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FOOD SECURITY STATUS IN DEVELOPING COUNTRIES: A CASE STUDY OF BURERA AND MUSANZE DISTRICTS OF RWANDA

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ABSTRACT

A research work entitled: "Food security status in developing countries: A case study of Burera and Musanze Districts of Rwanda," was carried out in the Northern Province of Rwanda. The survey involved a random sample of 50 households in each sector and was undertaken over two weeks, between August and September 2012. The problem was due to declining food security and natural resource depletion in rural areas of Burera and Musanze Districts. The granary system has disappeared in rural areas. Land conflict is complicated by big family size and polygamy. The major objective was to investigate the food security situation in both districts. The obtained results showed that there is land scarcity with an average of 0.5 hectares per household, joblessness of the youth at 20%, hunger at 10% with one meal per day and land conflict at 5% of rural people, amplified by lack of domestic animals and feeds for enough milk, meat, eggs, fish, honey production and organic manure for about 50% of the rural population. It was found that frequent erosion due to prohibitive slopes in hills, increasing population density, dispersed resettlement without vertical buildings, natural disasters and landslides exacerbated by global warming, heavy rains, storms, floods, lightening, deforestation, timbers and charcoal making, and grinding poverty risk lead to food insecurity. In Burera district, 60% of harvested food products were sold, 40% were consumed by household members, and 20% were seeds preserved for the next agricultural season. In Musanze district, 40% were sold, 40% were consumed and 20% were seeds conserved for next cultivation. This revealed that people are at risk of food insecurity just one month after harvesting. In this case, concerned stakeholders in agriculture should take immediate action of radical terraces, irrigation, compost application, land use consolidation and soil analysis, making local fertilizer from volcanic soil and lime, land tenure and rotation, official resettlement in less risk zones, and joblessness reduction. Actually, the government is dealing with the increase of food productivity and income generation in rural areas in order to meet the needs of the population.

Key words: Food security, erosion, fallow, fertilizer, floods, landslide, granary, crops rotation

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INTRODUCTION

A research on population welfare is a key determinant on sustainable development of any country [1]. Food security is the availability of safe foods for everybody at all times and refers to a household's physical and economic access to sufficient, safe, and nutritious food that fulfils the dietary needs and food preferences. Normally, food security should have three facets: food availability, food access, and food use. Food availability is having available sufficient quantities of food on a consistent basis [2].

In developing countries, there is permanent risk of food insecurity due to global warming and climate change leading to malnutrition. This malnutrition is frequent in less developed countries having permanent civil war, land scarcity and drought (Photo 1).

Plate 1: Food Insecurity and Malnutrition in Developing Countries [2, 3]

Plate 1 above shows that stunting, starvation and chronic nutritional deficiencies are not totally eradicated in developing countries. Many countries still experience perpetual food shortages and distribution problems [2].

Over 60% of the world's undernourished people live in Asia, and a quarter in Africa. The proportion of people who are hungry, however, is greater in Africa (33%) than in Asia (16%). The latest Food and Agriculture Organization (FAO) figures indicate that there are 22 countries, 16 of which are in Africa, in which the undernourishment prevalence rate is over 35% [3].

Eradicating hunger and poverty requires an understanding of the ways in which these two indicators interconnect. Food insecurity exists when people are undernourished as a result of the physical unavailability of food, their lack of social or economic access to adequate food, and/or inadequate food use [4, 5].

There are strong, direct relationships between agricultural productivity, hunger, and poverty. Three-quarters of the world's poor live in rural areas and make their living from agriculture. Hunger and child malnutrition are greater in these areas than in urban areas [6].

Moreover, the higher the proportion of the rural population that obtains its income solely from subsistence farming (without the benefit of pro-poor technologies and access to markets), the higher the incidence of malnutrition. Therefore, improvements

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in agricultural productivity aimed at small-scale farmers will benefit the rural poor first [7].

Deforestation, overpopulation, overexploitation of natural resources, population density, soil infertility, global warming are crucial issues in developing countries. Intensive farming often leads to a vicious cycle of exhaustion of soil fertility and decline of agricultural yields. Approximately 40% of the world's agricultural land is seriously degraded. In Africa, if current trends of soil degradation continue, the continent might be able to feed just 25% of its population by 2025 [8, 9].

