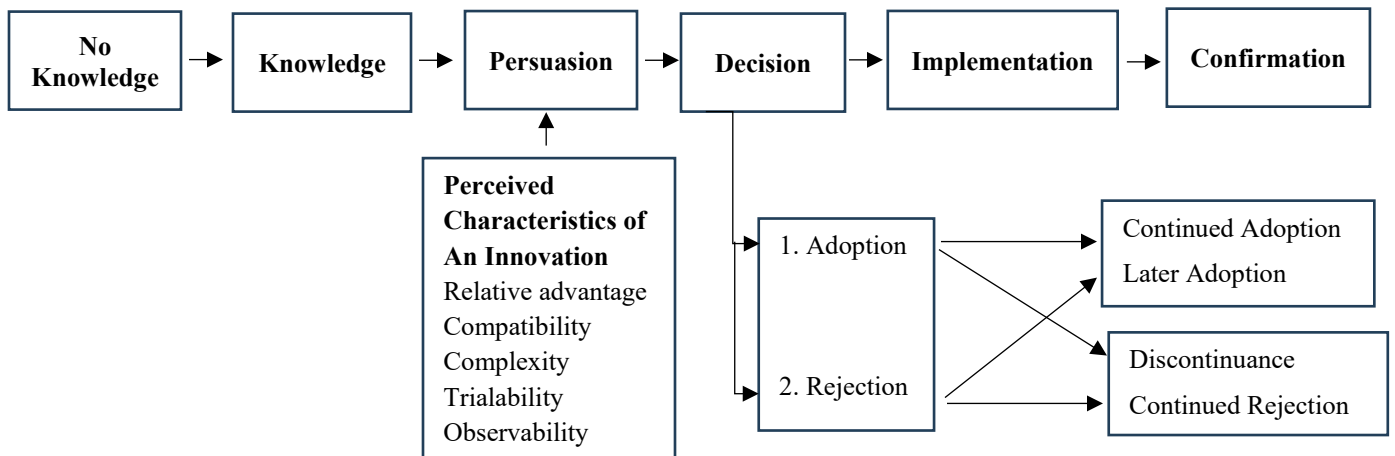


Figure 1.1. Theoretical Framework for the Innovation Decision Process. Adopted from Rogers, (2003).

### 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, based on Li's, (2004) and Harder's (2007) adaptation of Rogers' (2003) stages in the innovation-decision process (no knowledge, knowledge, persuasion, decision, implementation, and confirmation).
2. Determine farmers' perceptions of eradication methods/programs for the GAS based on Rogers' (2003) characteristics of an innovation (relative advantage, compatibility, observability, complexity, and trialability).
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 (Oxford Business Group, 2020). 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 was warranted against generalizing the findings beyond the study participants (Lindner et al., 2001).

### **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, (2007) study on the diffusion of eXtension among the Cooperative Extension agents in the state of Texas and modified for this study. 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, (2007) presented that the first stage includes no knowledge which was added to Rogers' (2003) theory of the decision-process and the innovation. After no knowledge there is knowledge, persuasion, decision, implementation, and confirmation. The perceived attributes of an innovation were categorized into five groups by Rogers (2003). 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 1.00 – 1.80), 2 = Disagree (range 1.81 - 2.60), 3 = Neither Agree nor Disagree (range 2.61 - 3.40), 4 = Agree (range 3.41 - 4.20), 5 = Strongly Agree (range 4.21 - 5.00), (Sözen & Güven, 2019) were used to interpret the overall construct mean for each innovation characteristic in relation to farmers perceived agreement.

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, (2007) and Benbaba & Lindner, (2023) stated five barriers to adoption of innovation. 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 1.00 – 1.80), 2 = Disagree (range 1.81 - 2.60), 3 = Neither Agree nor Disagree (range 2.61 - 3.40), 4 = Agree (range 3.41 - 4.20), 5 = Strongly Agree (range 4.21 - 5.00), (Sözen & Güven, 2019) were used to interpret the overall construct mean for each perceived barrier in relation to farmers agreement.

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  $\alpha$  level for trialability was 0.39 and therefore one item was deleted. Reliability levels  $\geq .80$  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 (Kuhar, 2010). 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' (2003) Diffusion of Innovations theory, this study examined farmers attributes of the eradication methods for the GAS as an innovation. 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 1.00 – 1.80), 2 = Disagree (range 1.81 - 2.60), 3 = Neither Agree nor Disagree (range 2.61 - 3.40), 4 = Agree (range 3.41 - 4.20), 5 = Strongly Agree (range 4.21 - 5.00), (Sözen & Güven, 2019) were used to interpret the overall construct mean for each innovation characteristic in relation to farmers perceived favorability.

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 (Davis, 1971).

## **Results**

### **Objective 1.1: Stages in the innovation-decision process**

Determine farmers' stages in the innovation-decision process, based on Li's, (2004);Harder's (2007) adaptation of Rogers' (2003) stages in the innovation-decision process (no knowledge, knowledge, persuasion, decision, implementation, and confirmation).

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

	Description	<i>f</i>	%
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
		44	100
<b>Total</b>			

### **Effect of GAS on Farmers**

Table 1.2 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 1.2. The Effects of the GAS on Farmers, Trinidad Farmers, 2023.

How GAS has Affected Farmers	<i>f</i>	%
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 1.2: Characteristics of an Innovation

Determine farmers' perceptions of eradication methods/programs for the GAS based on Rogers' (2003) characteristics of an innovation (relative advantage, compatibility, observability, complexity, and trialability).

The second objective was to characterize how farmers perceived the eradication methods of the GAS based on Rogers' (2003) characteristics of an innovation. (1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree). The summated range of the mean responses are: 1 = Strongly Disagree (1.00 – 1.80), 2 = Disagree (1.81 - 2.60), 3 = Neither Agree nor Disagree (2.61 - 3.40), 4 = Agree (3.41 - 4.20), 5 = Strongly Agree (4.21 - 5.00), (Sözen & Güven, 2019).

### **Relative Advantage**

Five statements were used to gauge the perceived relative advantage of using eradication methods for the GAS. In table 1.3, 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 ( $M = 3.61, SD = 1.13$ ).

Table 1.3. Responses of farmers by their perceptions about the relative advantage of using eradication methods for the GAS. Trinidad Farmers, 2023.

Relative Advantage	Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree		M	SD
	f	%	f	%	f	%	f	%	f	%		
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	13.6	2	4.5	15	34.1	20	45.5	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

### Compatibility

Four statements were used to gauge the perceived compatibility of using eradication methods for the GAS. Table 1.4 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 ( $M = 3.84, SD = 1.22$ ), the use of

eradication methods for the GAS is compatible with previously introduction ideas e.g. management, mitigation and control ( $M = 3.45, SD = 0.73$ ) 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” ( $M = 4.55, SD = 0.63$ ). Overall, farmers agreed that there is compatibility when it comes to adoption of the eradication methods for the GAS ( $M = 3.99, SD = 0.86$ ).

Table 1.4. Responses of farmers by their perceptions about the compatibility of using eradication methods for the GAS. Trinidad Farmers, 2023.

Compatibility	Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree		M	SD
	f	%	f	%	f	%	f	%	f	%		
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.

## Complexity

Four statements were used to gauge the perceived complexity of using eradication methods for the GAS. Table 1.5 displays the frequencies, percentages, means and standard deviations for each item. Respondents tended to strongly 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 strongly agreed that there is complexity when it comes to adoption of the eradication methods for the GAS ( $M = 4.38, SD = 0.93$ ).

Table 1.5. Responses of farmers by their perceptions about the complexity of using eradication methods for the GAS. Trinidad Farmers, 2023.

Complexity	Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree		M	SD
	f	%	f	%	f	%	f	%	f	%		
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
<b>Total Average</b>											<b>4.38</b>	<b>0.93</b>

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

## Triability

Three statements were used to gauge the perceived trialability of using eradication methods for the GAS. Table 1.6 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 agreed that trialability helps in adoption of the eradication methods for the GAS ( $M = 3.48$ ,  $SD = 0.98$ ).

Table 1.6. Responses of farmers by their perceptions about the trialability of using eradication methods for the GAS. Trinidad Farmers, 2023.

Triability	Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree		M	SD
	f	%	f	%	f	%	f	%	f	%		
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
<b>Total Average</b>											<b>3.48</b>	<b>0.98</b>

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



## Observability

Four statements were used to gauge the perceived observability of using eradication methods for the GAS. Table 1.7 displays the frequencies, percentages, means and standard deviations for each item. Respondents tended to neither agree nor disagree with the 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 ( $M = 2.68, SD = 1.34$ ) and the results of eradication methods for the GAS are easily visible to potential users ( $M = 3.36, SD = 1.18$ )”. They agree with the statement, “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 ( $M = 3.04, SD = 1.25$ ).

Table 1.7. Responses of farmers by their perceptions about the observability of using eradication methods for the GAS. Trinidad Farmers, 2023.

Observability	Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree		M	SD
	f	%	f	%	f	%	f	%	f	%		
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
<b>Total Average</b>											<b>3.04</b>	<b>1.25</b>

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

### **Objective 1.3: 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 of eradication methods/programs for the GAS based on Rogers (2003) 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.

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 1.8 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.

Table 1.8. 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

### Gender

Table 1.9 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.

Table 1.9. 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

\*\*Correlation is significant at the 0.01 level

### Level of Education

Table 1.10 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.

Table 1.10. 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

### Farming Status

Table 1.11 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 1.11. 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 1.12 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 triable. Also, farmers who have a master's degree were 1.12 times more likely to perceive that eradication methods were triable.

Table 1.12. 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 <sup>2</sup>	0.32	0.17	0.11	0.39	0.19
F-test	2.09	0.86	0.56	2.82*	1.04

\* $p < .05$

\*\* $p < .001$

## **Discussion, Conclusion and Recommendations**

The first objective was to determine farmers' stages in the innovation-decision process, based on Li's, (2004) and Harder's (2007) adaptation of Rogers' (2003) stages in the innovation-decision process (no knowledge, knowledge, persuasion, decision, implementation, and confirmation).

Approximately fifty-seven percent (56.8%) of respondents stated they were in the advanced stages of adoption. This meant that the vast majority of participants were already using eradication methods of the GAS at the time of data collection. There were approximately sixteen percent (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(Capinera, 2011).

The second objective was to determine farmers' perceptions of eradication methods/programs for the GAS based on Rogers' (2003) characteristics of an innovation (relative advantage, compatibility, observability, complexity, and trialability). Overall, it was agreed that there is a relative advantage to using eradication methods for the GASs as 4 out of the five statements were agreed upon. About 29.5 % of respondents agreed that economic profitability is an advantage of using eradication methods for the GAS while 45.5 % of respondents agreed there is a decrease in some kind of distress is an advantage of using eradication methods for the GAS. Also, 31.8 % of respondents agreed that saving time and/or effort is an advantage of using eradication methods for the GAS and 34.1 % of respondents agreed that the benefits of using eradication methods for the GAS are immediate and that is an advantage of using these methods. 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. (2019) 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.

Most farmers agreed when it comes to the compatibility of the eradication methods for the GAS. The Ministry of Agriculture, Land and Fisheries had programs in place previously to deal with the GAS when it first arrived in Trinidad and Tobago. These would have been mitigating methods that were used to control and eradicate. However, due to the invasive nature of the GAS, it has become a nuisance. In recent times the Ministry of Agriculture has included the farmers and members of the public to join in these efforts to eradicate the GAS instead of trying to deal with it themselves as an organization.

In general, the majority of farmers strongly agreed with the complexity of using eradication methods for the GAS. 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.

Overall, farmers agreed that trialability helps in adoption of the eradication methods for the GAS. They believed that by testing the methods encouraged them to fully commit to it especially if these methods work. Results from a study by (Hsbollah & Idris, 2009) 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.

Most farmers neither agree nor disagree that observability helps in adoption of the eradication methods for the GAS. Hayes et al., (2015) 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 do enough to publicize the eradication methods. Those that had no support but were affected either gained information from other farmers or used trial and error methods to determine what methods would work to eradicate the GAS.

The third objective was to describe the relationships between farmers' selected personal characteristics and their perceptions of eradication methods/programs for the GAS.

There was no relationship between farmers' age and the characteristics of an innovation and farmers' gender and the characteristics of an innovation. There was however a significant relationship between farmers' farming status and trialability and between farmers' highest level of education and relative advantage. Also, there was a significant relationship between farmers' highest level of education and trialability.

Education, particularly farmers who had a bachelor's degree or master's degree believed that eradication methods were both trialable and had a relative advantage. Also, females were less likely to perceive that eradication methods were not complex.

Some of the farmers that were interviewed stated that they did not have any knowledge of these programs and would utilize fellow farmers' knowledge or agro-chemical personnel on how to use eradication methods for GAS. This shows that there is a disconnect between farmers and extension in some areas. Although some farmers would have gained knowledge and directives on how to use eradication methods of GAS. This was due to limited/ no communication with extension officers. There is a 1:600 ratio of extension officers to farmers (Ganpat et al., 2017). There needs to be an increase in participatory extension to help close the gap between extension and farmers. Using participatory extension techniques can help government agencies, non-

governmental organizations, and other rural development-focused organizations increase the efficacy of their rural extension initiatives (Hagmann et al., 2000). Narine et al., (2019), 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).

Ultimately, the attributes that Rogers identified as characteristics of an innovation offer a thorough framework for comprehending the processes of innovation adoption in society. In this study, these traits provide insight into the elements that affect people's decisions to adopt eradication methods for the GAS. Through deliberate attention to these attributes, it was shown that even though not all farmers agreed with some of the attributes, those that did has led to the agreement of using eradication methods for GAS.

## PAPER 2

### Potential Barriers to Farmers Eradicating the Giant African Snail (*Achatina fulica*)

#### Abstract

Trinidad was first exposed to the Giant African Snail (*Achatina fulica*) in October 2008. With the introduction of awareness campaigns, surveillance, and chemical and cultural treatments to assist in eradicating the Giant African Snail (GAS), there were also some barriers that were encountered when implementing the eradication methods. This study used an adaptation of the Davis Technology Acceptance Model to explain barriers to the adoption of the eradication methods of the GAS by farmers in Trinidad and Tobago. A cross-sectional design was used for this study. Analytical and descriptive analysis was done and these included frequencies, percentages, means, standard deviations, and correlations. Results show that farmers believed that concerns about incentives, financial concerns, and planning concerns were very strong barriers to eradication methods for the GASs. Farmers felt that time constraints pose a moderate barrier to GAS eradication methods and concerns about technology were a strong barrier. There were significant relationships between farmers' gender and concerns about incentives, and planning concerns. Also, there were significant relationships between farmers' highest level of education and concerns about incentives, planning concerns, and technology concerns as well as between farmers' farming status and concerns about incentives, planning concerns, and technology concerns.

Keywords: Giant African Snail (*Achatina fulica*), Technology Acceptance Model, perceived barriers, eradication methods

## Introduction

Trinidad was first exposed to the Giant African Snail (*Achatina fulica*) in October 2008. The government immediately began an eradication operation utilizing the "New Pest Guidelines: Giant African Snails" published by the United States Department of Agriculture, (2007) as a guide. In the Diego Martin Valley's most densely populated areas, the pest has become well-established by 2012. The public awareness campaign, surveillance, and chemical treatment were three key pillars used in the eradication program to control and eventually eliminate the Giant African Snail (GAS) (Balfour et al., 2014). In order to combat the GAS, a four-pronged strategy was adopted, including surveillance, snail collection and eradication, snail bait application, and public education (Shripat, 2010). Due to the disease that the GAS carries along with it being very deadly and ease to repopulate, there are hesitance from some citizens of Trinidad and Tobago to deal with the issue.

The GAS's management tactics have been impacted by Trinidad and Tobago's dry and wet season periods. Snails are notably more common from July to December during the wet season and extremely rare from January to June during the dry season (Ramdwar, 2018). In Trinidad and Tobago, the production of vegetable crops is mostly dependent on rainfall, and the GAS poses a serious danger to public health, food security, and farmer livelihoods. Given that snails can become dormant during the dry season, their influence on crop productivity during this time is minimal to nonexistent.

With the introduction of awareness campaigns, surveillance, and chemical and cultural treatments to assist in eradicating the GAS, there are also some barriers that are encountered when implementing the eradication methods. In order to overcome this, (Moon et al., 2015), stated that many of the barriers to successful eradication can be removed if a functional approach

to stakeholder participation is used to co-produce and apply knowledge within a co-management governance system.

