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Studies of Agronomic Approaches and Techniques as One of the Strategies for Resilience to Food Insecurity: Case of Corn Cultivation in the Cendajuru Commune of Cankuzo Province

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Abstract
Food security is a crucial issue for sustainable development, public health, and economic stability. In the study conducted in the CENDAJURU municipality on good agricultural practices for cultivating Elite 89 maize variety, during the period from June 30, 2024, to July 25, 2024, with the participation of 16 seed multipliers, it25.0. Only variables with a $p < 0.05$ in the multivariate logistic regression were considered to be significantly associated with chronic malnutrition. As findings, the descriptive analysis showed a prevalence of chronic malnutrition of 55% in children less than five years Organic fertilization allows for an average yield of 1,316.67 kg; fertilization using only FOMI fertilizers gives an average yield of 1,550 kg, while combined fertilization (FOMI fertilizers and organic matter) enables achieving an average yield of 2,300 kg.

Keywords: Food Security, Good Agronomic Practices, Organic Fertilization, Fertilization Based on FOMI Products, Organo-Mineral Fertilization, Agricultural Yield

Introduction

Food security of households and the fight against poverty are now one of the main concerns in several countries around the world (Mortimore & Adams, 2001; Ouédraogo, Kaboré, & Kienou, 2007). To address this critical food insecurity situation affecting almost the entire population of the planet, countries, states, and some partner organizations fighting against food insecurity have developed certain strategies to save human lives in acute crisis situations, to protect and maintain the livelihoods of the most disaster-sensitive populations, to reduce vulnerability factors, and to promote economic and social develop ment. In Burundi, agriculture is a sector that plays a key role in food security. Accessibility to food is one of the dimensions of food security alongside availability, stability, and uti lization of food. This accessibility to food allows agriculture to produce affordable food for consumers. This means that farmers must obtain the right price for their products so that they can be purchased by those who need them. Furthermore, it is essential that farmers have access to appropriate technologies and knowledge to improve the production and quality of agricultural products. It is in this perspective that farmers must abandon outdated so-called traditional agricultural practices in favor of modern ones that increase agricultural production and thus respond to the shocks caused by food insecurity. A best practice is a method or technique that has been generally accepted as being su perior to all alternatives because it produces better results than those obtained by other methods or because it has become a standard way of doing things (OLUWOLE MAT THE AKINNAGBE AND KEHINDE ELIJAH OWOLABI, 2021) [5] Our study will focus on the investigation of agronomic techniques used for maize cultiva tion as one of the strategies for resilience to food insecurity adopted by seed entrepreneurs in the CENDAJURU commune of the CANKUZO province, in the MOSO region of Eas tern BURUNDI, in order to achieve effective resilience against food insecurity;given that maize and its derivatives rank second after beans in consumption for most Burundian households.

Materials and Methods
Materials
Study Location
Our study took place in the CENDAJURU commune of the CANKUZO Province.

Study Type and Period
This is a retrospective, cross-sectional study with an analytical and exploratory purpose on bean and maize seed entrepreneurs in the CENDA-JURU commune who produced maize seeds during the 2024A season.
This study was conducted from June 30 to July 25, 2024. This type of study was chosen to allow for the collection of details on more than one case and, at the same time, on the respondents, and to facilitate the determination of relationships between variables.

Study Population
The study population consisted of all seed entrepreneurs who produced maize seeds du ring the 2024A season and who conducted fertilization demonstration fields using FOMI fertilizers only, organic manure, and FOMI products combined with organic manure, and who had harvest data. These entrepreneurs received support from IFDC during the 2023A season in their seed multiplication activities. In addition to the yield analysis, taking into account the independent variable of seed type (improved or local), the seed entrepreneurs also conducted trials on fertilization types un der homogeneous conditions and their impact on agricultural yield.In addition to the yield analysis, taking into account the independent variable of seed type (improved or local), the seed entrepreneurs also conducted trials on fertilization types under homogeneous conditions and their impact on agricultural yield**.**

Inclusion Criteria
Any seed entrepreneur who established demonstration fields for corn cultivation during the 2024A season and who received support from IFDC during the 2023A growing season and who has the data in their register.