Harvested foods like cereals, legumes, roots and tubers, vegetables, fruits, milk, meat, fishes, honey and mushrooms are not compliant with a granary storage system. This is partly due to their nature and also the lack of crop rotation, fertilization, composting, and radical terraces which are responsible for land degradation in developing countries. Floods during the rainy season, climate change, global warming, drought and land scarcity, high population density and natural resources depletion are all major causes of food insecurity. In developing countries, there is overpopulation and overexploitation of natural resources leading to grinding poverty and environmental deterioration (see Plate 2).

Plate 2: Negative impact of deforestation and climate change on soil and food

Some countries are using the acquisition of land for agriculture in return for other gains. Egypt is seeking land acquisition in Ukraine in exchange for access to its natural gas [7].

Food security can be defined as the state of having reliable access to a sufficient quantity of affordable, nutritious food for everybody and at all times. The granary system is a crucial issue in developing countries and the distribution of food within a country is a political issue leading to social inequity and malnutrition [8, 9].

Many agrarian policies, especially the pricing of agricultural commodities, discriminate against rural areas. Governments often keep prices of basic grains at such artificially low levels that subsistence producers cannot accumulate enough capital to make investments to improve their production [9, 10]. Thus, the major problem to be addressed in this study was to scrutinise and critically analyse the factors that

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contribute to food availability leading to food security in developing countries like Rwanda.

This research work aimed to investigate the status of food security in two districts of Burera and Musanze in order to propose adequate solutions for prosperity and sustainability of the region.

MATERIALS AND METHODS

A questionnaire was set in order to gather all needed information from interviewed 50 households of Rwerere sector in Burera District and 50 households of Cyuve sector in Musanze District. In each sector foresaid, fifty respondents were questioned about the status of food security in terms of land management, land scarcity, climate change and global warming effects, food production, distribution and postharvest technology for granary system, handicap of land fertility and probable factors that affect food insecurity in both districts. In order to determine the sample size statistically the formula below was used as stated by Abdullah [1]:

$$n = \frac{N}{1 + N(e)^2}$$

Where:
n= Sample size, N= Population size (universe), e = Margin of error for an infinite population (< 10000 individuals) with a marginal error of 10%. This formula was used as follows:

$$n = \frac{9943}{1 + 9943\ (0, 10)^2}$$

$$n = \frac{9943}{1 + 99.43}$$

$$n = \frac{9943}{100.43}$$

Where:
n = 99, thus the sample size used in this study was about 100 respondents for both sectors.

To ensure the validity and reliability of the outcome from the study, 10% was used as the sampling size.

Statistical analysis

Data were statistically analysed using the Excel software.

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RESULTS

The results obtained from a survey conducted in the two sectors of Burera and Musanze show that the land has been progressively reduced by settlement, density of population, horizontal building of houses in agrarian areas, and soil erosion. In Cyuve sector of Musanze district, the land is scarce (see Figure 1) and this has been exacerbated by new buildings and high population density as it is indicated in below Figure 1.

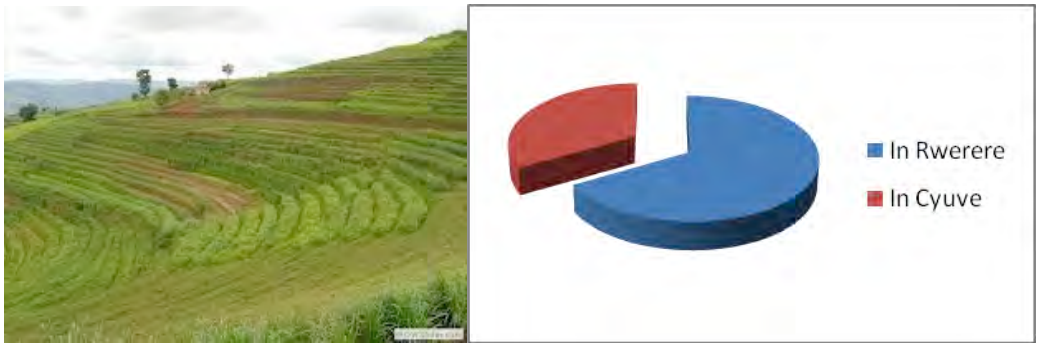

Figure 1: Average Arable Land in Hectares per Household

According to Figure 1, the land for farming is progressively reduced in Musanze. This is likely due to horizontal building and rapid industrialisation of the region. The land tenure was supported by radical terraces tracing in hills (see below Figure 2).

