

**CONTRIBUTION TO RESEARCH METHODOLOGY
THROUGH CAPACITY BUILDING AT THE WORLD
AGROFORESTRY CENTRE, RWANDA**

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the World Agroforestry Centre, Rwanda**

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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DEDICATION

To my wife, Umuhire Adrie and my children Keza Hagenimana Ange Darlene and Beza Hagenimana Ariella Marlene, for their patience, love, support, prayers and encouragement.

To my late father, my mother and my sisters, for their love, care and sacrifices.

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ABBREVIATION AND ACRONYMS

AGRA	: Alliance for a Green Revolution in Africa
ANOVA	: Analysis of Variance
ASARECA	: Association for Strengthening Agricultural Research in Eastern and Central Africa
BeCa	: Biosciences Eastern and Central Africa
CEFDHAC	: Conférence sur les Ecosystèmes des Forêts Denses et Humides d’Afrique Centrale
CFC	: Common Funds for Commodities
CGIAR	: Consultative Group on International Agriculture Research
CIP	: International Potato Center
DFID	: Department for International Development/United Kingdom
EU	: European Union
STABEX	: Système de stabilisation des recettes d’exploitation
GOR	: Government of Rwanda
ICRAF	: World Agroforestry Center
IDRC	: International Development Research Center
ISAR	: Institut des Sciences Agronomiques du Rwanda
IRST	: Institute of Scientific and Technological Research
NGO	: Non Governmental Organization
NUR	: National University of Rwanda
PADAB	: Projet d’appui au Développement Agricole de Bugesera

- RSSP** : Rural Sector Support Project
- RUFORUM** : Regional Universities Forum for Capacity Building in Agriculture
- RwF** : Rwandan Franc
- SSA** : Sub Sahara Africa
- UCRIDP** : Umutara Community Resource and Infrastructure development Project
- UNDP** : United Nations Development Program
- USAID** : United States Agency for International Development

ABSTRACT

The capacity to conceptualize, plan and implement effective research is often limited. The contribution in research methodology such as experimental design, data collection, management and analysis is crucial for improving research quality and delivery of high quality research results to the end users. Scientists at ICRAF Rwanda deal with many types of work including project design, data management and analysis and reporting. However, they do not have enough knowledge in research methods to improve their research and there are no research methods professionals with skills and experience to help them.

The overall objective of this work was to provide support to scientists, technicians and students on attachment at ICRAF Rwanda carrying out research activities which include conception and design of research, data handling and management, data analysis, interpretation and reporting.

To achieve this objective, many activities were planned including consultancy with researchers. Direct communication with scientists enhanced effective communication required for any research method professional. Previous research done at ICRAF Rwanda generated data; a study on how data were analyzed and the strategies for improving data quality, organization, analysis and archiving had been done.

Proposal writing is a vital component of the research. Two proposals have been developed. One on improving household nutrition and income by enhanced production, processing, marketing and consumption of tropical and temperate fruits in Rwanda, another one on Evergreen Agriculture in Africa for Improved Food Security Livelihoods and Environmental Resilience in Eastern and Southern Africa.

Two questionnaires were reviewed and two others developed. The reviewed questionnaires were on the current status of marketing of processed pineapple products by small and medium-scale processors in Rwanda and on Evergreen Agriculture project which was used to capture the baseline information regarding the current socio-economic and land use status in Bugesera district.

Data were collected, checked for quality, cleaned, organized into either metadata or data files analyzed and archived. The aspects transforming and modeling data with the goal of highlighting useful information, suggesting conclusions, and supporting decision making in data analysis have been taken into consideration in all data analyzed.

To participate in research conceptualization and identify a research gap/idea, two studies were been conducted. The aim was to assess the factors affecting the quality of reporting and publishing of research findings in ICRAF Rwanda, Institute of Agricultural Research of Rwanda (ISAR) and Institute of Scientific and Technological Research (IRST), and to assess factors determining fruits production in Rwanda.

The results showed that conditions for publications in international journals are hard because publishing needs hard work, time and concentration and high quality of research and innovation. Factors limiting publication in ICRAF Rwanda, ISAR and IRST are: few journals especially regional and sub-regional ones in some research areas, lack of research facilities and materials which lead to unreliable data, lack of knowledge and skills in paper writing, lack of incentive for those who publish, administration tasks for scientists, data analysis difficulties, lack of information on the journals, lack of laboratories and research funds and lack of mentorship of young scientists.

The limiting factors in fruit production are pests and diseases, lack of inputs (improved planting materials, fertilizers, pesticides etc), lack of land or limited land, lack of training on fruit production, family size and literacy level. Some farmers mentioned also that thieves are among factors limiting fruits production as well as the distance between home and farms and lack of skills in fruit tree grafting.

CHAPTER 1

1.0. INTRODUCTION

The National Agricultural Research and Extension systems in sub-Saharan Africa (SSA) have limited knowledge on research planning, experimental design, data collection and analysis. The most critical weakness in SSA is low level of publications mainly due to poor experimental design, data collection and management with the consequence of waste of time and money developing proposal without critical thinking of the results (publication and the results for the end users). Capacity building in research methodology such as experimental design, data collection, management and analysis is crucial for improving research quality and delivering high quality research results to the end users. Thus, National Agricultural Research and extension staff require training. This initiative aims to develop a new cadre of professionals who are able to support scientists in the planning, implementation and reporting of effective research for development and to train scientists in the research methods needed to work in emerging areas of research for development.

The Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) recognizes the existence of different levels of capacities and competencies in the member universities, and will marshal these to develop high quality research and graduate training programmes that respond to market needs and serve to strengthen

innovation capacity. But yet capacity to conceptualize, plan and implement effective research is often limited.

The vision of the World Agroforestry (Centre ICRAF), as a research institute, is a rural transformation in the developing world as smallholder households strategically increase their use of trees in agricultural landscapes to improve their food security, nutrition, income, health, shelter, energy resources and environmental sustainability. Her mission is to generate science-based knowledge about the diverse roles that trees play in agricultural landscapes, and use its research to advance policies and practices that benefit the poor and the environment.

ICRAF is interested in research organized around six global research priorities which are quality trees, on-farm productivity, marketing and extension, land health, climate change and environment services. Although more efforts have been directed at improving research, capacity in research skills including effective research project conceptualization, planning and implementation, data management and analysis and communication of research findings is still needed.

1.1. Institution of attachment: World Agroforestry Centre (ICRAF)

The World Agroforestry Centre is an autonomous, non-profit research organization. It is one of the 15 centers of the Consultative Group on International Agriculture Research (CGIAR).

The World Agroforestry Centre's research is organized around six global research priorities. These span trees to farms, landscapes and global issues: domestication, utilization and conservation of superior agroforestry germplasm, maximizing on-farm productivity of trees and agroforestry systems, improving tree product marketing for smallholders, reducing land health risks and targeting agroforestry interventions to enhance land productivity and food availability, improving the ability of farmers, ecosystems, and governments to cope with climate change and developing policies and incentives for multi-functional landscapes with trees that provide environmental services.

In sub-Saharan Africa, ICRAF works in six regions namely Eastern, Southern, western and Central Africa. All of these regions share the problems of poverty, hunger and environmental degradation to varying degrees and offer opportunities for agroforestry interventions. However, large differences exist in the challenges and opportunities for agricultural development among the regions, as well as in the differing roles that agroforestry can play to meet them (World Agroforestry Center, 2010).

1.2. Project involved in at ICRAF Rwanda

The mandate of ICRAF in Rwanda since 1989 is to provide to the government of Rwanda, technical and scientific support in agroforestry through 5 principal areas: exchange of technical and scientific specialists and researchers, secure scholarships to enable personnel pursue further studies, exchange of scientific publications and information, general technical cooperation and implementation of projects with partners.

Evergreen Agriculture is defined as conservation farming that integrates trees with annual crops. Depending on which woody species are used, and how they are managed, the incorporation of woody plants in conservation farming may contribute to maintaining vegetative soil cover, nitrogen fixation and nutrient cycling, weed suppression, enhancing soil structure and water infiltration and penetration, food, fodder, fuel, fibre, income from tree products, carbon storage, and biodiversity conservation. Evergreen Agriculture, the system of integrating conservation agriculture with proven agroforestry practices, has increasingly been recognized as a viable, cost-effective option for creating a sustainable agriculture, and adapting to climate change.

The project is being implemented in 3 countries in the eastern African region. These are Kenya, Tanzania and Rwanda. The project will support national research and development organizations in agriculture, the private sector and training institutions, and the development NGO community, to implement a national innovation platform for

supporting smallholder farmers in adopting Evergreen agricultural technologies and practices in the target countries.

1.3. Statement of the problem / Justification

ICRAF Rwanda is operating since 1988 to develop agroforestry technologies adapted to the land use of Rwanda in each agro-ecological zone and offer technical assistance in area of agroforestry. ICRAF Rwanda is formed by a team of five people: one scientist, two dissemination facilitators (technicians) and two supporting staff (the accountant and the driver). Due to the mandate of ICRAF Rwanda, the scientist deals with many types of work including project design, data management and analysis and reporting. There is therefore a need to increase knowledge to the dissemination facilitators in area of project design, data management and reporting because they do not have enough knowledge in research methods to improve their research and there are no research methods professionals with skills and experience to help them. This has a negative impact on research activities. It is imperative to build the capacity of the scientists in planning and design of research, in data management and analysis, so as to obtain quality data for the projects leading to valid conclusions and recommendations. It is important also to know the process of sharing of information with the general public and reporting.

A major reason for this attachment is to learn from the experiences of the ICRAF researchers in order to gain the necessary skills to assist other researchers to make progress towards the goal of quality research.

1.4. Objectives

1.4.1. General Objective

The overall objective of this study is to provide support to scientists, technicians and students (in attachment at ICRAF) carrying out research activities in ICRAF Rwanda in conception and design of research, data handling and management, data analysis, interpretation and reporting.

1.4.2. Specific objectives

- 1) To assess the factors that affect the quality of reporting and publishing of research findings in ISAR, IRST and ICRAF Rwanda
- 2) To contribute to capacity building through consultancy on data management and statistical analysis by assessing the factors affecting fruits production and marketing among smallholders in Rwanda
- 3) To improve the system of data management at ICRAF Rwanda

CHAPTER 2

2.0. LITERATURE REVIEW

2.1. Communication strategy and team work

Katzenbach and Smith (1992) define a team as a small group of people with complementary skills who are committed to a common purpose, performance goals, and approaches for which they hold themselves mutually accountable. Getting a group of people together does not make a team. A team develops products that are the result of the team's collective effort and involves synergy. Synergy is the property where the whole is greater than the sum of its parts. The process of gathering the right people and getting them to work together for the benefit of a project is team building (<http://www.ndt-ed.org/TeachingResources/ClassroomTips/Teamwork.htm>, 2010).

Within any organization are projects that require a team's effort. While working in a group has benefits, such as the ability to forge new friendships and equal distribution of work, it can often be a source of tension and stress among its members. Problems can come about when deadlines aren't met, for instance. However, most problems can be solved or prevented with effective communication among members. Effective communication involves open-mindedness, active listening and the ability to focus (Bihm, 2008).

Intra-team communication is a process through which team members communicate with one another. It is made up of the communication strategies and styles of each member of the team. A team can improve its intra-team communication skills through knowledge, practice, feedback, and reflection. Communication, the exchange of ideas and information, is the essence of how people interface with one another with regard to sharing ideas and working effectively together. Faulty communication breeds conflict. Over 90% of conflicts are attributed to faulty communication between sender and receiver (Algert, and Watson, 2002). However, when individuals and team members think about and choose their communication styles, then miscommunication and the resulting conflict are reduced.

2.2. Seminar and training course

Strengthening people's capacity to determine their own values and priorities, and to organize them to act on these, is the basis of development (Eade and Williams, 1995). Ann (1996) defines capacity building as a process of developing and strengthening the skills, instincts, abilities, processes and resources that organizations and communities need to survive, adapt, and thrive in the fast-changing world. UNDP (2010) defined capacity building as the creation of an enabling environment with appropriate policy and legal frameworks, institutional development, including community participation, human resources development and strengthening of managerial systems, adding that, UNDP recognizes that capacity building is a long-term, continuing process, in which all

stakeholders participate (ministries, local authorities, non-governmental organizations and water user groups, professional associations, academics and others.

The term training refers to the acquisition of knowledge, skills, and competencies as a result of the teaching of vocational or practical skills and knowledge that relate to specific useful competencies. It forms the core of apprenticeships and provides the backbone of content at institutes of technology (also known as technical colleges or polytechnics). In addition to the basic training required for a trade, occupation or profession, observers of the labor-market recognize today the need to continue training beyond initial qualifications; to maintain, upgrade and update skills throughout working life. People within many professions and occupations may refer to this sort of training as professional development.

Some commentators use a similar term for workplace learning to improve performance: training and development. One can generally categorize such training as on-the-job or off-the-job:

- 1) On-the-job training takes place in a normal working situation, using the actual tools, equipment, documents or materials that trainees will use when fully trained. On-the-job training has a general reputation as most effective for vocational work.
- 2) Off-the-job training takes place away from normal work situations. Off-the-job training has the advantage that it allows people to get away from work and

concentrate more thoroughly on the training itself. This type of training has proven more effective in inculcating concepts and ideas (Ann, 1996).

Basic steps in the training process

1. Needs analysis -This step identifies activities to justify an investment for training. The techniques necessary for data collection are surveys, observations, interviews, and customer comment cards. Several examples of an analysis outlining specific training needs are customer dissatisfaction, low morale, low productivity, and high turnover.

The objective is to find out the reasons the training is needed, the type of training, the time the training is needed and where the training is needed. In addition, the person who needs the training and those to conduct the training are identified.

By determining training needs, an organization can decide what specific knowledge, skills, and attitudes are needed to improve the employee's performance in accordance with the company's standards.

2. Developing training programs and manuals - This step establishes the development of current job descriptions and standards and procedures. Job descriptions should be clear and concise and may serve as a major training tool for the identification of guidelines. Once the job description is completed, a complete list of standards and

procedures should be established from each responsibility outlined in the job description. This will standardize the necessary guidelines for any future training.

3. Delivery of the training program- This step includes the instruction and delivery of the training program. Once trainers have been designated, the training technique must be decided. One-on-one training, on-the-job training, group training, seminars, and workshops are the most popular methods.

The trainer should have a desire to teach the subject content, a working knowledge of the subject being taught, an ability to motivate participants to “want” to learn, a good sense of humor, a dynamic appearance and good posture, a strong passion for their topic, a strong compassion towards their participants and an appropriate audio/visual equipment to enhance the training session.

For a training program to be successful, the trainer should be conscious of several essential elements, including a controlled environment, good planning, the use of various training methods, good communication skills, and trainee participation.

4. Evaluate the training program- This step will determine how effective and profitable your training program has been. Methods for evaluation are pre-and post- surveys of customer comments, the establishment of a cost/benefit analysis outlining your expenses and returns, and an increase in customer satisfaction and profits.

The reason for an evaluation system is simple. The evaluations of training programs are without a doubt the most important step in the training process. It is this step that will indicate the effectiveness of both the training as well as the trainer.

There are several obvious benefits for evaluating a training program. First, evaluations will provide feedback on the trainer's performance, allowing them to improve themselves for future programs. Second, evaluations will indicate its cost-effectiveness. Third, evaluations are an efficient way to determine the overall effectiveness of the training program for the employees as well as the organization.

The importance of the evaluation process after the training is critical. Without it, the trainer does not have a true indication of the effectiveness of the training.

2.3 Reviewing reports and proposals

Reviewing is both a privilege and responsibility. It takes time to prepare a useful, critical review. Moreover, it is clearly a service to the journal, to the authors, to science at large, and to the reviewer because the reviewer becomes privy to the latest in cutting-edge research (http://en.wikipedia.org/wiki/Research_proposal, 2011).

