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EVALUATION OF THE NUTRITIONAL AND ORGANOLEPTIC QUALITY OF FIELD-GROWN TOMATO IN BURUNDI

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ABSTRACT

This study aims to evaluate the nutritional and organoleptic quality of field-grown tomatoes in Burundi using vermicompost and chemical fertilizers. It was conducted in a completely randomized block design (CRBD) with four blocks and four replicates. The plant material used in this experiment was the “Tengeru 97” variety of tomato. A sample of 128 plants was randomly selected from 192 plants. The mean concentration of vitamin C and the mean concentration of protein were compared to the theoretical mean concentration of 18.92 mg/100g and 12.65 respectively using one-sample Student’s t-test. Principal Component Analysis (PCA) and Hierarchical Clustering based on Principal Components (HCPC) were applied to continuous variables related to the tasting scores attributed to the piece of tomato. Findings showed that applying vermicompost at an optimal dose of 210 g led to the higher concentration of vitamin C (41.1 mg/100 g). The same treatment achieved the highest tasting score (3.7). Tomatoes grown using chemical fertilizers showed lower mean score (2.1) for these sensory qualities. Cluster analysis showed three groups of individuals. These results highlighted the potential of vermicompost as a sustainable and effective alternative to chemical fertilizers for improving the nutritional and organoleptic qualities of tomatoes, while promoting environmentally-friendly agriculture and preserving human health.

Keywords: Nutritional Quality, Organoleptic Quality, Tomato, Principal Component Analysis, Burundi

1. INTRODUCTION

The rapid growth of the world’s population, which could reach 9.1 billion by 2050, poses major challenges in terms of food security and nutrition **(Oluwole *et al.*, 2023)**. The growing demand for agricultural products is driving many producers to resort to intensive farming practices, often based on the use of chemical fertilizers. Although these fertilizers have enabled a notable increase in yields over the past few decades, their prolonged use has led to adverse effects on the environment and human health, including soil degradation, water pollution and food alteration **(Sharma *et al.*, 2018).** These practices also raise concerns about the sustainability of current agricultural systems, as agriculture is the world of biodiversity but, unfortunately, it is also experiencing chemical relentlessness and overexploitation **(Rahman, 2022).**

In this context, vermicompost, a pathogen-free organic fertilizer derived from the degradation of organic matter by earthworms, is emerging as an ecological alternative to chemical fertilizers.

Given that vermicompost is made of earthworm castings packed with various micro-organisms and contains not only humic acid but also gibbelleric acid, it is a fine and enriched manure made from the digested cocoons or worm castings excreted by earthworms. Besides, it contains humus that could be used in agricultural production systems. Furthermore, vermicompost is considered as a high-quality biofertilizer that is sustainable and environmentally friendly, enabling the farmer to boost soil fertility and plant growth **(Oyege**, ***et al*****., 2023)**. Cow dung is considered as a good organic fertilizer. Compared to cow dung, vermicompost offers multiple additional advantages such as availability of easily assimilated nutrients, water retention capacity, aeration of soil, reduction of pathogens, destruction of weed seeds, and improved plant growth and yield. This makes the vermicompost more beneficial for plants and soil. Vermicompost helps not only to improve the physico-chemical properties of soils, but also promote the slow and continuous release of nutrients essential for plant growth. In addition, its use enhances soil microbial biodiversity, optimizes water retention and reduces dependence on external chemical inputs **(Coulibaly *et al*., 2016).**

Compared to chemical fertilizers, vermicompost also proves beneficial for the nutritional quality of crops, enriching the vitamin, mineral and antioxidant content of the fruit. Numerous studies have shown that the addition of vermicompost rapidly improves plant growth parameters, notably tomato weight and height. The use of vermicompost brings out plant hormones leading to desirable changes in plant growth parameters. The gibbelleric acid helps plants to uptake calcium and potassium and improves shoot elongation development **(Oyege *et al*., 2023).** Considered as one of the most widely grown and consumed vegetable crops in the world, tomatoes play a key role in human nutrition **(Raiola *et al*., 2014)**. The "Tengeru 97" variety, prized for its resilience and nutritional qualities, is particularly important in sub-Saharan African countries. Improving its productivity, nutritional quality and organoleptic quality could thus help resolve some of the current challenges linked to food security and malnutrition, particularly in settings where access to a diversified diet remains limited **(Rodríguez *et al*., 2021).**