Figure 2: Land Use Consolidation with Radical Terraces in High Lands of Burera and Musanze

It was found that the use of radical terraces is vital in preventing soil erosion and improving productivity in a country of thousand hills. According to contacted residents of Burera and Musanze Districts, cultivating on radical terraces increases crop production and prevents soil erosion in the hills (high lands) if organic manure and Nitrogen, Phosphorous and Potassium (NPK) fertilizer are available for proper fertilization of the soil.

According to respondents, making these radical terraces is not easy because it demands special knowledge or techniques or an expert. This activity is part of government's programmes. However, there is a need for compensation to the farmers because when radical terraces are made, farmers cannot cultivate immediately. They have to wait a while for compost and NPK input as fertilizers. This best program has been introduced

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by the Government of Rwanda through the Ministry of Agriculture in charge of land reform policy, in order to resolve the crucial problem of erosion in mountainous regions. As you know food productivity is related to to soil fertility and the region of Musanze has good soil due to ancient volcanic eruption (see Figure 3)**.**

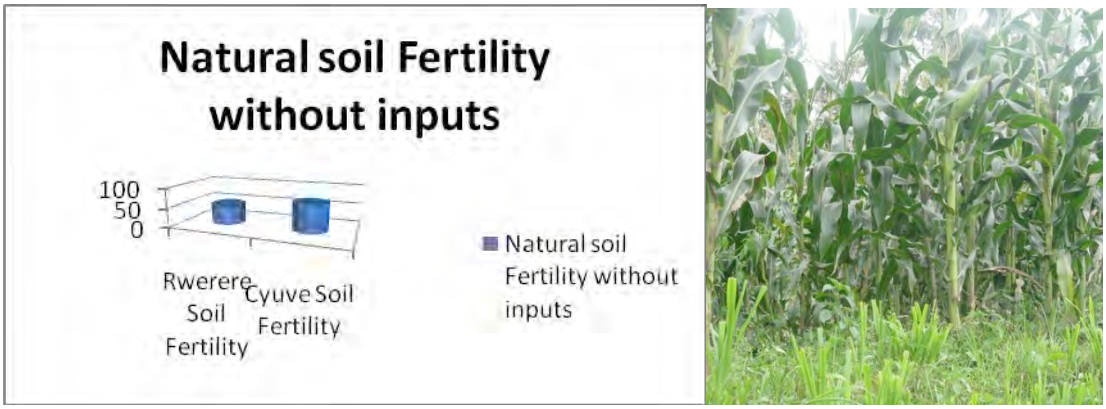

Figure 3: Natural Fertility of Local Soil without Inputs

According to Figure 3, the soil of Musanze is mainly volcanic soil from lava, which is fertile and without apparent erosion while in Burera, the soil is generally lateritic with landslides. It seems to be imperative to apply organic fertilizer as compost from crop residues and cow's dung (Figure 4).

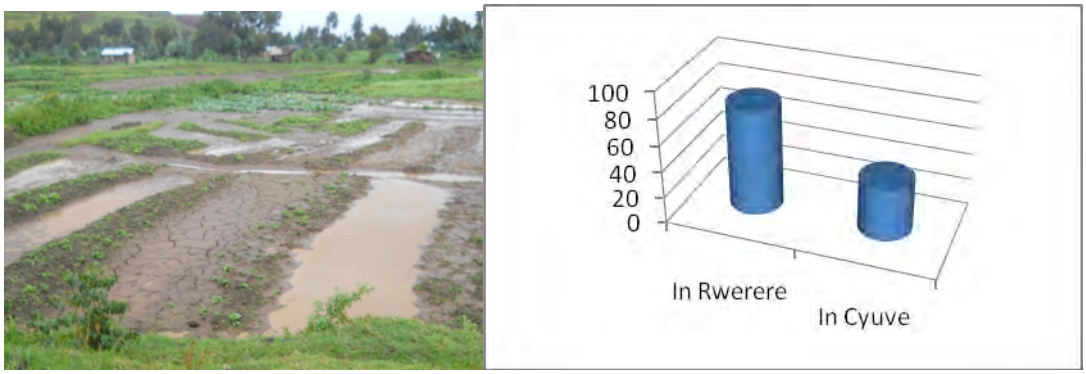

Figure 4: Status Organic Fertilizer Use (Use of Mixed Compost with Dung)

This Figure 4 shows that in Burera, farmers use mainly the compost as organic fertilizer and the imported manure is widely used in Musanze District. The imported inputs (NPK and DAP) could be expensive for poor farmers of Burera (see Figure 5).