Like any skill, the art of reviewing manuscripts improves with practice. Although reviewer is an acquired skill, the characteristics (such as fairness, thoroughness, integrity) of that person certainly contribute to the activity. Unfortunately, it is rare to find a scientist whose formal training has incorporated instruction in the art of

reviewing. Nonetheless, the techniques of peer reviewing a manuscript can be nurtured and developed. Yet, peer review is a recognized and critical component of the overall publication process that confers "added value" to a submitted paper. Moreover, editors are dependent on the identification of a cadre of "good" reviewers that they can be relied on for quality control and process efficiency. Reviewers, for the most part, act in this capacity from a sense of duty, selflessness, and a desire to contribute in an important way to the maintenance of high standards and veracity in their specific areas of research.

Elements of manuscript review

Manuscript review can be divided into two main categories; the technical and the ethical. Both aspects are primarily concerned with making the manuscript better and ensuring that it is reporting trustworthy data. Some technical issues to take into consideration are clear, concise, and intelligible writing, the logical manuscript which makes a significant and novel contribution to the field, presence of fatal methodological flaw, the clear and necessary figures. For ethical issues, some points to take into consideration are the proper use and care of animals, if human studies were done, they have to be conducted with the prior approval of the subjects and institutions, the human protocols has to conform to prevailing ethical and legal standards.

The manuscript must be treated in a confidential manner. Thus, a reviewer must not only provide an unbiased evaluative analysis of the structural components of a manuscript but must do so in an acceptable, ethical context.

2.4. Data management

Data management is the development and execution of policies, practices and procedures in order to manage the information lifecycle needs of an enterprise in an effective manner.

The Data Management System

A data management system is a set of procedures and people through which information is processed. It involves the collection, manipulation, storage, and retrieval of information. Perhaps its most visible tool is the computer; however, this is merely one of many. Other “tools” are the instruments and data collection forms, the data management protocol, quality control mechanisms, documentation, storage facilities for both paper and electronic media, and mechanisms of retrieval.

The purpose of a data management system is to ensure (i) high quality data: - the variability in the data is derived from the phenomena under study and not from the data collection process, and (ii) accurate, appropriate analysis and interpretation of the data.

2.5. Data analysis

Analysis of data is a process of inspecting, cleaning, transforming, and modeling data with the goal of highlighting useful information, suggesting conclusions, and supporting decision making. Data analysis has multiple facets and approaches, encompassing

diverse techniques under a variety of names, in different business, science, and social science domains (http://en.wikipedia.org/wiki/Data_analysis, 2010).

With the availability of statistical packages, it is easy to compute many statistics that previously required the assistance of someone with biostatistical training (and with fewer distractions from the task of data analysis), with an increase in the danger of uniformed, inappropriate, or incorrect use of statistical tests (Paul et al., 1989). The first stages of data analysis should emphasize obtaining a “feel” for the data, for example, some familiarity with their essential features. The process of examining the data to understand them is integrated throughout the cleaning and analysis. Always question data and examine them with a critical view.

Some methods of approaching a dataset are:

1. Univariate distributions (frequency distributions, summary statistics, graphs or other).
2. Cross tabulations (frequency distributions across important groupings, such as sex, race, exposure, disease)
3. Scatter plots showing pairs of continuous variables
4. Correlation matrices

These analyses should include the assessment of agreement where it is expected to occur. It is often helpful to prepare summary tables of basic information from the above examination that can be used for reference purposes during later stages of analysis and writing.

CHAPTER 3

3.0. FACTORS AFFECTING THE QUALITY OF REPORTING AND PUBLISHING OF RESEARCH FINDINGS IN ICRAF RWANDA, ISAR AND IRST

3.1. Abstract

The purpose of this research is to assess the factors affecting the quality of reporting and publishing of research findings in ICRAF Rwanda, ISAR and IRST. A sample of 37 scientists was randomly selected and the data were collected using a questionnaire. The data were analyzed using descriptive analysis statistics with SPSS 16 software. The study showed that the highest level of education of scientists interviewed is Masters which constitute 70.4% of all respondents. It showed also that the biggest challenges facing some scientists not to be involved in project/proposal writing are the lack of knowledge, skills and experience in project writing and long administrative process to acquire money for research and there is a high competition of projects on financing agencies' side. A big number of respondents (60%) have never attempted to submit an article to the journal in the last 10 years.

Respondents who published reported that what motivated them to publish is to help advance knowledge (40%), to be promoted in their career (30%) and to communicate (20%). The conditions for publishing had been judged hard (84% of respondents) and the challenges for publication are lack of quality innovation of their research, lack of

research facilities and materials which lead to unreliable data, lack of knowledge and skills in paper writing, lack of incentive for those who publish, administration tasks for scientists which don't leave them time to conduct research and publish, data analysis difficulties, lack of internal publications plan and lack of mentorship of young scientists.

The assistance which could motivate scientists to publish are training on scientific writing, collaboration with skilled scientist and reinforce mentorship with experienced senior scientists and incentive and promotion for those people who publish.

3.2. Introduction

Publishing in a scientific journal is one of the major objectives of any scientific work (Day, 1998). No matter how good the results are, the research is not completed until it is written and disseminated by publishing (Becker & Richards, 1986). Authors may have different publication motivations. Among the important reasons are:

Personal sense of achievement-the sense of achievement coming from seeing your ideas in print and the recognition that others in your professional circle have acknowledged that the work is worthy.

Development of writing and communication skills-it is invaluable to write in different styles for different audiences. Publication is an opportunity not only to share your research with readers but also to receive comments on your work from experts. New

ideas and perspectives emerge during the writing process and also feedback from the review process.

Publications always complement a CV, and add an external validation for your ideas (Rowley & Slack, 2000). The publication of research in journals certifies new contributions to knowledge, as well as validates the skills of authors (Miller & Perrucci, 2001). Publication determines promotion, tenure and salary and it will also have an influence on securing grants (McKercher, 2002).

Written dissemination of information is an essential part of science (Waser & Price, 1992). Writing a publishable paper, however, is not as easy as it sounds. The manuscript has to meet certain criteria to qualify for publication and, therefore, dissemination to a wider audience. ISAR, IRST and ICRAF as research institutes are called to disseminate the research findings through published works.

The three research institutes have many scientists whom the main task is to conduct researches in many areas. The publications are the main ways of findings dissemination. However, the publications of research findings still being very low in the three organizations. There are so many reasons limiting publications. Some are individuals, others are organizational and others are politics.

The objective of this research is to determine the factors affecting the quality of reporting and publishing of research findings in ICRAF Rwanda, ISAR and IRST

3.3. Methodology

This study was a descriptive survey. The population consisted of 148 scientists: 101 in ISAR, 44 in IRST and 3 in ICRAF. A sample of 37 scientists (25%) was randomly selected. The data were collected through a questionnaire (appendix 1) consisting of both open-ended and closed-ended questions. The tool was tested for its content validity. The questionnaire was distributed using internet because most of scientists work far from their respective headquarters; it was not possible to reach each one individually. There was a 73% questionnaire response rate (27 out of 37). The SPSS 16 was used in data processing.

3.4. Results and discussion

3.4.1. Age of respondents

The majority of scientists interviewed are between 30 and 45 ages (74%). ISAR have more scientists interviewed (74.1%) (Figure 1).

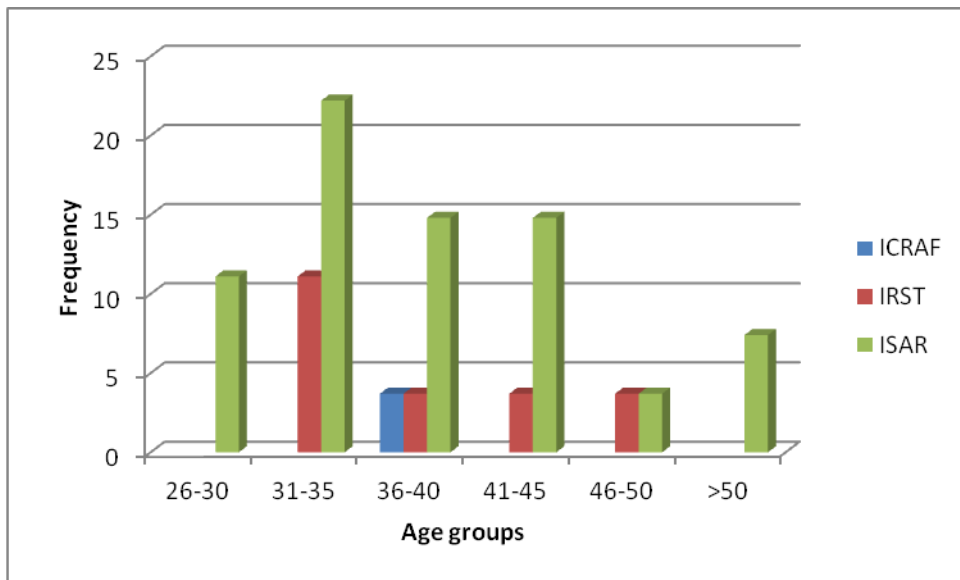


Figure 1: Age groups of respondents

3.4.2. Education level and area of specialization of respondents

The highest level of education of scientists interviewed is masters which constitute 70.4% of all respondents. A big number having masters level belongs to ISAR (59.3%). Plant breeders from ISAR only constituted the biggest number of respondents (26%). Crop production and food science also constitute a considerable number (11% each) of interviewed scientists (table 1).

Table 1: Area of specialization of scientist interviewed

Area of specialization	Working institution							
	ICRAF		IRST		ISAR		Total	
	Number	%	Number	%	Number	%	Number	%
Agriculture extension					1	3.7	1	3.7
Animal nutrition					1	3.7	1	3.7
Biodiversity conservation					1		1	3.7
Biology			1	3.7			1	3.7
Biotechnology					1	3.7	1	3.7
Chemistry			2	7.4			2	7.4
Crop production	1	3.7			2	7.4	3	11.1
Food Science					3	11.1	3	11.1
Geo information and Earth Observation					1	3.7	1	3.7
Human nutrition					1	3.7	1	3.7
Lexicography linguistics			1	3.7			1	3.7
Plant breeding					7	25.9	7	25.9
Psychology			1	3.7			1	3.7
Rural development sociology					1		1	3.7
Soil Science					1	3.7	1	3.7
Total	1	3.7	6	22.2	20	74.1	27	100

3.4.3. Year of experience of respondents

The majority of interviewed scientists have less than 10 years of experience (84.4%) with 44.4% less than 6 years of experience (table 2). This has a big impact on publication because those scientists don't have enough skills in publications.

Table 2: Researchers working institutions

Year of experience	Working institution			Total
	ICRAF	IRST	ISAR	
0-5		7.4	37.0	44.4
6-10	3.7	11.1	22.2	37.0
11-15		3.7	7.4	11.1
16-20			3.7	3.7
>20			3.7	3.7
Total	3.7	22.2	74.1	100.0

3.4.4. Involvement in project/proposal design

The majority of respondents (81.5%) have been involved in project design, while 18.5% of respondents have never been involved. The majority of scientists who have never been involved in proposal/project writing reported that the biggest challenge is the lack of knowledge, skills and experience in project writing and long administrative process to acquire money (28.6% of respondents). Another challenge is that some scientists don't involve other scientists having technicians' status (table 3).

Table 3: Reasons for not involved in project writing

Limitations	Percentage
Lack of knowledge and experience in project writing	28.6
Lack of linkage and partnership with donors	7.1
Technicians are not involved in project writing	21.4

Some commodities are not under country's crop priority to be funded	7.1
Long administrative process to acquire money	28.6
Lack of diffusion policy to make research findings profitable to the target population	7.1

3.4.5. Number of project submitted and funded

The average number of projects/proposals submitted and funded per scientist is two, while maximum is six per scientist. The average money in dollar per project is \$213,912; the maximum amount per project \$718,350 and the minimum is \$38,200 (table 4).

Table 4: Projects per scientist and amount per project

	Minimum	Mean	Maximum
Number of projects per scientist	0	2	6
Amount in \$ per project	213,912	38,200	718,350

4.4.6. Main sponsors of the projects

Most of projects in ISAR, ICRAF and IRST are financed by ASARECA (22% of the total project elaborated by respondents interviewed). Alliance for a Green Revolution in Africa (AGRA) finances around 8% of research institutes projects in Rwanda (table 5).

Table 5: Sponsors of the projects

Projects Sponsors	Percentage (%)
AGRA	8.3
ASARECA	22.2
BeCa	2.8
Bill and Melinda Gates Foundation	5.6
CEFDHAC	2.8
DFID/UK	2.8
EU	2.8
GOR	5.6
IDRC	5.6
NUR	2.8
PADAB	2.8
RSSP	2.8
UCRIDP	2.8
World Bank	5.6
CFC	2.8
Harvest Plus	2.8
Holland Embassy	2.8
EU/STABEX	2.8
Rockefeller Foundation	2.8
USAID	2.8
CIP	5.6

3.4.7. Why some project are rejected and not sponsored

The main reason for rejecting the submitted project to the donor is the big number of the projects submitted to the financing agencies which have about 27% of all reasons (table 6). Other reasons are to meet donor's requirements/criteria and fit into his format properly, the lack of communication with donor and follow up of the submitted project. The respondents reported also that the conditions which journals look for are originality of the research work and to comply with the journals' guidelines.

Table 6: Limiting reasons for the project to be financed by donors

Limiting reasons	Percentage
Competition with many other projects	26.7
Format not respected and poor English	13.3
Lack of communication with donor (follow up process)	13.3
Respect of deadline	13.3
Selection criteria	13.3
Slow and long administrative issues	6.7
To meet donor's requirement and to fit into country's priorities	13.3

3.4.8. Beneficiaries of projects reports

All respondents claimed that the elaborate technical reports. 57.4% of them send the reports to their direct supervisors, 16.7% send the reports to conference organizers and 14.8% to the donors (Figure 2).

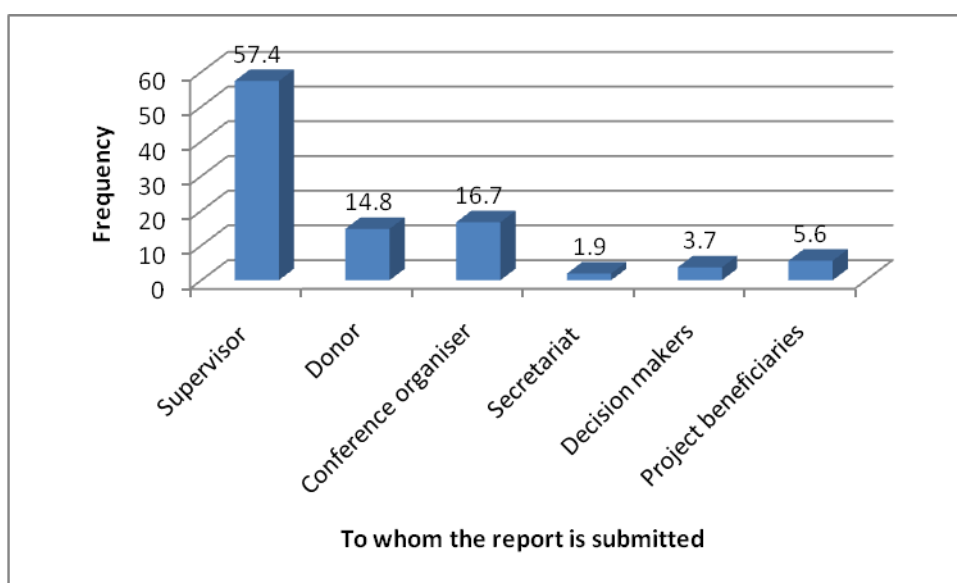


Figure 2: The beneficiaries of the scientific reports

3.4.9. Attempt to submit an article to the journal

A big (60%) number of respondents have never attempted to submit an article to the journal in last 10 years. only 40% have tried to submit an article. areas in which those article were talking about were Agroforestry, animal nutrition, botanic/phytomedicine, chemistry, crop production, ecology, food science, gender, human nutrition and pharmacognosy. Journals in which the respondents have tried to submit the articles are

advanced journal of food science and technology, Africa crop science journal, Biodiversity conservation and natural resources management in Africa, Cambridge journal, Cereal chemistry, Food and bioprocess technology, Food chemistry, Medical journal, Pakistan journal of nutrition, Planta medica, South African journal of clinical nutrition and Systematique et conservation des plantes africaines journal. Main publishers mentioned by respondents are Africa World Press of New Jersey, American Association of Cereal chemists, Asian network for scientific information, Elsevier, Fauna and Flora international, Maxwell, Royal botanic gardens and Springerlink.