Tomatoes are also used in many dishes. They can be eaten fresh in salads or cooked in sauces, soups or meat and fish dishes. They can also help to get tomato purees, juices and ketchup. Dried and canned fruit are also processed products of economic importance**.** Fruits that form part of a healthy and balanced diet are enriched with minerals, vitamins, essential amino acids, sugars and dietary fiber, and contain high levels of vitamins B and C, iron and phosphorus, helping to reduce micronutrient deficiencies for the consumer. They also contain antioxidants (lycopene and beta-carotene) whose dietary consumption helps reduce the risk of chronic diseases such as cancer and cardiovascular disease **(Ali, 2018).** This article therefore aims to assess the nutritional quality and organoleptic quality of field-grown tomato in Burundi. This research will provide crucial data to encourage more sustainable agricultural practices that respect the environment and meet the normal growing nutritional requirements.

2. MATERIALS AND METHODS

Tomato variety and type of fertilizer

The plant material used in this experiment is tomato genus Lycopersicon, species esculentum, variety "Tengeru 97" and family Solanaceae. This variety has a planting-maturity cycle varying between 110 and 150 days, with a mean fruit weight of 35-50 grams. It is resistant to sunburn and fusariosis, and highly susceptible to tomato moth and whitefly. The types of fertilizers used in the experiment were vermicompost and chemical fertilizer.

Experimental study

The study was conducted in a completely randomized block design (CRBD). The study plot was subdivided into four blocks and four replicates were adopted for each block. The block comprised four experimental units and 48 tomato plants (12 in each unit) were used, leading to 192 tomato plants. The experimental units within a block were separated each other by 0.60m, while the blocks were separated by 0.80m. A buffer of 1m was left as a margin around the 4 blocks to minimize the influence of the edge effect.

Soil and vermicompost analysis

Two types of analysis were carried out on the cultivated soil and the vermicompost used. These analyses were carried out in the laboratory of the "Institut des Sciences Agronomiques du Burundi (ISABU)" to determine the composition of the vermicompost and the nutrient concentration in the soil used as the experimental field. The analyzed physico-chemical properties of both the vermicompost and the soil were pH, electrical conductivity, nitrogen (N), phosphorus (P), potassium (K), sodium (Na), calcium (Ca), magnesium (Mg), manganese (Mn), copper (Cu) and zinc (Zn) (**Table 1**). Additional properties were carbon/nitrogen (C/N) ratio, iron (Fe), cobalt (Co), nickel (Ni), cadmium (Cd), lead (Pb), organic carbon, cationic exchange capacity (CEC), aluminum acid (A-Al^{3+}) and hydrous acid (A-H^+).

Table 1. Composition of vermicompost and soil

Characteristic	Vermicompost	Soil
pH	8	5.36±0.05
Electrical conductivity (µS/cm)	1120	35.8
Total nitrogen (%)	0.879	0.066
Total phosphorus	1.26 (% P_2O)	4.58 mg/kg
Total potassium	0.971 (% K_2O)	0.382 meq/100g
Carbon/Nitrogen ratio	7.17	-
Sodium	0.19 (% Na_2O)	≤ 0.01 meq/100g
Calcium	1.97 (% CaO)	2.38 meq/100g
Magnesium	1.027 (% MgO)	0.466 meq/100g
Iron (%)	0.38	-
Manganese	0.11 (%)	9.33 mg/kg
Copper (mg/kg)	17.6	2.23
Zinc (mg/kg)	92.6	1.79
Cobalt (mg/kg)	≤ 5	-
Nickel (mg/kg)	1.4	-
Cadmium (mg/kg)	≤ 0.8	-
Lead (mg/kg)	8.72	-
Organic carbon (% C)	-	1.72

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CEC (meq/100g)	-	11.9
A-Al^{3+}(meq/100g)	-	0.125
A-H^{+} (meq/100g)	-	0.703

Carrying out the experiment

The experiment was carried out in the fields of the University of Ngozi, located itself in the north of Burundi. The site was laid out as a single-level earthwork using hoes after weeding. The land was subdivided into four parallel blocks using metric tape, stakes and string. The trial took place in a randomized experimental set-up at the end of the rainy season (September 15th 2023 to March 15th 2024), growing tomatoes with and without organomineral amendments. Seedlings were transplanted on September 15th 2023, after a month and a half (45 days) in the nursery. Depending on the treatment, tomatoes were grown in the experimental units using vermicompost and chemical fertilizers.