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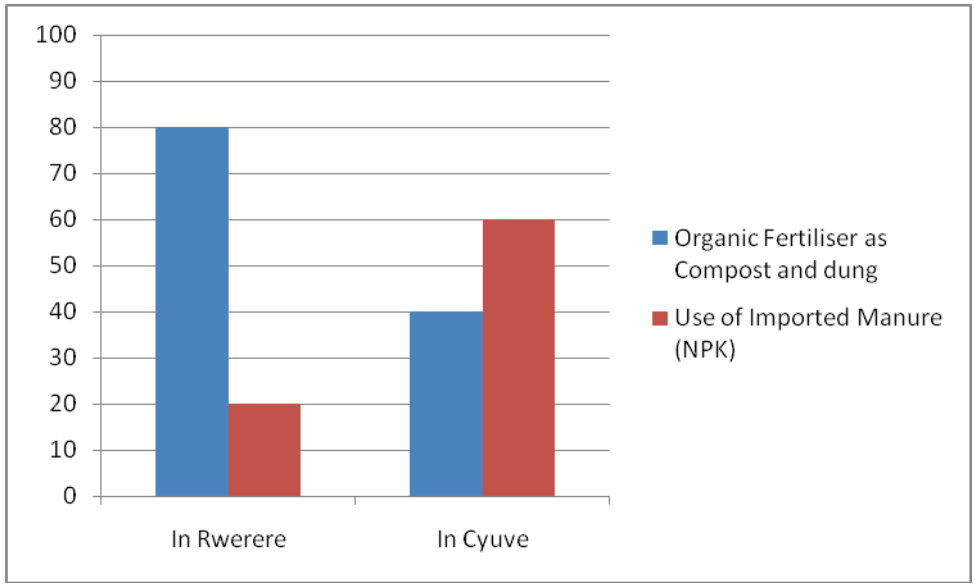

Figure 5: Organic Fertilizer versus Imported Manure (NPK)

According to Figure 5, the imported manure is widely used in Musanze District while the organic fertiliser is greatly applied in Burera. Therefore, the use of combined manure with imported inputs improves the soil fertility and enhances the crop productivity. The food availability indicators are as indicated in Figure 6.

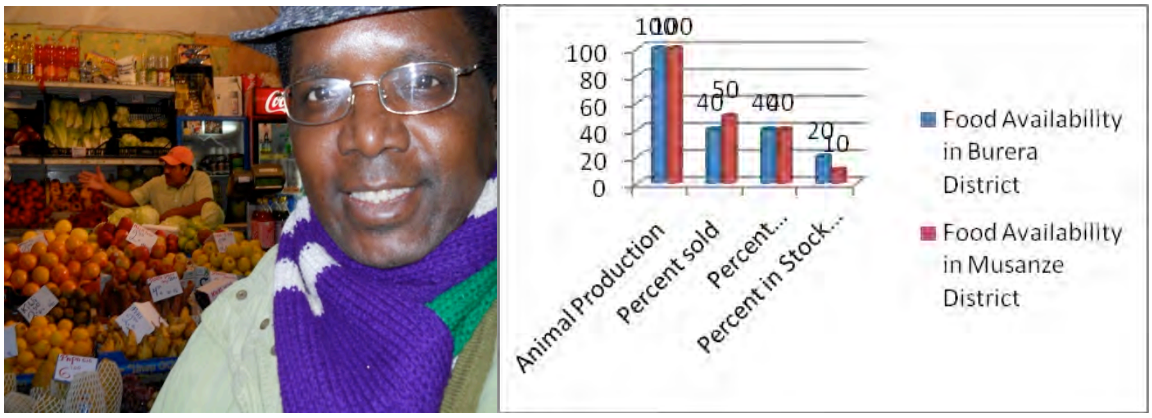

Figure 6: Food Availability Indicators in Burera and Musanze Districts

This Figure 6 shows that the crop production allows people to gain money, foods for consumption and seeds for next season of cultivation. The sector of animal production is exhausted by the one cow per household programme set by the government. The figure 7 gives the animal products indicators for food security prosperity in the region.