3.4.10. Types of articles

The majority of publications belong to proceedings (41.2%) (Figure 3). Papers constitute 29.4%. Books and book chapters occupy small portion of publications. ISAR has more publications than IRST.

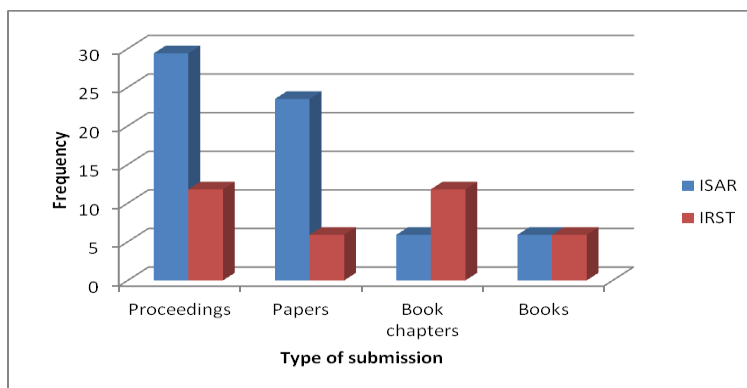


Figure 3: Type of submission by institution

3.4.11. Source of information on journals and publishers

The major source of information on the journals' requirements is internet (38.5%) (Figure 4). Other source of information is supervisors, colleagues/friends and lecturers.

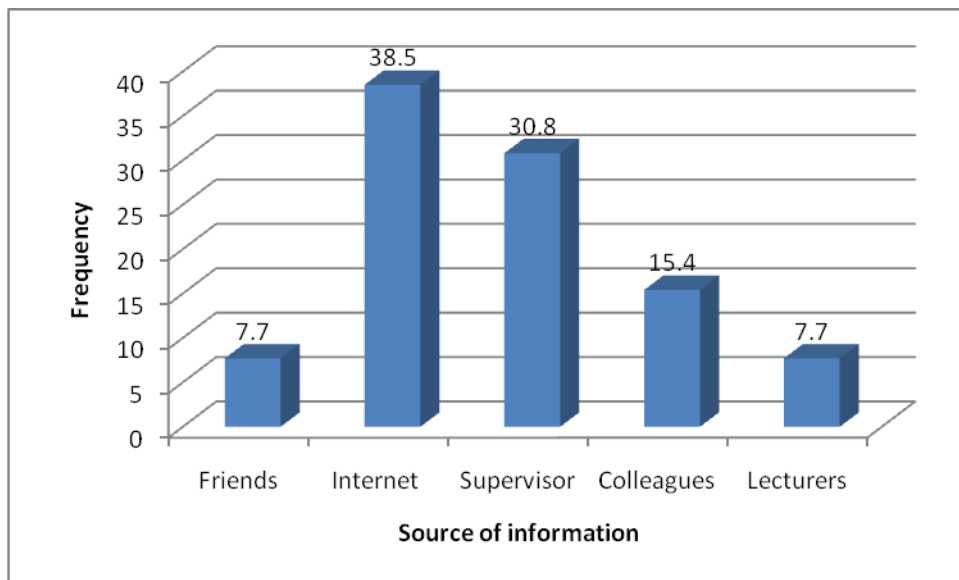


Figure 4: Source of information on journals and publishers

3.4.12. What motivate researchers to publish

Many respondents reported that what motivates them to publish is to help advance knowledge (40% of respondents), to be promoted in their career (30%) and to communicate (20%) (Figure 5). Other things which motivated them to publish are to satisfy donors who spent money for research, to fit into universities requirements in order to obtain a degree, to become famous and to be credible in research.

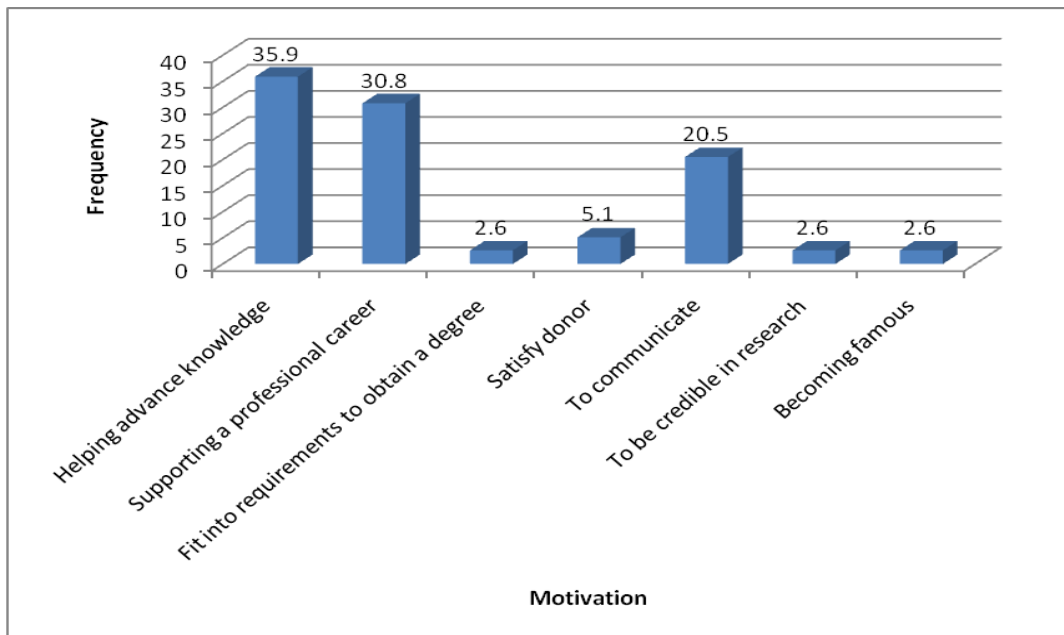


Figure 5: What motivated researchers to publish

3.4.13. Conditions for publication

The majority of respondents reported (84%) that it's hard to publish. only 16% don't see any problem in publication. The challenges for publication are hard conditions for publications in international journals, hard work, time and concentration for paper writing, need of high quality of research and innovation, some journals seek for page charges to publish, lack of journals especially region and sub-region ones in some research areas, lack of research facilities and materials which lead to unreliable data and lack of knowledge and skills in paper writing. Other challenges reported by respondents are many corrections from paper reviewers, the use of different methodologies from a journal to another, a lot of time to read other related articles, lack of incentive for those who publish, difficulties to convince the editors of the facts and the trueness of the

obtained results, a lot of administration tasks for scientists which do not leave them with time to publish, data analysis difficulties, difficulties to identify the right journal and its requirements for publication, lack of internet connectivity, lack of information on the journals, lack of team work spirit, laboratories and research funds, lack of internal publications plan and lack of mentorship of young scientist.

Assistance to scientists which could motivate them to publish are training on scientific writing, access to international journals, availability of appropriate working equipments and research funds, availability of information on journals and their requirements and create linkage with journals, collaboration with skilled scientist mentorship with experienced senior scientists, encourage reading more books and articles, availability of incentive and promotion for those people who publish, availability of internet connectivity and availing in respective research programs a budget line allocated to publication.

3.5. Conclusion

The inability to write scientific papers effectively remains a problem for many researchers. The researchers fear to publish because of lack of high quality research and innovation. Lack of publications plan, limited knowledge and skills in paper writing, data analysis difficulties and lack of mentorship of young scientists are among limiting factors for research publication. Training on paper writing is the solution for promoting publication.

CHAPTER 4

4. FACTORS AFFECTING FRUITS PRODUCTION AND MARKETING AMONG SMALLHOLDERS IN RWANDA

4.1. Summary

This is a descriptive survey to assess factors affecting fruits production, consumption, processing and marketing among smallholders in Rwanda. A sample of 274 farmers was randomly selected in two districts of Rwanda. The districts were selected based on agroecological zones. Musanze in high elevation and Huye in middle elevation and the data were collected using a questionnaire. The data were analyzed using descriptive analysis statistics. The study showed that the fruits produced in two districts are Avocado, Papaya, Mango, Tree tomato, Orange, Lemon, Guava, Passion Fruit, Pineapple, Mandarin and Gooseberry. Avocado is the most fruit produced in Rwanda. 53.8% of farmers grow fruits for home consumption and sale. 63% of fruit farming system are trees scatted in the farms. Small farm size is the major reasons limiting fruit production. 78.6% of farmers do not use input for fruit production. Availability of inputs, farmers' trainings and the use of improved planting materials which reported by 40.3%, 35% and 18.9% of respondents are the major interventions to increase fruit production. The most preferable fruits in the market are avocado, orange, tree tomato and mango with 27%; 18.7%; 16.7% and 11.5% respectively. The most sold fruits in the markets are Tree tomato (52%), passion fruit with (44%), orange with 36% and apple

with 36%. Almost all fruits are rare from August to January, while almost all are in plenty from January to July. The biggest problems in fruits market is the perishability of fruits (60%) and shortage of buyers (26%).

4.2. Introduction

In its Vision 2020 plan, Rwanda set ambitious goals for its development. Between 2000 and 2020, the country would like to grow its per capita GDP from \$250 to \$900, which implies that the overall economy needs to expand by over 600% (MINICOFIN, 2000).

Within the framework of the agricultural transformation, the government of Rwanda has embarked on an ambitious strategic program of horticulture sector development mainly fruits aiming at modernizing and professionalizing this sector so as to contribute to the national economy. Given its potential to contribute to Rwanda's export diversification, horticulture essentially fruits has been identified as a priority export sector.

The fact that the potential is undeniable; but equally undeniable is the fact that little or nothing has been done as yet to develop the full potential of Rwanda's fruit sector. Market fruits should be contributing much more to the economy and export receipts, as well as to the livelihood of rural farmers through improving nutrition and income generation.

Horticulture (defined as fresh and ornamental flowers, fruits, vegetables and shrubs) is the single largest traded industry in the world, with annual trade generating around \$57

billion. Sub-Saharan Africa contributes only 5% to this trade. In addition, neighboring countries of Rwanda, like Kenya with quite similar environment conditions, horticulture is the largest export industry generating more than \$ 400 m surpassing even coffee and tea. Likewise, horticulture in Rwanda is a potential driver for boosting the national economy.

In addition to economical considerations, fruits are essential in human nutrition, particularly for vitamins and micronutrients. The most advantage is that in general fruits are consumed fresh, so vitamins are preserved, while in other crops these nutrients are destroyed by cooking and storage processes.

The livelihoods of Rwandan people largely rest upon subsistence agriculture with over 90% directly derive their living from farming. Traditional crops which have dominated the landscape for a long period include maize, sorghum, sweet potatoes, cassava, beans, and a narrow range of fruits and vegetables. Very remarkable is that all fruits of commercial importance are imported except banana, pineapple and avocado. These include mainly mango, apple, papaya, passion fruit, orange and other citrus species. Until some few years ago, the horticultural sector including fruits was not a national priority and largely neglected. However, the favourable climatic and soil conditions of the country offer a high potential for the development of a range of temperate and tropical fruit species. Although many of the mentioned fruit species are already cultivated on most farms of rural Rwanda, their full potential is largely not achieved due

to the use of inferior, unimproved varieties, poor on-farm fruit trees management techniques, diseases and a focus of farmers on subsistence production only. This problematic situation is increased by poor access to the clean fruit tree planting materials, lack of knowledge on post-harvest handling, few numbers of fruit processing facilities and poorly organized fruit marketing. Analyzing this above situation, the government of Rwanda through the Ministry of Agriculture has embarked on a broad program of agricultural sector transformation as a strategy to modernize and professionalize agricultural activities in the country.

Rwanda has favourable climatic conditions for growing different fruit tree species, including temperate ones such as apples, pears and peaches as well as tropical ones such as mango, avocado and passion fruits. Considering this favourable environment and the success of the fruit industry in neighbouring countries such as Uganda and Kenya, the government through Ministry of Agriculture and animal resources (MINAGRI) gave priority to the development of the fruit sector for economic diversification in its large program of agricultural modernization and transformation. Given its potential to significantly contribute not only to supplying domestic markets but also to Rwanda's export diversification, fruits have been identified as a priority export sector.

However, few assessments of market potentials of fruits have been done so far, thus the potential of improved fruit production to enhance incomes and livelihoods in the country have largely remained unexploited. Production of high quality fruits should be

contributing much more to Rwanda's economy and export receipts, as well as to the livelihoods of rural communities.

A consultancy study on inventory of existing fruit species in Rwanda resulted in a number of cultivated fruits namely banana (*Musa x paradisiaca*), avocado (*Persea americana*), papaya (*Carica papaya*), orange (*Citrus sinensis*) and other citrus species, mango (*Mangifera indica*), passion fruit (*Passiflora* spp.), tree tomato (*Cyphomandra betacea*), pineapple (*Ananas comosus*) and guava (*Psidium guajava*). These fruits are mostly planted around homestead for subsistence and very limited local commercialization. It is rare to find monoculture orchards of fruits. Few fruit processing industry exist in Rwanda. Large amounts of fruits such as apple and mango are imported and commercialized in both local markets and super market chains. The majority of farmers don't consider the mentioned fruits as source of income. In rural areas, the fruits are also often not considered as important for a healthy nutrition. For the majority farmers, the fruits are not incorporated in daily meal supply.

Actually program of promotion of comprehensive and poverty reduction at district level are driven by a number of government orientation strategies, vision 2020, millennium development goals and EDPRS. The District of Huye and Musanze are characterized by high population and small size of land. These districts are particularly vulnerable with highest population proportion with risk of majority of population falling below poverty

line. The density is estimated at 600 inhabitants per km², showing the high pressure on land and consequently resulting in less land.

Fruit trees plantation was identified as strategy to reduce poverty, improve livelihood in rural area through income generation and nutrition. Despite, the favorable climatic conditions for fruits production in the districts of Musanze and Huye, the production of fruits remains low due to the lack of clean fruit planting materials, diseases, research on fruits and lack of awareness on importance of fruits for contributing in economy growth. Fruit trees planting promotion is among the strategies to increase nutrition, income and welfare of the district residents. In long run, implementing such poverty reduction programs, fruits products development is thought to be a key area to reduce vulnerability for better livelihood.

Therefore, the introduction of trees in particularly fruits should contribute to address the challenges of poverty, nutrition, diversification of export products and boost Rwanda's economy. Beneficiaries are farmers and development economic partners who execute economic transformation in line with the government policies. Farmer's top priorities and preferences are keystone in developing new opportunities and improving the overall communities and district development.

4.3. Objectives

4.3.1. General objective

The general objective of this study is to enhance fruit production, processing marketing and consumption for improved nutrition and income of smallholder farmers.

4.3.2. Specific objectives

The specific objectives are:

1. To assess biophysical and socio-economic factors determining fruits production in Rwanda
2. To determine the types of fruits produced in Rwanda
3. To assess existing and potential fruits markets in Rwanda

4.4. Methodology

The survey was conducted as a questionnaire (appendix 2 and 3) aimed at capturing information regarding the current fruit production in Rwanda and factors affecting fruits production. Sites Selection was based on agroecological zones. In high altitude, Musanze district had been chosen. In medium altitude, Huye district had been chosen.

Musanze District is one of the 5 Districts of the Northern Province. It is the most mountainous district, containing the largest part of the Volcanoes National Park. It has a total surface area of 530.4 square Kilometers. The district has a population of 314,242

inhabitants with an average of 593 inhabitants per square kilometer and lies between longitudes 1.437S and latitudes 29.57E

Huye District is one of the eight districts that make up Rwanda's Southern Province. It has a total surface area of 581.5 square Kilometers. The district has a population of 314,022 inhabitants with an average of 540 inhabitants per square kilometer. The District has rainfall distribution pattern of 1.200 mm and an average temperature of 19°C and lies between longitudes 2.17S and latitudes 29.79E.