Four treatments were tested in each complete randomized block. These treatments were T0 (with no amendment), T1 (140g of vermicompost), T2 (210g of vermicompost) and T3 (with chemical fertilizer, NPK).

Transplanting and mulching with dry eragostis straw took place the same day to maintain soil moisture and water retention. To maintain the tomato crop in good health, watering frequency, weed management, disease control and phytosanitary protection were carried out according to the pre-established schedule or as needed. Tomato staking was carried out on October 20th 2023 using wooden stakes and string. The strings were wound into a figure-of-eight and attached to a vertical stem of 1.50m, to leave a little slack. Harvesting was staggered and done by hand. Some tomatoes fruits were harvested before they were fully ripe, to ensure good preservation, analysis and protection against pests. Harvesting was carried out progressively from 100 Days After Transplanting (DAT) to 160 DAT.

Sample size calculation

The sample size was calculated using the formula **(Krecjie and Morgan, 1970**):

$$n = \frac{z^2 p\left(1-p\right)N}{d^2\left(N\text{-}1\right)+z^2 p\left(1-p\right)}$$

(1)

where *n* denotes the sample size, *N* is the total number of tomato plants (*N=192*), *p* represents the proportion of tomato plants with a productivity above the median (*p=0.50*), z is the quantile of the normal distribution with a probability of 0.975 (*z=1.96*) and *d* is the acceptable margin error (*d=0.05*). The statistical analysis was conducted using 128 plants, i.e 8 plants per experimental unit.

Data collection

Monitoring and data collection focused on physiological and agronomic parameters tomato. Specifically, growth and productivity parameters were measured. Height and number of branches during the vegetative and flowering periods were the two growth parameters that enabled to measure the influence of the type of fertilizer on the behavior of tomato plants. Plant growth parameters were the number of branches, the number of flowers, the number of fruits and height. Data for the first three parameters were collected every 15 days, from one month after transplanting to 90 days after transplanting, while height was recorded every 30 days until 120 days after transplanting. Productivity parameters were the total number of fruits, the mean fruit weight per experimental unit and root biomass. All these parameters were taken at harvest. The first harvest took place on 100 DAT and ended around 160 DAT. Four harvests and fruit counts were carried out, followed by fresh weighing. The 20-day interval was respected throughout. However, root biomass was measured after one night, to ensure that rinsing water did not distort the results after the plants had been uprooted.

The sensorial analysis was based on the taste quality of tomatoes grown with and without vermicompost, according to each treatment. In practice, ten tasters (namely Aurora, Cynthia, Peter, Lily, John, Robert, Sophia, Marc, Audrey and Jimmy) were selected using the convenience sampling technique. This was done on February 26th, 2024 at 9:45 a.m., after morning mass. We asked Christians leaving the mass organized at the University of Ngozi if they had any notions of tasting until we had a total of ten individuals. For those who responded positively, we explained the purpose of our study before analysis. Next, we cut each tomato from each treatment into four pieces of almost equal weight and placed them on a saucer labeled, in terms of treatment, underneath. The tasters entered in turn one by one and each taster took different pieces for the four treatments. The score attributed to the piece of tomato was coded as 1 (poor), 2 (good), 3 (very good) and 4 (most excellent), based on positive sensory attributes such as taste, aroma and texture **(Vazquez D. V *et al.*, 2024).** Once data had been collected, they were entered into Microsoft Excel. The parameters of interest were related to nutritional value (nutritive and organoleptic quality). The nutritive quality was measured in terms of the concentration of protein and vitamin C.

Statistical analysis

Descriptive statistics **(**frequency, minimum, mean, standard deviation and maximum) of the concentration of vitamin C and protein respectively were computed. Boxplots helped detect outliers of the concentration. The mean concentration of vitamin C was compared to the theoretical mean concentration of 18.92 mg/100g and the mean concentration of protein was compared to 12.65 using one-sample Student's t-test **(Asia *et al.*, 1988)**. Additionally, Principal Component Analysis (PCA) **(Diel *et al.*, 2022)** and Hierarchical Clustering based on Principal Components (HCPC) were performed using continuous variables related to the tasting scores attributed to the piece of tomato obtained using the treatments T0 (Score_T0), T1 (Score_T1), T2 (Score_T2) and T3 (Score_T3) respectively **(Abdi, H., and Williams, L. J., 2010)**.