Exclusion Criteria
Any other farmer or seed entrepreneur who does not meet the profile mentioned above.

Methodology and Methods
Data Collection Tools**:**

- Pens
- Tablets
- Survey

Questionnaire

- Notebooks
- Register of Seed Entrepreneurs
- Letter of Approval from the ONCCS
- Various seed analysis certificates issued by the ONCCS
- Co-financing contract with the IFDC during the 2023 season

The data collected were recorded on a pre-prepared survey form, a copy of which is attached. The data to be analyzed are collected by interviewers recruited for this purpose. The investigators received training on the use of tablets and especially on the Comecare tool.

Sample Size
We have a sample size of 16 seed multipliers who meet the profile because they are the only ones who meet this profile.

Data Entry and Statistical Analysis
Data entry and collection were carried out using the following software:Microsoft Word,Excel 2013. Quantitative variables were expressed as means and qualitative variables as proportions.
The variables studied include:

— **Agricultural practices:** Use of dolomite, organic manure, earthing up, phytosa nitary treatments, type of sowing;
— **Yields:** Organic, chemical, organo-mineral (kg/ha);
— **Crops:** Corn and beans for the 2023A, 2023B, 2024A, and 2024B seasons**.**
— **Others:** Soil analysis, location type, and organic fertilization level.

A linear regression was performed.The difference was significant if the p-value was less than 0.05.

Analysis Methods
The analysis was performed using Python in the Anaconda Integrated Development En vironment (IDE) under Jupyter Notebook, which required importing libraries such as pandas, numpy, scipy, sklearn, matplotlib, and seaborn. It includes:

— **Descriptive statistics:** Distribution of practices and yields.
— **Pivot tables:** Relationships between practices, yields, and locations.
— **Predictive models: Linear regressions, etc.**
— **Visualizations:** Bar charts, box plots, correlation matrices

Presentation of Analysis Results

Summary Description of the Data Studied
The following tables show a descriptive analysis conducted to describe the study:

Table 1: Distribution of Farmers by Gender, Locality, and Hill

category	Subcategory	Proportion (%)
Gender	Male	75.0
	Female	25.0
Locality	Semi-urban	62.5
	Rural	37.5
Hill	Twinkwavu	50.0
	Kiruhura	18.75
	Nyamugari	12.5
	Nyakuguma	6.25
	Kibande	6.25
	Misugi	6.25

The total population studied is composed of 16 farmers. Regarding gender distribution, the majority are men, representing 75% of the workforce, compared to 25% women. In terms of geographical location, 68.75% of farmers are located in semi-urban areas, while the remaining 31.25% work in rural areas. In terms of geographical location, 68.75% of farmers are located in semi-urban areas, while the remaining 31.25% work in rural areas. In terms of distribution by hill, the geographical diversity is notable: the hill of TWINKWAVU accounts for 50% of participants, making it the most represented. Other hills, such as KIRUHURA (18.75%), NYAMUGARI (12.5%), NYAKU-GUMA, KIBANDE, and MISUGI (each at 6.25%), show lower representation. This description highlights a predominantly male population, concentrated in a semi urban setting, with a high representation in a single hill, which could influence the results related to agricultural practices and observed yields.

Table 2: Yield characteristics (kg/hectare)

Fertilization type	Average	Standard deviation	Min-Max
Organic	1309	57	1200-1400
chemical	1416	62	1450-1700
Organo-mineral	2316	92	2100-2500

Table 2 shows the yield characteristics in kilograms per hectare according to three types of fertilization: organic, chemical, and organo-mineral. Average yields vary depending on the type of fertilization. Organic fertilizer produces an average yield of 1309 kg/ha with a standard deviation of 57, and a variation range from 1200 to 1400 kg/ha. Chemical fertilizers have a slightly higher average yield of 1416 kg/ha, with a standard deviation of 62, and a range of 1450 to 1700 kg/ha. Finally, organo-mineral fertilizers have the highest yields, with an average of 2316 kg/ha, a standard deviation of 92, and yields ranging from 2100 to 2500 kg/ha. These data indicate that organo-mineral fertilizers offer the highest and most variable yields among the three types evaluated.

