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ANALYSIS OF THE EFFECTS OF THE ADOPTION OF EDIBLE MUSHROOM CULTIVATION ON THE FOOD SECURITY OF HOUSEHOLDS IN KIREMERA HILL: CASE OF WOMEN IN GIHETA COMMUNE

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ABSTRACT

Recent population growth observed in many sub-Saharan African countries has negative repercussions, affecting food supply (Manirakiza, 2012). It leads to increasing poverty, malnutrition (Razuri, 2014) and is linked to the effects of climate change (Springmann et al., 2018; Weindl et al., 2020).

Mushroom cultivation, as an alternative agricultural practice, offers a promising prospect for food security and economic empowerment, especially in rural communities where women play a central role in agriculture. Teaching mushroom cultivation to women could therefore make them self-sufficient while reducing food insecurity; because as (Jacquelin, 2018) states in her article entitled "gender and food insecurity" "Food security for women can have positive and considerable impacts on the children in their care."

Given the importance of edible mushrooms and the fact that there are still few studies focusing on this crop, we deemed it relevant to conduct research in the Giheta commune with the aim of analyzing the effects of adopting edible mushroom cultivation on the food security of households in Kiremera hill in the Giheta commune.

Keywords: Edible mushrooms, Food security, Farm income, Households.

1. INTRODUCTION

Recent population growth observed in many sub-Saharan African countries has negative repercussions, affecting food supply (Manirakiza, 2012). It leads to increasing poverty, malnutrition (Razuri, 2014) and is linked to the effects of climate change (Springmann et al., 2018; Weindl et al., 2020). Thus, the fight against hunger and extreme poverty is increasingly becoming a daily challenge for developing countries (Gbaguidi et al, 2023) especially in rural areas where women and children are most exposed. Faced with these challenges, edible mushrooms, belonging to Non-Timber Forest Products (NTFPs) of high commercial value (Degreef et al., 2020); are emerging as natural resources with dietary, medicinal and commercial benefits often exploited by women for their well-being and empowerment (Swedi et al., 2023).

Mushroom cultivation, as an alternative agricultural practice, offers a promising prospect for food security and economic empowerment, especially in rural communities where women play a central role in agriculture. Teaching mushroom cultivation to women could therefore make them

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self-sufficient while reducing food insecurity; because as (Jacquelin, 2018) states in her article entitled "gender and food insecurity" "Food security for women can have positive and considerable impacts on the children in their care."
Burundi, with its wealth of agricultural resources, faces challenges related to food security and women's empowerment in an often precarious economic context.
If these women are to fully benefit from mushrooms and avoid their periodic consumption and sale, they will have to produce them themselves (Oei and Nieuwenhuijzen, 2005; van Nieuwenhuijzen *et al*., 2007).

Given the importance of edible mushrooms and the fact that there are still few studies focusing on this crop, we deemed it relevant to conduct research in the Giheta commune with the aim of analyzing the effects of adopting edible mushroom cultivation on the food security of households in Kiremera hill in the Giheta commune.

2. MATERIALS AND METHODS

Our work was conducted in the Giheta commune in the province with households that cultivate edible mushrooms. Geographically, the Giheta commune is bordered by the Bugendana commune to the north, Gitega commune to the south, Shombo commune of Karusi to the east, Nyabihaga communes in Mwaro province, and Rutegama commune of Muramvya to the west.
This is a cross-sectional, analytical study that focused on farmers operating in the edible mushroom cultivation sector in Giheta commune, Gitega province, over a period from March to April 2025. The sampling frame consisted of farmers who owned mushroom farms during the study period.
In total, we found 160 farmers with mushroom farms. After applying the inclusion criteria, we found that 134 farmers met the criteria to participate in the survey. The sample size was calculated according to the following equation (Eq.1) (Krejce and Morgana, 1970, Rea, L. *et al* 1997).
$n=(tp^2*P(1-P)*N)/(tp^2*P(1-P)+(N-1)*y^2)$ (Eq. 1)
n: sample size.
• N: size of the target population (number of households, users, etc.), actual or estimated.
• P: expected proportion of a population response or actual proportion.
In the case of a multi-criteria study or when no other study has been conducted, the actual proportion can be set to 0.5 by default, which allows for the largest possible sample.
• tp: sampling confidence interval: 1.96
y: margin of sampling error: 0.05
After applying the formula, we found the sample size to be:

$$n = \frac{1{,}96^2 * 0{,}5(1-0{,}5) * 134}{1{,}96^2 * 0{,}5(1-0{,}5) + (134-1) * 0{,}05^2} = 98{,}43\ donc\ 98$$

Thus, the sample size for our study is 98 farmers.
A total of 98 farmers with mushroom farms were surveyed in five hills for 1 month. To obtain the farmers with mushroom farms to be surveyed, we opted for the use of the simple random sampling technique. Data collection was done using questionnaires developed and tested before the start of the survey. To ensure the confidentiality and anonymity of the respondents, the

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names did not appear on the questionnaires. Data collection was done by ourselves using a questionnaire and an observation guide developed and configured in the Kobo Collect application then downloaded to the smartphone. Interviews were conducted using semi-structured questionnaires specific to the different types of key informants consulted.