Each principal component c_j was the coordinate of each variable on the factorial axis:

$$c_j = Zu_j \quad (2)$$

where Z is a centered-reduced data matrix projected on the director-vector u_j of the corresponding factorial axis. This principal component is the linear correlation coefficient between this variable and the considered axis and this coefficient is also the coordinate of the variable and the axis. The Cattell criterion (elbow rule) was used to choose the number of principal components **(Shi *et al.*, 2021)**. Gender was used as an illustrative variable. Clustering analysis was performed based on principal components, yielding to classification plot of individuals and dendrogram. Data analysis was done using R software, version 4.1.2.

3. RESULTS

Table 2 displays descriptive statistics **(**frequency, minimum, mean, standard deviation and maximum) of the concentration of vitamin C and protein. Applying vermicompost at an optimal dose of 210 g led to the higher vitamin C concentration (41.1 mg/100 g).

Table 2. Descriptive statistics of the concentration of vitamin C and protein

Concentration	Frequency,	Minimum	Mean	Standard deviation	Maximum
Vitamin C	4	24.6	31.18	7.07	41.1
Protein	4	18.9	20.70	1.57	22.7

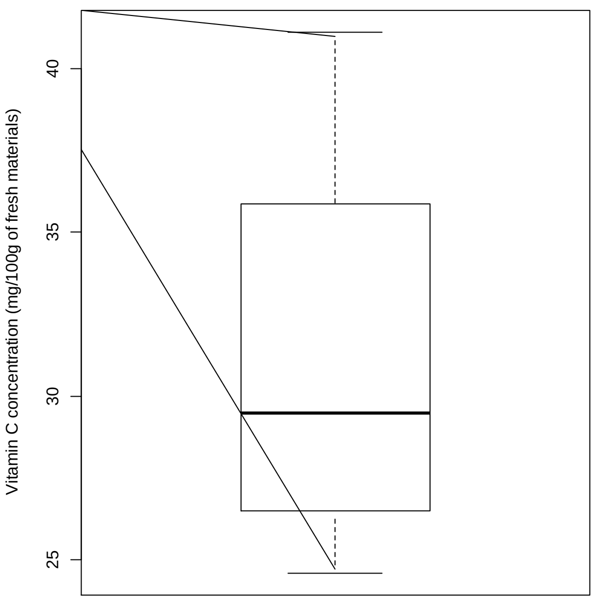

Figure 1. Boxplot of vitamin C concentration

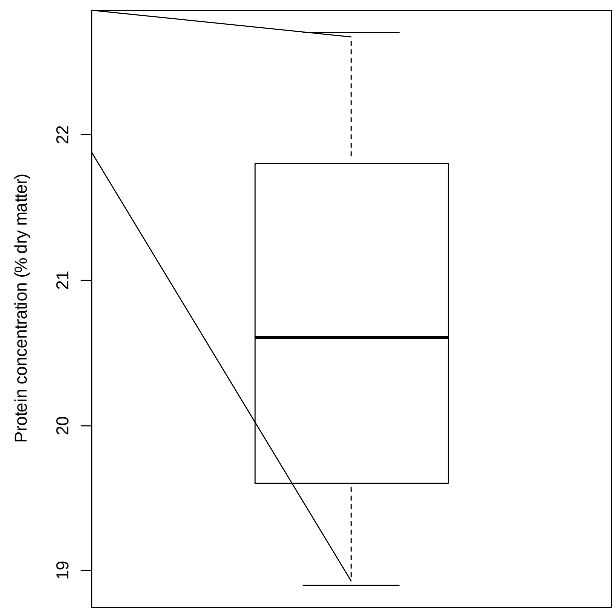

Figure 2. Boxplot of protein concentration

The Student's t-test rejected the null hypothesis which states that the mean concentration of vitamin C is equal to the theoretical mean concentration of 18.92 mg/100g (t=3.47, df=3, p-value=0.020). The mean concentration of vitamin C found in our study (mean±standard deviation: 31.18±7.07) was therefore significantly higher than 18.92 mg/100g. However, this test rejected the null hypothesis which states that the mean concentration of protein equals to the

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theoretical mean concentration of 12.65 ($t=10.22$, $df=3$, p-value=0.001). Therefore, the mean protein concentration found in this study (20.70 ± 1.57) was significantly greater than 12.65.