Table 3: Dolmite Use by Locality Type

Locality Type	Non (0)	Yes (1)
Rural	3	4
Semi_Rural	1	8

Table 3 shows dolomite use by locality type. It was observed that in rural areas, three localities do not use dolomite, while four do. On the other hand, in semi-rural areas, the use of dolomite is more widespread: only one locality does not use it, compared to eight that do. These results suggest that the use of dolomite is more common in semi-rural localities than in rural localities. **Observation:** Dolomite adoption is higher in semi-urban areas (88.9%) than in rural areas (57.1%).

Table 4: Average yields by fertilization type

Fertilization type	Average yield (kg /ha)	Standard deviation
Organic	1303,3	64,5
Chimical	1516,7	75,6
Organo-mineral	2330,0	119,3

Table 4 shows the average yields, in kilograms per hectare, by fertilization type, as well as the associated standard deviations. Organic fertilization generates an average yield of 1303.3 kg/ha with a standard deviation of 64.5. Chemical fertilization achieved a higher average yield of 1516.7 kg/ha, with a standard deviation of 75.6. Finally, organo-mineral fertilization offered the best results, with an average yield of 2330.0 kg/ha and a standard deviation of 119.3. These data confirm that organo-mineral fertilization performed best in terms of yield, although it also exhibited the greatest variability.

Observation: The combined yield is highest in both locations, with no significant difference.

Table 5: Average yields (kg/ha−1) by degree of organic fertilization

Degree of Fertilizer	Organic	Chemical	Combined
Medium(2)	1316,67	1550.00	2300.00
High(3)	1307.69	1507.69	2319.23

Table 5 shows the average yields (in kg/ha) according to the degree of organic fertilization, and according to three types of fertilization: organic, chemical, and combined. For a medium fertilization level (level 2), yields were 1316.67 kg/ha with organic fertilization, 1550.00 kg/ha with chemical fertilization, and 2300.00 kg/ha with combined fertilization. At a high fertilization level (level 3), yields were slightly lower with organic fertilization (1307.69 kg/ha) and slightly higher with chemical fertilization (1507.69 kg/ha), while combined fertilization yielded 2319.23 kg/ha. Thus, regardless of the fertilization level, the combination of organic and chemical fertilization achieved the best yields.

Evaluation of Selected Variables

The following tables present the absolute and relative frequencies (in percentages) of the variables studied in the survey of 16 farmers in Cendajuru. The corresponding visuali zations illustrate the distribution of the data, with the percentages indicated on each bar.

Table 6: Evaluation of the Gender Variable

Gender	Frequency	Percentage
Femele	4	25,00
Male	12	75,00

Table 6 presents the distribution of individuals according to the "Gender" variable. It shows that the majority of participants are men, representing 75% of the total number, or 12 people. Women, for their part, constitute 25% of the sample, with a number of 4. This distribution shows a clear male predominance in the population studied.

Table 7: Evaluation de la variable Type de localité

Locality Type	Frequency	Percentage (%)
Rural	5	31,25
Semi_ Rural	11	68,75

Table 7 illustrates the distribution of individuals by locality type. It can be seen that the majority of participants, 68.75% (11 people), reside in semi-urban areas. On the other hand, a minority of 31.25% (5 people) live in rural areas. This distribution indicates a predominance of residents of semi-urban areas in the sample studied.

Table 8: Frequency of Soil Tests

Number of Tests	Frequency	Percentage (%)
1	12	75,00
2	4	25,00

Table 8 shows the frequency of soil tests performed. It appears that the majority of cases, 75% (12 cases), benefited from a single soil analysis. Furthermore, 25% of cases (4 cases) underwent two analyses. These results show that in most situations, a single analysis is sufficient, although in some cases, a second analysis is performed.

Table 9: Frequency of Dolomite Use

Dolomite Use	Frequence	Percentage (%)
Non (0)	4	25,00
Yes(1)	12	75,00

Table 9 shows the frequency of dolomite use. It shows that 75% of respondents (12 people) use dolomite, compared to 25% (4 people) who do not. These results reveal a majority adoption of dolomite among the individuals surveyed.