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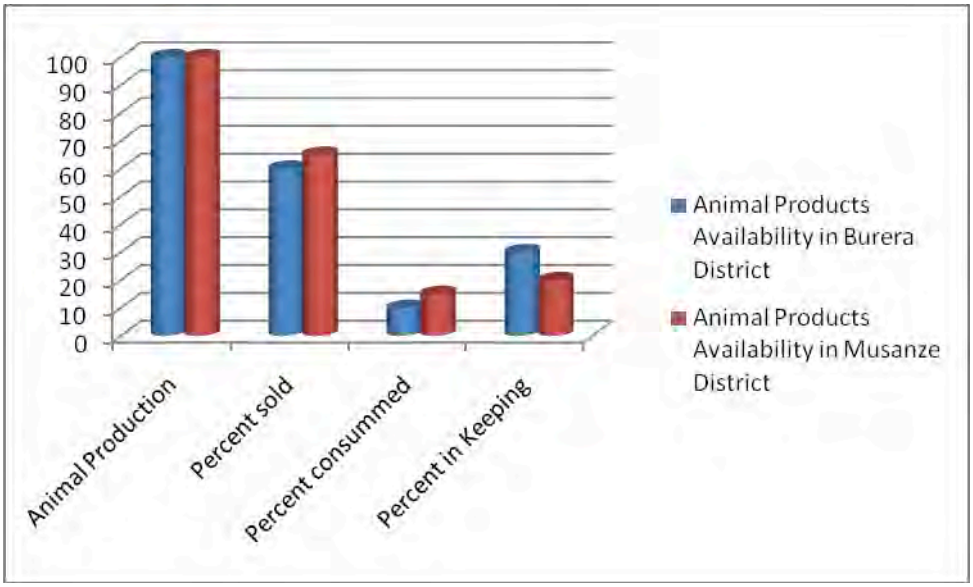

Figure 7: Animal Products Indicators in Burera and Musanze Districts

Figure 7 shows that animal products are more widely sold and consumed in Musanze District than in Burera District. It means that the livestock are kept for selling and for further animal husbandry, but the derivative products are more consumed in Musanze than in Burera.

Strong growth in animal production and safe water adduction is attributed to the good policy of the Rwandan Government. Complementary investments in marshland irrigation, integrated soil fertility management, farmer field schools have also played a role, as well as favourable weather conditions. The safe water distribution in rural areas was initiated by the local administration for human health improvement (see Figure 8).

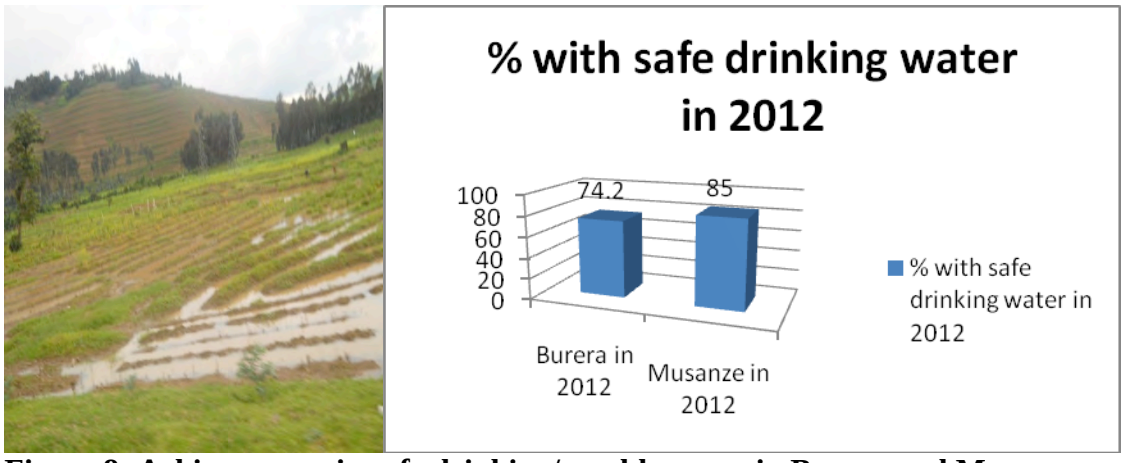

Figure 8: Achievements in safe drinking/potable water in Burera and Musanze

The figure 8 indicates that Musanze has recorded a high percentage in safe drinking water as adduction model done in Cyuve sector. In Burera, the water adduction is also planned for all population. Due to global warming, water and food shortage can be exacerbated by exorbitant prices leading to food insecurity in the region (see Figure 9).