Table 3 summarizes descriptive statistics **(**frequency, minimum, mean, standard deviation and maximum) of the tasting score. The higher mean score was found for treatment T2 (210g of vermicompost) and the lower for the treatment T0 (with no amendment).

Table 3. Descriptive statistics of scores

Variables	Frequency	Minimum	Mean	Standard deviation	Maximum
Score_T0	10	1	1.4	0.70	3
Score_T1	10	2	2.8	0.63	4
Score_T2	10	3	3.7	0.48	4
Score_T3	10	1	2.1	1.10	4

The correlation coefficient between the tasting score given for tomatoes obtained using the treatment T2 (210g of vermicompost) and the tasting score given for tomatoes obtained using the treatment T3 (with chemical fertilizer, NPK) was significantly different from zero (p-value=0.009) (**Table 4**).

Table 4. Correlation matrix of the tasting score

Variables	Score_T0	Score_T1	Score_T2	Score_T3
Score_T0	1.00	-0.30	0.39	-0.64
Score_T1		1.00	0.15	-0.45
Score_T2			1.00	-0.77*
Score_T3				1.00

***:** significant (p-value<0.05)

Eigen values were 2.255, 1.279, 0.466 and 0.000 respectively. The percentage of the explained variance was then 56.385%, 31.966%, 11.648% and 0.000% respectively. The two first factorial axes explained 88.36% of the total inertia (**Figure 3**). Individuals (plants) and variables (related to the tasting scores) were projected on the principal plan generated by the two first factorial axes (F1, F2).