### **Literature Review and Theoretical Framework**

In today's rapidly evolving world, innovation is the lifeline of progress and success for individuals, organizations, and societies. However, the adoption of innovation is not always seamless. According to several studies, overcoming consumers' reluctance to adopt innovations requires a more nuanced approach than the traditional innovation research that has focused on innovation characteristics as the path to success (Rogers, 2003). There are two types of barriers that are identified when researching consumer resistance: (1) functional barriers, where consumers assess the adoption's implications in terms of usage, value, and risk; and (2) psychological barriers, which primarily result from conflicts with consumers' preexisting beliefs (Porter & Donthu, 2006). There were studies conducted on low-input agriculture that looked at barriers that would prevent it from being adopted, such as lower yields, more labor expenses, greater variable costs, and a lack of alternative inputs (Diebel et al., 1993). These are the main financial barriers that hamper the adoption of low-input agriculture. In looking at the barriers preventing Integrated Pest Management (IPM) adoption in underdeveloped nations, Parsa et al., (2014) discovered that the most commonly mentioned impediments to non-adoption include ignorance, lower literacy rates, insufficient IPM training, and a lack of supportive legislation.

According to a study by Butler & Sellbom, (2002) there are three factors that imposed barriers to adoption. They lack institutional support, lack of financial support and lack of time to learn new technologies. A study based on web-based technology in instruction by Abrahams, (2010) also stated there are three barriers to adopting an innovation. They are technological

support, financial support and infrastructure. Hovey et al., (2019) also stated that lack of time, logistical difficulties, and satisfaction with existing teaching methods are all factors that decreased faculty willingness to adopt an innovation.

Li's, (2004) study on Web-Based Distance Education (WBDE) identifies ten perceived barriers to the diffusion of WBDE. They are “concerns about time, concerns about incentives, WBDE program credibility, financial concerns, planning issues, conflict with traditional education, fear of technology, technical expertise, administrative support, and infrastructure.”

Harder, (2007) and Benbaba & Lindner, (2023) conducted similar studies and selected five barriers to adoption of innovation from Li, (2004) study that were applicable to their research. These are concerns about time, concerns about incentives, financial concerns, planning concerns and technology concerns.

Concerns about time: One of the most common barriers to innovation adoption is the perception that it will consume valuable time. Persons can often resist change due to concerns about disruptions to their daily routines. Consequently, asking persons to switch to a method that may be more time-consuming by nature, may lead to persons resisting adoption (Brownell & Tanner, 2012).

Concerns about incentives: Incentives boost workers' motivation and foster employee loyalty because they give the impression that employers value both their contributions and their needs. Employees who have performed well will feel demotivated and perform worse if their employers do not offer incentives. They will also be less likely to trust the organization's policies and processes, which could also reduce employee loyalty (Tetrault Sirsly & Lamertz, 2008).

Financial concerns: Investing in innovation can be expensive, and there might be reluctance to allocate substantial funds without a clear return on investment. Adoption can be severely hampered by high initial expenses (Tidd & Bessant, 2021).

Planning concerns: A barrier that can arise from implementing a plan is ambiguity and the inability to encourage candid communication among the participants. With careful planning, it is possible to overcome many implementation issues (Masters, 1996). Adopting innovation entails careful planning, which is a difficult undertaking for many firms. The planning process may be hampered by unclear departmental goals or inconsistencies. Planning issues frequently result from a lack of clearly defined plans, which causes uncertainty and opposition within the business (Chesbrough, 2003).

Technology concerns: New technologies are frequently introduced as part of innovations, which might be frightening for people who are not technologically inclined. Adoption may be hampered by worries about technology, such as its compatibility, security, and complexity. These issues are examined in (Davis, 1989) research on the Technology Acceptance Model.

The conceptual model (Figure 2.1) has been constructed based on the Davis Technology Acceptance Model. This adapted model uses potential barriers to adoption which are concerns about time, concerns about incentives, financial concerns, planning concerns and technology concerns.



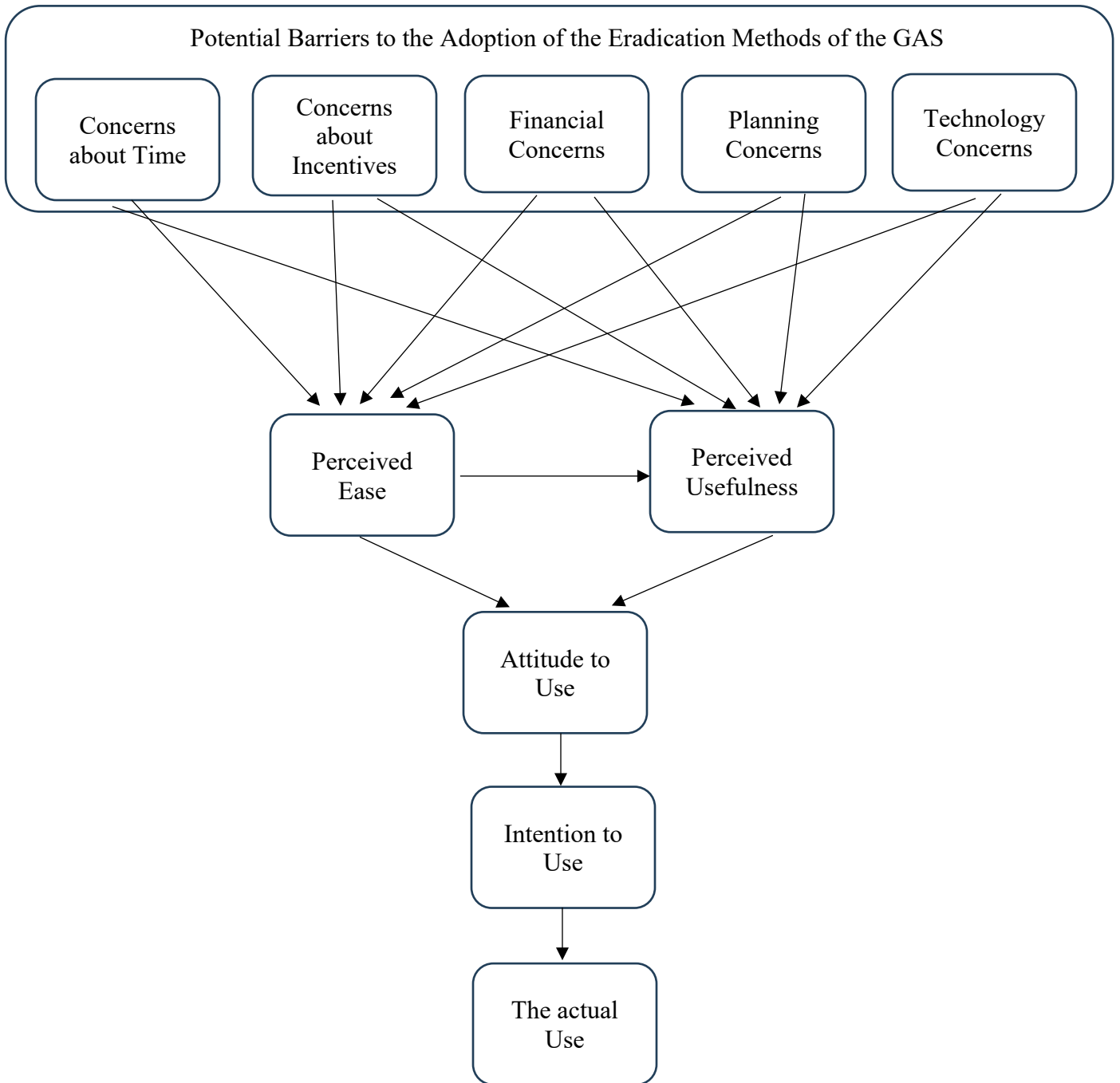


Figure 2.1. Theoretical Framework for the potential barriers to the adoption of the eradication methods of the GAS. Adapted from Esmailpour et al., (2016).

## **Objectives**

The purpose of this study is to understand the influence of barriers to the adoption of eradication methods/programs for the GAS by farmers in Trinidad and Tobago.

The objectives for this study are:

1. Determine farmers' perceptions of potential barriers (concerns about time, concerns about incentives, financial concerns, planning issues, and technology concerns) to the adoption of eradication methods/programs for the GAS.
2. Describe the relationships between farmers' selected personal characteristics and potential barriers of eradication methods/programs for the GAS.

## **Methods**

### **Sample**

Participants (n=53) are farmers from Trinidad. There are approximately 23 000 registered farmers of the 35,000 farmers in general in Trinidad and Tobago (Oxford Business Group, 2020). 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 was warranted against generalizing the findings beyond the study participants (Lindner et al., 2001).

## **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, (2007) study on the diffusion of eXtension among the Cooperative Extension agents in the state of Texas and modified for this study. 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, (2007) presented that the first stage includes no knowledge which was added to Rogers' (2003) theory of the decision-process and the innovation. After no knowledge there is knowledge, persuasion, decision, implementation, and confirmation. The perceived attributes of an innovation were categorized into five groups by Rogers (2003). 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 1.00 – 1.80), 2 = Disagree (range 1.81 - 2.60), 3 = Neither Agree nor Disagree (range 2.61 - 3.40), 4 = Agree (range 3.41 - 4.20), 5 = Strongly Agree (range 4.21 - 5.00), (Sözen & Güven, 2019) were used to interpret the overall construct mean for each innovation characteristic in relation to farmers perceived agreement.

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, (2007) and Benbaba & Lindner, (2023) stated five barriers to adoption of innovation. 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 1.00 – 1.80), 2 = Disagree (range 1.81 - 2.60), 3 = Neither Agree nor Disagree (range 2.61 - 3.40), 4 = Agree (range 3.41 - 4.20), 5 = Strongly Agree (range 4.21 - 5.00), (Sözen & Güven, 2019) were used to interpret the overall construct mean for each perceived barrier in relation to farmers agreement.

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. Concerns about time = 0.93, Concerns about incentives = 0.78, Financial concerns = 0.80, Planning concerns = 0.86, and Technology = 0.78.

Reliability levels  $\geq .80$  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 (Kuhar, 2010). 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' (2003) Diffusion of Innovations theory, this study examined farmers attributes of the eradication methods for the GAS as an innovation. 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 1.00 – 1.80), 2 = Disagree (range 1.81 - 2.60), 3 = Neither Agree nor Disagree (range 2.61 - 3.40), 4 = Agree (range 3.41 - 4.20), 5 = Strongly Agree (range 4.21 - 5.00), (Sözen & Güven, 2019) were used to interpret the overall construct mean for each innovation characteristic in relation to farmers perceived favorability.

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 (Davis, 1971).

### Eradication Methods

Table 2.1 shows the distribution of participating farmers who are familiar or not familiar with the eradication methods for the GAS. Forty-two respondents stated that they are familiar with the different types of eradication methods for the GAS. Two respondents stated that they are not familiar with the different types of eradication methods for the GAS. All forty-four respondents answered this question.

Table 2.1. Familiarity with Eradication Methods. Trinidad Farmers, 2023.

Familiarity with the different types of eradication methods of the GAS	<i>f</i>	%
Yes	42	95.5
No	2	4.5
Total	44	100

### Types of Eradication Methods

Table 2.2 shows the distribution of participating farmers who are familiar with the different types of eradication methods for the GAS. It can be shown that five respondents stated that they are familiar with the trap method while thirty-four respondents stated that they are familiar with the bait method. Results also show that twenty-four respondents are familiar with the spray method and twenty-six respondents are familiar with the salt water solution. Twenty-one respondents are familiar with the bleach water solution and fourteen respondents are familiar with the bounty system.

Table 2.2. Eradication Methods. Trinidad Farmers, 2023.

Eradication Methods for the GAS	<i>f</i>	%
Chemical method 1 - trap method	5	11.4
Chemical method 2 - bait method	34	77.3
Chemical method 3 - spray method	24	54.5
Cultural method 1 - salt water solution	26	59.1
Cultural method 2 - bleach water solution	21	47.7
GAS Sensitization Campaign - bounty system	14	31.8
Total responses	124	281.8



## **Objective 2.1: Perceived Barriers**

Determine farmers' perceptions of potential barriers (concerns about time, concerns about incentives, financial concerns, planning issues, and technology concerns) to the adoption of eradication methods/programs for the GAS. (1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree). The summated range of the mean responses are: 1 = Strongly Disagree (1.00 – 1.80), 2 = Disagree (1.81 - 2.60), 3 = Neither Agree nor Disagree (2.61 - 3.40), 4 = Agree (3.41 - 4.20), 5 = Strongly Agree (4.21 - 5.00), (Sözen & Güven, 2019).

### **Time Concerns**

Four statements were used to gauge the time concerns of farmers as a result of using the eradication methods for GAS. Table 2.3 displays the frequencies, percentages, means and standard deviations for each item. Respondents perceived that the potential barriers with regards to time were moderate for these statements “There is a lack of time available to farmers to learn about eradication methods of GAS ( $M = 2.80$ ,  $SD = 1.07$ ), there is a lack of time available to source materials to conduct eradication methods of GAS ( $M = 2.66$ ,  $SD = 1.06$ ), there is a lack of time to meet your needs using eradication methods of GAS ( $M = 2.80$ ,  $SD = 1.00$ ) and there is a lack of time available to search for information of eradication methods of GAS ( $M = 2.75$ ,  $SD = 1.04$ ).” Overall, farmers believe that time concerns were a moderate barrier of using eradication methods for the GASs ( $M = 2.75$ ,  $SD = 1.04$ ).

Table 2.3. Responses of farmers time concerns as a perceived barrier to using eradication methods for the GAS. Trinidad Farmers, 2023.

Time Concerns	No Barrier		Weak Barrier		Moderate Barrier		Strong Barrier		Very Strong Barrier		M	SD
	f	%	f	%	f	%	f	%	f	%		
There is a lack of time available to farmers to learn about eradication methods of GAS	3	6.8	19	43.2	8	18.2	12	27.3	2	4.5	2.80	1.07
There is a lack of time available to source materials to conduct eradication methods of GAS	4	9.1	20	45.5	9	20.5	9	20.5	2	4.5	2.66	1.06
There is a lack of time to meet your needs using eradication methods of GAS	3	6.8	17	38.6	11	25	12	27.3	1	2.3	2.80	1.00
The is a lack of time available to search for information of eradication methods of GAS	4	9.1	17	38.6	10	22.7	12	27.3	1	2.4	2.75	1.04
Total Average											2.75	1.04

Note: Overall M=2.75; SD=1.04, scale: 1=No Barrier, 2=Weak Barrier, 3=Moderate Barrier, 4=Strong Barrier, 5=Very Strong Barrier.

### Concerns About Incentives

Three statements were used to gauge the incentive concerns of farmers as a result of using the eradication methods for GAS. Table 2.4 displays the frequencies, percentages, means and standard deviations for each item. Respondents perceived that the potential barriers with regards to incentives were very strong for all statements “there is a lack of compensation for farmers using eradication methods of GAS ( $M = 4.64, SD = 0.78$ ), there is lack of recognition for farmers using eradication methods of GAS ( $M = 4.50, SD = 0.93$ ) and there is a lack of support from the Ministry of Agriculture ( $M = 4.34, SD = 1.10$ ).” Overall, farmers believe that concerns

about incentives were a very strong barrier of using eradication methods for the GASs ( $M = 4.49$ ,  $SD = 0.94$ ).

Table 2.4. Responses of farmers' concerns about incentives as a perceived barrier to using eradication methods for the GAS. Trinidad Farmers, 2023.

Concerns about Incentives	No Barrier		Weak Barrier		Moderate Barrier		Strong Barrier		Very Strong Barrier		M	SD
	f	%	f	%	f	%	f	%	f	%		
There is a lack of compensation for farmers using eradication methods of GAS	0	0	2	4.5	2	4.5	6	13.6	34	77.3	4.64	0.78
There is lack of recognition for farmers using eradication methods of GAS	1	2.3	1	2.3	4	9.1	7	15.9	31	70.5	4.50	0.93
There is a lack of support from the Ministry of Agriculture	1	2.3	4	9.1	3	6.8	7	15.9	29	65.9	4.34	1.10
<b>Total Average</b>											<b>4.49</b>	<b>0.94</b>

Note: Overall  $M=4.49$ ;  $SD=0.94$ , scale: 1=No Barrier, 2=Weak Barrier, 3=Moderate Barrier, 4=Strong Barrier, 5=Very Strong Barrier.