Within each district one sector was randomly selected. In Musanze district, Kinigi sector was selected. In Huye District, Rusatira sector was selected. At sector level, two cells had been randomly selected and at cell level, two villages had been randomly selected. Observation unit is Household in each village. The total sampled HH are 274 (Table 7). In addition to that 10 fruits sellers in each district had been interviewed in the biggest market of the district and one supermarket. Five supermarkets in Kigali town had been randomly selected because Kigali markets and supermarkets are the biggest fruits sellers in the country. The research extended from 17th June 2011 to 23rd June 2011.

Table 7: Number of HH interviewed (respondents) in each village

Districts	Sectors	Cells	Villages	No of respondents
Huye	Rusatira	Kimuna	Kamabuye	34
			Nyabusunzu	32
		Kimirehe	Kavumu	34
			Nyakabuye	36
Musanze	Kinigi	Kaguhu	Kabeza	34
			Rugeshi	35
		Kampanga	Muhe	35
			Nyejoro	34
Total	2	4	8	274

4.5. Results and discussion

4.5.1. Socio-economic characterization of household

4.5.1.1. Gender characteristics, age and marital status of household heads

The majority of household (HH) heads interviewed are males (62.4%). Musanze District has the highest number of males (33.9%) than Huye (28.5%). However, there are HH currently headed by women (37.6%), with Huye having the highest number of women heading HH (21.5%).

The high age range is registered between 36-55 years of age with 38.7% of respondents followed by above 55 years age (31.3%). Compared the two districts, Huye has the highest number of people in this category of 36-55 (21.5%) than Musanze (17.2%) and above 55 years, Huye had higher (18.2%) than Musanze (13.1%). In category of 21-35

years of age, Musanze indicate high age range with 17.5% of respondents while Huye had 9.9%.

Most of the respondents (56.6%) were married living with their spouses while 29.9% of the respondents were widowed. The high number of widows was due to the Genocide against Tutsi of 1994. Musanze has the highest number of married people living with their spouse (30.7%) while Huye has the highest number of widows/widowers (17.5%).

4.5.1.2. Education level and occupation of households heads

The highest level of education attained by any household head was secondary school, with only 7.9% having had reached that level (Figure 6). Majority of the household heads (47.8%) had never attended school while 43.6% had reached primary school level. Few farmers received a post-primary training in handcraft activities. These imply that the literacy level of respondents in two districts is extremely low.

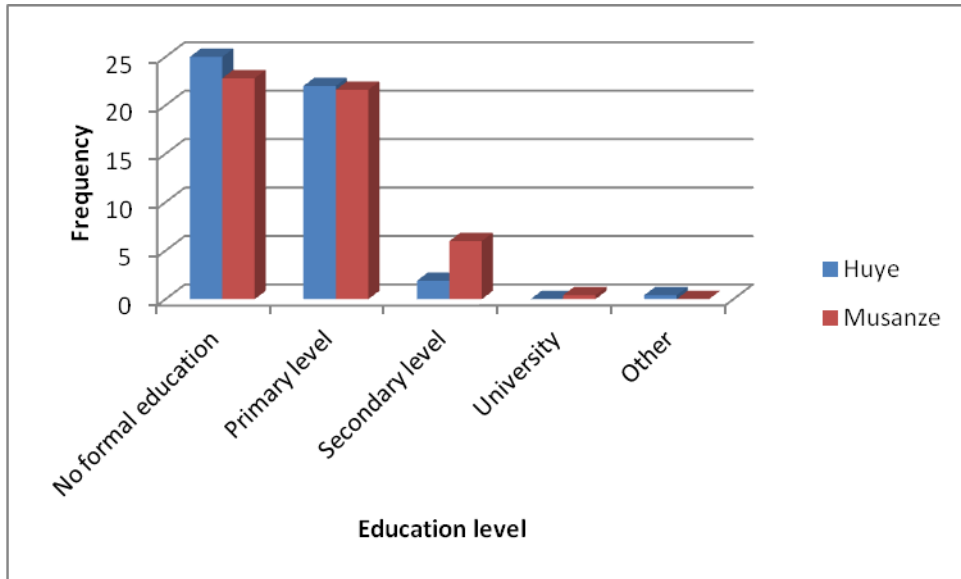


Figure 6: Education level of respondents

The majority of household heads are farming crop and livestock (90.2%). This reveals the lack of off-farm activities in Rwandan rural areas. However, Musanze compared to Huye reported number of off-farm activities namely in business (2.4%) and salary (1.5%) (Figure 7).

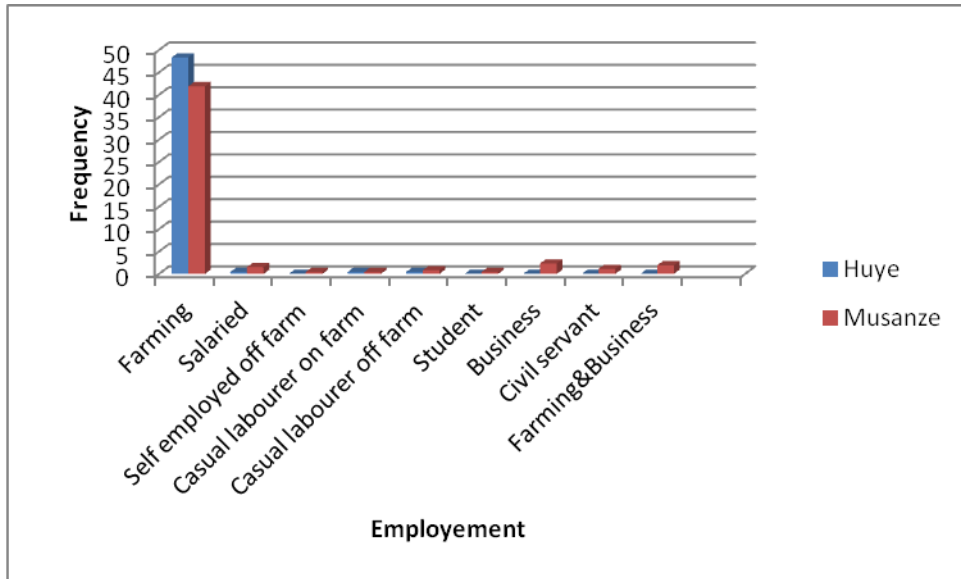


Figure 7: Occupation of household head

4.5.1.3. Land size (in ares) in selected districts

The figure 8 shows some landless farmers (2.2%). Majority of the respondents (33.2%) has between 0.0 and 0.25 ha and Huye has high size of land (21.2%) while Musanze has (12.0 in the range of 26 – 50 ares, Huye has the high land size (10.6%) and Musanze has the low land size (4.7%). The size of land is small in Musanze because Musanze is characterized by high density of population compared to Huye. These figures are confirmed by Statistics of Rwanda (census 2002).

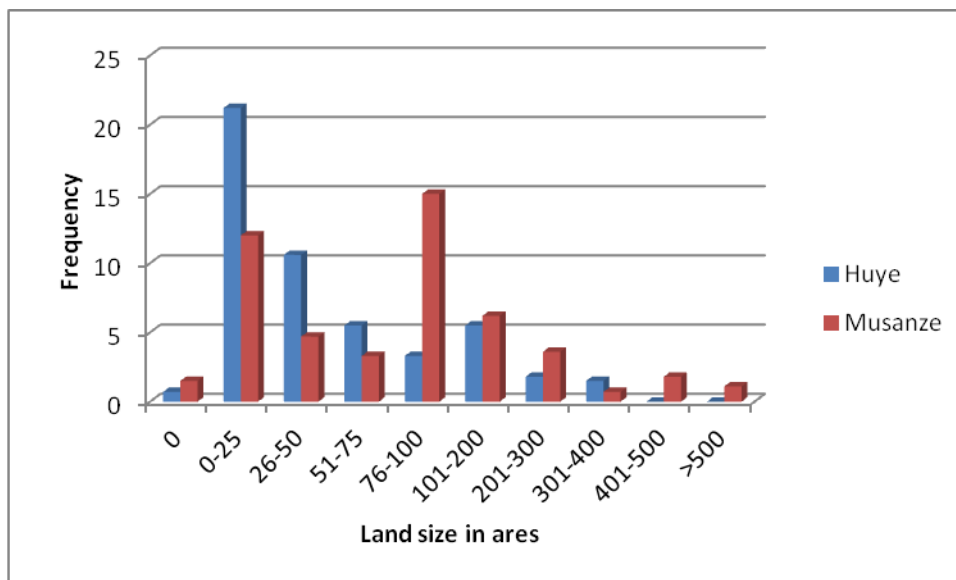


Figure 8: Household land size in selected districts

4.5.1.4. Land ownership, dominant crops and reasons for growing crops

Majority of the respondents (76.6%) owned land by inheritance. Other ways in which the respondents obtained their land were through purchasing (13.7%), borrowing (8.1%) and renting (2.1%).

The crops grown most by farmers in Huye district are beans, cassava, sorghum, peanuts and Coffee. In Musanze district, the common crops are irish potatoes, maize, Pyrethrum, beans and sorghum. Beans, irish potatoes, maize and sorghum are found both in Huye and Musanze. There are no cassava, coffee, peanuts, rice and soybeans in Musanze district (table 8).

Majority of respondents reported that the main reason for growing food crops is consumption and sale (66.5%). Only, 28.3% reported that food crops are produced for home consumption, while 5.3% only reported that food crops are produced for sale.

Table 8: Major crops in selected districts

Crop	Districts					
	Huye			Musanze		
	Frequency	%	Rank	Frequency	%	Rank
Beans	42	15.4	1	18	6.7	4
Cassava	39	14.3	2	0	0.0	
Coffee	7	2.5	6	0	0.0	
Irish potatoes	3	1.0	10	45	16.5	1
Maize	3	1.1	9	31	11.2	2
Peanuts	10	3.7	4	0	0.0	
Pyrethrum	0	0		30	10.5	3
Rice	6	2.2	7	0	0.0	
Sorghum	20	7.3	3	1	0.4	5
Soybean	2	0.9	8	0	0.0	
Sweet potatoes	10	3.7	5	0	0.0	

4.5.1.5. Status of fruit trees production in selected Districts

The majority of respondents (61.6%) have fruits in their farms while 38.8% don't have any fruit in their farms. Farmers in Huye district have fruits in their farm (37.2%) than in Musanze district (24.4%). Musanze is located in high altitude (1600- 2000 m) with low temperature, which could explain probable low fruits in area due to the problems of adaptability and lack of information on temperate fruits adapted in the area.

Fruits produced in two districts are Avocado, Papaya, Mango, Tree tomato, Orange, Lemon, Guava, Passion Fruit, Pineapple, Mandarin and Gooseberry (Figure 9). Avocado is the most fruit produced in Rwanda (36.6%). Huye district produces more avocado (28.4%) than Musanze (8.2%) (Figure 9). Papaya is the second fruit produced in the two districts at the same rate (8%) followed by Mango which is more produced in Huye (12.3%) than in Musanze (0,7%). Musanze is in high altitude, climate inappropriate for mango production, which could explain the low percentage of respondents. Tree tomato is more produced in Musanze (10.3%) than in Huye (1.4%). In General, Huye produces more fruits (71.6%) than Musanze (28.4%). Musanze does not grow Lemon, Orange, Guava and Mandalin while Huye grows almost all fruits except Gooseberry. Passion fruit is rare in the two districts even if they have passion fruit production potential, because of passion fruit woodiness virus which attacked passion fruits in Rwanda. In general, the types of fruits produced are low in both selected districts. In the past, fruits productions were not a priority crops and in addition there is no strategy to assist farmers

in diseases control and provide the clean and improved materials. The majority of fruits consumed are imported.

The majority of respondents (53.8%) reported that they grow fruits for home consumption and sale while 41.9% of respondents grow fruits for home consumption. Farmers in two districts producing fruits for sale are very few (3.1%). The majority of fruits sold to the market are imported except banana, avocado and pineapple. As fruits were not a priority crops, the market value of fruits was not known.

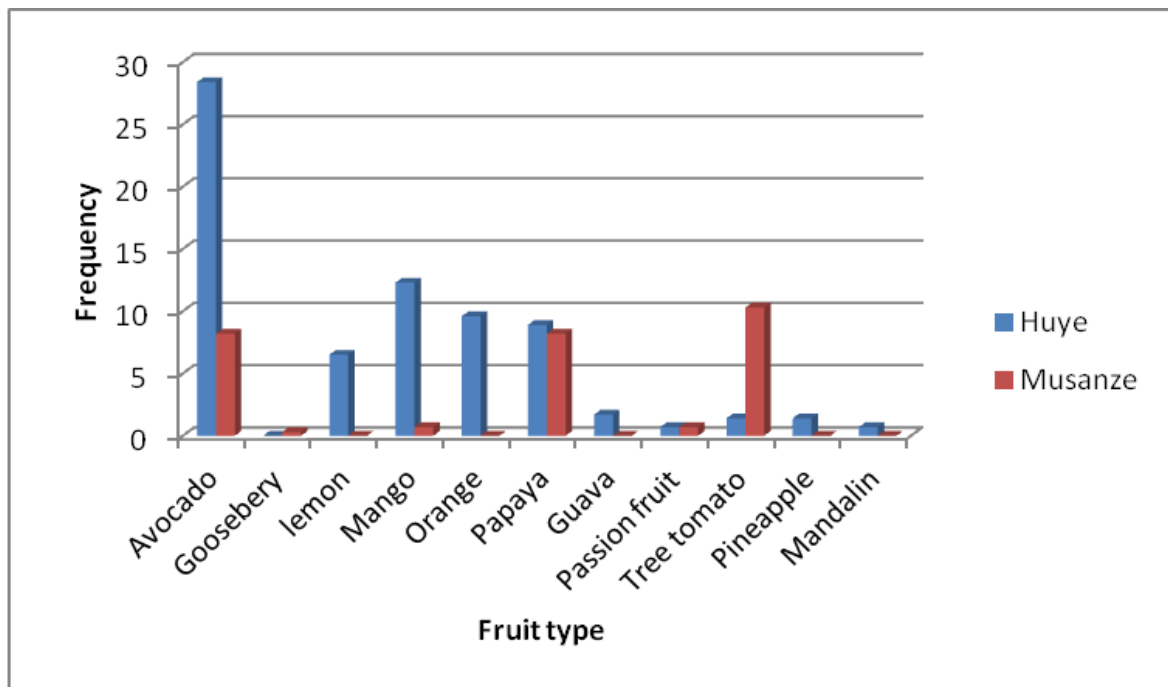


Figure 9: Type of fruits production in selected districts

4.5.1.6. Niches for fruits production

The majority of respondents (63.2%) reported that their fruit trees are scatted in the farms, others (16%) use fruit tree on the trenches as erosion control while (9.7%) have fruit orchards planted alone in separate farms (Figure 10). Only, 9.0 % of respondents reported intercropping fruits with other crops and 2.1 % of respondents rotating with crops. The usually niches in Rwanda for fruits production are scartted, monoculture, terraces. Banana and peanapple are planted as monoculture, avocado, mango and tree tomatoes are scartted in farms

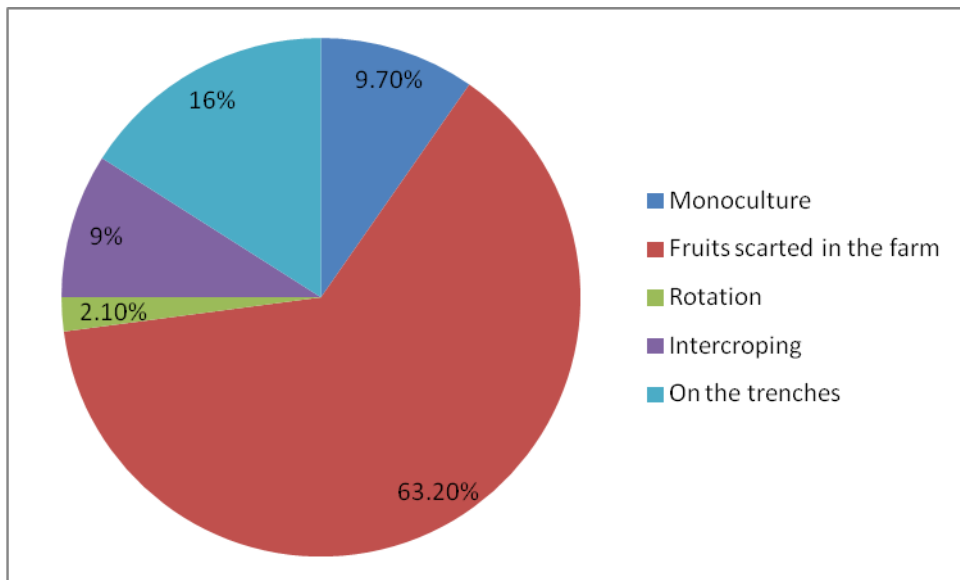


Figure 10: Fruit farming system

4.5.1.7. Perception of farmers on economic importance of fruits at household level

Only 4.5% of respondents reported that selling fruit production from their farms cover their needs while 95.5% reported that fruit production from their farms is not enough to cover their needs. In Huye, some farmer got money from avocado while in Musanze fruits production is low.