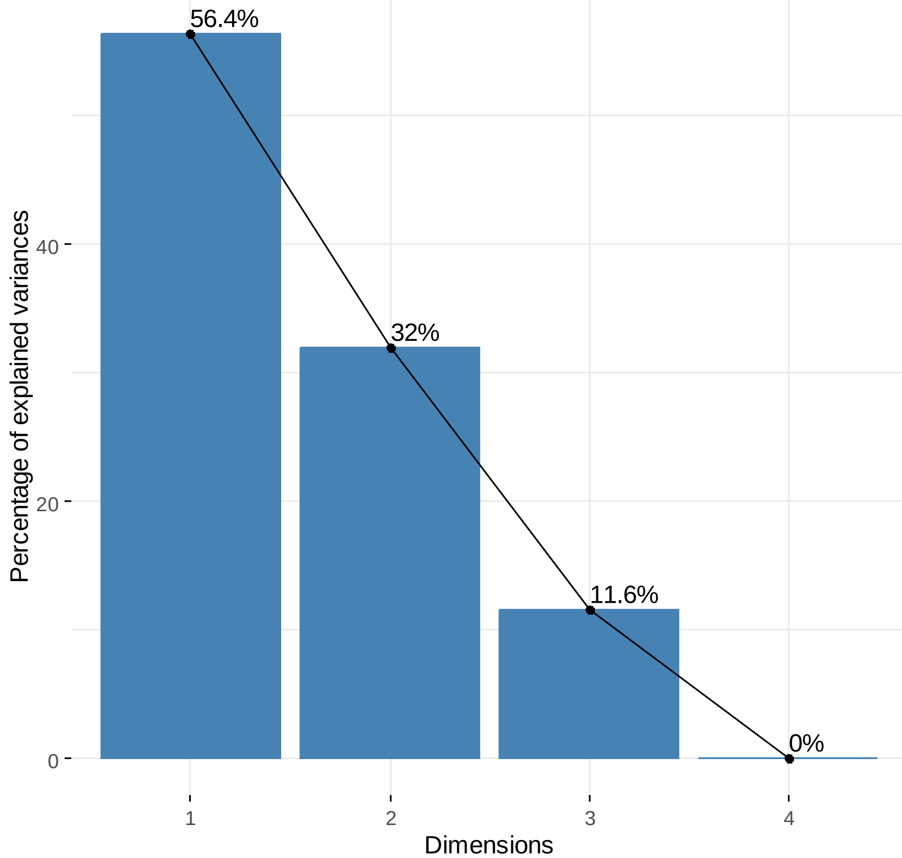

Figure 3. Scree plot

The first factorial axis opposed Score_T2 and Score_T3 while the second factorial axis opposed Score_T0 and Score_T1 according to the coordinates (COORD) of the variables on the axes (**Table 5**, **Figure 4**). The variable Score_T3 contributed (CTR) the most to the construction of the first factorial axis whereas the variable Score_T1 contributed the most to the construction of the second factorial axis. The most represented variable on first factorial axis was Score_T3 while the most represented variable on the second factorial axis was Score_T1 according to the values of square cosines (COS2) between each variable and each axis. Variables significantly correlated with the first factorial axis were Score_T0 (r=0.697, p-value=2.50×10^{-2}), Score_T2 (r=0.855, p-value=1.61×10^{-3}) and Score_T3 (r=-0.979, p-value=7.57×10^{-7}). Only the variable Score_T1 was significantly correlated with the second factorial axis (r=0.9312, p-value=8.84×10^{-5})

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Table 5. Coordinates, contribution and square cosine of variables

	Dimension 1			Dimension 2		
Variables	COORD	CTR	COS2	COORD	CTR	COS2
Score_T0	0.697*	21.556	0.486	-0.622	30.262	0.387
Score_T1	0.280	3.485	0.079	0.932*	67.867	0.868
Score_T2	0.855*	32.422	0.731	0.027	0.059	0.001
Score_T3	-0.979*	42.537	0.959	-0.152	1.812	0.023

*: significant (p-value<0.05)

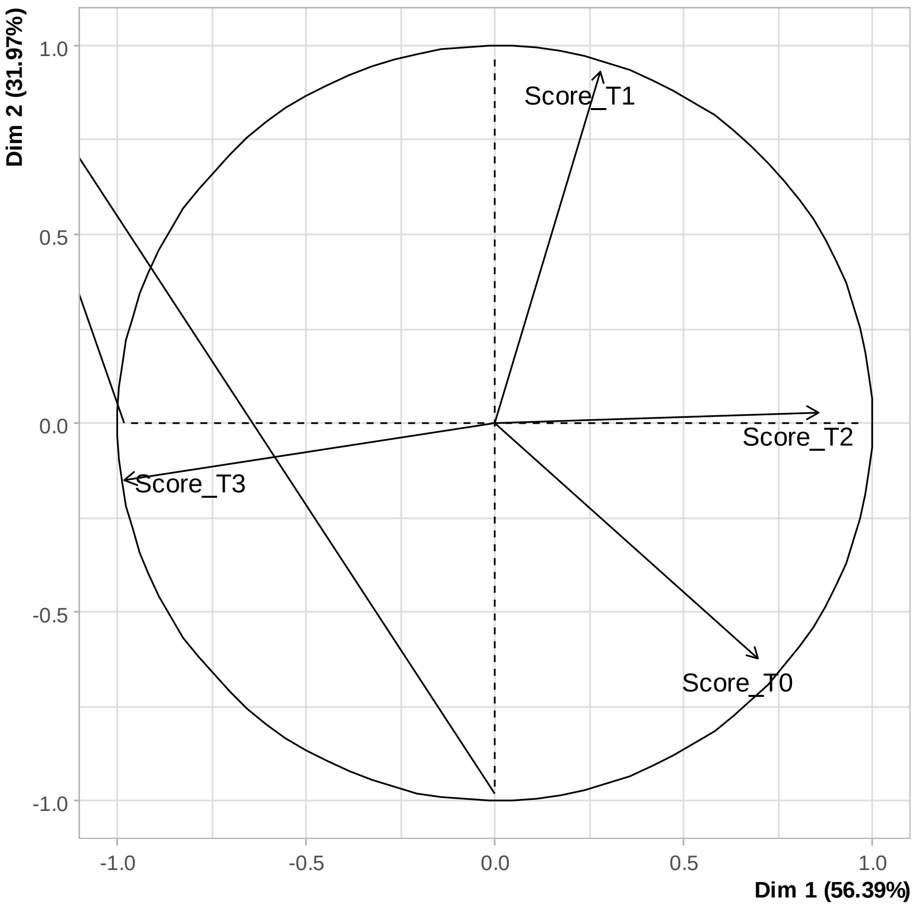

Figure 4. Variables projection

The first factorial axis opposes the group (John, Robert) and Cynthia while the second factorial axis opposes Cynthia and the group (Aurora, Peter, Lily, Audrey) according to the coordinates (COORD) of the variables on the axes (**Table 6**, **Figure 5**). The group (John, Robert) contributes (CTR) the most to the construction of the first factorial axis whereas Cynthia contributes the most to the construction of the second factorial axis. The most represented variable on first factorial axis is the group (Sophia, Marc) while the most represented variable on second factorial