Table 10: Assessment of the Degree of Organic Fertilization

Degree of Organic Fertilization	Frequency	Percentage (%)
Medium (2)	3	18,75
High (3)	13	81,25

Table 10 shows the distribution of individuals according to the degree of organic fertilizer used. It emerged that a large majority, 81.25% (13 individuals), applied a high level of organic fertilization. In comparison, only 18.75% (3 individuals) used a medium level. These results indicate a clear preference for intensive organic fertilization in the study population.

Table 11: Seeding rate assessment (kg/ha)

Range (kg/ha)	Frequency	Percentage (%)
[22,998; 23,4]	7	43,75
[23,4; 23,8]	0	0,00
[23,8,; 24,2]	4	25,00
[24,2; 24,6]	1	6,25
[24,6,; 25,0]	4	25,00

Table 11 shows the frequency of seeding rates used, expressed in kilograms per hectare (kg/ha). It is observed that the majority of participants (43.75%, or 7 individuals) use a rate between 22.998 and 23.4 kg/ha. No individual applies a rate in the range of 23.4 to 23.8 kg/ha. In contrast, 25% (4 individuals) were in the 23.8 to 24.2 kg/ha range, and the same number were in the 24.6 to 25.0 kg/ha range. A small proportion, 6.25% (1 individual), used a rate between 24.2 and 24.6 kg/ha. These data show a significant concentration around the low sowing rates, particularly in the first interval.

Table 12: Combined Yield Assessment (kg/ha)

Range (kg/ha)	Frequence	Percentage (%)
(2099,6; 2180,0]	1	6,25
[2180,0; 2260,0]	1	6,25
[2260,0, 2340,0]	8	50,00
[2340,0; 2420,0]	4	25,00
[2420,0; 2500,0]	2	12,50

Table 12 shows the distribution of combined yields in kilograms per hectare (kg/ha). The majority of individuals, 50% (8 cases), achieved a yield between 2260.0 and 2340.0 kg/ha. A quarter of individuals (25%, 4 cases) fell within the range of 2340.0 to 2420.0 kg/ha, while 12.5% (2 cases) achieved yields between 2420.0 and 2500.0 kg/ha. The lower ends of the distribution, namely the ranges of 2099.6 to 2180.0 kg/ha and 2180.0 to 2260.0 kg/ha, each account for 6.25 % of individuals (1 case each). These data indicate a concentration of yields around the median range, between 2260.0 and 2340.0 kg/ha.

General Interpretation of These Tables

The observations collected reveal clear trends in crops and agricultural practices. During the 2023A and 2024Aseasons, corn was grown exclusively, representing 100% of the land area. However, for the 2023B and 2024B seasons, crops diversified: beans were grown on 81.25% of plots, while 18.75% were left fallow.

- **From the perspective of agricultural practices:**

The adoption of modern tech niques is notable. Dolomite was used by 75% of farmers, while organic manure was adopted by all farmers, with a marked predominance (81.25%) for high-level appli cations. Row sowing is also universal, with a strong preference (93.75%) for a density of two seeds per hole. Furthermore, earthing up and phytosanitary treatments are systematically applied. There are also other agricultural practices not listed, such as fertilization, soil preparation, sowing techniques, irrigation, crop rotation, weeding, pest control, and all other activities requiring soil analysis

- **Regarding agricultural yields**:

results vary depending on the type of fertiliza tion used. On average, plots receiving only organic manure achieved a yield of 1303.3(645)kgha−1. Those treated with chemical fertilizers achieved a slightly hi gher yield, with 1516.7(756)kgha−1. However, it was the organo-mineral system that achieved the highest performance, reaching2330.0(1193)kgha−1, thus demons trating the value of a combined approach to fertilization.

The Regressive Model in Estimating Combined Yield: Linear Regression

A linear regression was performed to predict combined yield (kgha−1) using six explana tory variables, including (Degree of Organic Fertilizer, Dolomite, Seeding Rate kg ha, Soil Analysis Number, 'Grain Holes', Organic Yield kg ha).