### Financial Concerns

Four statements were used to gauge the financial concerns of farmers as a result of using the eradication methods for GAS. Table 2.5 displays the frequencies, percentages, means and standard deviations for each item. Respondents perceived that the potential barriers with regards to financial resources were very strong for all statements “there is a lack of compensation for farmers using eradication methods of GAS ( $M = 4.57$ ,  $SD = 0.79$ ), there is a lack of financial resources to conduct eradication methods of GAS ( $M = 4.59$ ,  $SD = 0.76$ ), there is a lack of financial resources to promote eradication methods of GAS among the farming community ( $M =$

4.45,  $SD = 0.88$ ) and there is a high cost to purchasing the necessary materials/ chemicals ( $M = 4.68, SD = 0.74$ ). Overall, farmers believe that financial concerns were a very strong barrier of using eradication methods for the GASs ( $M = 4.57, SD = 0.79$ ).

Table 2.5. Responses of farmers’ financial concerns as a perceived barrier to using eradication methods for the GAS. Trinidad Farmers, 2023.

Financial Concerns	No Barrier		Weak Barrier		Moderate Barrier		Strong Barrier		Very Strong Barrier		M	SD
	f	%	f	%	f	%	f	%	f	%		
There is a lack of funds for farmers using eradication methods of GAS	0	0	1	2.3	5	11.4	6	13.6	32	72.7	4.57	0.79
There is a lack of financial resources to conduct eradication methods of GAS	0	0	1	2.3	4	9.1	7	15.9	32	72.7	4.59	0.76
There is a lack of financial resources to promote eradication methods of GAS among the farming community	0	0	2	4.5	5	11.4	8	18.2	29	65.9	4.45	0.88
There is a high cost to purchasing the necessary materials/ chemicals	0	0	2	4.5	1	2.3	6	13.6	35	79.5	4.68	0.74
Total Average											4.57	0.79

Note: Overall  $M=4.57$ ;  $SD=0.79$ , scale: 1=No Barrier, 2=Weak Barrier, 3=Moderate Barrier, 4=Strong Barrier, 5=Very Strong Barrier.

### Planning Concerns

Four statements were used to gauge the financial concerns of farmers as a result of using the eradication methods for GAS. Table 2.6 displays the frequencies, percentages, means and standard deviations for each item. Respondents perceived that the potential barriers with regards to planning were very strong for these statements “there is a lack of identifying needs for farmers

for eradication methods program ( $M = 4.43$ ,  $SD = 0.85$ ), there is a lack of strategic planning for farmers ( $M = 4.50$ ,  $SD = 0.85$ ) and there is a lack of coordination between farmers and the Ministry of Agriculture ( $M = 4.59$ ,  $SD = 0.76$ ).” Respondents also perceived that “there is a lack of planned opportunities for farmers to learn about eradication methods of the GAS ( $M = 4.68$ ,  $SD = 0.74$ )” is a strong barrier. Overall, farmers believe that planning concerns were a very strong barrier of using eradication methods for the GASs ( $M = 4.43$ ,  $SD = 0.89$ ).

Table 2.6. Responses of farmers planning concerns as a perceived barrier to using eradication methods for the GAS. Trinidad Farmers, 2023.

Planning Concerns	No Barrier		Weak Barrier		Moderate Barrier		Strong Barrier		Very Strong Barrier		M	SD
	f	%	f	%	f	%	f	%	f	%		
There is a lack of identifying needs for farmers for eradication methods program	0	0	2	4.5	4	9.1	11	25	27	61.4	4.43	0.85
There is a lack of strategic planning for farmers	0	0	2	4.5	4	9.1	8	18.2	30	68.2	4.50	0.85
There is a lack of coordination between farmers and the Ministry of Agriculture	0	0	1	2.3	4	9.1	7	15.9	32	72.7	4.59	0.76
There is a lack of planned opportunities for farmers to learn about eradication methods of the GAS	0	0	6	13.6	6	13.6	6	13.6	26	59.1	4.18	1.13
Total Average											4.43	0.89

Note: Overall  $M=4.43$ ;  $SD=0.89$ , scale: 1=No Barrier, 2=Weak Barrier, 3=Moderate Barrier, 4=Strong Barrier, 5=Very Strong Barrier.

## Technology Concerns

Three statements were used to gauge technology concerns of farmers as a result of using the eradication methods for GAS. Table 2.7 displays the frequencies, percentages, means and standard deviations for each item. Respondents perceived that “there is a lack of technology transfer for farmers ( $M = 4.14, SD = 1.05$ ) and there is a lack of training programs for farmers to learn how to conduct eradication methods of the GAS ( $M = 4.14, SD = 1.11$ )” were strong technological barriers. Respondents also perceived that “there is a lack of information provided online on eradication methods of GAS ( $M = 3.00, SD = 1.03$ )” is a moderate barrier.

Table 2.7. Responses of farmers Technology concerns as a perceived barrier to using eradication methods for the GAS. Trinidad Farmers, 2023.

Technology Concerns	No Barrier		Weak Barrier		Moderate Barrier		Strong Barrier		Very Strong Barrier		M	SD
	f	%	f	%	f	%	f	%	f	%		
There is a lack of technology transfer for farmers	1	2.3	3	6.8	6	13.6	13	29.5	21	47.7	4.14	1.05
There is a lack of training programs for farmers to learn how to conduct eradication methods of the GAS	1	2.3	4	9.1	6	13.6	10	22.7	23	52.3	4.14	1.11
There is a lack of information provided online on eradication methods of GAS	1	2.3	15	34.1	16	36.4	7	15.9	5	11.4	3.00	1.03
Total Average											3.76	1.06

Note: Overall  $M=3.76$ ;  $SD=1.06$ , scale: 1=No Barrier, 2=Weak Barrier, 3=Moderate Barrier, 4=Strong Barrier, 5=Very Strong Barrier.

## **Objective 2.2: Relationships Between Personal Characteristics and Perceived Barriers**

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

The second objective was to describe the relationships between farmers' selected personal characteristics including age, gender, level of education, farming status. Farmers' perceptions of eradication methods were described based on the following potential barriers: time concerns, concerns about incentives, financial concerns, planning concerns, and technology concerns. Pearson's correlation and Kendall Tau- b were used to show the relationships between selected personal characteristics and the characteristics of an innovation.

### **Age**

Table 2.8 displays the correlations between age and perceived barriers.

*Pearson:* There were no significant relationships between the age of respondents and perceived barriers. All associations were low or negligible.

*Kendall Tau-b:* There were no significant relationships between the age of respondents and perceived barriers. All associations were low or negligible.

Table 2.8. Pearson and Kendall Tau-b Correlations between Age and Perceived Barriers. Trinidad Farmers, 2023.

	Pearson \ Kendall Tau-b Correlations					
	1.	2.	3.	4.	5.	6.
1. Age	1	-0.058	-0.195	-0.102	-0.164	-0.136
2. Time Concerns	-0.038	1	0.042	0.123	0.038	0.136
3. Concerns About Incentives	-0.083	-0.014	1	.689**	.749**	.525**
4. Financial Concerns	-0.069	0.095	.693**	1	.497**	.541**
5. Planning Concerns	-0.127	0.004	.676**	.561**	1	.659**
6. Technology Concerns	-0.07	0.08	.476**	.501**	.525**	1

\*Correlation is significant at the 0.05 level

\*\*Correlation is significant at the 0.01 level

### Gender

Table 2.9 displays the correlations between age and perceived barriers.

*Pearson:* There was a significant, moderate negative relationship between respondents' gender and concerns about incentives,  $r(44) = -.328, p < .05$ . No other significant relationships were found for time concerns, financial concerns, planning concerns, and technology concerns.

*Kendall Tau-b:* There was a significant, moderate negative relationship between respondents' gender and concerns about incentives,  $tb(44) = -.302, p < .05$ , and gender and planning concerns,  $tb(44) = -.307, p < .05$ . No other significant relationships were found for time concerns, financial concerns, and technology concerns.

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



Table 2.9. Pearson and Kendall Tau-b Correlations between Gender and Perceived Barriers. Trinidad Farmers, 2023.

	Pearson \ Kendall Tau-b Correlations					
	1	2	3	4	5	6
1. Female	1	0.117	-.328*	-0.062	-0.273	-0.052
2. Time Concerns	0.086	1	0.042	0.123	0.038	0.136
3. Concerns About Incentives	-.302*	-0.014	1	.689**	.749**	.525**
4. Financial Concerns	-0.21	0.095	.693**	1	.497**	.541**
5. Planning Concerns	-.307*	0.004	.676**	.561**	1	.659**
6. Technology Concerns	-0.105	0.08	.476**	.501**	.525**	1

\*Correlation is significant at the 0.05 level

\*\*Correlation is significant at the 0.01 level

### Level of Education

Table 2.10 displays the correlations between level of education and perceived barriers.

*Pearson:* There were no significant relationships between the level of education of respondents and perceived barriers. All associations were low or negligible.

*Kendall Tau-b:* There was a significant, low negative relationship between respondents' level of education and concerns about incentives,  $tb(44) = -.270, p < .05$ , and level of education and planning concerns,  $tb(44) = -.320, p < .05$ . There was also a significant, moderate negative relationship between respondents' level of education and technology concerns,  $tb(44) = -.270, p < .05$ . No other significant relationships were found for time concerns and financial concerns.

Table 2.10. Pearson and Kendall Tau-b Correlations between Level of Education and Perceived Barriers. Trinidad Farmers, 2023.

	Pearson \ Kendall Tau-b Correlations					
	1	2	3	4	5	6
1. Level of Education	1	-0.008	-0.145	-0.153	-0.247	-0.172
2. Time Concerns	-0.039	1	0.042	0.123	0.038	0.136
3. Concerns About Incentives	-.270*	-0.014	1	.689**	.749**	.525**
4. Financial Concerns	-0.222	0.095	.693**	1	.497**	.541**
5. Planning Concerns	-.320*	0.004	.676**	.561**	1	.659**
6. Technology Concerns	-.270*	0.08	.476**	.501**	.525**	1

\*Correlation is significant at the 0.05 level

\*\*Correlation is significant at the 0.01 level

### Farming Status

Table 2.11 displays the correlations between farming status and perceived barriers.

*Pearson:* There was a significant, moderate negative relationship between respondents' farming status and concerns about incentives,  $r(44) = -.463, p < .05$ , farming status and planning concerns,  $r(44) = -.356, p < .05$ , and farming status and technology concerns,  $r(44) = -.489, p < .05$ . No other significant relationships were found for time concerns and financial concerns.

*Kendall Tau-b:* There was a significant, moderate negative relationship between respondents' farming status and concerns about incentives,  $tb(44) = -.436, p < .05$ , farming status and planning concerns,  $tb(44) = -.365, p < .05$ , and farming status and technology concerns,  $tb(44) = -.452, p < .05$ . No other significant relationships were found for time concerns and financial concerns.

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 2.11. Pearson and Kendall Tau-b Correlations between Farming Status and Perceived Barriers. Trinidad Farmers, 2023.

	Pearson \ Kendall Tau-b Correlations					
	1	2	3	4	5	6
1. Part-time Farmer	1	-0.025	-.463**	-0.246	-.356*	-.489**
2. Time Concerns	-0.044	1	0.042	0.123	0.038	0.136
3. Concerns About Incentives	-.436**	-0.014	1	.689**	.749**	.525**
4. Financial Concerns	-0.259	0.095	.693**	1	.497**	.541**
5. Planning Concerns	-.365**	0.004	.676**	.561**	1	.659**
6. Technology Concerns	-.452**	0.08	.476**	.501**	.525**	1

\*Correlation is significant at the 0.05 level

\*\*Correlation is significant at the 0.01 level

### Regression of Perceived Barriers to Eradication Prevention

Table 2.12 displays an Ordinary Least Squares (OLS) regression of perceived barriers to eradication prevention on selected farmers.

The R-Square (concerns about incentives) was 0.36. This means 36% of variance in the perceived barrier of concerns about incentives 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 part-time farmers were 0.60 times less likely to perceive that concerns about incentives were a barrier to eradication methods.

The R-Square (planning concerns) was 0.36. This means 36% of variance in the perceived barrier of planning concerns 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 master's degree were 0.87 times less likely to perceive that financial concerns were a barrier to eradication methods.

The R-Square (technology concerns) was 0.48. This means 48% of variance in the perceived barrier of technology concerns 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 went to trade school were 1.11 times more likely to perceive that technology concerns were a barrier to eradication methods. Also, farmers who have a master's degree were 1.33 times less likely to perceive that technology concerns were a barrier to eradication methods.

Table 2.12. Regression of Perceived Barriers to Eradication Prevention on Selected Farmers Trinidad Farmers 2023.

	Standardized Beta Coefficient				
	Time Concerns	Concerns about Incentives	Financial Concerns	Planning Concerns	Technology Concerns
(Constant)	3.04**	5.45**	5.24**	5.48**	4.59**
Age	-0.01	-0.02	-0.01	-0.02	-0.01
Female	0.28	-0.21	0.19	-0.16	0.25
Primary education	0.01	0.70	0.70	0.68	0.36
Trade school	0.16	0.36	0.49	0.46	1.11*
Associates degree	-0.80	0.11	0.06	-0.59	-0.35
Bachelor's degree	-0.05	-0.24	-0.44	-0.36	-0.23
Master's degree	-0.45	0.23	-0.11	-0.87*	-1.33*
Part-time farmer	0.15	-0.60*	-0.15	0.00	-0.33
R <sup>2</sup>	0.09	0.36	0.24	0.36	0.48
F-test	0.45	2.40*	1.36	2.46*	3.99*

\* $p < .05$

\*\* $p < .001$

## **Discussion, Conclusion and Recommendations**

The first objective was to determine farmers' perceptions of potential barriers (concerns about time, concerns about incentives, financial concerns, planning issues, and technology concerns) to the adoption of eradication methods/programs for the GAS. Farmers believed that time concerns were a moderate barrier as all four statements were considered moderate barriers. Brownell & Tanner, (2012) stated that people may reject adoption if the adoption an innovation is inherently more time-consuming. Concerns about incentives, financial concerns and planning concerns were very strong barriers for farmers when it came to adopting eradication methods of GAS. More than 65% of farmers have stated that that all three statements for incentive concerns were very strong barriers. Tetrault Sirsly & Lamertz, (2008) stated that offering incentives makes employees feel that their bosses appreciate their needs and contributions, which increases motivation and cultivates employee loyalty. If incentives are not provided, motivated employees will become less productive or participative This was the same for financial concerns where all four statements were considered very strong barriers. Farmers stressed that there is a high cost to the eradication of the GAS. The main chemical used as well as the bait is very expensive. According to Tidd & Bessant, (2021), innovation investment can be costly, and large sums of money may be reluctantly spent in the absence of a definite return on investment. Exorbitant upfront costs can seriously impede adoption. More than 59% of farmers have stated that all four statements for planning concerns were very strong barriers. Lack of clearly defined plans often leads to ambiguity and resistance inside the company, which in turn generates planning challenges (Chesbrough, 2003). There is a disconnect and lack of coordination between the Ministry of Agriculture. However, farmers believe that technology concerns were a moderate barrier. Access has an impact on how information technology is used, so farmers' access to

resources would be restricted in countries within the Caribbean with low internet penetration (Renwick, 2010) .

There were 95.5% of farmers who were familiar with the eradication methods for the GAS. Of the 95.5% of farmers, 77.3 were familiar with the bait method while 54.5% were familiar with the spray method. Approximately 59% of farmers were familiar with the salt water solution while 47.7% were familiar with the bleach water solution.

The second objective was to describe the relationships between farmers' selected personal characteristics and potential barriers of eradication methods/programs for the GAS. There was no relationship between farmers' age and potential barriers to eradication methods for GAS. There were however significant relationships between farmers' gender and concerns about incentives and between farmers' gender and planning concerns. Also, there were significant relationships between farmers' level of education and the potential barriers concerns about incentives, planning concerns, and technology concerns. Similarly, there were significant relationships between farmers' farming status and the potential barriers concerns about incentives, planning concerns, and technology concerns.

Part-time farmers were less likely to perceive that concerns about incentives were a barrier to eradication methods while farmers who have a master's degree were less likely to perceive that financial concerns and technology concerns were barriers to eradication methods. Farmers who went to trade school were more likely to perceive that technology concerns were a barrier to eradication methods.