The survey was conducted between 9 a.m. and 12 p.m. to maximize the participation of mothers attending the vaccination service. Data were analyzed question by question based on the variables selected for this study. After data collection, the data were imported into Microsoft Excel. These data were analyzed using R software, version 4.1.2.

3. MAIN RESULTS

Table 1. Main crops grown by farmers in Giheta commune and their respective production

Crop	Quantity Harvested in kg	Quantity Consumed		Quantity Sold	
		Q in kg	%	Q in kg	%
CORN	31755	30555	96,22%	1208	3,80%
RICE	8557	8177	95,56%	400	4,67%
BEANS	20444	19874	97,21%	570	2,79%
PEAS	160	160	100,00%	0	0,00%
POTATOES	8060	3550	44,04%	4510	55,96%
SWEET POTATOES	7959	7799	97,99%	210	2,64%
Mushrooms	9984	757	7,58%	8977	89,91%

Source: Our 2025 survey

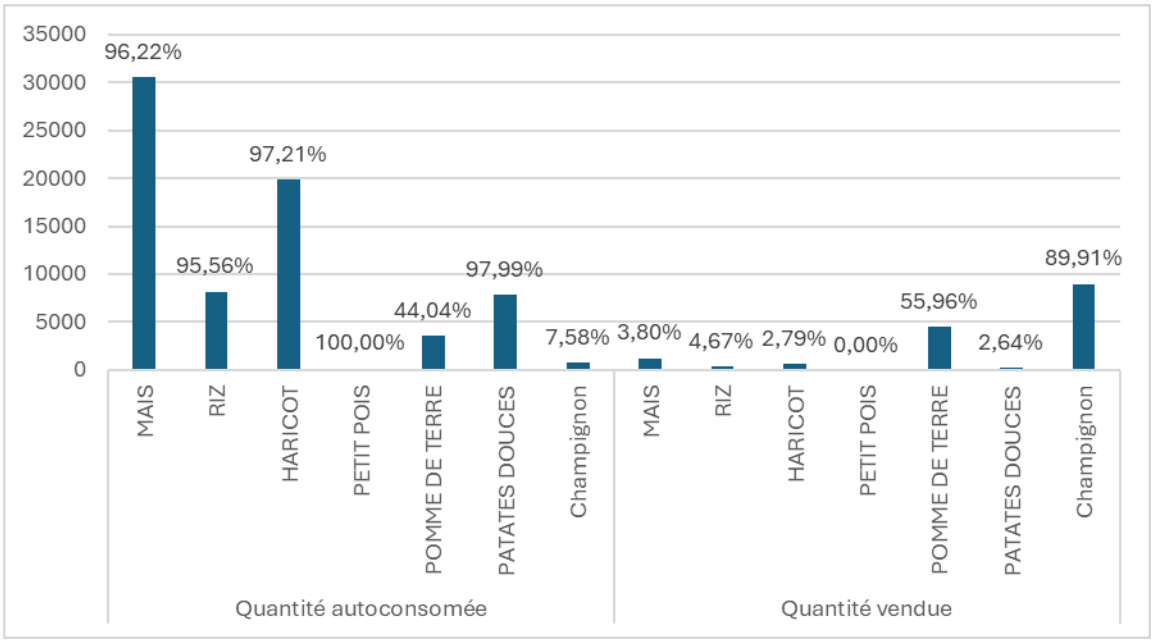

Figure 1: Main crops grown by farmers in Giheta commune and their respective production

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The results show that 96.22% of corn, 95.56% of rice, 97.21% of beans, 100.00% of peas, 44.04% of potatoes, and 97.99% of sweet potatoes are self-consumed within the household, while 55.96% of potatoes and 89.91% of edible mushrooms are sold to generate agricultural income to meet needs and ensure family well-being.