Fig 1: The visualization of linear regression in predicting yield

This linear regression was performed to explain Combined Yield kg ha using six ex planatory variables, including (Degree of Organic Fertilizer, Dolomite, Seeding Rate kg ha, Soil Analysis Number, 'Grain Holes', Organic Yield kg ha). 'Grain_Hole', 'Orga nic_Yield_kg_ha'), on a sample of 16 observations. The model, estimated using the ordinary least squares (OLS) method, shows a good fit with a coefficient of determination R2 of 0.829 and an adjusted R2 of 0.715. The F statistic (7.277) and its associated p-value (Figure 3.1? Visualization of linear regression in yield prediction) (0.00467) indicate that the model is overall significant. The AIC (175.0) and BIC (180.4) criteria provide elements for comparing this model to others, as shown in the following table:

Table 13: Summary of Linear Regression Model Results

Parameter	Value
Dependent Variable	Combined_Yield_kg_ha
Method	Ordinary Least Squares (OLS)
Number of Observations	16
Model Degrees of Freedom	6
Residual Degrees of Freedom	9
R^2	0,829
Adjusted R^2	0,715
F-Statistic	7,277
p-Value (F-Statistic)	0,00467
Log Likelihood	-80,505
AIC (Akaike Criterion)	175,0
BIC(Bayesian Criterion)	180,4

Visualizing the Results

The average yields obtained with different fertilization methods are illustrated in the following bar chart:

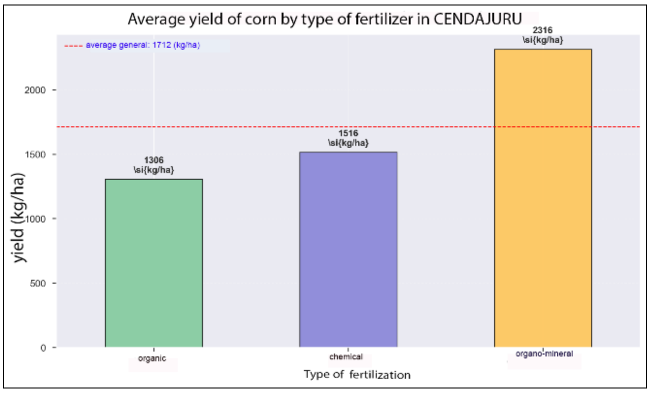

Fig 2: The barchart shows that combined fertilization (organic + chemical) provides the highest average yield for maize in Cendajuru (approximately 2,325 kg/ha), outper forming chemical (1,513 kg/ha) and organic (1,306 kg/ha) methods. These results, based on consistent data from 16 farmers, highlight the effectiveness of a combined approach to optimizing agricultural yields

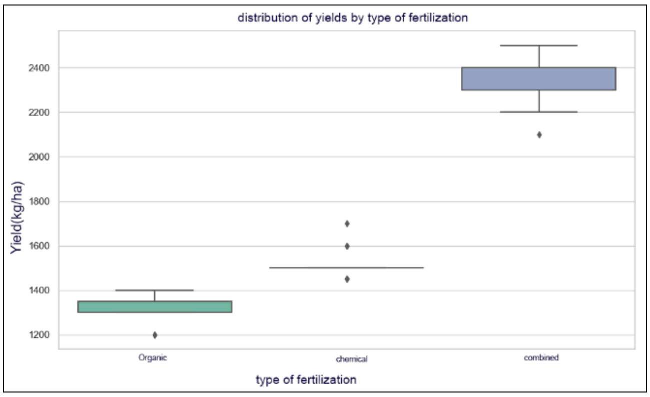

Fig 3: The box plot shows the distribution of maize yields by fertilization type (organic, chemical, combined) in Cendajuru. Combined fertilization shows the highest and most consistent yields (median 2,325 kg/ha), followed by chemical (1,513 kg/ha) and organic (1,306 kg/ha). Organic yields show lower variability, while combined yields vary more