There are potential barriers at every stage of the adoption innovation process. The degree and effectiveness of innovation adoption are influenced by a number of factors, including concerns about time, concerns about incentives, financial concerns, planning concerns, and technology concerns. To

embrace and reap the benefits of innovation, people, companies, and society must recognize these barriers and take proactive steps to overcome them.

## PAPER 3

### Determinants of the Giant African Snail (*Achatina fulica*) Eradication Program

#### Effectiveness: Farm, and Personal Characteristics

#### Abstract

There has been an active drive by the Ministry of Agriculture to get the public involved in participating in the eradication methods for the Giant African Snail (*Achatina fulica*). Some of these would include disseminating information to the public, offering training to farmers, and orchestrating a bounty system for a reward. Some of the factors that would affect participation would not only include characteristics of an innovation or perceived barriers, but also the characteristics of persons participating. This study uses an adaptation of the Mobile Money Transfer Services (MMT's) model to explain the relationship between sociodemographic factors and the level of participation in the use of eradication methods for the Giant African Snail (GAS) by farmers in Trinidad and Tobago. A cross-sectional design was used for this study. Analytical and descriptive analysis was done and these included frequencies, percentages and ordinal regression. Results show that the majority of farmers in this study were males (68.2%) while (31.8%) were females. Thirteen respondents (29.5%) were ages 31- 40, 41- 50, and over the age of 50. Five respondents (11.4%) were under 30 years old. The majority of farmers were from Caroni County (29.5%) and most of the farmers (61.4%) were full-time farmers. Most farmers' (40.9%) level of education was secondary education while there was a substantial amount that had a bachelor's degree (22.8%). Farmers who have secondary education and a bachelor's degree were more likely to have a lower participation rate in eradication methods of GAS.



Keywords: Giant African Snail (*Achatina fulica*), sociodemographic factors, level of participation, Mobile Money Transfer Services model, eradication methods.

## **Introduction**

The impacts of the Giant African Snail (*Achatina fulica*) in Trinidad and Tobago are far-reaching and diverse. In addition to causing direct damage to crops and landscapes, the snail is also capable of transmitting a number of diseases to both humans and livestock, which can have significant economic and public health impacts. The snail can also be a nuisance to homeowners, as it often invades gardens and other landscaped areas, causing significant damage to vegetation (Thiengo et al., 2007).

In order to control the Giant African Snail (GAS) populations in Trinidad and Tobago, a variety of control strategies have been implemented. These strategies include the use of chemical controls, such as snail baits and molluscicides, as well as biological controls, such as the introduction of predator species that feed on the snail. Additionally, a number of non-lethal control methods, such as the use of physical barriers and manual removal, have also been employed (Shirpat, 2010).

Despite the efforts of agricultural and wildlife authorities, the GAS remains a persistent and challenging problem in Trinidad and Tobago. In order to better understand the biology and ecology of the species and to develop more effective control strategies, a number of research studies have been conducted in Trinidad and Tobago and in other regions where the snail has become established. These studies have aimed to better understand the distribution and abundance of the snail, as well as its life cycle, reproductive biology, and feeding habits.

There has also been an active drive by the Ministry of Agriculture to get the public involved in participating in the eradication methods for the GAS. Some of these would include disseminating information to the public, offering training to farmers, and orchestrating a bounty system for a reward. Some of the factors that would affect participation would not only include characteristics of an innovation or perceived barriers (Rogers, 2003; Benbaba & Lindner, 2023), but also the characteristics of persons participating.

### **Literature Review and Theoretical Framework**

Socio-demographic statuses are the sociological and demographic characteristics that a person or people in a population acquires and which establish their socio-demographic roles, positions, or niches, as well as the associated socio-demographic advantages they achieve and succeed in. It gives us information about the sociodemographic makeup of the person or people. Sociodemographic characteristics of a population or an individual have primarily been studied not only to provide information on the social and demographic makeup of a group/ population but also to offer a connected understanding of a particular phenomenon (Bindawa Abdullahi, 2020). These factors include a variety of characteristics pertaining to people's social and economic standing, age, gender, race, ethnicity, income, and marital status, to name a few.

Certain individuals are more likely than others to try and embrace new ideas, and early adopters play a crucial role in the adoption of innovation. Research has indicated that employment, along with factors like age, gender, education level, and income play a significant role in the adoption of an innovation (Im et al., 2003; Westin et al., 2018). There are a few studies that look at sociodemographic factors impacting adoption and/or level of participation. The relationships

between sociodemographic factors impacting adoption and/or level of participation shown in these studies were determined using some type of regression.

Panyavaranant et al., (2023) looked into the sociodemographic variables affecting the level of public participation in Khon Kaen, Thailand's light rail transit (LRT) project. The results of the multinomial logit regression analysis showed that the likelihood of participation at a high level was significantly influenced by residential location and income. Conversely, there were significant effects of age and occupation on medium participation.

Yoon et al., (2021) looked at the relationship between leisure participation and sociodemographic factors. An ordinal regression determined sociodemographic factors associated with older adults were found to be significantly correlated with their involvement in leisure activities. These factors included age, gender, education level, economic activity, and perceived financial satisfaction.

Azam, (2015) study also looks at how sociodemographic characteristics affect the adoption of organic farming practices. Sociodemographic factors were educational qualification, mode of transport, electronic accessories, agricultural training, and agricultural loans. The outcome shows how these sociodemographic variables have impacted farmers' decisions to make the transition to organic farming. Conventional farmers continue to lag behind in many areas, while organic farmers were more informed and in touch with society.

Age: One basic sociodemographic factor that has a big impact on a lot of different facets of a person's life is their age. Age groupings frequently display unique demands, preferences, and behaviors. Early adopters are typically younger than later adopters and laggards, according to the diffusion of innovation theory (Rogers, 2003), therefore, focus should be placed on marketing to the elderly and raising awareness (Margaret & Ngoma, 2013).

Gender: Gender significantly influences the roles and expectations of society. Individuals' chances and choices are influenced by societal ideas regarding gender roles. There are still differences between both genders in areas like employment, education, and resource availability (World Economic Forum, 2019). In a study on mobile phone adoption among farmers in Bangladesh, the gender ratio revealed that most of the farmers were men (Islam & Grönlund, 2011).

Education: One important sociodemographic factor that influences a person's possibilities and socioeconomic status is their level of education. Higher education levels are frequently linked to greater income and job opportunities. Research done on the adoption of mobile banking shows that mobile usage is more common among men, who tend to be better educated and earn higher wages (Sulaiman et al., 2007).

Employment Status: A person's employment status has a significant impact on both their financial security and their ability to contribute to society. Social problems and financial difficulties might result from underemployment or unemployment. The welfare of society as a whole is enhanced by policies that promote entrepreneurship, vocational training, and job creation (Blinder, 2006).

The conceptual model (Figure 3.1) has been constructed based on Marumbwa's, (2014) sociodemographic variables and acceptance and use of Mobile Money Transfer Services (MMT's) model. This adapted model uses levels of participation (from no participation to very high participation) and consumers adoption of MMT's was replaced by adoption of eradication methods of GAS.

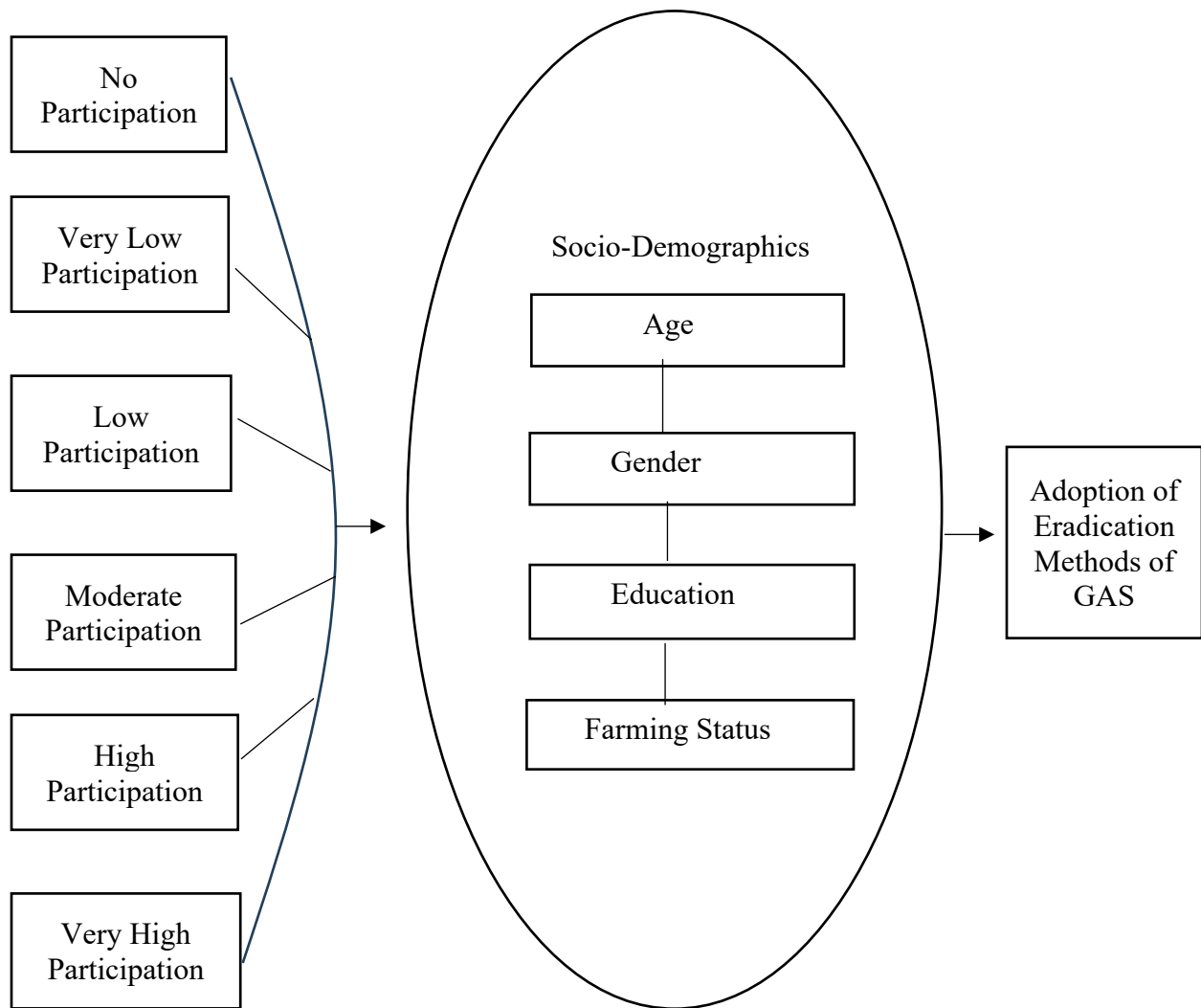


Figure 3.1. Conceptual model of adoption of eradication methods based on level of participation and socio-demographic variables. Adapted from Marumbwa, (2014).

## **Objectives**

The purpose of this study is to show the relationship between sociodemographic variables and the level of participation in the use of eradication methods for the GAS by farmers in Trinidad and Tobago.

The objectives for this study are:

1. Describe selected personal characteristics of farmers.
2. Determine the effects of the level of participation in using the eradication methods for the GAS on sociodemographic factors.

## **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 (Oxford Business Group, 2020). 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 was warranted against generalizing the findings beyond the study participants (Lindner et al., 2001).

## **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, (2007) study on the diffusion of eXtension among the Cooperative Extension agents in the state of Texas and modified for this study. 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, (2007) presented that the first stage includes no knowledge which was added to Rogers' (2003) theory of the decision-process and the innovation. After no knowledge there is knowledge, persuasion, decision, implementation, and confirmation. The perceived attributes of an innovation were categorized into five groups by Rogers (2003). 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 1.00 – 1.80), 2 = Disagree (range 1.81 - 2.60), 3 = Neither Agree nor Disagree (range 2.61 - 3.40), 4 = Agree (range 3.41 - 4.20), 5 = Strongly Agree (range 4.21 - 5.00), (Sözen & Güven, 2019) were used to interpret the overall construct mean for each innovation characteristic in relation to farmers perceived agreement.

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 (2007) and Benbaba & Lindner, (2023) stated five barriers to adoption of innovation. 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 1.00 – 1.80), 2 = Disagree (range 1.81 - 2.60), 3 = Neither Agree nor Disagree (range 2.61 - 3.40), 4 = Agree (range 3.41 - 4.20), 5 = Strongly Agree (range 4.21 - 5.00), (Sözen & Güven, 2019) were used to interpret the overall construct mean for each perceived barrier in relation to farmers agreement.



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.

Reliability levels  $\geq .80$  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 (Kuhar, 2010). 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' (2003) Diffusion of Innovations theory, this study examined farmers attributes of the eradication methods for the GAS as an innovation. 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 1.00 – 1.80), 2 = Disagree (range 1.81 - 2.60), 3 = Neither Agree nor Disagree (range 2.61 - 3.40), 4 = Agree (range 3.41 - 4.20), 5 = Strongly Agree (range 4.21 - 5.00), (Sözen & Güven, 2019) were used to interpret the overall construct mean for each innovation characteristic in relation to farmers perceived favorability.

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 (Davis, 1971).

## Results

### Objective 3.1: Personal Characteristics

The first objective was to show and describe the findings related to the selected characteristics of Farmers who may or may not be affected by the GAS. Frequency tables were used to describe the personal characteristics of farmers.

#### Characteristics of Farmers

Table 3.1 shows the distribution of participating farmers ( $n=44$ ) by their characteristics. Five respondents (11.4%) were under 30 years old. Thirteen respondents (29.5%) were ages 31-40 and thirteen respondents (29.5%) were ages 41- 50. Another thirteen respondents (29.5%) were over the age of 50. Thirty respondents (68.2%) were male and fourteen respondents (31.8%) were female. It can be shown that four respondents (9.1%) have up to primary school education while eighteen respondents (40.9%) have secondary education. Five respondents (11.4%) have an associate degree while 10 respondents (22.8%) have a bachelor's degree. Results also show that five respondents (11.4%) have a master's degree and two respondents (4.5%) went to trade school. Twenty-seven respondents (61.4%) were full-time farmers and seventeen respondents (38.6%) were part-time farmers. It can be shown that Thirteen respondents (29.5%) farms are located in Caroni County while one respondent (2.3%) farm is located in Mayaro County. Three respondents (6.8 %) and one respondent (2.3%) have their farms located in Nariva County and St. Andrew County respectively. Also, seven respondents (15.9%) farms are located in St. George East County while eight respondents (18.2%) farms are located in St. George West County. Three respondents (6.8 %) and one respondent (2.3%) have their farms located in St. Patrick East County and St. Patrick West County respectively. Seven

respondents' farms are located in Victoria County. Thirty-four respondents stated that there is GAS on their farms while ten stated that they do not have GAS present on their farms. All forty-four respondents responded to these questions.

Table 3.1. Personal Characteristics of Farmers. Trinidad Farmers, 2023.

Age	<i>f</i>	%	Farming Status	<i>f</i>	%
< 31	5	11.4	Full-time	27	61.4
31 - 40	13	29.5	Part-time	17	38.6
41 - 50	13	29.5	Total	44	100
> 50	13	29.5	Farm Location		
Total	44	100	Caroni	13	29.5
Gender			Mayaro	1	2.3
Male	30	68.2	Nariva	3	6.8
Female	14	31.8	St. Andrew	1	2.3
Total	44	100	St. George East	7	15.9
Level of Education			St. George West	8	18.2
Primary education	4	9.1	St. Patrick East	3	6.8
Secondary education	18	40.9	St. Patrick West	1	2.3
Associate degree	5	11.4	Victoria	7	15.9
Bachelor's degree	10	22.7	Total	44	100
Master's degree	5	11.4	GAS on Farm		
Trade school	2	4.5	Yes	34	77.3
Total	44	100	No	10	22.7
			Total	44	100

### Methods Used to Inform the Public About Eradication Methods

Table 3.2 shows the methods used to inform the public about eradication methods for the GAS. It can be shown that respondents thirty-three respondents knew about eradication methods through advertisements while fourteen stated that they knew through factsheets. Ten farmers stated that they saw bulletins while eight saw pest advisories. Five farmers were informed through social media while three got the information from word of mouth. Two farmers were informed through manuals and another two by attending an exhibition. One farmer each were inform through extension or through outreach.