4.5.1.8. Perception of farmers on requirements for optimum fruits production

Over 40 % of respondents reported that suitable environment and fertile land are major requirements for optimum fruits production while small family size (11.8%) indicate small could lead to produce fruits which could satisfy the needs of the family. The acquisition of improved seeds or improved planting materials as condition to increase fruits production was reported by 5.9% (Figure 11).

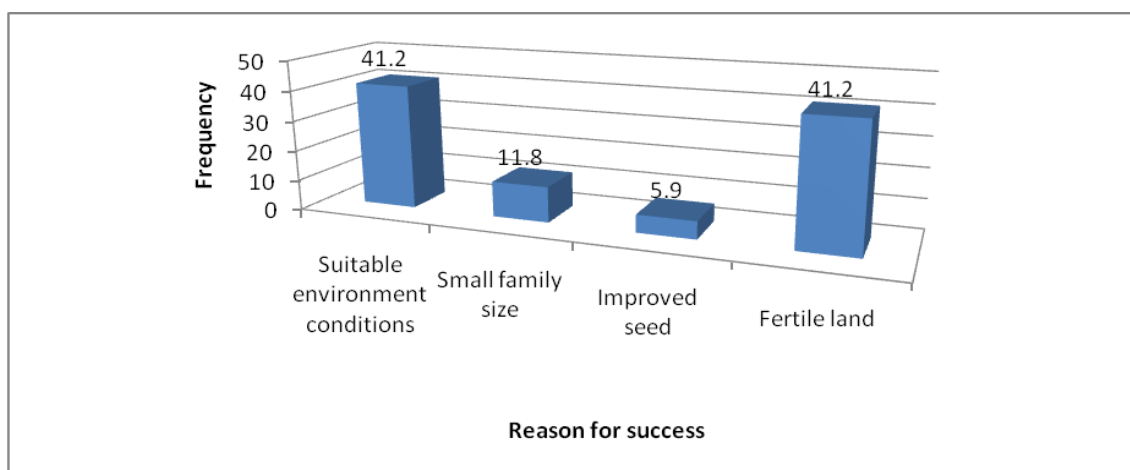


Figure 11: Requirements for optimum fruits production for family satisfaction

4.5.1.9. Limiting factors for fruits production

The major reasons limiting fruit production is the small land size, pest and diseases, lack of inputs and planting materials and other reasons not expressed. The majority of respondents 31.2% reported that the limited land is the major cause limiting fruits production while 13.8% mentioned pests and diseases, and 20.5% cited lack of inputs and planting materials as the reason limiting fruits production. Infertile land, big size of family and lack of market were mentioned by few farmers interviewed as the factors limiting also fruits production (Figure 12).

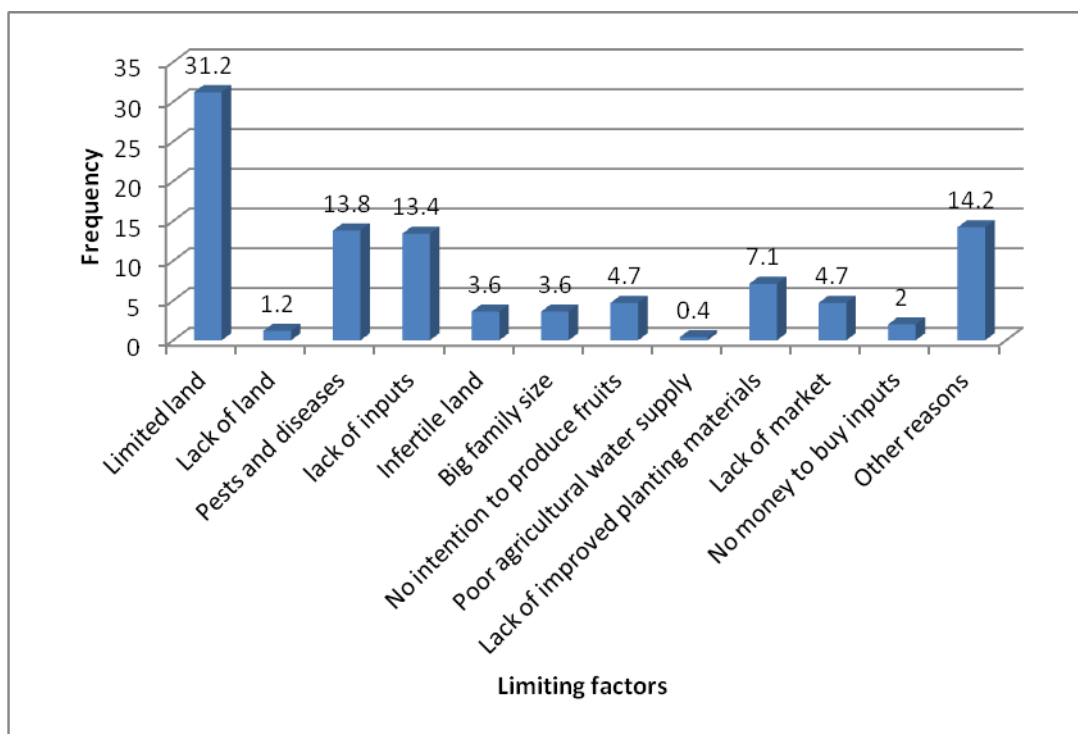


Figure 12: Limiting factors for fruits production

4.5.1.10. Utilization of inputs and types of fertilizers in fruits production

The majority of respondents (55.8%) use fertilizers while 8.4% use pesticides to control diseases and 34.7% use both (fertilizers and pesticides).

The majority of respondents (75.3%) use farm yard while 14.6 % use mineral fertilizers namely DAP (6.7%) and NPK (7.9%) (Figure 13). The green manure and compost are used by small proportion of farmers. In rural areas of Rwanda the available fertilizer is animal manure.

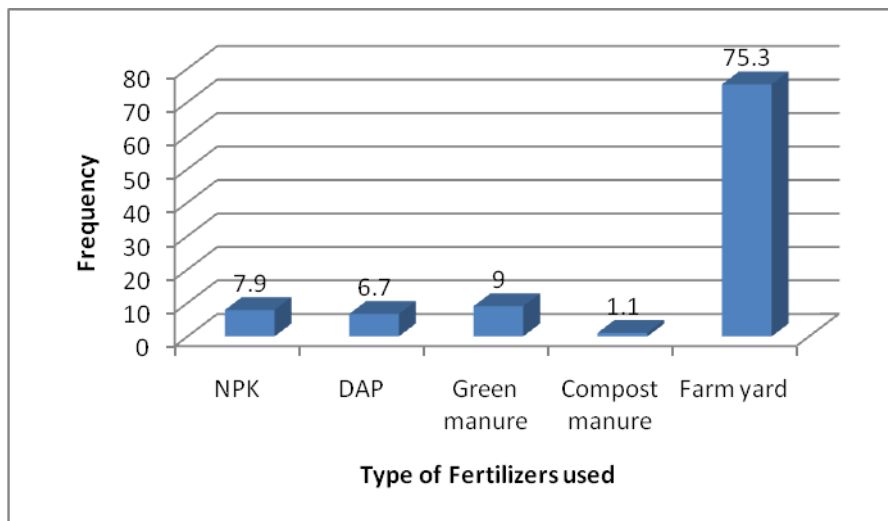


Figure 13: The type of fertilizers used

The majority of respondents use Thiodan (32.1%) and Dithan (30.4%) to control diseases (Figure 20) Thiodan (endosulfan) and dithan are the most phytosanitary products used in fruits production in the two districts because of their availability on market. An important proportion (25.4%) did not indicate the methods used.

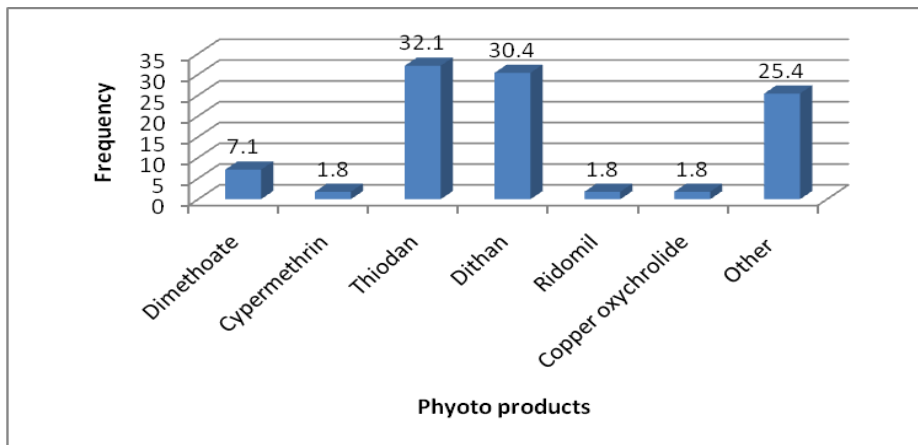


Figure 14: Diseases Control products

4.5.1.11. Accessibility to the inputs and training for fruits production

The respondents (35%) had access to the training, 40% reported the availability of the inputs and 18.9% have access to the improved planting materials, 8% have access to the credit and only 0.8% of respondents have received land for crops production including fruits.

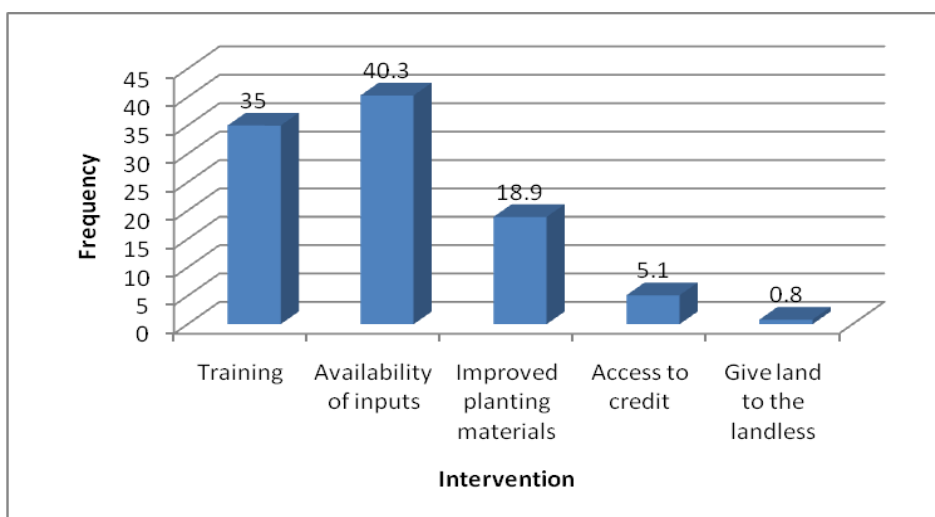


Figure 15: Accessibility to the inputs and training for fruits production

4.5.1.12. Estimated distance between home and market

In average, farmers use 4 km to reach the nearest market, 3.8 km to reach nearest agro-dealers shop, 1.5 km to selling place and 1.8 km to reach the main road. The maximum km used by some farmers to reach market, agro-dealers shop is 12 km. For market place and road side sales, the farmers use 10 and 15 km respectively.

Table 9: Distance between field /home and market

Statistics	Distance to the nearest market (km)	Distance to the nearest agro-dealers shop (km)	Distance from field to the selling place (km)	Distance from home to the main road (km)
Minimum	0 Few meters	Few meters	Few meters	Few meters
Maximum	12	12	10	15
Mean	4.05	3.83	1.48	1.81
SEM	0.22	0.23	0.20	0.13

4.5.1.13. Transport in fruits transaction

Transport means used by farmers

The majority of respondents (75.3%) transport by head their fruits to the market, 14.6% fruits are collected directly from field by sellers (Middle man) to the market and 9% of respondents use bicycle to transport their fruits to market. Majority of farmers transport fruits and other products to the market by head.

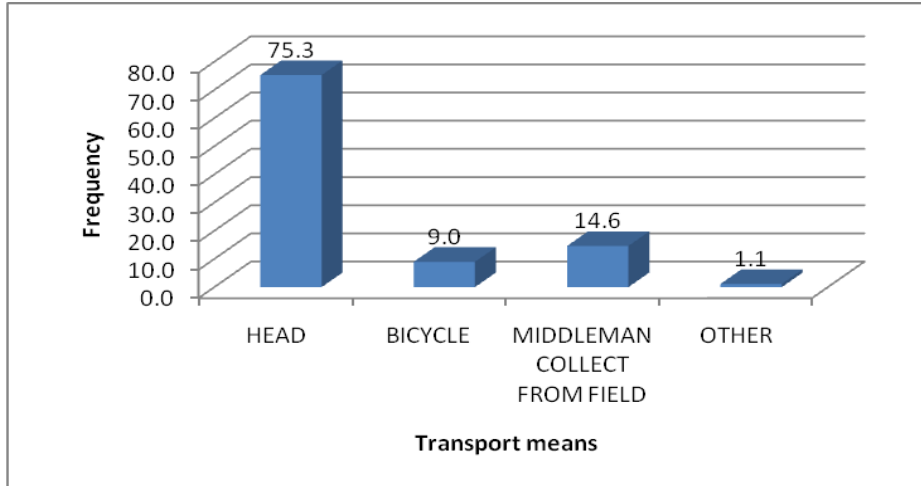


Figure 16: Fruits transport from field to the market

Transport means used by sellers

The major fruits transport used by fruit sellers is taxi (38.6%) and head (30.1%). Motorcycles and Van car are also used.

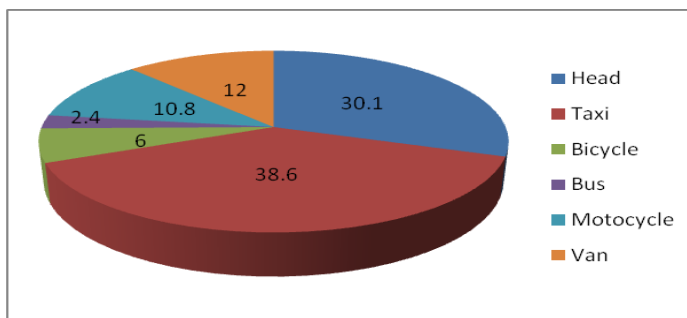


Figure 17: Means of fruits transport used by sellers

4.5.1.14. Criteria for sorting fruits

The majority of farmers (45.7%) use the criteria for mature (ripen) to sort their fruits before selling (Figure 18). The respondents (15.7%) use the size of fruits to sort the

fruits before selling. The other respondents (38.6%) use the criteria damage to sort their fruits.