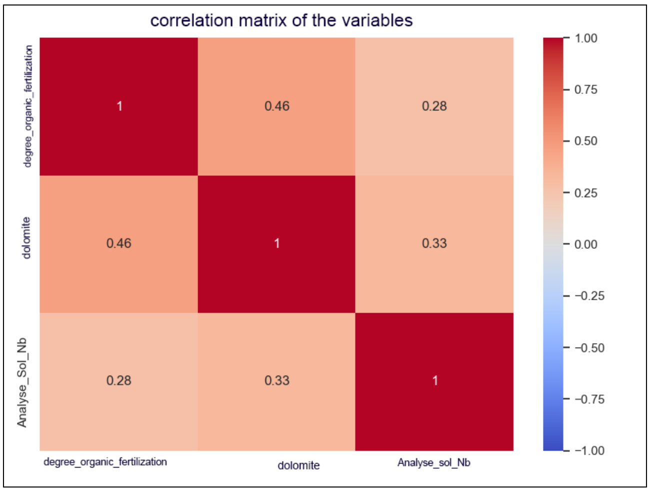

Fig 4: The correlation matrix, represented by a heatmap, shows the relationships between Organic_Fertilization_Degree, Dolomite, and Soil_Analysis_Number. Values close to 0 (annotated on the graph) indicate a weak correlation between these variables, suggesting the absence of significant collinearity. The colors (cool-warm palette) visually reinforce this weak interdependence, with neutral hues dominating.

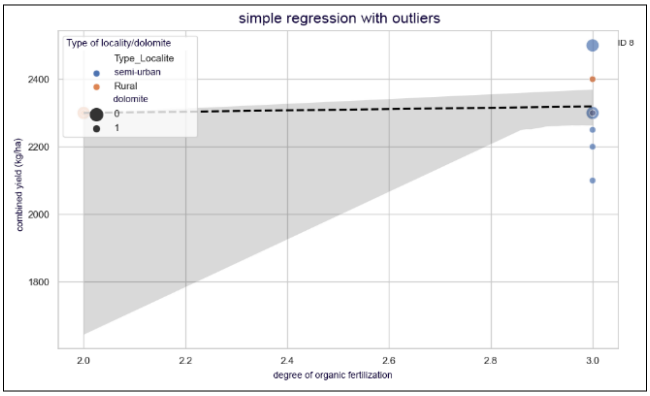

Fig 5: This graph highlights a limited relationship between the level of organic fertilization and yield, while identifying exceptional cases for future investigation

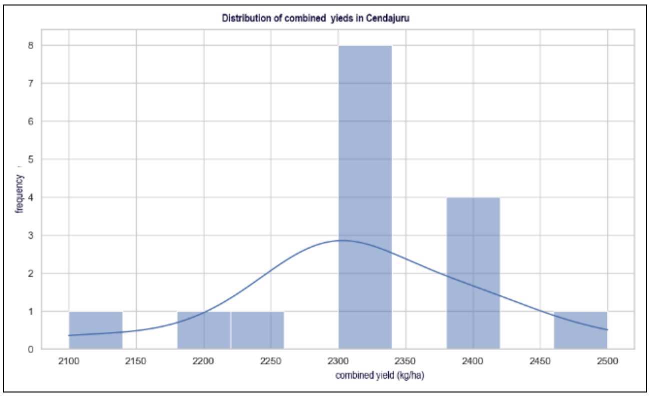

Fig 6: The histogram shows the distribution of combined (organic + chemical) maize yields in Cendajuru. The majority of yields are around 2300 kg/ha, with a density curve (KDE) indicating a slightly skewed distribution. A few extreme values (around 2500 kg/ha) suggest exceptional yields.

Discussion of Results

Fertilization Type

In this study, organo-mineral fertilization yields were significantly higher than those ob tained using organic or FOMI-based fertilizers. The average yield was 2,316 kg/ha for organo-mineral fertilization, compared to 1,416 kg for FOMI products and 1,309 kg for organic manure alone.

These results are comparable to those of the IRD (Institute for Rural Development) study on maize in Burkina Faso. ABGA Pascaline Tené (February 2013) states that organo mineral fertilization offers higher and more stable yields than organic and mineral ferti lizers alone, thanks to the combined contribution of fast- and slow-release nutrients and organic matter beneficial to the soil. Organic fertilizers improve soil structure over the long term, while mineral fertilizers provide concentrated, fast-acting nutrients.

With the use of organic fertilizer alone, yields are often lower and less stable, as nutrients are released slowly and their NPK content is generally lower than that of mineral fertili zers (ABGA, 2013). Mineral fertilizer alone provides rapidly available nutrients, which can lead to high yields in the short term, but can also increase the risk of leaching losses (Agryco, 2025).