Table 3.2. Methods Used to Inform the Public About Eradication Methods, Trinidad Farmers, 2023.

Methods Used to Inform the Public About Eradication Methods	<i>f</i>	%
Advertisements	33	75
Factsheets	14	31.8
Bulletins	10	22.7
Pest advisories	8	18.2
Social Media	5	11.4
Word of mouth	3	6.8
Manuals	2	4.5
Exhibition	2	4.5
Extension	1	2.3
Outreach	1	2.3
Total Responses	79	179.5

### **Objective 3.2: Level of Participation in Using the Eradication Methods on Sociodemographic Factors**

The second objective was to assess how sociodemographic factors affect the level of participation in using the eradication methods for the GAS. An ordinal regression was used to determine the relationship between sociodemographic factors and the level of participation in using the eradication methods for the GAS.

In table 3.3, the model shows a good fit to the data as the significance level is .000 for the model fitting information. The goodness of fit statistic indicates a good fit as the significant value  $p > .05$ . The Nagelkerke value of R-Square is 0.433. This means 43.3% of variance in the level of participation in eradication methods can be accounted for by sociodemographic factors. The test of parallel lines tests the assumption of proportional odds and is 0.484 which is  $> .05$ . Based on the results it is shown that farmers who have secondary education are more likely to have a lower participation rate in eradication methods of GAS. Also, farmers who have a bachelor's degree are more likely to have a lower participation rate in eradication methods of GAS. Farmers who were full-time were more likely to have a higher participation rate in the eradication methods of GAS. All other sociodemographic factors were not significant.

Table 3.3. Ordinal regression showing the relationship between sociodemographic factors and the level of participation in using the eradication methods for the GAS. Trinidad Farmers, 2023.

	Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Very Low Participation	-17.19	1.752	96.26	1	<.001	-20.63	-13.76
High Participation	-15.35	1.786	73.88	1	<.001	-18.85	-11.85
Age	0.044	0.031	2.022	1	0.155	-0.017	0.105
Male	-0.199	0.762	0.068	1	0.794	-1.694	1.295
Female	0 <sup>a</sup>	.	.	0	.	.	.
Primary Education	0.065	6654.21	0	1	1	-13041.9	13042.08
Secondary Education	-19.09	1.265	227.71	1	<.001	-21.57	-16.611
Associate degree	1.367	5994.85	0	1	1	-11748.3	11751.06
Bachelor's Degree	-18.34	1.168	246.59	1	<.001	-20.63	-16.05
PhD Degree	-17.27	0	.	1	.	-17.27	-17.27
Trade School	0 <sup>a</sup>	.	.	0	.	.	.
Full-time Farmer	1.923	0.977	3.879	1	0.049	0.009	3.838
Part-time Farmer	0 <sup>a</sup>	.	.	0	.	.	.
<b>Model Fitting Information</b>			<b>-2 Log Likelihood</b>		<b>Chi-Square</b>	<b>df</b>	<b>Sig.</b>
Intercept Only			81.601				
Final			61.252		20.349	8	0.009
<b>Test of Parallel Lines</b>							
Null Hypothesis			61.252				
General			53.758		7.494	8	0.484
<b>Goodness-of-Fit</b>					<b>Chi-Square</b>	<b>df</b>	<b>Sig.</b>
Pearson					62.772	70	0.718
Deviance					58.244	70	0.841
<b>Pseudo R-Square</b>							
Cox and Snell					0.370		
Nagelkerke					0.433		
McFadden					0.239		

Note: <sup>a</sup> This parameter is set to zero because it is redundant

### Comments and Recommendations by Trinidad Farmers

Table 3.4 shows comments and recommendations by Farmers of Trinidad on how to manage the GAS and assist farmers. Nine farmers believe that the Ministry of Agriculture should provide/subsidize snail bait and chemicals for farmers while eight farmers believe that the Ministry of Agriculture should be more innovative in training their farmers as well as trying to conduct further outreach. Four farmers stated that there are some farmers who may not know how to use smartphones or the internet. This was in relation to technology concerns as a potential barrier. Three farmers stated that the bounty system was not feasible as it did not benefit farmers. One farmer each stated there is no literature stating how safe and successful these eradication methods are, there need to be a more results-oriented and real systems with proper metrics & and reporting nationally and there should be targeted policies/policies that will be more effective.

Table 3.4. Comments and Recommendations, Trinidad Farmers, 2023.

Comments and Recommendations by Farmers	<i>f</i>	%
The Ministry of Agriculture should provide/subsidize snail bait and chemicals for farmers since it is very expensive.	9	20.5
Poor outreach by extension officers. External experts should be sourced. There is a lack of approach to training farmers by the Ministry of Agriculture	8	18.2
There are some farmers who may not know how to use smart phones or the internet	4	9.1
Bounty system not feasible. Farmers did not benefit from this program	3	6.8
There is no literature stating how safe and successful these eradication methods are.	1	2.3
There should be targeted policies/policies that will be more effective.	1	2.3
More results oriented and real systems with proper metrics & reporting nationally. Better education with monthly updates on all constituencies on both islands to be published to public especially agriculture stakeholders.	1	2.3
No Response	17	38.7
Total	44	100



## **Discussion, Conclusion and Recommendations**

Among those surveyed, males outnumbered females. There was 68.24% male participation and 31.8% female participation. In the Caribbean, women are more proficient at food marketing and males dominate in farming (Beckford & Campbell, 2013). Farmers' ages were almost equivalent across age groupings. About 11.4% of farmers were under 30 years old while 29.5% of farmers were ages 31- 40, ages 41- 50, and over the age of 50 respectively. CSO (2004) statistics state that farmers are primarily men, with an average age of fifty. Farmers in this study were either full-time or part-time farmers. About 61.4% were full-time farmers and 38.6% were part-time farmers. A study by Patterson & Ganpat, (2019) showed farmers that are full-time and depend only on agriculture for an income is 65% while 33% of farmers are part-time and have another source of income. Due to similarities, it can be said that approximately two-thirds of farmers are full-time farmers. Most of the respondents' highest level of education is secondary education (40.9 %). Participation in using the eradication methods for GAS, farmers who have secondary education and a bachelor's degree are more likely to have a lower participation rate in eradication methods of GAS. Also, farmers who were full-time were more likely to have a higher participation rate in the eradication methods of GAS. This means that full time farmers are more committed to participating in eradication methods due to farming being their only source of income compared to part time farmers.

There were approximately 10 methods used to inform the public about eradication methods. Of these, advertisements (33), fact sheets (14), and bulletins (10) were the most popular way to inform the public. There are many complaints about the high prices of chemicals and snail bait but using the cultural methods of salt water solution and bleach water solution are cheaper alternatives. Farmers can switch to cultural methods to reduce input costs.

Farmers also complained about poor outreach by extension officers. To bridge the gap between extension and farmers, more participatory extension is required. Governmental agencies, non-governmental organizations, and other groups with an emphasis on rural development can boost the effectiveness of their rural extension programs by utilizing participatory extension strategies (Hagmann et al., 2000).

When discussing the relationship between sociodemographic factors and the stages in the Innovation Decision Process, it's important to consider that these factors can interact in complex ways. Individuals from different demographic backgrounds may experience these stages differently, and the adoption process can vary based on the nature of the innovation and the specific context.

The adoption of innovations is significantly influenced by sociodemographic characteristics such as age, gender, income and education. Understanding the role of these factors can help policymakers tailor their strategies to encourage the adoption of innovations among different demographic groups. Given how quickly technology is developing and how society is changing, future studies should keep looking into these connections.

## OVERVIEW AND CONCLUSION

According to Rogers (2003), the innovation-decision process involves a number of factors, including trialability, observability, compatibility, relative advantage, and complexity. Overall, it was agreed that eradication methods for the GAS have a relative advantage, are compatible and trialable. This means farmers use or plan to use eradication methods of GAS because they see a relative advantage, compatibility and trialability in using these methods. The Ministry of Agriculture, Land and Fisheries had programs in place previously to deal with the GAS when it first arrived in Trinidad and Tobago. These would have been mitigating methods that were used to control and eradicate. However, due to the invasive nature of the GAS, it has become a nuisance. In recent times the Ministry of Agriculture has included the farmers and members of the public to join in these efforts to eradicate the GAS instead of trying and deal with it themselves as an organization.

When it comes to the GAS eradication methods' compatibility, the majority of farmers agreed overall. When it came to their perception regarding the complexity of employing eradication techniques for the GAS and the GAS, most farmers expressed a solid consensus overall. Farmers generally thought that GAS eradication techniques were straightforward and easy to follow. Overall, farmers agreed that trialability helps in adoption of the eradication methods for the GAS. Most farmers neither agree nor disagree that observability helps in adoption of the eradication methods for the GAS.

There was no correlation found between the age or gender of the farmer and the characteristics of an innovation. Nonetheless, a strong correlation was found between a farmer's trialability and farming position, as well as between a farmer's level of education and relative

advantage. Additionally, there was a strong correlation between trialability and farmers' highest level of education.

Overall, it was perceived by farmers that there were very strong barriers to eradication methods for the GAS with regard to concerns about incentives, financial concerns, and planning concerns. In general, farmers feel that time constraints pose a moderate barrier to GAS eradication methods. Financial concerns, planning concerns, and concerns about incentives were seen as very strong barriers to adopting GAS eradication methods for farmers. Farmers feel that concerns about technology were a moderate barrier. Farmers reported that a large number of farmers lack internet browsing and smartphone usage skills. This indicates that their access to information is limited and that it is not prompt.

Most of the farmers are over the age of 30 and more than half of the farmers are full time farmers. Forty-nine percent of the respondents have secondary education. When it comes to their involvement in the GAS eradication process, farmers with a bachelor's degree and a secondary education are more likely to have lower rates of participation.

Due to some farmers and citizens not being affected by GAS, it can be difficult to eradicate if they do not partake in these eradication methods. If farmers can work together, the GAS can be eradicated completely. Also, data for agriculture in Trinidad and Tobago is outdated. The last agricultural census was in 2004. This is a great opportunity to conduct another agricultural census at this time. This will help with research purposes such as trends and forecasting. This can give more accuracy to the farming population and better assist all farmers. There is also the need for policies that will correspond with assisting farmers. Increased communication with farmers to find the gaps and know their needs can help in better policy making.

The eradication of the Giant African Snail in Trinidad and Tobago is crucial for the preservation of agricultural productivity and economic stability. Farmers can efficiently manage snail populations and enjoy the advantages of higher crop yields, cost savings, and sustainable agriculture by implementing a combination of chemical, biological, and cultural control strategies. These techniques guarantee a peaceful coexistence between agriculture and the environment and are in line with international initiatives to develop ecologically friendly pest management techniques.

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## APPENDIX A

### Description of Tables

#### Cronbach Alpha of the Characteristics of An Innovation

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.

Table 1 Cronbach Alpha of the Characteristics of An Innovation

Measures	Scale	Cronbach Alpha	Number of Items by Construct (Items Used for This Research)
Relative Advantage	Five-point summative scale	0.63	5 (5)
Compatibility	Five-point summative scale	0.69	4 (4)
Complexity	Five-point summative scale	0.96	4 (4)
Observability	Five-point summative scale	0.81	4 (4)
Trialability	Five-point summative scale	0.45	4 (3)

The original  $\alpha$  level for trialability was 0.39 and therefore one item was deleted. Reliability levels  $\geq .80$  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).

### Cronbach Alpha of Perception of Potential Barriers

Cronbach alphas were determined for internal consistency with data from the Survey. Concerns about time = 0.93, Concerns about incentives = 0.78, Financial concerns = 0.80, Planning concerns = 0.86, and Technology = 0.78.

Table 2. Cronbach Alpha of Perception of Potential Barriers

Measures	Scale	Cronbach Alpha	Number of Items by Construct (Items Used for This Research)
Concerns about time	Five-point summative scale	0.93	4 (4)
Concerns about incentives	Five-point summative scale	0.78	3 (3)
Financial concerns	Five-point summative scale	0.80	4 (4)
Planning concerns	Five-point summative scale	0.86	4 (4)
Technology concerns	Five-point summative scale	0.78	3 (3)

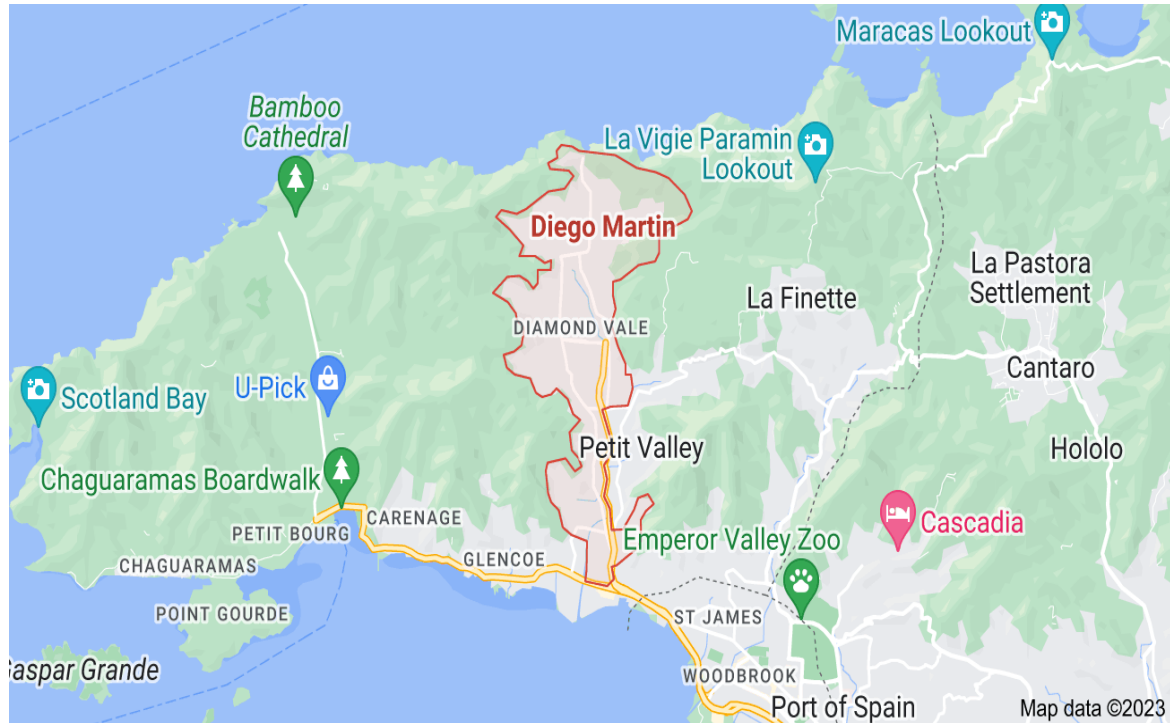
Reliability levels  $\geq 0.80$  were considered acceptable (Harder, 2007) but Taber, (2018)

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).

## APPENDIX B

### Maps

Figure 1. Map of Diego Martin Trinidad and Tobago. Trinidad Farmers 2023.