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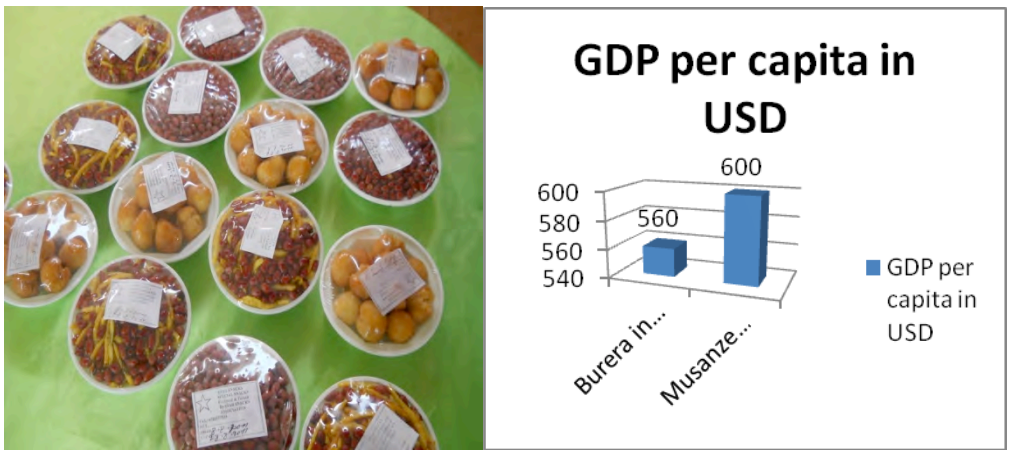

Figure 8: GDP per Capita in USD for the Exercise in 2012

According to Figure 8, the Gross Domestic Product (GDP) per capita is higher in Musanze than in Burera. This was due to job creation for income generation in the sector of Cyuve where buildings are growing up more quickly than in Rwerere sector of Burera District. Musanze region can be the second town of Rwanda. However, more investiments are needed in both districts for food security prosperity.
The investigation indicates that the major causes of food insecurity in both districts of Rwanda were as shown in Figure 9 below:

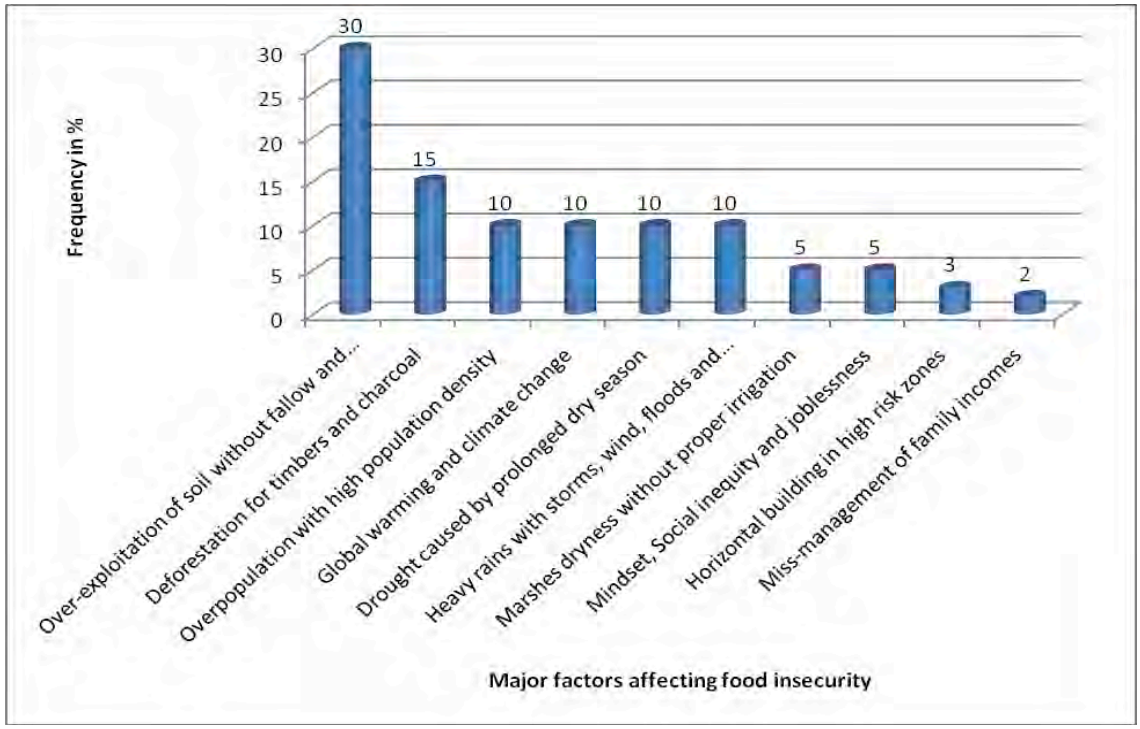

Figure 9: Risk factors affecting food insecurity

According to Figure 9, the major causes of food insecurity include soil over-exploitation without fallow of farmlands and compost inputs. However, presently the

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government is striving to solve these crucial issues in order to meet the needs of the population as expected. Some important factors that can be implemented for food security prosperity and sustainability are presented in Figure 10 below:

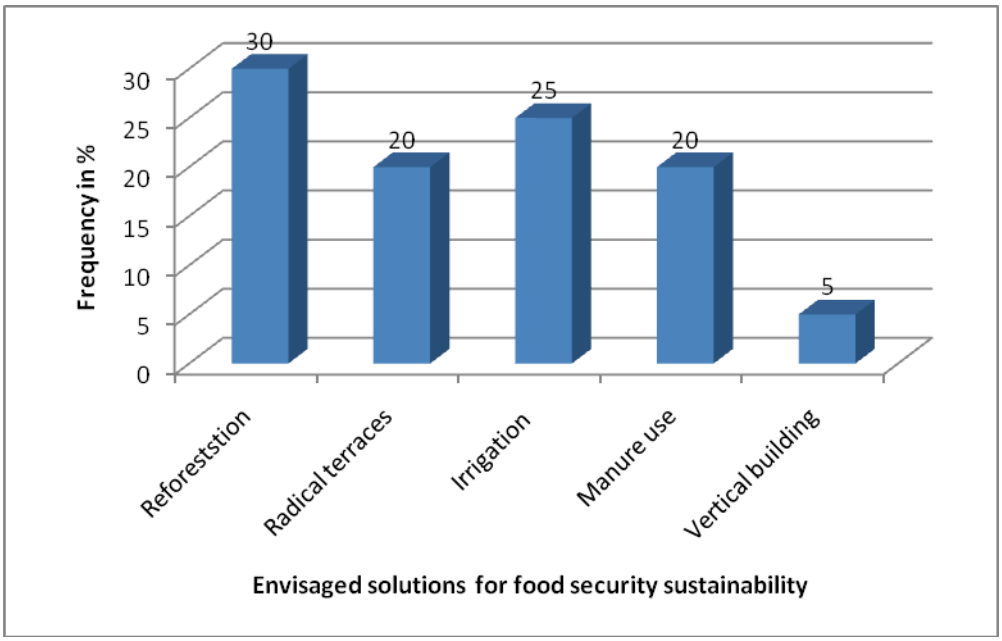

Figure 10: Planned solutions for food security prosperity and sustainability

According to Figure 10, the emitted solutions by respondents were reforestation, irrigation, radical terraces tracing in hills with high slopes, application of inputs including organic manure, compost and NPK for soil fertilization, land tenure, building in heights that allows a best and effective land management in order to achieve food security and sustainable development.

DISCUSSION

Concerning the food security in the region of Burera and Musanze Districts, it was found that the increased food crop production in lands consolidation and tenure with irrigation led to improved food availability. This statement had also been confirmed by other researchers [2, 3].