Type of Locality

In this study, 11 out of 16 people, or 68.75%, reside in semi-urban areas, but their agri cultural activities are carried out in rural areas where there is sufficient land. According to the survey, seed entrepreneurs prefer to live in semi-urban areas because these areas straddle rural and urban areas. However, their agricultural activities are concentra ted in rural areas. These results are similar to those found in West Africa. Serge Snrech, in his 2000 study on urbanization, "Links between rural and urban areas and strategic implications for rural and agricultural development: A case study in West Africa," found that the distribution of agricultural entrepreneurs is concentrated in rural and semi-urban areas due to the very nature of agricultural activity, which requires production space. Ru ral areas, which are sparsely populated and dedicated to agriculture, are the main location of activity, while semi-urban or peri-urban areas can accommodate agricultural businesses close to consumer markets or processing activities (Snrech, 2000).

Distribution of Agricultural Entrepreneurship by Gender

The results of this study showed that men occupy the first place in seed production acti vities (75%) than women (25%). These results are justified by the fact that men are heads of households and projects are assigned to them. These results are quite comparable to the results obtained in France by the MSA (Mutualité Sociale Agricole). MSA statistics from March 2025 highlighted the proportions of agricultural entrepreneurship by gender: 26.5% of women versus 73.5% of men.

Level of Dolomite Use by Type of Locality

In the study, three localities do not use dolomite, while four do. On the other hand, in semi-rural areas, the use of dolomite is more widespread: only 1 locality does not use it, compared to 8 that do. These results suggest that the use of dolomite is more common in semi-rural areas than in rural areas.

Observation: The adoption of dolomite is higher in semi-urban areas (88.9%) than in rural areas (57.1%). These results are supported by studies conducted in Quebec (CA NADA), which have highlighted the reasons for these disproportions.

Farmers in semi-urban areas, closer to decision-making centers and potentially more ex posed to new technologies and scientific information, may be more inclined to adopt soil amendment practices such as the use of dolomite to optimize soil health and yields (Go vernment of Quebec, 2025).

Level of Dolomite Use

This study demonstrated that 75% of the cases studied use dolomite on their farms. This is justified by the high acidity of Burundian soils caused by the loss of essential elements, including calcium and magnesium. This loss of these elements is often due to erosion and export, leaving only aluminum in the soil. Dolomite then helps correct acidity by pro viding calcium and magnesium, which neutralize the aluminum present in the soil. The increased use of dolomite in Burundian soils was also corroborated by Professor Kabo neka Salvator, Agricultural Expert, in 2022 during the workshop to validate Burundi's soil fertility maps, 2022 edition, and to present the feasibility study report on strengthe ning the dolomite sector in Burundi. He emphasizes that dolomite, which was previously relegated to oblivion, must now be the basis for boosting agricultural production, and that its use could triple agricultural production. However, he confides that the technique of using dolomite alone is not enough. "We must plant agroforestry trees in the fields and create anti-erosion hedges to combat erosion and soil leaching, which are the major causes of soil acidity," he argues.

Level of soil analysis practice

The research results clearly showed that all the studied cases conduct soil analysis: 75% of cases performed two analyses and 25% performed a single soil analysis. This highlights the critical importance assigned to the practice of soil analysis as it better aligns fertilization for improved agricultural production. These results are confirmed by the journal Smart Agriculture in 2023. The marketing team behind the article on Agricultural Soil Analysis stated that soil analysis allows for accurate determination of soil content in elements and nutrients. **By comparing it with the needs of the plant, it is possible to establish an optimal input strategy. It thus defines the right amount to apply at the right place and the right time.** Conducting an agricultural soil analysis, therefore, has **a positive impact both environmentally and economically.**

Level of Organic Manure

Use In this study, it was proven that 81.25% of the cases studied, or 13/16, used a significant amount of organic matter, ranging from 15 to 18 bins per hectare. This demonstrates the crucial role that organic matter plays in soil fertility by providing nutrients necessary for plants, including nitrogen, phosphorus, potassium, and trace elements. These results are similar to those obtained by the French Environment Service in 2011 during the study on the importance of organic matter. Hubert G. *et al.* have demonstrated the triple role of organic matter in the overall functioning of the soil.