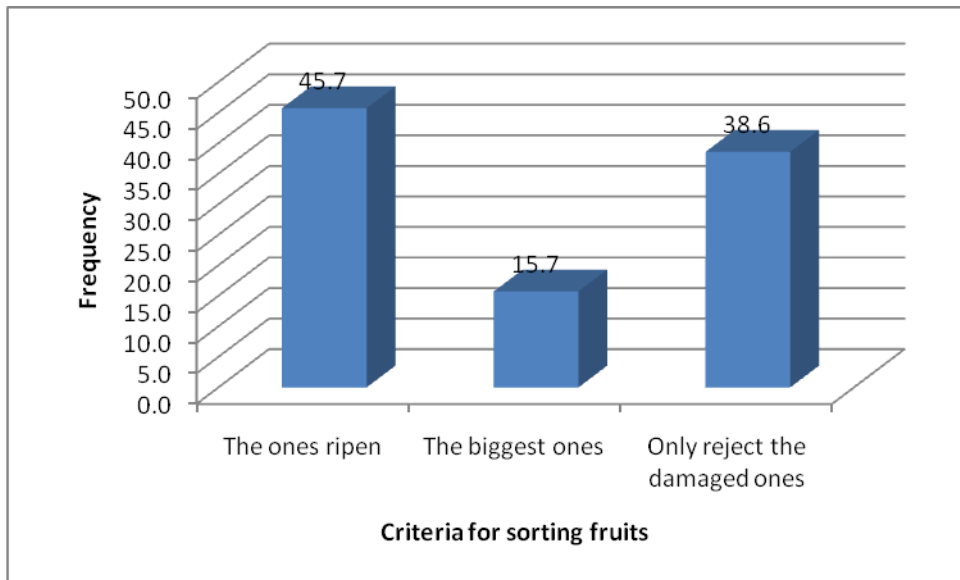


Figure 18: Criteria for sorting fruits

4.5.1.15. Dominant and preferred fruits in the market

The most dominant fruits in the market are avocado (27%), orange (18.7%), tree tomato (16.7%), Mango (11.5%). Passion fruit, Guava and gooseberry are less dominant (Figure 19).

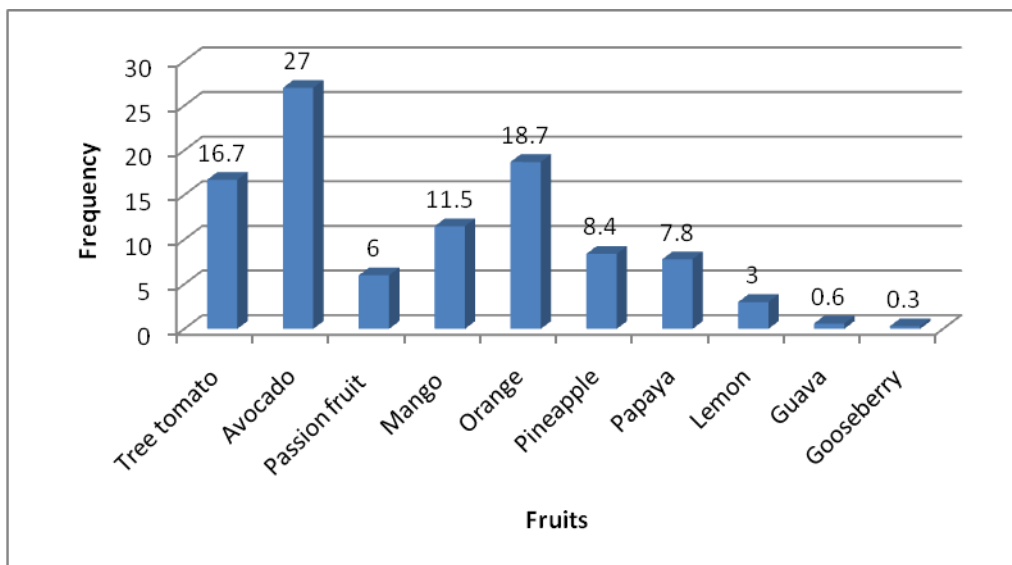


Figure 19: Dominant and preferred fruits in the market

4.5.1.16. Origin of fruits sold to the market

The most sold fruits in the visited markets are tree tomato (52%), passion fruit (44%), orange and apple (36%), pineapple (32%), lemon (24%), papaya (20%) (Table 10). Mango, Mandarin and Apple are imported from Burundi, Kenya, South Africa, Uganda and USA. Other fruits are produced locally. Surprisingly Avocado is not the dominant sold fruits in these visited markets.

Table 10: Origin of fruits sold to the visited market

Fruit	Percentage of sellers	Origin
Avocado	12	Local producers, Gitarama
Orange	36	Local producers, Gasabo District, Burundi, South Africa
Mango	20	Burundi, Kenya
Papaya	20	Gitarama, Kibungo, Kibuye
Lemon	24	Gakenke, Gitarama, Kibungo
Passion fruit	44	Gakenke, Gitarama, Ruhengeli
Pineapple	32	Gakenke, Gitarama, Kibungo
Tree tomato	52	Local producers, Ruhengeli, Burundi
Mandarin	24	Burundi, USA
Apple	36	South Africa, Uganda

4.5.1.17. Category of customers in visited market

The sellers interviewed reported that the majority of customers are women (57.9%) followed by men (26.3%) and children (15.8%). In Rwanda, women are responsible for budget for food in the house while the men occasionally buy fruits. The children buy the fruits when the parents send them to the market after school.

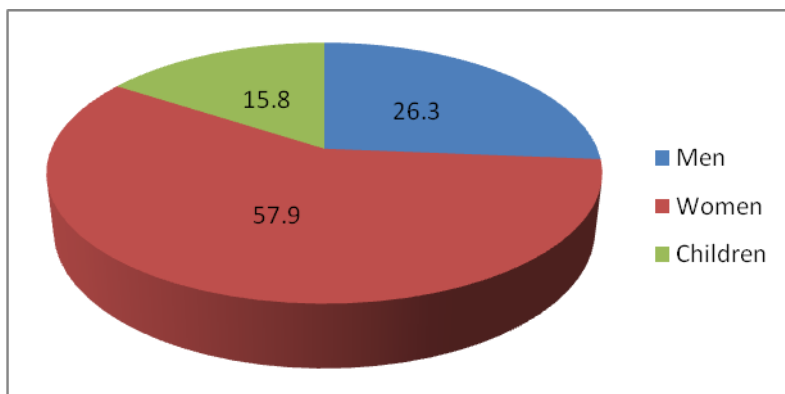


Figure 20: Category of customers

4.5.1.18. Fruits storage

Most of fruits sellers prefer to store fruits in wooden boxes (31.4%). Basket and plastic crates are also used for storage fruits. The sellers interviewed (20%) use baskets while 14.3% use plastic crates. The systems used by sellers to store fruits in ordinary market lead to high fruits losses. All methods of storage reported by sellers lead to the high fruits losses. The modern methods of storage for fruits are found in super market where the fridges are used.

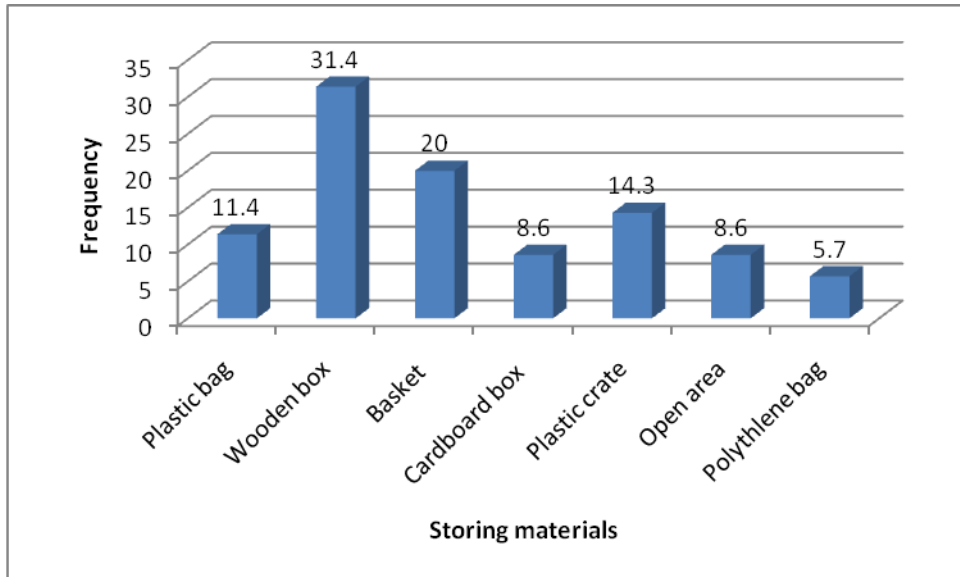


Figure 21: Storage fruits

4.5.1.19. Factors limiting availability of fruits to the market

The majority of respondents (87%) reported that there are problems in fruits market while 13% don't indicate any problem. The major problems mentioned are lack of equipment of storage (perishability of fruits) (60%), lack customers (25.6%), low price of fruits (10%), transport cost (3.3%) and poor quality (1.1%) (Figure 22).

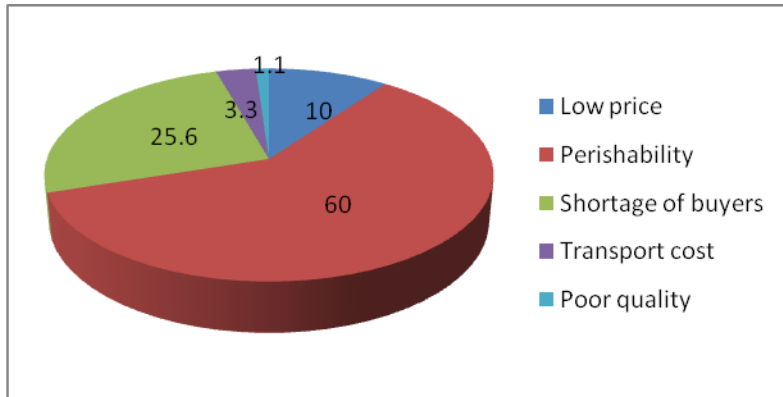


Figure 22: Factors limiting fruits in market

4.5.1.20. Fruits price negotiation

Majority of respondents (62.5%) reported that the price of fruits is the results of negotiation between customers and sellers, while 37.5% reported that the price is fixed by sellers themselves. The price varied according to the abundance of fruits in the market. According to the law of demand and supply, the price will be higher during the abundance period and low in period where fruits are few at the market. This fluctuation of fruits supply is due to the physiology of fruit tree and environment conditions which determine the harvesting period. Rwanda promotes free market and there are cases concerning the government price fixation reported.

4.5.1.21. Source of income per household per year

The major sources of income per household per year are described in Table 11. Selling crops including fruits are the important source of income (320,500 Rwf) followed by salary (24,110 RWF) and Business (37,386 RWF).

Table 11: Source of income for household per year (RWF)

Statistics	Salary (RWF)	Business (RWF)	Wage labor (RWF)	Remittanc e (RWF)	Leasin g land (RWF)	Selling crops (RWF)	Other sources (RWF)
Mean	24,110	37,386	1,5391	2,446	2,359	320,500	14,737
SEM	6,878	1,1720	3,585	1,111	1,440	26,220	6,480
Minimum	0	0	0	0	0	0	0
Maximum	1,000,000	2,000,000	600,000	200,000	250,000	3,000,000	700,000

Table 12: Fluctuation in fruits supply and price

Fruit name	Months of plenty supply	Months of scarcity supply	supply per day in plenty (kg)	supply per day in scarcit y (kg)	Buying price per kg in plenty (Rwf)	Selling price per kg in plenty (Rwf)	Buying price per kg in scarcity (Rwf)	Selling price per kg in scarcity (Rwf)
Avocado	Feb-june	Aug-Jan	28.9	11.8	212	220	117	159
Orange	Feb-June	Aug-Jan	22.5	17.6	418	578.5	647.3	757.4
Mango	Feb-May	June-Jan	18.5	17	454.2	731.2	583.3	816.6
Papaya	Feb-Aug	Sept-dec	59.6	14.2	216.6	325	391.6	533.3
Lemon	Feb-July	Aug-ma	14	11.2	258.5	396.6	452.8	622.1
Passion fruit	Jan-Aug	Sept-dec	19.8	14	443.2	657.6	699.2	868.6
Pineapple	Jan-Sept	Sept-dec	132.1	22.7	186.8	286.1	583.3	755.5
Tree tomato	Jan-Sept	Aug-dec	21.7	21	710.7	1613.3	1020	1873.3
Mandarin	Jan- une	July-Jan	11.7	7.1	631.2	887.5	785.7	1021.4
Apple	Sept-Jan	Jan-Aug	42.3	13.2	487.5	562.5	1075.7	1387.1

4.5.1.23. Access to credit

The majority of respondents (71.6%) interviewed did not have access to credit and only 28.4% had. The main reasons for asking credit are for agricultural activities (44.4%), medical care (26.9%) and housing (10.2%). The sources of farmer's credit are banks,

SACCOs, private lenders, women associations, local traders, farmers’ associations, relatives and friends. The credit in banks is supplemented by loan from the relatives and friends and farmer associations.

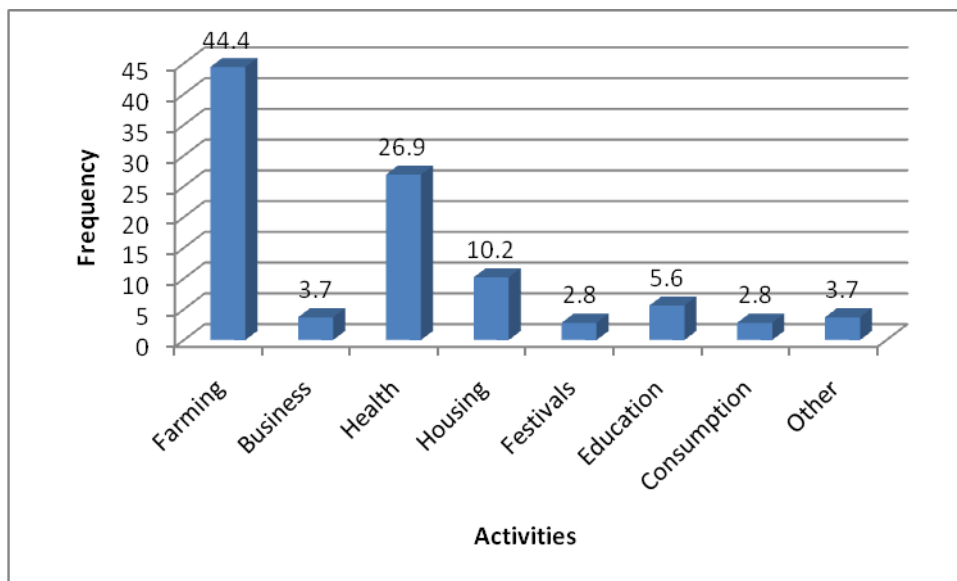


Figure 23: Household access to the credit

4.5.1.24. Accessibility to the training by fruit producers

The majority of respondents (84.1%) reported that they don’t have access to training while 15.9 % have received training on fruits. Focus training on fruits production is critical issue and is lacking. However, they participate in other training namely agriculture in general, health, economy handcraft, conflict management. The majority of farmers are illiterate so there is need for special training for this kind of farmers which should involve use of mass media, radio, pictures and field visits.

4.6. Conclusion

This survey aims to conduct a study on characterization of the biophysical and socio-economic factors for fruit production and utilization in Rwanda. The survey, and indirect observation shows that Rwanda have favorable climate for temperate and tropical fruits (biophysical factors) production. The socio economic factors analyzed revealed that fruits in Rwanda is limited by many factors namely limited land, pest diseases, lack of improved of planting materials, lack of fertilizers and training for few farmers who grow fruits. The analysis of the market shows the fluctuation of fruits supply and price. During the high period of fruit production the price are low and in low period of production the price is high. The lack of equipment for fruits conservation led to the loss excess fruits produced during high period of production. In the market of rural areas where the survey was conducted, the inexistence of equipment of conservation was observed and fruits are not consider as business capable to contribute to the economy growth of household and nutrition. The absence of fruits processing units was also noted. The price is fixed between the producer and the buyer and the fruit pass through middle man before reaching consumers. The high value fruits such as Mango, apple, tree tomato, passion fruit and mandarin are imported from Burundi, Kenya, Uganda, South Africa and USA. Only avocado is abundant in the market but is not fully used, it is only used for direct consummation without processing it for oil extraction other useful products.

The policy of the government of Rwanda to promote fruits should be accompanied by a strong research on appropriate planting materials adapted in different agroecological zones; strategy to scaling up and out the adapted species and the strategy for controlling pests and diseases is highly needed.