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Global warming and deforestation lead to food shortages and hunger in the region and this also was confirmed by other researchers [4, 5]. Considering the stark regional differences in food availability and food security, connected to seasonality, it appears that a better market-based food crop distribution system could contribute significantly to country-wide food security [4].

Food availability was accompanied by improved food and nutrition intake across the province, with new agricultural policy of Household Garden called "Akarima k'igikoni", despite climate change disparities. The floods and landslides can lead to food insecurity in hill lands. Comprehensive Food Security and Vulnerability Analysis and Nutrition Survey may reflect a trend towards better food security. The causes of poverty should be eradicated in the region by applying better land use methods like land consolidation, land tenure, proper irrigation during the dry season and improving soil fertility as stipulated by other scientists dealing with food security and distribution for social equity, and sustainable development [6, 7].

Thus, the poverty reduction leads to improved food security. Rwanda's agricultural sector faces a set of unique challenges due to improper land use, global warming and climate change. As a result, soil fertility has deteriorated dramatically over time, while fertilizer use, both organic and inorganic, remains low. Furthermore, much of Rwanda's land is at a high risk of erosion, because of the need for smallholders to cultivate on the slopes up to 55% to bring land under cultivation that is not suited to this purpose. Food crops remain dominant in the agricultural sector, and farmers are beginning to shift slightly towards higher value food crops, such as fruit and vegetables, rice, sorghum, maize, groundnuts and soybeans. While livestock is an important potential source of income, livestock numbers remain relatively low. The government has sought to address the low-levels of livestock ownership in the context of land scarcity through its 'One Cow per Poor Family' programme, which involves distributing heifers to poor families and ensuring that these are zero grazed. This good idea was appreciated by other specialists from developed countries [10, 11].

Finally, Rwandan agriculture continues to be characterised by low levels of input use, especially mineral fertilisers. Prior to this decade, the national rate of fertilizer consumption per cultivated hectare remained in the neighbourhood of 4kg – far below the average of 9 to 11kg/ha for sub-Saharan Africa, which still has the lowest fertilizer utilization rate compared to other regions of the world. Similarly, use of fertilisers, land consolidation, radical terraces, organic manure, maturated cow dung, biogas sludge, irrigation and improved plant seeds is encouraged in order to overcome the food shortage in rural area during dry season.

Nowadays, Rwanda is gradually reducing the poverty levels among rural people with formidable programmes such as the second *Economic Development and Poverty Reduction Strategy* (EDPRS 2*)*, which is well linked to the National Vision 2020, 8 Millennium Development Goals (MDGs) and 17 Sustainable Development Goals (SDGs) and Vision 2030. During the first Economic Development and Poverty Reduction Strategy (EDPRS 1), the commitment to poverty reduction has resulted in a

significant decline in national poverty rates between 2011 and 2012, largely the result of improved living standards in urban and rural areas. However, improving rural livelihoods has proven a challenge due to the rise in the number of rural households dependent on scarce wage labour opportunities (agriculture-based economy) for survival, partly due to increasing land shortages and climate change.

CONCLUSION

In both Burera and Musanze Districts, food security exists but it could change to food insecurity if efforts are not reinforced by appropriate land management methods, irrigation, inputs application and transformation of the economy by applying value to both crop and animal production.

Soil fertility and land management are handicapped by soil erosion in the land of a thousand hills, little crop rotation and lack of long fallow in land farming, lack of soil analysis (soil chemistry and microbiology) for better formulation and use of imported NPK and DAP fertilisers. Lack of enough animal feeds (diversified legumes, forage and concentrate), and resettlement in the area of agriculture vocation, high population density, environmental pollution, natural resources in continuous depletion, global warming, desertification, flood, land-slides, storm, drought, irrigation facilities, water shortage, land scarcity and horizontal building, are some of the major challenges affecting food security and sustainable development.

Landslides during heavy rain season and prohibitive slopes are a major problem in this land of a thousand hills. It is, therefore, important that more effort is made to reduce soil loss. The implementation of known methods and research are important for the control of soil erosion and mitigation of global warming and climate change effects. The government is doing the best for better land tenure and protecting soil loss by applying use of radical terraces and leguminous tree plantation (horticulture in crops), contribution to mitigating global warming effects and reinforcing soil fertility by use of compost (organic manure) and application of lands consolidation, fallow and crops rotation.

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