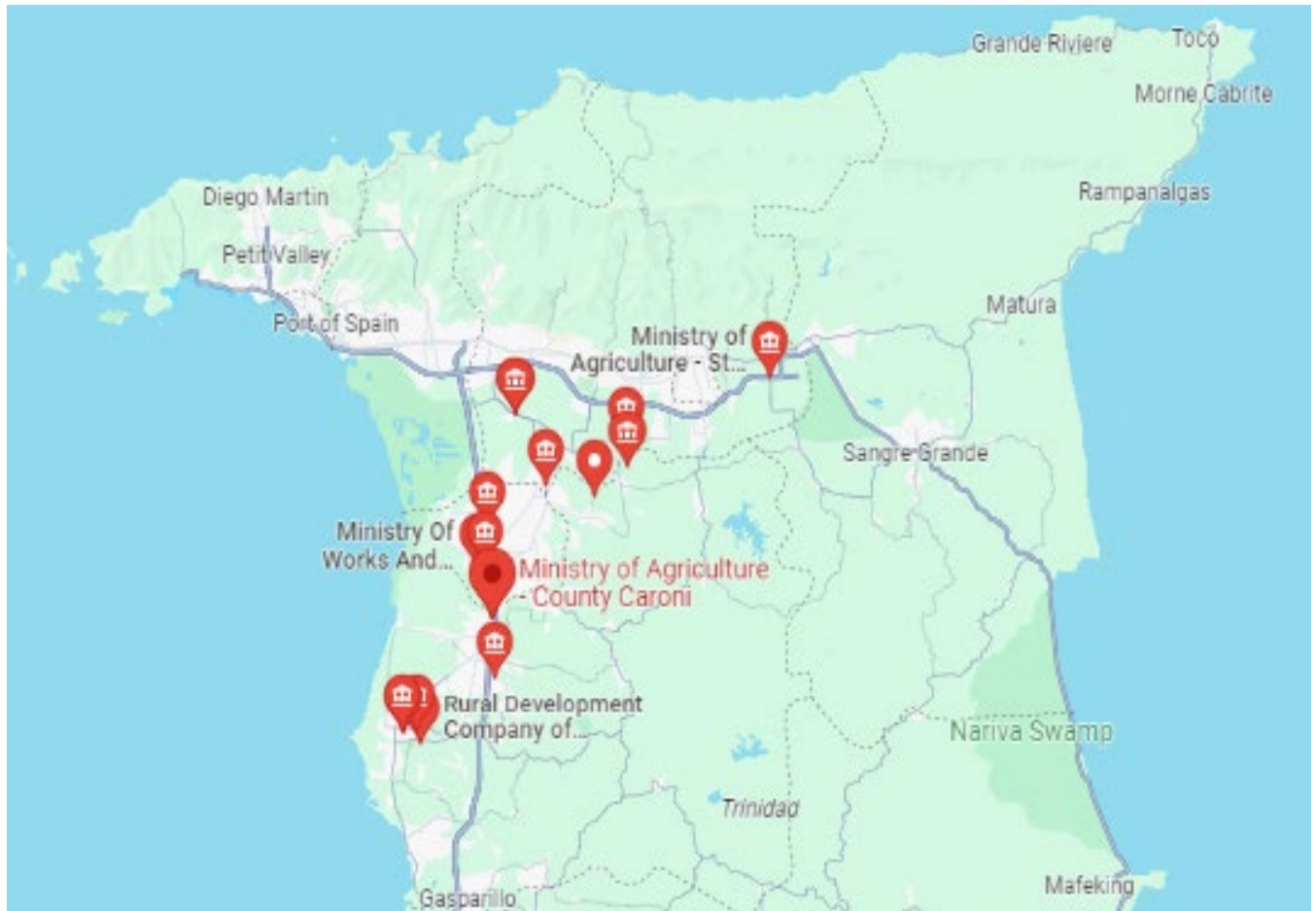


Source: <https://www.google.com/maps/place/Diego+Martin,+Trinidad+and+Tobago/>

The figure above shows the location of where the GAS was first sited in 2006 in Diego Martin, Trinidad and Tobago.



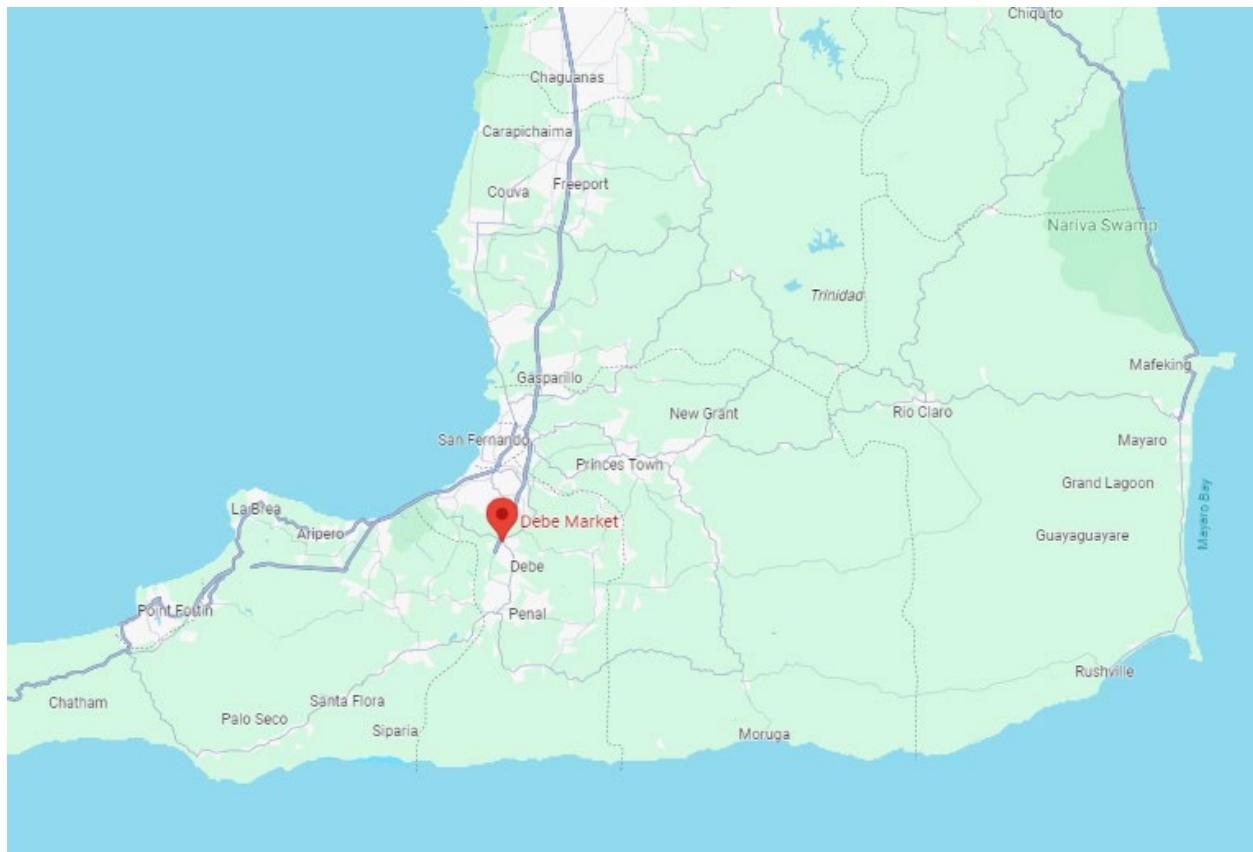
Figure 2. Location of Ministry of Agriculture – County Caroni, Trinidad and Tobago. Trinidad Farmers 2023.



Source: <https://www.google.com/maps/place/Ministry+of+Agriculture+-+County+Caroni/>

The figure above shows one of the locations for data collection, Ministry of Agriculture, County Caroni, Central Trinidad.

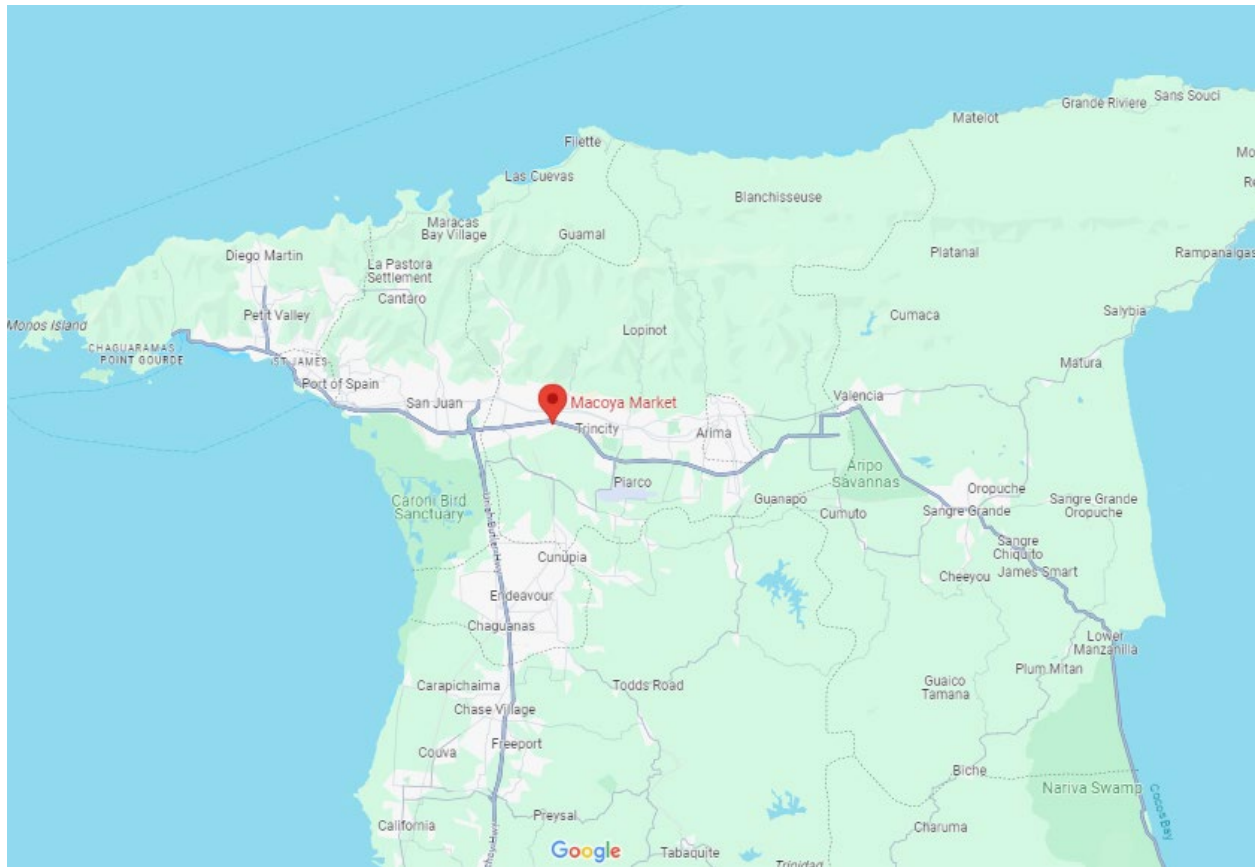
Figure 3. Location of the NAMDEVCO Farmers Market Debe, Trinidad and Tobago. Trinidad Farmers 2023.



Source: <https://www.google.com/maps/place/Debe+Market/>

The figure above shows one of the locations for data collection, Debe Market, South Trinidad.

Figure 4. Location of the NAMDEVCO Farmers Market Macoya, Trinidad and Tobago. Trinidad Farmers 2023.



Source: <https://www.google.com/maps/place/Macoya+Market/>

The figure above shows one of the locations for data collection, Macoya Market, Northern Trinidad.

## **APPENDIX C**

### **IRB with Survey Instrument**

# EXEMPT REVIEW APPLICATION

For assistance, contact: **The Office of Research Compliance (ORC)**

Phone: **334-844-5966** E-Mail: [IRBAdmin@auburn.edu](mailto:IRBAdmin@auburn.edu) Web Address: <http://www.auburn.edu/research/vpr/ohs>

**Submit completed form and supporting materials as one PDF through the [IRB Submission Page](#)**

*Hand written forms are not accepted. Where links are found hold down the control button (Ctrl) then click the link..*

## 1. Project Identification

**Today's Date: July 5, 2023**

**Anticipated start date of the project: July 5, 2023 Anticipated duration of project: 1 Year**

**a. Project Title: Characteristics and Barriers Impacting the Eradication of an Invasive Species in Trinidad and Tobago: Case Study of the Giant African Snail**

**b. Principal Investigator (PI): Tracy James** Degree(s): MS Rank/Title: Graduate Student  
Department/School: Curriculum and Teaching  
Role/responsibilities in this project: **All aspect of the evaluation including study design, instrument development, data collection, data analysis and data presentation**  
Preferred Phone Number: **347-481-9057** AU Email: [tcj0019@auburn.edu](mailto:tcj0019@auburn.edu)

**Faculty Advisor Principal Investigator (if applicable): James Lindner**  
Rank/Title: Professor Department/School: Curriculum and Teaching  
Role/responsibilities in this project: **advisor, will advise in all aspect of the evaluation to include design, instrument development, data analysis, and data presentation**  
Preferred Phone Number: **(334) 844-4434** AU Email: [jrl0039@auburn.edu](mailto:jrl0039@auburn.edu)

**Department Head: Paul Fitchett** Department/School: Curriculum and Teaching  
Preferred Phone Number: **(334) 844-4434** AU Email: [pgf0011@auburn.edu](mailto:pgf0011@auburn.edu)  
Role/responsibilities in this project: *Click or tap here to enter text.*

**c. Project Key Personnel** – Identify all key personnel who will be involved with the conduct of the research and describe their role in the project. Role may include design, recruitment, consent process, data collection, data analysis, and reporting. *(To determine key personnel, see decision tree). Exempt determinations are made by individual institutions; reliance on other institutions for exempt determination is not feasible. Non-AU personnel conducting exempt research activities must obtain approval from the IRB at their home institution.*

Key personnel are required to maintain human subjects training through [CITI](#). Only for EXEMPT level research is documentation of completed CITI training NO LONGER REQUIRED to be included in the submission packet. NOTE however, **the IRB will perform random audits of CITI training records to confirm** reported training courses and expiration dates. Course title and expiration dates are shown on training certificates.

**Name: Tracy James** Degree(s): MS  
Rank/Title: Graduate Student Department/School: Curriculum and Teaching  
Role/responsibilities in this project: **All aspect of the evaluation including study design, instrument development, data collection, data analysis and data presentation**

- AU affiliated?  Yes  No If no, name of home institution: *Click or tap here to enter text.*
- Plan for IRB approval for non-AU affiliated personnel? *Click or tap here to enter text.*
- Do you have any known competing financial interests, personal relationships, or other interests that could have influence or appear to have influence on the work conducted in this project?  Yes  No
- If yes, briefly describe the potential or real conflict of interest: *Click or tap here to enter text.*
- Completed required CITI training?  Yes  No If NO, complete the appropriate [CITI basic course](#) and update the revised Exempt Application form.
- If YES, choose course(s) the researcher has completed: Human Sciences Basic Course 4/1/2026

Choose a course      Expiration Date

Name: James Lindner

Degree(s): PhD

Rank/Title: Choose Rank/Title

Department/School: Choose Department/School

Role/responsibilities in this project: Click or tap here to enter text.

- AU affiliated?  Yes  No If no, name of home institution: Click or tap here to enter text.
- Plan for IRB approval for non-AU affiliated personnel? Click or tap here to enter text.
- Do you have any known competing financial interests, personal relationships, or other interests that could have influence or appear to have influence on the work conducted in this project?  Yes  No
- If yes, briefly describe the potential or real conflict of interest: Click or tap here to enter text.
- Completed required CITI training?  Yes  No If NO, complete the appropriate [CITI basic course](#) and update the revised EXEMPT application form.
- If YES, choose course(s) the researcher has completed: Human Sciences Basic Course      2/20/2025  
Choose a course      Expiration Date

Name: Click or tap here to enter text.

Degree(s): Click or tap here to enter text.

Rank/Title: Choose Rank/Title

Department/School: Choose Department/School

Role/responsibilities in this project: Click or tap here to enter text.

- AU affiliated?  Yes  No If no, name of home institution: Click or tap here to enter text.
- Plan for IRB approval for non-AU affiliated personnel? Click or tap here to enter text.
- Do you have any known competing financial interests, personal relationships, or other interests that could have influence or appear to have influence on the work conducted in this project?  Yes  No
- If yes, briefly describe the potential or real conflict of interest: Click or tap here to enter text.
- Completed required CITI training?  Yes  No If NO, complete the appropriate [CITI basic course](#) and update the revised EXEMPT application form.
- If YES, choose course(s) the researcher has completed: Choose a course      Expiration Date  
Choose a course      Expiration Date

**d. Funding Source** – Is this project funded by the investigator(s)? Yes  No

Is this project funded by AU? Yes  No  If YES, identify source Click or tap here to enter text.

Is this project funded by an external sponsor? Yes  No  If YES, provide name of sponsor, type of sponsor (governmental, non-profit, corporate, other), and an identification number for the award.

Name: Click or tap here to enter text.      Type: Click or tap here to enter text.      Grant #: Click or tap here to enter text.

**e.** List other AU IRB-approved research projects and/or IRB approvals from other institutions that are associated with this project. Describe the association between this project and the listed project(s):  
Click or tap here to enter text.