CHAPTER 5

5. ACTIVITIES UNDERTAKEN DURING THE ATTACHMENT PERIOD

5.1. Consultancy and team spirit

5.1.1 Introduction

Team work plays an important role in a modern organization. The vast expansion of research activities during the last few decades is due mainly to the rapid growth of the type of research for a practical purpose which tends to be done by teams. Teamwork is work performed by a team towards a common goal. It is a joint action by a group of people, in which each person subordinates his or her individual interests and opinions to the unity and efficiency of the group. Teamwork goes beyond individual accomplishments. The most effective teamwork is produced when all the individuals involved harmonize their contributions and work towards a common goal. The results from team work are proposal writing, design questionnaires, work plans development, organizing meetings, trainings, seminars and workshops.

5.1.2 Proposals development

Introduction

A research proposal is a document written by a researcher that describes in details a program proposed. It is the presentation of an idea that you wish to pursue. It is also an outline of the entire research process that gives a reader a summary of information discussed in project (http://en.wikipedia.org/wiki/Research_proposal, 2011).

The development of relevant research begins with the earliest stages of research planning. Well designed research consists of continuity of elements that start with clearly stated and substantiated objectives that in turn lead to key research questions and counterpart working hypothesis. Properly stated hypotheses identify treatment contrasts and necessary measurements which are in turn translated into experimental design and procedures.

Methods

A team comprising ICRAF staff and the student in internship was set up to write proposals. The proposals developed specified why the research is important, what will be tested, how it will be tested, what measurements will be made, how data will be compiled and analyzed, who is likely to benefit from the research, when it will be completed and how beneficiaries will receive the information and what funds are required. The student helped the team to follow all steps in proposal writing including:

- Title page having proposal title, principle investigator, cooperating investigators, contact details of principal investigator, proposal duration, funds requested and brief summary.
- Introduction, justification and literature review with statement of the problem
- Objectives with overall and specific objectives
- Hypotheses with general and specific hypotheses
- Research approach with general research approach and site characteristics, how will each hypothesis be tested, the study design, measurements and analysis of results
- Research outputs and impacts showing what anticipated accomplishments of the project and how will these be popularized
- Time frame and logistics showing what will be done and when and to whom the funds will be dispersed and what equipments to be used
- Budget showing what funds are required for general budget items by year

Results

Two proposals have been developed. One is on Improving household nutrition and income by enhanced production, processing, marketing and consumption of tropical and temperate fruits in Rwanda. Another project proposal developed is on Creating an Evergreen Agriculture in Africa: Scaling-up Conservation Agriculture with Trees for Improved Livelihoods and Environmental Resilience in Eastern and Southern Africa.

The first proposal on improving household nutrition and income by enhanced production, processing, marketing and consumption of tropical and temperate fruits in Rwanda has been submitted to the Ministry of Agriculture for approval and funding, the second one has been submitted to the ICRAF for approval and funding.

Conclusion

Proposal writing is entirely different from most other types of writing. When writing proposals, we began by stating why our approach should be selected. We then provided details that support our claims and gave our reviewers confidence in ourselves and our approach.

5.1.3. Questionnaires development

Introduction

Survey questionnaires are typically used for feedback research to determine the current status or situation or to estimate the distribution of characteristics in a population. Writing a survey questionnaire is one of the most critical stages in the survey development process. Much of survey questionnaire construction is common sense, but there are intricacies with which survey authors should be familiar. It is common sense to require that the concepts be clearly defined and questions unambiguously phrased; otherwise, the resulting data are apt to be seriously misleading. How questions are

phrased, what order they are in, and the length of a questionnaire are all things that can affect the accuracy of the data to collect in a survey.

Methods

A guideline for questionnaire development has been set up including the following points:

- Determine the purpose of the research and what information will be found in order to relate survey questionnaire to research objectives.
- Decide how the questionnaire will be administered (phone, mail, and e-mail)
- Determine the content of each question by writing down every question which can be relevant
- Determine the structure of response to each question: opened-ended and closed-ended
- Develop the wording for each question to help the respondents to understand
- Establish the sequence of questions in order to classify them.

Results

Two questionnaires were reviewed and two other ones developed. One of the reviewed questionnaires was for a PhD student studying at Sokoine University of Agriculture, working on Current status of processing and marketing of processed pineapple products by small and medium processors in Rwanda, another one was for Evergreen Agriculture

project, which was used to capture the information regarding the current socio-economic and land use status in Bugesera district.

One fully developed questionnaire has been used in characterization of the biophysical and socio-economic factors for fruits production and utilization in Rwanda, another one has been used to assess factors affecting the quality of reporting and publishing of research findings in ICRAF Rwanda, ISAR and IRST.

Conclusion

The questionnaires designed and reviewed clarified the objectives of the surveys, determined the data which is to be produced by the survey and devised a list of questions to obtain this data. A careful consideration has been given to a number of factors, including the type of questions to be used, the logical sequence and wording of questions, and the physical design of the form. These aspects have been confirmed by the data generated by them because respondents completed them accurately and quickly with a minimum of errors.

5.2 Data management

5.2.1. Introduction

It is imperative to manage data in order to increase the visibility of the research by making data available to other researchers through widely-searched repositories which can increase the prominence and demonstrate continued use of the data and relevance of

the research. Data management is also needed to save time because planning for data management needs ahead of time will save the time and resources in the long run. Data management is needed to preserve data to be available to other researchers in the long-term, increase research efficiency, to document, to meet grant requirements because many funding agencies require that researchers deposit in an archive data which they collect as part of a research project, facilitate new discoveries enabling other researchers to use previous data reinforces open scientific inquiry and can lead to new and unanticipated discoveries, and doing so prevents duplication of effort. The task on data management has been accomplished through different activities which are data collection, quality assurance, organization of data, archiving and protection of data.

5.2.1.1. Data Collection

Data collection has been achieved through field work carried out in Evergreen agriculture project and through research projects designed. As mentioned above, questionnaires have been developed as data collection tools. Data collected have been entered in analyzed using SPSS 16th edition packages.

5.2.1.2. Quality assurance

Since conclusions are based on data, accuracy is paramount and errors resulting from wrong data entry, incorrect methods of conversion and combining numbers must be avoided. Data archived should be free of errors and must be fully documented. The data

collected using questionnaires was entered into SPSS database, checked and cleaned. To ensure that the quality of the data is not compromised, a double data entry system (DDS) has been applied where two data entry clerks have entered the same questionnaires and the two data files compared to check for inconsistencies.

Data from ICRAF’s experiments and other from Bsc and Msc students’ experiments have been checked for consistencies and quality in the original data set in excel files.

5.2.1.3. Organization of data

Data organization is very paramount for any organization. The data from questionnaires and those from experiments have been organized into either metadata or data files. The metadata and their accompanying data files have given names that enhance easy location or identification of this information. The description of data (metadata) aimed to show why data was collected to make it possible to easily understand the rationale of the data-collection exercise and to give additional information on the procedures and processes of data collection. The format used in description of data is summarized in table 13.

Table 13: Description of data

Item	Description
Title	Name of the dataset or research project that produced it
Creator	Names and addresses of the organization or people who created the data
Identifier	Number used to identify the data, even if it is just an internal project reference number

Subject	Keywords or phrases describing the subject or content of the data
Funders	Organizations or agencies who funded the research
Rights	Any known intellectual property rights held for the data
Access information	Where and how your data can be accessed by other researchers
Language	Language(s) of the intellectual content of the resource, when applicable
Dates	Key dates associated with the data, including: project start and end date; release date; time period covered by the data; and other dates associated with the data lifespan, e.g., maintenance cycle, update schedule
Location	Where the data relates to a physical location, record information about its spatial coverage
Methodology	How the data was generated, including equipment or software used, experimental protocol, other things one might include in a lab notebook
Data processing	Along the way, record any information on how the data has been altered or processed
Sources	Citations to material for data derived from other sources, including details of where the source data is held and how it was accessed

List of file names	List of all data files associated with the project, with their names and file extensions (e.g. 'NWPalaceTR.WRL', 'stone.mov')
File Formats	Format(s) of the data, e.g. FITS, SPSS, HTML, JPEG, and any software required to read the data
File structure	Organization of the data file(s) and the layout of the variables, when applicable
Variable list	List of variables in the data files, when applicable
Code lists	Explanation of codes or abbreviations used in either the file names or the variables in the data files (e.g. '999 indicates a missing value in the data')

5.2.1.4. Archiving and protection of data

Archiving is the process of storing data for future use. The user of archived data is not necessarily the person who did the experiments, or carried out a survey. Indeed a well archived data set can be used by others to derive new relationships in the data or to compare primary data with secondary data. Archiving and storage of generated data have been done using different ICRAF computers, CDs and flash disks. Backups of computer files were made every month to enable future researcher to replicate the experiment or survey for scientific validation of the findings.

5.3. Data analysis

5.3.1. Introduction

Jorgensen (1989) defines analysis as a breaking up, separating, or disassembling of research materials into pieces, parts, elements, or units. With facts broken down into manageable pieces, the researcher sorts and sifts them, searching for types, classes, sequences, processes, patterns or wholes. The aim of this process is to assemble or reconstruct the data in a meaningful or comprehensible fashion.

Analysis of data is a process of inspecting, cleaning, transforming, and modeling data with the goal of highlighting useful information, suggesting conclusions, and supporting decision making.

5.3.2. Methods

Data entry system in excel for data from experiments and template of data entry for data from surveys have been developed. SPSS 16th edition was used to analyze data from qualitative studies and Genstat 12th edition was used for fitting ANOVA, regression analysis, logistic and Poisson models.

5.3.3. Results

Five Msc students and five Bsc students have been helped to understand the relationship between research objectives, experimental design and data analysis. All data sets from students were from experiments. Analysis used Genstat 12th edition. Summary statistic,

statistical tests, one way ANOVA, two ways ANOVA, regression, test of normality are among statistical analysis done on data sets from students' experiments. Students also have been helped to understand and to interpret the output from data analysis package using narratives, charts, graphs or tables. Univariate distributions (frequency distributions, summary statistics, graphs or other) and cross tabulations (frequency distributions across important groupings) have been developed in case of qualitative data analysis done on data from the questionnaires.

5.3.4. Conclusion

The aspects of inspecting, cleaning, transforming, and modeling data with the goal of highlighting useful information, suggesting conclusions, and supporting decision making in data analysis have been taken into consideration in all data set analyzed.

CHAPTER 6

6. GENERAL DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

The overall objective of this thesis was to provide support to scientists, technicians and students (in attachment at ICRAF) carrying out research activities in ICRAF Rwanda in conception and design of research, data handling and management, data analysis, interpretation and reporting.

Consultancy with the entire researchers by direct communication with scientists had enhanced effective communication required for any research method professional. Strategies for improving data quality, organization, archiving and analysis had been set up.

Research instrument tools such as questionnaires, proposals were reviewed and developed. Data management and analysis with the aspects of transforming, modeling data with the goal of highlighting useful information, suggesting conclusions, and supporting decision making in data analysis have been taken into consideration.

Publishing in a scientific journal is one of the major objectives of any scientific work. Written dissemination of information is an essential part of science. Writing up a publishable paper, however, is not as easy as it sounds. The manuscript has to meet certain criteria to qualify for publication and, therefore, dissemination to a wider audience. ISAR, IRST and ICRAF as research institutes are called to disseminate the research findings through published works but till now publications are very limited in

those institutes. some of limitation for publishing are lack of research facilities and materials which lead to unreliable data, lack of knowledge and skills in paper writing, lack of incentive for those who publish, administration tasks for scientists, data analysis difficulties, lack of information on the journals, lack of laboratories and research funds and lack of mentorship of young scientist.

Rwanda has favourable climatic conditions for growing different fruit tree species. However, the majority of farmers don't consider the importance of fruits for a healthy nutrition or fruits as source of income. The reasons limiting fruit production and marketing are limited land, pest diseases, lack of improved of planting materials, lack of fertilizers and lack of training. Other factors are fluctuation of fruits supply and price, absence of fruits processing units and importation cost of high value fruits such as Mango, apple, tree tomato, passion fruit and mandarin imported from Burundi, Kenya, Uganda, South Africa and USA.

More efforts have to be put on capacity building by training research scientists, technicians working in research institutes of Rwanda on projects/proposals development, data management, statistical analysis and scientific writing techniques.

Research institutes should facilitate access to international journals by creating partnership, availability of appropriate working equipments and research funds, collaboration with skilled scientist mentorship with experienced senior scientists, availability of incentive and promotion for those people who publish, availability of

internet connectivity, availing in respective research programs a budget line allocated to publication.

There is little training in fruit production. Farm based skills are needed and a farmer hands on training programme will go a long way in alleviating the situation.

The majority of farmers uses unimproved planting material and hence do not benefit optimally. The reasons for this could be varied. Awareness is also needed to enable farmers to access some of the improved materials that are available locally.

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APPENDICES

Appendix 1: Questionnaire for Editing and Publication Factors

My Name is **Gregoire Hagenimana**, I am an Msc Student in Research Methods at Jomo Kenyatta University of Agriculture and technology (JKUAT). Also I am a research Scientist at ISAR. I am carrying out a research on **Editing and Publication among ICRAF, IRST and ISAR scientists**. The objective of my research is **to assess the factors that affect the quality of reporting and publishing of research findings in Rwandan research institutes and provide the methods of review of scientific reports**. Your name has been randomly selected for the interview. All the information you will give will be treated with anonymity and confidentiality. The information will be used to perform my thesis but will not include any specific name.

Part 1: INTERVIEW BACKGROUND

Date of Interview: _____

Title of Respondent (Mr, Mrs, Dr, Prof) _____

1. Age of Respondent _____

2. Gender of Respondent

1. Male [] 2. Female []

3. Education level of Respondent

1. High school A2 [] 4. University Msc []

2. College A1 [] 5. University PhD []

3. University Bsc [] 6. Post doc

7. Other, specify _____

4. Area of specialisation _____

5. How many years of employment _____

6. First post _____

7. Current post of respondent _____

8. Years in current post: _____

9. Tel.: _____

Part 2: Designing

1. Have you ever been involved project/research planning/proposal writing?

1. Yes [] 2. No []

If yes, how many were successful? _____

2. If yes, what are successful/financed projects/proposal have you designed?

Name of the project	Objectives?	When developed	Project total budget	Who financed?	Who implemented?
1.					
2.					
3.					
4.					
5.					

3. How many were not successful? _____

4. State the reasons why they were not successful

5. If no, what were the limitations or challenges?

6. Have you ever written a scientific report? 1. Yes [] 2. No []

7. if yes, to whom the report has been submitted?

- | | | | |
|------------------------|------------------------------|---------------------------------|------------------------------|
| 1. My supervisor | [<input type="checkbox"/>] | 5. Conference organisers | [<input type="checkbox"/>] |
| 2. Secretariat | [<input type="checkbox"/>] | 6. Decision makers (government) | [<input type="checkbox"/>] |
| 3. Donor | [<input type="checkbox"/>] | 7. Other, specify _____ | |
| 4. Project beneficiary | [<input type="checkbox"/>] | | |

8. Have you ever attempted to submit an article to the publisher in last 10 years?

1. Yes [] 2. No []

9. If yes, answer the following

	Title	Area	Publisher	Journal	When
1					
2					
3					
4					
5					

10. How many articles had been accepted?

	Title	Area	Category (code A)	Publisher	Journal	When
1						
2						
3						
4						
5						

Code A: 1. Proceedings 2. Journal 3. Book chapter 4. Book

11. How were your submissions?

Type	Number	Where published? (Code A)	Peer reviewed 1: Yes 2 No	(1) Main Autor (2) Co-autor
Proceedings				
Paper				
Book chapter				
Book				

Code A: 1. Conference 2. Local journal 3. Regional journal 4. International journal 5. Other, specify_____

12. How did get information on the publishers and journals where you sent your paper?

13. How could you appreciate the impact fact of those journals? Precise those impact factors

Journal	Impact factor

14. What were the conditions for publishing?

Publisher/journal	Conditions
1.	
2.	
3.	
4.	
5.	