Table 2. Distribution of households according to food practices

Type of food eaten in the last 7	Number of households	Frequencies	
		Less than 3 times	3 times or more
CORN	99	1	98
RICE	58	42	16
SWEET POTATO	27	21	6
POTATO	19	12	7
CASSAVA	52	27	25
BEANS	98	6	92
PEAS	8	7	1
MEAT	19	19	0
FISH	0	0	0
EGGS	15	14	1
MILK	11	8	3
FRUIT	87	21	66
VEGETABLES	100	0	100
MUSHROOMS	91	72	19

Source : Our 2025, Survey

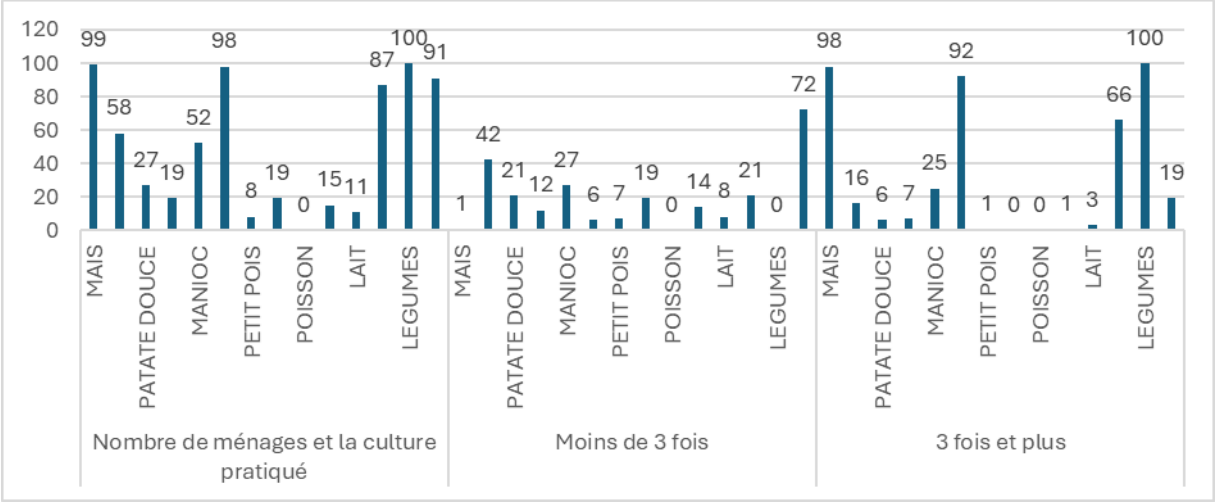

Figure 2: Household Dietary Practices

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The results show that more than 90% of respondents consume foods made up of corn, vegetables, beans, and edible mushrooms more than three times over a seven-day period, while foods made up of peas, meat, fish, eggs, and milk are consumed less than three times. These results explain the limited access of households to animal-based protein due to lack of financial means. Hence, edible mushrooms, seconded by beans, occupy the first place as the main source of protein used by these households.

Relationship between quantity harvested and quantity sold

"Pearson correlation coefficient for corn: 0.421"

	Estimate	**Std. Error**	**t value**	**Pr(>|t|)**
(Intercept)	-20.69937	9.27614	-2.231	0.0279
Quantity Harvested in kg	0.10323	0.02244	4.601	**1.26_e-05**

This means that there is a moderate and positive correlation between the quantity of corn harvested and that sold: the more you harvest, the more you sell, but the relationship is not very strong (compared to that with self-consumption which was 0.97). The coefficients show that the intercept of (-20.70), theoretically, if the quantity harvested was zero, the quantity sold would be slightly negative (which does not make sense in practice, but it is not worrying) while for the slope of (0.103), each kg of corn harvested leads on average to an increase of 0.103 kg sold. For significance, the slope is highly significant ($p < 0.001$), confirming a reliable statistical relationship and the goodness of fit shows that the coefficient of determination R2 = 0.1776R^2 = 0.1776R2 = 0.1776 → approximately 17.8% of the variation in the quantity sold is explained by the quantity harvested. Corn appears to play a priority role in self-consumption, much more than in sales. This suggests that it is a staple food source, before being a source of income.

Pearson correlation coefficient for fungus: 0.969"

	Estimate	**Std. Error**	**t value**	**Pr(>|t|)**
(Intercept)	-7.55.418	2.95305	-2.558	0.0121
Quantity Harvested in kg	0.97480	0.02529	38.538	**$<2_e$-16**

This means that the more mushrooms are harvested, the more are sold. Unlike what was observed with corn, here production seems strongly geared toward sales. Mushrooms are therefore probably grown primarily as a commercial product, and not for self-consumption (which is confirmed by the weaker correlation with self-consumption). By calculating the regression coefficient (0.975), the results show that each kg of mushrooms harvested is associated with approximately 0.975 kg sold. This indicates a very high conversion of harvest to sales; almost the entire harvest is sold.