**2. Project Summary**

**a. Does the study TARGET any special populations? Answer YES or NO to all.**

- Minors (under 18 years of age; if minor participants, at least 2 adults must be present during all research procedures that include the minors)      Yes  No
- Auburn University Students      Yes  No
- Pregnant women, fetuses, or any products of conception      Yes  No
- Prisoners or wards (unless incidental, not allowed for Exempt research)      Yes  No
- Temporarily or permanently impaired      Yes  No

Revised 10/18/2022

**b. Does the research pose more than minimal risk to participants?** Yes  No

*If YES, to question 2.b, then the research activity is NOT eligible for EXEMPT review. Minimal risk means that the probability and magnitude of harm or discomfort anticipated in the research is not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or test. 42 CFR 46.102(i)*

**c. Does the study involve any of the following?** *If YES to any of the questions in item 2.c, then the research activity is NOT eligible for EXEMPT review.*

Procedures subject to FDA regulations (drugs, devices, etc.) Yes  No

Use of school records of identifiable students or information from instructors about specific students. Yes  No

Protected health or medical information when there is a direct or indirect link which could identify the participant. Yes  No

Collection of sensitive aspects of the participant's own behavior, such as illegal conduct, drug use, sexual behavior or alcohol use. Yes  No

**d. Does the study include deception? Requires limited review by the IRB\*** Yes  No

**3. MARK the category or categories below that describe the proposed research. Note the IRB Reviewer will make the final determination of the eligible category or categories.**

- 1.** Research conducted in established or commonly accepted educational settings, involving normal educational practices. The research is not likely to adversely impact students' opportunity to learn or assessment of educators providing instruction. 104(d)(1)
- 2.** Research only includes interactions involving educational tests, surveys, interviews, public observation if at least ONE of the following criteria. (The research includes data collection only; may include visual or auditory recording; may NOT include intervention and only includes interactions). **Mark the applicable sub-category below (I, ii, or iii). 104(d)(2)**
- (i)** Recorded information cannot readily identify the participant (directly or indirectly/ linked); **OR**
- surveys and interviews: no children;
  - educational tests or observation of public behavior: can only include children when investigators do not participate in activities being observed.
- (ii)** Any disclosures of responses outside would not reasonably place participant at risk; **OR**
- (iii)** Information is recorded with identifiers or code linked to identifiers and IRB conducts limited review; no children. **Requires limited review by the IRB.\***
- 3.** Research involving Benign Behavioral Interventions (BBI)\*\* through verbal, written responses including data entry or audiovisual recording from adult subjects who prospectively agree and ONE of the following criteria is met. (This research does not include children and does not include medical interventions. Research cannot have deception unless the participant prospectively agrees that they will be unaware of or misled regarding the nature and purpose of the research) **Mark the applicable sub-category below (A, B, or C). 104(d)(3)(i)**
- (A)** Recorded information cannot readily identify the subject (directly or indirectly/ linked); **OR**
- (B)** Any disclosure of responses outside of the research would not reasonably place subject at risk; **OR**

- (C) Information is recorded with identifies and cannot have deception unless participants prospectively agree. **Requires limited review by the IRB.\***
4. Secondary research for which consent is not required: use of identifiable information or identifiable bio-specimen that have been or will be collected for some other 'primary' or 'initial' activity, if one of the following criteria is met. Allows retrospective and prospective secondary use. **Mark the applicable sub-category below (i, ii, iii, or iv).** 104 (d)(4)
- (i) Bio-specimens or information are publicly available;
- (ii) Information recorded so subject cannot readily be identified, directly or indirectly/linked investigator does not contact subjects and will not re-identify the subjects; **OR**
- (iii) Collection and analysis involving investigators use of identifiable health information when us is regulated by HIPAA "health care operations" or "research" or "public health activities and purposes" (does not include bio-specimens (only PHI and requires federal guidance on how to apply); **OR**
- (iv) Research information collected by or on behalf of federal government using government generated or collected information obtained for non-research activities.
5. Research and demonstration projects which are supported by a federal agency/department AND designed to study and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or service under those programs. (must be posted on a federal web site). 104.5(d)(5) (must be posted on a federal web site)
6. Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives and consumed or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the Food and Drug Administration or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture. The research does not involve prisoners as participants. 104(d)(6)

*\*Limited IRB review – the IRB Chair or designated IRB reviewer reviews the protocol to ensure adequate provisions are in place to protect privacy and confidentiality.*

*\*\*Category 3 – Benign Behavioral Interventions (BBI) must be brief in duration, painless/harmless, not physically invasive, not likely to have a significant adverse lasting impact on participants, and it is unlikely participants will find the interventions offensive or embarrassing.*

*\*\*\* Exemption categories 7 and 8 require broad consent. The AU IRB has determined the regulatory requirements for legally effective broad consent are not feasible within the current institutional infrastructure. EXEMPT categories 7 and 8 will not be implemented at this time.*

#### **4. Describe the proposed research including who does what, when, where, how, and for how long, etc.**

##### **a. Purpose**

The purpose of this study is to understand the influence of selected factors on the adoption of eradication methods/programs for the Giant African Snail by farmers. The population of this study is farmers from Trinidad. Farmer and agricultural consultant, Dr. Jeet Ramjattan has provided a letter of support and is the primary contact in Trinidad.



- b.** Participant population, including the number of participants and the rationale for determining number of participants to recruit and enroll. Note if the study enrolls minor participants, describe the process to ensure more than 1 adult is present during all research procedures which include the minor.  
Participants are Farmers from Trinidad. The participants are a percentage of the farming population.
- c.** Recruitment process. Address whether recruitment includes communications/interactions between study staff and potential participants either in person or online. *Submit a copy of all recruitment materials.*  
The PI will be provided with a list of farmers names from Dr. Jeet Ramjattan, and the PI will recruit farmers from this list and contact them via email and/or telephone informing them about the study and asking for their participation. An information letter will be provided to them. .
- d.** Consent process including how information is presented to participants, etc.  
Before data collection occurs, a consent form and information letter will be provided to participants for review
- e.** Research procedures and methodology  
An Primary data will be collected through the use of a questionnaire. The population for this study will include up to 250 farmers. A listing of farmers' contacts throughout Trinidad will be provided by farmer and agricultural consultant, Dr. Jeet Ramjattan. Farmers complete a written questionnaire (see attached). The data will be entered into Statistical Package for Social Science (SPSS) software for data analysis. Analytical and descriptive analysis will be done using SPSS version 29.
- f.** Anticipated time per study exercise/activity and total time if participants complete all study activities.  
The data collection process for each participant should take approximately 10 minutes to be conducted.
- g.** Location of the research activities.  
**Data will be collected at farmers' workshops that are conducted in different areas of Trinidad.**
- h.** Costs to and compensation for participants? If participants will be compensated describe the amount, type, and process to distribute.  
none
- i.** Non-AU locations, site, institutions. *Submit a copy of agreements/IRB approvals.*  
see letter of support
- j.** Describe how results of this study will be used (presentation? publication? thesis? dissertation?)  
The results for this study will be used for dissertation, presentation, and publications.
- k.** Additional relevant information.  
none

## 5. Waivers

**Check applicable waivers and describe how the project meets the criteria for the waiver.**

- Waiver of Consent (Including existing de-identified data)

Revised 10/18/2022

Waiver of Documentation of Consent (Use of Information Letter, rather than consent form requiring signatures)

Waiver of Parental Permission (in Alabama, 18 years-olds may be considered adults for research purposes)

<https://sites.auburn.edu/admin/orc/irb/IRB 1 Exempt and Expedited/11-113 MR 1104 Hinton Renewal 2021-1.pdf>

a. Provide the rationale for the waiver request.

Participants will be given the opportunity to voluntarily complete the questionnaire. They can choose to simply not accept the instrument or they may return the instrument not completed. There will be no way to connect participants responses to anyone participating or not participating in the project evaluation.

**6. Describe the process to select participants/data/specimens. If applicable, include gender, race, and ethnicity of the participant population.**

Participants are Farmers from Trinidad. Up to 250 participants for the project will be participating in training related to the Giant African Snail. Dr. Ramjattan is a farmer and agricultural consultant and interacts with farmers on a daily basis and project evaluations such as this are a normal part of the trainings provided by Dr. Ramjattan. The PI will select farmers to participate and complete the questionnaire based on a list that will be provided by Dr. Ramjattan. The participants are male and female that are at least 18 years old. Participants' contact information will be secured through Dr. Jeet Ramjattan.

**7. Risks and Benefits**

**7a. Risks - Describe why none of the research procedures would cause a participant either physical or psychological discomfort or be perceived as discomfort above and beyond what the person would experience in daily life (minimal risk).**

Risks in this study are minimal and are no more than experienced in everyday life.

**7b. Benefits – Describe whether participants will benefit directly from participating in the study. If yes, describe the benefit. And, describe generalizable benefits resulting from the study.**

There is no direct benefit to the participant. General benefits are being more aware of the study topic.

**8. Describe the provisions to maintain confidentiality of data, including collection, transmission, and storage.**

**Identify platforms used to collect and store study data.** *For EXEMPT research, the AU IRB recommends AU BOX or using an AU issued and encrypted device. If a data collection form will be used, submit a copy.*

Data will be collected via the attached questionnaire. Data will be transferred from the questionnaire to a spreadsheet and stored in Auburn Box's secure server. No identifiable information will be collected. The physical questionnaires will be destroyed once the data is transferred and verified.

a. If applicable, submit a copy of the data management plan or data use agreement.



9. Describe the provisions included in the research to protect the privacy interests of participants (e.g., others will not overhear conversations with potential participants, individuals will not be publicly identified or embarrassed).

Individual participants will not be identified. Data collected will not identify participants. There will be no audio or video collected.

10. Does this research include purchase(s) that involve technology hardware, software or online services?

YES  NO

If YES:

- A. Provide the name of the product Click or tap here to enter text. and the manufacturer of the product Click or tap here to enter text.
- B. Briefly describe use of the product in the proposed human subject's research. Click or tap here to enter text.
- C. To ensure compliance with AU's Electronic and Information Technology Accessibility Policy, contact AU IT Vendor Vetting team at [vetting@auburn.edu](mailto:vetting@auburn.edu) to learn the vendor registration process (prior to completing the purchase).
- D. Include a copy of the documentation of the approval from AU Vetting with the revised submission.

11. Additional Information and/or attachments.

In the space below, provide any additional information you believe may help the IRB review of the proposed research. If attachments are included, list the attachments below. Attachments may include recruitment materials, consent documents, site permissions, IRB approvals from other institutions, data use agreements, data collection form, CITI training documentation, etc.

The attachments include: CITI training certificates, information letter and sample questionnaires for interviews.

**Required Signatures** (If a student PI is identified in item 1.a, the EXEMPT application must be re-signed and updated at every revision by the student PI and faculty advisor. The signature of the department head is required only on the initial submission of the EXEMPT application, regardless of PI. Staff and faculty PI submissions require the PI signature on all version, the department head signature on the original submission)

Signature of Principal Investigator: Tracy James Date: 7.5.23

Signature of Faculty Advisor (If applicable): James R. Pender Date: 7.5.23

Signature of Dept. Head: Paul G. Fitchett Digitally signed by Paul G. Fitchett Date: 2023.07.05 14:17:12 -05'00' Date: \_\_\_\_\_

Version Date: 7/5/2023

Dr. Jeet Ramjattan  
Farmer and Agricultural Consultant  
72 Preysal Village,  
Couva,  
Trinidad, W.I.

3<sup>rd</sup> July, 2023

Auburn University Institutional Review Board  
c/o Office of Research Compliance  
115 Ramsay Hall  
Auburn, AL 36849

Please note that Ms. Tracy James, AU Graduate Student, will have my support in data collection for her study, "The characteristics and barriers impacting the eradication of an invasive species in Trinidad and Tobago: Case study of the Giant African Snail". Ms. James will have access to farmers with my assistance. Her plan is to conduct evaluations with farmers throughout Trinidad and Tobago. Ms. James's on-site research activities will be finished by 5<sup>th</sup> September 2023. Ms. James has agreed to conduct the evaluations at an assigned space with farmers that agree to partake in this orally administered instrument. Ms. James has also agreed to provide me and the farmers a copy of the Auburn University IRB-approved, stamped consent document before she conducts data collection, and will also provide a copy of any aggregate results. No further oversight or approvals are needed on my behalf to collect and use this data.

If there are any questions, please contact me at [jeetramjattan@gmail.com](mailto:jeetramjattan@gmail.com) or 1-868-685-9250.

Signed,



Dr. Jeet Ramjattan,  
Farmer and Agricultural Consultant



COLLEGE OF EDUCATION  
CURRICULUM & TEACHING

(NOTE: DO NOT AGREE TO PARTICIPATE UNLESS AN IRB APPROVAL STAMP  
WITH CURRENT DATES HAS BEEN APPLIED TO THIS DOCUMENT.)

INFORMATION LETTER

for a Research Study entitled

*Characteristics and Barriers Impacting the Eradication of an Invasive Species in Trinidad and  
Tobago: Case Study of the Giant African Snail*

You are invited to participate in a research study on the characteristics and barriers impacting the eradication of an invasive species in Trinidad and Tobago: Case study of the Giant African Snail. The study is being conducted by Tracy James under the direction of James Lindner of the Auburn University Department of Curriculum and Teaching's Agriscience Education Program. You are invited to participate because you work in agricultural sector. You must be at least 18 years old to participate in this study.

**What will be involved if you participate?** Your participation is completely voluntary. If you decide to participate in this research study, you will be interviewed. The interview will take approximately ten minutes.

**Are there any risks or discomforts?** The risks associated with participating in this study are minimal and no more than encountered in everyday life.

**Are there any benefits to yourself or others?** There are no direct benefits to your participation in this study. Benefits to others may include a better understanding of how the Giant African Snail has affected the agricultural sector in Trinidad and how their knowledge of eradication methods can assist in eradicating the Giant African Snail.

**Will you receive compensation for participating?** You will not receive any compensation for your participation.

**Are there any costs?** Other than your time there are no costs associated with your participation.

If you change your mind about participating, you can withdraw at any time by choosing to stop the interview. Your decision about whether or not to participate or to stop participating will not jeopardize your future relations with Auburn University, the College of Education, the department of Curriculum and Teaching, and the Agriscience Education program.

5040 HALEY CENTER  
AUBURN, AL 36849-5212

TELEPHONE:  
334-844-4434

FAX:  
334-844-6789

WWW.AUBURN.EDU

Any information you have provided will remain anonymous. We will protect your privacy and the information you provide by maintaining your anonymous responses and insuring the responses you give would not be connected to you. At the end of this study all data collected will be destroyed. Information collected through your participation may be used for presentations at academic conferences, journals, population publications, and student research outlets (dissertation, thesis).

If you have questions about this study, please contact Tracy James at [tcj0019@auburn.edu](mailto:tcj0019@auburn.edu) or James Lindner at [jrl0039@auburn.edu](mailto:jrl0039@auburn.edu).

If you have questions about your rights as a research participant, you may contact the Auburn University Office of Research Compliance or the Institutional Review Board by phone (334)-844-5966 or e-mail at [IRBadmin@auburn.edu](mailto:IRBadmin@auburn.edu).

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE IF YOU WANT TO PARTICIPATE IN THIS RESEARCH PROJECT. IF YOU DECIDE TO PARTICIPATE, THE INFORMATION YOU PROVIDE WILL SERVE AS YOUR AGREEMENT TO DO SO. YOU CAN SAVE OR PRINT A COPY OF THE INFORMATION LETTER FOR YOUR RECORDS.



Tracy James  
Graduate Student

July 5<sup>th</sup>, 2023



James Lindner, PhD  
Alumni Professor

July 5<sup>th</sup>, 2023

The Auburn University Institutional  
Review Board has approved this  
Document for use from  
07/15/2023 to -----  
Protocol # 23-352 EX 2307

## QUESTIONNAIRE

### Farmers' Perception of Eradication Methods of The Giant African Snail (GAS)

#### SECTION I: CHARACTERISTICS IMPACTING THE DIFFUSION OF ERADICATION METHODS OF THE GIANT AFRICAN SNAIL

1. Which of the following invasive species is your biggest concern as a farmer?

Tropical Fire Ants (*Solenopsis germinata*)



Photo by Joanie King, [www.joegardener.com/](http://www.joegardener.com/)

Sweet Potato Whitefly (*Bemisa tabaci*)



Photo by Stephen Ausmus USDA

Giant African Snail (*Lissachatina fulica*)



Photo by Andrew Derksen, [FDACS/DPI Bugwood.org](http://FDACS/DPI Bugwood.org)

The Auburn University Institutional  
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2. The Ministry of Agriculture Land and Marine Affairs has been disseminating information on eradication methods for the Giant African Snail over the past few years, with a new one being introduced in January of 2023. Please indicate your level of participation in the eradication methods for the Giant African Snail (GAS).
- I had never heard of eradication methods for the GAS before reading the description provided in this questionnaire
  - I understand its purpose and techniques but have not decided whether or not I like or dislike the eradication methods
  - I have decided that I like or dislike the eradication methods for the GAS
  - I have decided that I will or will not use eradication methods for the GAS
  - I am using eradication methods for the GAS
  - I have used eradication methods for the GAS long enough to evaluate whether these eradication methods will be part of my future in farming

Below is a list of Characteristics that may impact the diffusion of eradication methods of the GAS.