15. What motivated (or could motivate) you to submit an article for publication? (Who has published or not)

1. Helping advance knowledge []
2. Supporting a professional career []
3. Satisfying donor []
4. Becoming famous []
5. To communicate []
6. other, specify _____

16. How could you judge the conditions for publishing? (Who has published or not)

1. very hard []
2. hard []
3. fair []
4. easy []

17. Please comment on the above response (Who has published or not)

18. What are the challenges in publishing a paper? (Who has published or not)

**19. What assistance could you require to be more successful/efficient in publishing?
(Who has published or not)**

Thank you for your participation!

Appendix 2: Questionnaire for Fruits production Survey (questions for farmers)

Hello, my name is **Gregoire Hagenimana**, I am conducting a survey for the fruits production in Rwanda. Your household has been randomly selected for the interview. The information you provide will be useful in project planning

The interview may take about 60 minutes and your participation is voluntary; you can choose not to take part. All the information you give will be treated with anonymity and confidentiality. The information will inform me on the best action points, prepare general reports, but will not include any specific names. If you have any questions about the survey, you can ask me. Can we continue with the interview?

PART 0. INTERVIEW BACKGROUND

Questionnaire Number: _____

Region*: _____

*M=Musanze, H=Huye, N=Nyagatare

Date of Interview: _____

Name of Respondent: _____

4. Age of House hold head _____

1. Less than 21 [] 3. Between 36-55 []
2. Between 21-35 [] 4. More than 55 []

5. Gender of House hold head

1. Male [] 2. Female []

6. Relation of respondent to House hold head

1. self [] 2. wife [] 3. son/daughter [] 4. other (specify) _____

7. Marital status of House hold head

1. Single [] 4. Widow/widower []
2. Married living with spouse [] 5. Divorce []
3. Married but spouse away [] 6. Separated []

8. Education levels of House hold head

4. Does not have formal education [] 3. secondary school []
5. Primary school [] 4. University []
5. Other, specify _____

6. Tel.: _____

7. GPS readings location (each cell)

1. GPS point _____ 2. Latitude _____ (S)
3. Longitude _____ (E) 4. Elevation. _____ (m)

8. Sector: _____

9. Cell: _____

10. Village name _____

11. Enumerator: _____

12. Occupation of House hold head

- | | |
|-----------------------------------|-----------------------------|
| 1. Farming (crop + livestock) [] | 7. Business [] |
| 2. Salaried employment [] | 8. Herding [] |
| 3. Self-employed off-farm [] | 9. Household chores [] |
| 4. Casual labourer on-farm [] | 10. Civil servant [] |
| 5. Casual labourer off-farm [] | 11. Farmer and business [] |
| 6. Student [] | 12. Others (specify) _____ |

13. Household composition

Number of male		Number of female	
Less than 5years		Less than 5years	
5-14 years		5-14 years	
15-21 years		15-21 years	
22-35 years		22-35 years	
36-55 years		36-55 years	
More than 55 years		More than 55 years	

PART 1: Type of fruits produced

Land use characteristics

1. What is the total size of your land?

Parcel No	Area (ares or Ha)	land ownership ¹

¹1. Inherited 2. Bought 3. Borrowed 4 Rented 5. Others (specify) _____

2. List five most important crops you grow and rank them in order of importance

Crop	Ranking	Main reason for growing the crop (See code A)*

*Main reason for growing the crop Code A: 1= home consumption, 2= sale, 3= consumption and sale, 4= others _____

3. Do you have fruits in your farm? 1. Yes [] 2. No []

4. If yes, list fruits you grow and rank them in order of importance

Fruit Crop	Year of establishment	Land area planted	Number of trees if applicable	Production (kg/year)	Total consumed	Sales (kg/year)	Average unit price (RWF/kg)	Main reason for growing the crop (See code A)*	Farming system (Code B)*
1									
2.									
3.									
4.									
5.									

Code A: 1: home consumption, 2: sale, 3: consumption and sale, 4: ornamental 5: medicinal 6: Others _____

Code B: *1=Monoculture, 2=fruit scatted in the farm, 3=rotation, 4=Intercropping, 5=Relay, 6=Strip

PART 2: Factors influencing fruit production

1. Is the fruit production from your farm sufficient for all you need? 1. Yes [] 2. No []

2. If yes, rank the reason for the success

- 1 _____
- 2 _____
- 3 _____
- 4 _____

If No, What are reasons limiting fruit production from your farm?

Fruit	reasons limiting fruit production Code A
1	
2	
3	
4	
5	

4. Code A: 1. Limited land 2. No land 3. Pest and diseases 4. Lack of inputs 5. Low land productivity 6. Big family size 7. Infertile Land 8. No intention to produce fruit 9. Poor agricultural water supply 10. Get hand outs from Gov/NGOs 11. Lack of quality seed 12. Lack of market 13. No funds to buy inputs 14. Others_____

4. What are other fruits do you willing to plant in you farm and want are reasons for none planting them?

Fruit	reasons limiting fruit production Code A
1	
2	
3	
4	
5	

Code A: 1. Limited land 2. No land 3. Pest and diseases 4. Lack of inputs 5. Low land productivity 6. Big family size 7. Infertile Land 8. No intention to produce fruit 9. Poor agricultural water supply 10. Get hand outs from Gov/NGOs 11. Lack of quality seed 12. Lack of market 13. No funds to buy inputs 14. Others_____

3. **Do you use inputs in fruit production?** 1. Yes [] 2. No []

4. **If yes please list them.**

Fruit	inputs (Code A)
1	
2	
3	
4	
5	

Code A: 1. Fertilizer 2. Pesticide 3. Both 4. Improved seeds 5. Other (specify_____

5. **Do you use fertilizer in your fruit farm?** 1. Yes [] 2. No []

6. **If yes, what type of fertilizer do you use?**

Fruit	type of fertilizer (Code A)
1	
2	
3	
4	

5	
---	--

Code A: 1. NPK 2. DAP 3. urea 4. Compost manure 5. Farm yard 6. Green manure
7. Other (specify_____)

7. **Do you use pesticide in your fruit farm?** 1. Yes [] 2. No []

8. **What type of pesticide do you use?**

Fruit	type of pesticide (Code A)
1	
2	
3	
4	
5	

Code A: 1. Insecticide 2. Fungicide 3. Traditional product 4. Other (specify_____)

9. **Which pesticides do you use?**

Fruit	Pesticide (Code A)
1	
2	
3	
4	
5	

Code: 1. Dimethoate 2. Cypermethrin 3. Thiodan (Endosulfan) 4. Dithane 5. Ridomil
6. Copper oxychloride 7. Other (specify_____)

10. **Do you buy the inputs?** 1. Yes [] 2. No []

11. **If not, how do you get them?**

1. Other farmers [] 2. Cooperative/association [] 3. NGO [] 4. Government institution []
5. Other source (specify_____)

12. **If yes, from where do buy them?**

1. Agrochemical dealers [] 2. Market [] 3. Other (specify_____)

13. **Do you find problems getting the input?** 1. Yes [] 2. No []

14. If yes what are the reasons?

1. Can't afford [] 2. Not available [] 3. Other (specify_____)

15. What do you think can be done to improve the fruit production?

1. Training [] 2. Improving availability of inputs [] 3. Quality planting materials []
 4. Access to credit [] 5. Other (specify_____)

PART 3: Existing and potential market

1. How far from your home is: Nearest market ____KM ; Agrovet shop ____KM
 2. What are the source of your income?

Sources of income

Source of income	Total Income/year
Salary from employment	
Income from business	
Income from wage labor	
Remittances (family/relatives)	
Income from leasing land	
Income from crops	
Other (specify_____)	

3. Where do you sell your fruit production?

1. Market [] 2. In the field [] 3. at home [] 4. association/cooperative []
 5. processors/industries [] 6. Middleman []
 7. Other (specify_____)

4. How long does it take for the fruits production to reach the selling place from the field?

1. 1hour [] 2. 2 hours [] 3. 3 hours [] 4. 4 hours [] 5. 5 hours []
 6. 6 hours [] 7. 7hours [] 8. 1 day [] 9. 2 days []
 10. others (please specify) the time in terms of hours or days) _____

5. How far (in km) is your farm from the main road? _____km

- 6. Do you think the road linking you to the market is good?** 1. Yes [] 2. No []

7. How do you package your fruits product?

- 1. Plastic bag []
- 2. Polythene bag []
- 3. Paper bag []
- 4. Basket []
- 5. Plastic crate []
- 6. cardboard box []
- 7. Metal box []
- 8. glass box []
- 9. wooden box []
- 10. fabric []
- 11. Others (please specify) _____

8. How do you transport your fruits products?

- 1. Head []
- 2. Bicycle []
- 3. Motorcycle []
- 4. Lorry []
- 5. Wheelbarrow []
- 6. No transport needed(middleman collect) []
- 7. Taxi []
- 8. Bus []
- 9. Van (pickup) []
- 10. airplane []
- 11. animal []
- 12. others (please specify) _____

9. Do you do sorting of fruits before selling? 1. Yes [] 2. No []

10. If yes, how do you sort it?

- 1. Select the enough ripe one []
- 2. Select big one []
- 3. Only reject damaged one []
- 4. Any other characteristic used to sort (specify)

11. What kind of fruits is more preferable in the market? Please rank

1 _____

2 _____

3 _____

4 _____

5 _____

What are the sources of those fruits?

Fruit	Source (CodeA)
1	
2	
3	
4	
5	

Code A 1 From local fruits producers 2 from neighbouring sector 3 from neighbouring district 3 from other Districts in this province 4.From other provinces (specify those provinces) 5. From outside the country (specify the country)

12. When do you have plenty of fruits during the year?

Fruit	Month	Price (1kg)
1		
2		
3		
4		
5		

13. When do you experience scarcity of fruits?

Fruit	Month	Price (1kg or piece)
1		
2		
3		
4		
5		

In what do you use income from fruits?

- | | |
|------------------------|---------------------------|
| 1. Food [] | 4. Hire labor [] |
| 2. School fees [] | 5. Others (specify) _____ |
| 3. Health expenses [] | |

- 14. Have you ever experienced fruit production marketing problems?** 1. Yes []
2. No []

15. If yes, what are the constraints do you find in marketing fruit production?

- | | |
|---------------------------|---------------------------|
| 1. Low price [] | 4. Transport cost [] |
| 2. Shortage of buyers [] | 5. Others (specify) _____ |
| 3. Poor quality [] | |

16. If no, rank the reason for the success

- 1 _____
- 2 _____
- 3 _____
- 4 _____
- 5 _____

17. **Have you borrowed any money during the past 12 months?** 1. Yes [] 2. No [] (If Yes fill up the table)

Sources of loan	Duration of loan (months)	Amount borrowed	Amount Paid	Purpose of loan*
Bank				
Credit (SACCOs)				
Private lender				
Women association				
Local trader				
Farmer Association				
Relatives, friends				
Others (specify): -----				

Purpose of loan *:(1)= Farming; (2)= Off-farm (business, micro-enterprise, etc); (3)= Health;(4)= Housing;(5)= Festivals;(6)= Education;(7)= Consumption;(8)= Others (specify)

18. **If No, please specify reason:** _____

19. **Have you ever experienced non-payment of your loan?** 1. Yes [] 2. No []

20. **If yes, reason for non-repayment** _____

21. **What are your 2 most important sources of credit?**

Most important source: _____

Second most important source: _____

22. **Do you have difficulties in obtaining credit loan?** 1. Yes [] 2. No []

Please explain

PART 4: TRAINING

1. **Did you or any member of your family attend any training, workshop over the last 3 years?** 1. Yes [] 2. No []
2. **If yes, please answer the following:**

Name of the training / workshop	Who organized the training?/who invited you?	Duration (days)	Who attended the training? 1= Male 2= Female	What was the training about? (Main theme)
1.				
2.				
3.				

3. **Have you received any technical training on fruit production?** 1. Yes [] 2. No []
4. **What other trainings would you like to attend?**
5. **(If No) Are you willing to attend a farmers training?** 1. Yes [] 2. No []
6. **If Yes, in what particular area?**
7. **If No, what is the reason?**

Thank you!

Appendix 3: Questionnaire for Fruits production Survey (questions for fruits Sellers and supermarkets)

Hello, my name is **Gregoire Hagenimana**, I am conducting a survey for the fruits production in Rwanda. Your household has been randomly selected for the interview. The information you provide will be useful in project planning

The interview may take about 30 minutes and your participation is voluntary; you can choose not to take part. All the information you give will be treated with anonymity and confidentiality. The information will inform me on the best action points, prepare general reports, but will not include any specific names. If you have any questions about the survey, you can ask me. Can we continue with the interview?

FRUIT MARKETING

Fruits Sellers/ Super market

1. Name of Respondent: _____

2. Age

1. Less than 21 [] 3. Between 36-55 []
2. Between 21-35 [] 4. More than 55 []

3. Gender

1. Male [] 2. Female []

4. Marital status

1. Single [] 4. Widow/widower []
2. Married living with spouse [] 5. Divorce []
3. Married but spouse away [] 6. Separated []

5. Education level

1. Does not have formal education [] 4. university []
2. Primary school [] 5. Other, specify _____
3. Secondary school []
6. Tel.: _____

10. When do you experience scarcity of fruits supply?

Fruit	Month
1	
2	
3	
4	
5	

11. What is the price during that period of scarcity?

Fruits	Quantity per day	Quantity per month	Quantity per season	Buying price (1kg or piece)	Selling price (1kg or piece)

12. How do fix the price?

1. Negotiation with customer [] 2. Fixed by the government [] 3. Fixed by customer committee [] 4. Fixed by sellers [] 5. Fixed by sellers' committee []
6. others specify

13. Have you ever experienced fruit production marketing problems? 1. Yes []
2. No []

14. If yes, what are the constraints do you find in marketing fruit production?

Fruits	Transport Code A	Limiting factors Code B
1		
2		
3		
4		
5		

Code A: 1. Head 2. Taxi 3. Bicycle 4. Bus 5. Motorcycle 6. Van (pickup) 7. Lorry
8. airplane 9. Wheelbarrow 10. animal 11. Others (please specify) _____

Code B: 1. Low price 2. Perishability 3. Shortage of buyers 4. Transport cost 5. Poor quality 6. Others (specify) _____

15. If no, rank the reason for the success

1 _____
2 _____
3 _____
4 _____
5 _____

16. What are the abundant fruits in the market (Enumerator and seller)? Please list them

1 _____
2 _____
3 _____
4 _____
5 _____

17. What are the most preferred fruits by customers? Please list them

1 _____
2 _____
3 _____
4 _____
5 _____

How did you get money for your business?

- | | |
|---------------------------------------|--|
| 1. Loan [] | 6. Money from wage labor [] |
| 2. Accumulated salaries [] | 7. Money from leasing/selling land [] |
| 3. Other business [] | 8. Money from leasing/selling house [] |
| 4. Remittances (family/relatives) [] | 9. Money from selling other household material [] |
| 5. Aid/gift [] | 10. Others source (specify) _____ |

18. Who buy your products?

- | | |
|-----------------|----------------------------------|
| 1. Men [] | 4. NGOs [] |
| 2. Women [] | 5. Processors [] |
| 3. Children [] | 6. Other sellers (specify) _____ |

19. How do you store your products?

- | | |
|----------------------|-----------------------------------|
| 1. Plastic bag [] | 7. Cardboard box [] |
| 2. Polythene bag [] | 8. Metal box [] |
| 3. Paper bag [] | 9. Glass box [] |
| 4. Basket [] | 10. Wooden box [] |
| 5. Plastic crate [] | 11. Fabric [] |
| 6. Open area [] | 12. Others (please specify) _____ |

How many day can you store your products

- | | | | |
|---|-----|------------|-----|
| 1. 1hour | [] | 6. 6 hours | [] |
| 2. 2 hours | [] | 7. 7hours | [] |
| 3. 3 hours | [] | 8. 1 day | [] |
| 4. 4 hours | [] | 9. 2 days | [] |
| 5. 5 hours | [] | | |
| 10. others (please specify) the time in terms of hours or days) _____ | | | |

Thank you!