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The coefficient of determination $R^2 = 0.9381$ shows that approximately 94% of the variation in the quantity sold is explained by the quantity harvested. Therefore, the model performs very well. The p-value < 2.2e-16 shows that the model is highly significant. The relationship between the two variables is statistically very strong. Mushroom cultivation is almost exclusively for sale. The strong correlation and the slope close to 1 confirm this. This could be a good indicator that mushrooms play an important role in the income of farm households.

4. DISCUSSION OF RESULTS

The results obtained showed that, on average, households consume little of their mushroom harvest (≈ 2.8%) and keep around 5 kg, regardless of total production. This means that mushroom cultivation is primarily intended for sale to access other agri-food products available on the market, and not primarily for self-consumption.

The coefficient of determination $R^2 = 0.9381$ shows that approximately 94% of the variation in the quantity sold is explained by the quantity harvested. Therefore, the model performs very well. The p-value < 2.2e-16 shows that the model is highly significant. The relationship between the two variables is statistically very strong. By calculating the regression coefficient (0.975), the results show that each kg of mushrooms harvested is associated with approximately 0.975 kg sold. This indicates a very high conversion of the harvest into sales; almost the entire harvest is sold.

Mushroom cultivation is almost exclusively for sale. The strong correlation and the slope close to 1 confirm this. This could be a good indicator that mushrooms play an important role in the income of farming households. The results show that more than 90% of respondents consume foods composed mainly of corn, vegetables, beans, and edible mushrooms more than three times over a seven-day period, while foods composed of peas, meat, fish, eggs, and milk are consumed less than three times. These results explain the limited access of households to animal-based proteins due to lack of financial means. Hence, edible mushrooms, seconded by beans, occupy the first place as the main source of protein used by these households.

In Benin, another study demonstrated awareness of the benefits of edible mushrooms. Women eat mushrooms and recognize that they can be substituted for meat. These results are consistent with those of BONI AND YOROU, 2015 in their enthnomycological work on edible mushrooms in the national park who reported that women know mushrooms better than men and that their harvests are sources of financial income for these women.

Furthermore, mushroom sales are largely dominated by women, providing them with a significant source of income (SWEDI *et al*., 2023).

Other findings confirm that edible mushroom cultivation, as an alternative agricultural practice, offers a promising prospect for food security and economic empowerment, particularly in rural communities where women play a central role in agriculture. Teaching women mushroom cultivation could therefore empower them while reducing food insecurity (JACQUELIN, 2018).

5. CONCLUSION

The aim of the study, entitled "Analysis of the effects of adopting edible mushroom cultivation on household food security in the Giheta commune, Gitega province, in the country of Burundi," was to assess the standard of living of households that cultivate edible mushrooms. The results of this research showed that the majority of agricultural income from edible mushroom cultivation is intended for sale to improve their economic accessibility to food and their standard of living.

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On average, households consume little of their mushroom harvest (≈ 2.8%) and keep around 5 kg, regardless of total production. This suggests that mushroom cultivation is primarily intended for sale to access other agrifood products available on the market.

The results show that foods consisting of peas, meat, fish, eggs and milk are consumed less than 3 times. These results explain the limited access of households to animal protein due to lack of financial means. Hence edible mushrooms, seconded by beans, occupy the first place as the main source of protein used by these households. All these results show that the cultivation of edible mushrooms allows farmers in Giheta commune to improve food availability, economic accessibility to food and food use as pillars of food security. Finally, the importance of the results obtained in this work leads us to make some suggestions to the government and future researchers:

- Development projects must take into account the cultivation of edible mushrooms throughout the country;
- Mushroom cultivation must be increasingly popularized in both villages and cities;
- Strengthen gender integration or inclusion in mushroom production, given that it is, above all, an activity largely reserved for women, which will allow them to have an activity that can generate a source of income, provide for or contribute to the needs of the family, and achieve independence and autonomy.

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. NDAYIZEYE Felix was done the Data collection using a questionnaire and an observation guide developed and configured in the Kobo Collect application then downloaded to the smartphone. Interviews were conducted using semi-structured questionnaires specific to the different types of key informants consulted. NIYUKURI Jonathan monitored and assessed all stages of the collect;the analysis of the article. NDAYIZEYE Felix and NIYONGERE Viateur carried out statistical analysis and wrote the draft of the article.

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