1. **Biological role (energizing)**: Stimulates biological activity (earthworms, microbial biomass) through degradation, mineralization, reorganization, aeration, and facilitates root growth;

2. **Physical role (cohesion) by improving soil structure and porosity:** water pe netration, water storage, runoff limitation, erosion limitation;

3. **Chemical role (nutrient) by:**

- **Degradation, mineralization:** supply of mineral elements (N, P, K, trace elements,);
- **Cation exchange capacity (CEC)**: storage and availability of mineral elements;
- **METcomplex**: limitation of toxicities (e.g: Cu);
- **Retention of organic micropollutants and pesticides**: quality of Water.

Assessment of the Quantity of Corn Seeds per Hectare

In this study, it was shown that the quantity of corn seeds used varies, but this variation is significantly low. Indeed, 43.75%, or 7 individuals, used a dose between 22.998 and 23.4 kg/ha. No individual applied a dose in the range of 23.4 to 23.8 kg/ha. In contrast, 25% (4 individuals) were in the range of 23.8 to 24.2 kg/ha, and the same number in the range of 24.6 to 25.0 kg/ha. A small proportion, 6.25% (1 individual), used a dose between 24.2 and 24.6 kg/ha.

These data show a significant concentration around low seeding doses, particularly in the first interval. These results are confirmed by the Burundi Research Institute (ISABU). ISABU resear chers recommend less than 30 kg of small-sized maize seeds (ISABU, 2012), such as in our case: the Elite 89 variety. In Ivory Coast, the quantity of maize seeds per hectare is estimated at between 20 and 25 kg per hectare (Ministry of Agriculture of Ivory Cost).

Evaluation of organo-mineral fertilization on agricultural yield

The majority of individuals, 50% (8 cases), achieved a yield between 2260.0 and 2340.0 kg/ha. A quarter of the individuals (25%, 4 cases) fell within the range of 2340.0 to 2420.0 kg/ha, while 12.5% (2 cases) achieved yields between 2420.0 and 2500.0 kg/ha. The lower ends of the distribution, namely the ranges of 2099.6 to 2180.0 kg/ha and 2180.0 to 2260.0 kg/ha, each accounted for 6.25% of individuals (1 case each). These data indicate a yield concentration around the median range, between 2260.0 and 2340.0 kg/ha. This yield is also approved by ISABU. The National Catalogue of Plant Species and Varieties cultiva ted in Burundi stipulates that the yield per hectare of Elite 89 seed, pre-basic category, is 2 to 3 tons (CNEVVCB, 2021 edition).

Interaction between maize yield and food security

The adoption of good cultural practices as described in this study results in high maize yields, increases the availability of this essential cereal, and reduces the risk of malnu trition, thus strengthening food security at the household and community levels. On the contrary, poor farming practices and climate change are causing low production of this commodity, threatening food availability and supply stability.

The resulting production will be used in two ways:

1. A portion will be devoted to consumption:

This statement is corroborated by studies conducted in Cameroon. Ndjouenkeu R. *et al*. were able to demonstrate that maize is characterized by the diversity of its forms of consumption (fresh boiled or grilled cobs, couscous, corn porridge), which may explain its significant share of the cereal budget (*Ndjouenkeu R. et al., 2010*);

2. Another portion for sale:

The sale of maize products will allow households and communities to obtain other foodstuffs that can fill the food gaps found in maize. This way, they can stockpile various food products and have money to access other short-term staples (fresh vegetables, meat, fruit, etc.).

Conclusion

The use of good agricultural practices, in particular the organ-mineral fertilization of crops, offers significant added value by improving soil fertility, ensuring a balanced and lasting nutrition of plants thanks to the combination of rapid and progressive liberation of nutritious elements, and by increasing the yields and the quality of harvests. The mineral part brings the nutrients available immediately, while the organic part ensures a slow and progressive release of the elements, guaranteeing lasting nutrition to the plant.Adapted and balanced fertilization associated with other good cultural practices ensure the avai lability of essential nutrients to the plant (nitrogen, phosphorus, potassium) during its rapid growth phase, leading to better yields. The latter make it possible to master food security by the availability, accessibility, stability and use of food.

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