	Relative Advantage				
3.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Economic profitability is an advantage of using eradication methods for the GAS					
Low initial cost is an advantage of using eradication methods for the GAS					
A decrease in some kind of distress is an advantage of using eradication methods for the GAS					



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Saving time and/or effort is an advantage of using eradication methods for the GAS

The benefits of using eradication methods for the GAS are immediate and that is an advantage of using these methods

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Compatibility

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4.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
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The eradication methods for the GAS will keep farmers safe from diseases

The use of eradication methods for the GAS is compatible with previously introduced ideas eg, management, mitigation, and control

The eradication methods for the GAS are a suitable way for farmers to increase their production yield

My vision for the future of agriculture includes the continued use of eradication methods for the GAS

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Complexity

5.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Information given on eradication methods for the GAS is easily understandable					
Eradication methods for the GAS seem simple					
Eradication methods for the GAS seem easy to exercise					
Eradication methods for the GAS can be conducted with little to no mistakes					

Triability

6.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I can select specific eradication methods for the GAS that I want					
I can test eradication methods for the GAS with no obligation for continued these methods in the future					

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I can use eradication methods for the GAS without providing new materials for it

There are mechanisms that enable the users to easily try the eradication methods for the GAS

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Observability

7.

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Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
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The eradication methods for the GAS are well publicized

The use of eradication methods for the GAS is a highly visible program

The results of eradication methods for the GAS are easily visible to potential users

The benefits of eradication methods for the GAS are easily visible to potential users

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SECTION II: POSSIBLE BARRIERS TO THE DIFFUSION OF ERADICATION METHODS OF THE GIANT AFRICAN SNAIL

Below is a list of potential barriers to the diffusion of eradication methods of the Giant African Snail (GAS) among farmers

Concerns About Time					
8.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
There is a lack of time available to farmers to learn about eradication methods of GAS					
There is a lack of time available to source materials to conduct eradication methods of GAS					
There is a lack of time to meet your needs using eradication methods of GAS					
There is a lack of time available to search for information on eradication methods of GAS					

Concerns About Incentives

9.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
There is a lack of compensation for farmers using eradication methods of GAS					
There is lack of recognition for farmers using eradication methods of GAS					
There is a lack of support from the Ministry of Agriculture					

Financial Concerns

10.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
There is a lack of funds to implement eradication methods of GAS					
There is a lack of financial resources to conduct eradication methods of GAS					
There is a lack of financial resources to promote eradication methods of GAS among the farming community					
There is a high cost to purchasing the necessary materials/chemicals					

### Planning Concerns

11.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
There is a lack of identifying needs for farmers for eradication methods program					
There is a lack of strategic planning for farmers					
There is a lack of coordination between farmers and the Ministry of Agriculture					
There is a lack of planned opportunities for farmers to learn about eradication methods of GAS					

### Technology Concerns

12.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
There is a lack of technology transfer for farmers					
There is a lack of training programs for farmers to learn how to conduct eradication methods of GAS					
There is a lack of information provided online on eradication methods of GAS					

### SECTION III: ADOPTION OF ERADICATION METHODS

13. Please indicate the varying methods that you are aware of used to inform the public about the eradication methods of the Giant African Snail (GAS):

- Bulletins
- Factsheets
- Manuals
- Pest advisories
- Advertisements
- Other \_\_\_\_\_

14. Are you familiar with the different types of eradication methods for the Giant African Snail (GAS)?

Yes  No

15. If yes, please select the one you are most familiar with.

- Chemical method 1- trap method
- Chemical method 2 – bait method
- Chemical method 3 – Spray method
- Cultural method 1 – salt water solution
- Cultural method 2 – bleach water solution
- GAS Sensitization Campaign – bounty system

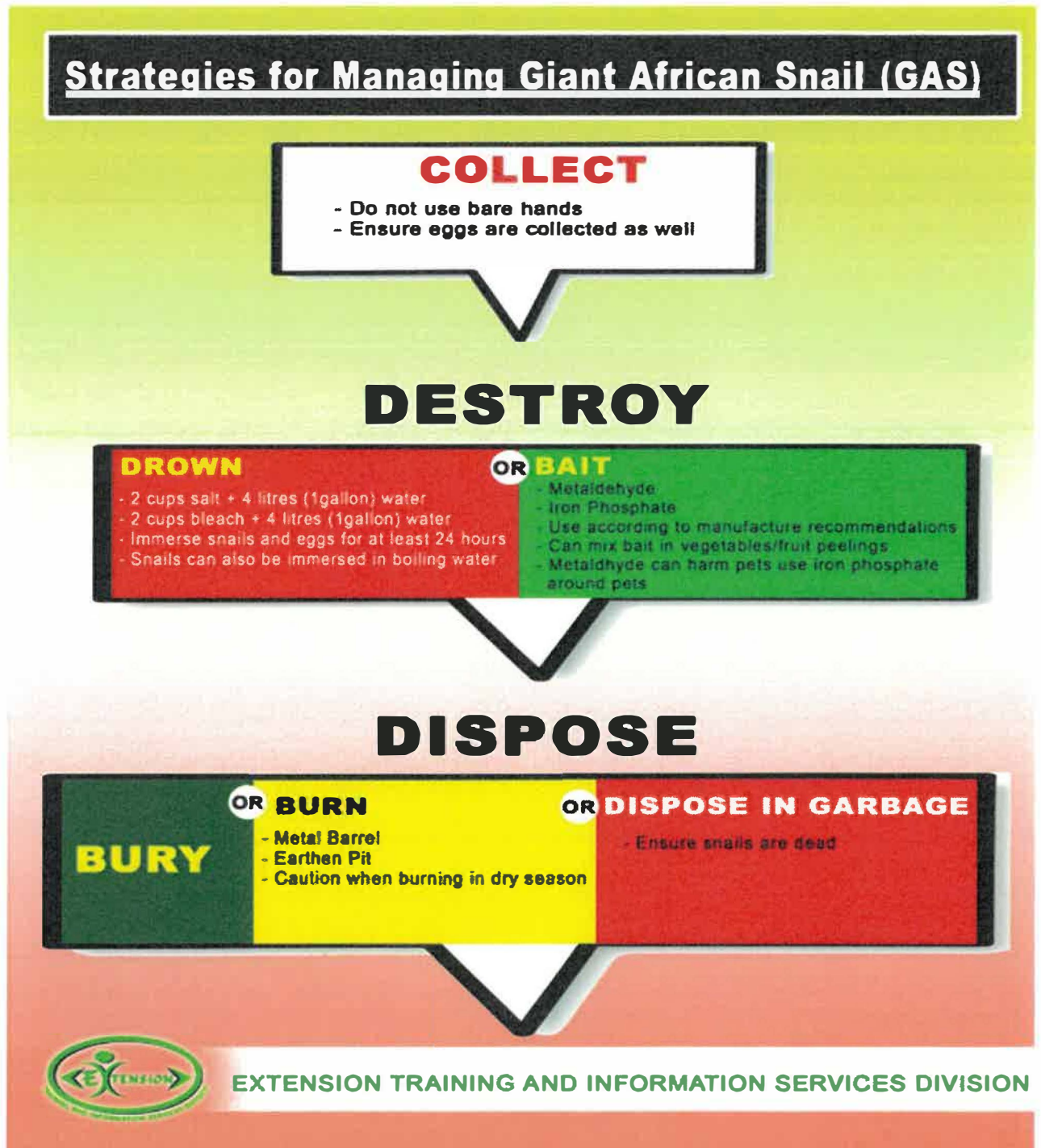
16. Were you able to meet with personnel that is vastly knowledgeable on the Giant African Snail?

Yes  No

17. If Yes, what type of personnel?

- Extension Officer
- Faculty from UWI
- Agro Chemical Supplier
- Other

18. Please look at the following pictures. Are you able to understand the instructions and names of chemicals used to eradicate the Giant African Snails? Please choose those that apply?







  
 Ministry of Agriculture, Land and Fisheries  
**YOU can control**  
**The Giant African Snail (GAS)**

---

**COLLECT**


**Use gloves**  
**DO NOT TOUCH** with bare hands

---

**DESTROY**

**Non-chemical**

**DROWN**

In Bleach:-  +   
 2 cups bleach to 4 litres (1 gallon) of water  
 OR  
 In Salt solution:-  +   
 2 cups salt to 4 litres (1 gallon) of water  
 OR

**Chemical**

**BAIT Metaldehyde**  
 (according to manufacturer's directions)

**Iron Phosphate**  
 (according to manufacturer's directions)

---

**DISPOSE** of Dead Snails

**Burn** in barrel  **OR** **Place** in garbage bag  **OR** **Bury** 2 feet (60 cm) or deeper in the ground 






Government of the Republic of Trinidad and Tobago  
Ministry of Agriculture, Land and Fisheries

## YEAR ROUND MANAGEMENT OF GIANT AFRICAN SNAIL (GAS)





Government of the Republic of Trinidad and Tobago

Ministry of Agriculture, Land and Fisheries

# It's the Rainy Season!!

## LOOK OUT for Giant African Snails (GAS)

IDENTIFY



Check these for snails and their eggs:

- plants
- equipment
- tools
- sheds
- vehicle wheels

DISPOSE

**Collect** snails and eggs using gloves or plastic bag  
**DO NOT TOUCH WITH BARE HANDS!**

**Drown** in bleach or salt solution for 24 hours  
**Cover** containers to prevent snails from escaping

**Burn, Bury or Place** dead snails in garbage bag



2 cups bleach to 4 litres  
(1 gallon) of water  
OR  
2 cups of salt to 4 litres  
(1 gallon) of water

PREVENT

**Inspect** vehicles, tractors and other equipment for hitchhikers (snails)

**Place** snail bait (in water-proof container) around farm

**Protect** irrigation water  
Attach fine strainer to pump to filter out eggs and small snails



Prepared by Ministry of Agriculture, Land and Fisheries  
Extension Training and Information Services Division 2019  
[www.agriculture.gov.tt](http://www.agriculture.gov.tt)



Ministry of Agriculture, Land and Fisheries

# Managing the Giant African Snail Population

## IDENTIFY



Hook  
(Truncated columella)

## GAS is Dangerous!

- Snails feed on more than 500 plant species
- The slime defaces buildings
- Snails may cause Meningitis  
**DO NOT EAT SNAILS!!**

## COLLECT



Use gloves  
**DO NOT TOUCH**  
with bare hands

## DESTROY

**DROWN**  
(for 24hrs)

In Bleach  
2 cups bleach to 4 litres  
(1 gallon) of water  
OR  
In Salt Water  
1/4 cup (60 g) salt to  
4 litres (1 gallon)  
of water  
**COVER containers!!**

OR **DEHYDRATE** OR



Place up to 10 snails  
in a plastic bag  
Add 1/4 cup (60 g) salt  
to the bag  
Tie and leave for at  
least 24 hours

OR **BAIT**  
Metaldehyde  
or  
Iron Phosphate



USE according  
to manufacturer's  
recommendations

## DISPOSE of Dead Snails

**BURN**  
(in barrel)



OR

**PUT DEAD** snails into  
heavy-duty garbage bags



OR

**BURY** 2 feet (60 cm) or  
deeper in the ground



## PROTECT

Inspect vehicles, tractors and other equipment for hitchhikers (Snails)



Produced by EXTENSION TRAINING AND INFORMATION SERVICES DIVISION

Division of Marketing and Extension Services, St. John's, Trinidad

Fax: (868) 610-219-6516

For further information visit website: [agriculture.gov.tt](http://agriculture.gov.tt)

December 2011

#### SECTION IV: PERSONAL CHARACTERISTICS

Please indicate your response for the following statements:

19. Gender

Male

Female

20. What year were you born?

\_\_\_\_\_

21. What is your highest level of education

No education

Primary education

Secondary education

Associate's degree

Bachelor's degree

Master's degree

PhD degree

22. Are you a full-time farmer or a part-time farmer?

Full time

Part time

23. In which county is your farm located:

- Caroni
- Mayaro
- Nariva
- St. Andrew
- St. David
- St. George East
- St. George West
- St. Patrick East
- St. Patrick West
- Victoria

24. Do you have GAS on your farm?

Yes  No

25. If yes, how long has the Giant African snail been present on your farm?

\_\_\_\_\_

26. Describe how the GAS has affected you as a farmer?

\_\_\_\_\_

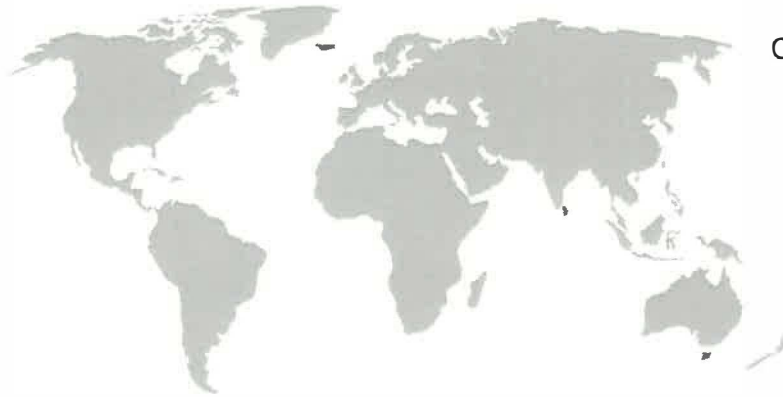
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\_\_\_\_\_

\_\_\_\_\_





Completion Date 02-Apr-2021  
Expiration Date 01-Apr-2026  
Record ID 41540064

This is to certify that:

**Tracy James**

Has completed the following CITI Program course:

Not valid for renewal of certification through CME.

**Responsible Conduct of Research for Social and Behavioral**  
(Curriculum Group)  
**Social, Behavioral and Education Sciences RCR**  
(Course Learner Group)  
**1 - RCR**  
(Stage)

Under requirements set by:

**Auburn University**



Verify at [www.citiprogram.org/verify/?w72fb779e-8f3c-4446-a1b7-5e5929448bd9-41540064](http://www.citiprogram.org/verify/?w72fb779e-8f3c-4446-a1b7-5e5929448bd9-41540064)





Completion Date 21-Feb-2022  
Expiration Date 20-Feb-2025  
Record ID 45538260

This is to certify that:

**james lindner**

Has completed the following CITI Program course:

Not valid for renewal of certification through CME.

**IRB # 2 Social and Behavioral Emphasis - AU Personnel - Basic/Refresher**  
(Curriculum Group)

**IRB # 2 Social and Behavioral Emphasis - AU Personnel**  
(Course Learner Group)

**1 - Basic Course**  
(Stage)

Under requirements set by:

**Auburn University**

Verify at [www.citiprogram.org/verify/?wacb8cd2d-b45f-48ef-a60c-ff4651b18525-45538260](http://www.citiprogram.org/verify/?wacb8cd2d-b45f-48ef-a60c-ff4651b18525-45538260)



Completion Date 07-Jan-2019  
Expiration Date 06-Jan-2024  
Record ID 23890842

This is to certify that:

**james lindner**

Has completed the following CITI Program course:

**Responsible Conduct of Research for Social and Behavioral** (Curriculum Group)  
**Social, Behavioral and Education Sciences RCR** (Course Learner Group)  
**1 - RCR** (Stage)

Under requirements set by:

**Auburn University**

Collaborative Institutional Training Initiative

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Completion Date 23-Feb-2023  
Expiration Date 23-Feb-2026  
Record ID 50319504

This is to certify that:

**james lindner**

Has completed the following CITI Program course:

Not valid for renewal of  
certification through CME.

**Responsible Conduct of Research**

(Curriculum Group)

**AU Basic RCR Training for ALL Faculty, Staff, Postdocs, and Students**

(Course Learner Group)

**1 - RCR**

(Stage)

Under requirements set by:

**Auburn University**

Training Initiative

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