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axis is Jimmy according to the values of square cosines (COS2) between each variable and each axis.

Table 6. Coordinates, contribution and square cosine of individuals

		Dimension 1			Dimension 2		
Individuals	DISTANCE	COORD	CTR	COS2	COORD	CTR	COS 2
Aurora	0.955	0.217	0.210	0.052	0.635	3.155	0.442
Cynthia	3.022	1.931	16.531	0.408	-2.268	40.215	0.563
Peter	0.955	0.217	0.210	0.052	0.635	3.155	0.442
Lily	0.955	0.217	0.210	0.052	0.635	3.155	0.442
John	2.790	-2.586	29.641	0.859	-1.049	8.602	0.141
Robert	2.790	-2.586	29.641	0.859	-1.049	8.602	0.141
Sophia	1.571	1.542	10.544	0.964	-0.065	0.033	0.002
Marc	1.571	1.542	10.544	0.964	-0.065	0.033	0.002
Audrey	0.955	0.217	0.210	0.052	0.635	3.155	0.442
Jimmy	2.590	-0.714	2.260	0.076	1.955	29.896	0.570

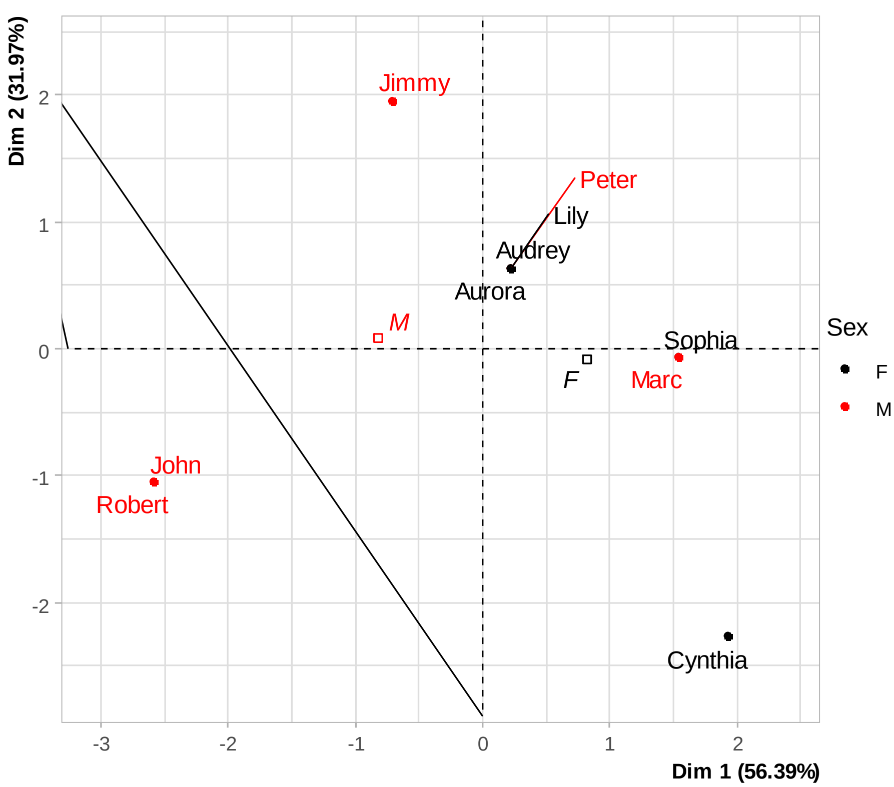

Figure 5. Individuals projection

Three groups of individuals (John, Robert), (Cynthia, Sophia, Marc) and (Jimmy, Aurora, Peter, Lily, Audrey) are formed (**Figure 6, Figure 7**).

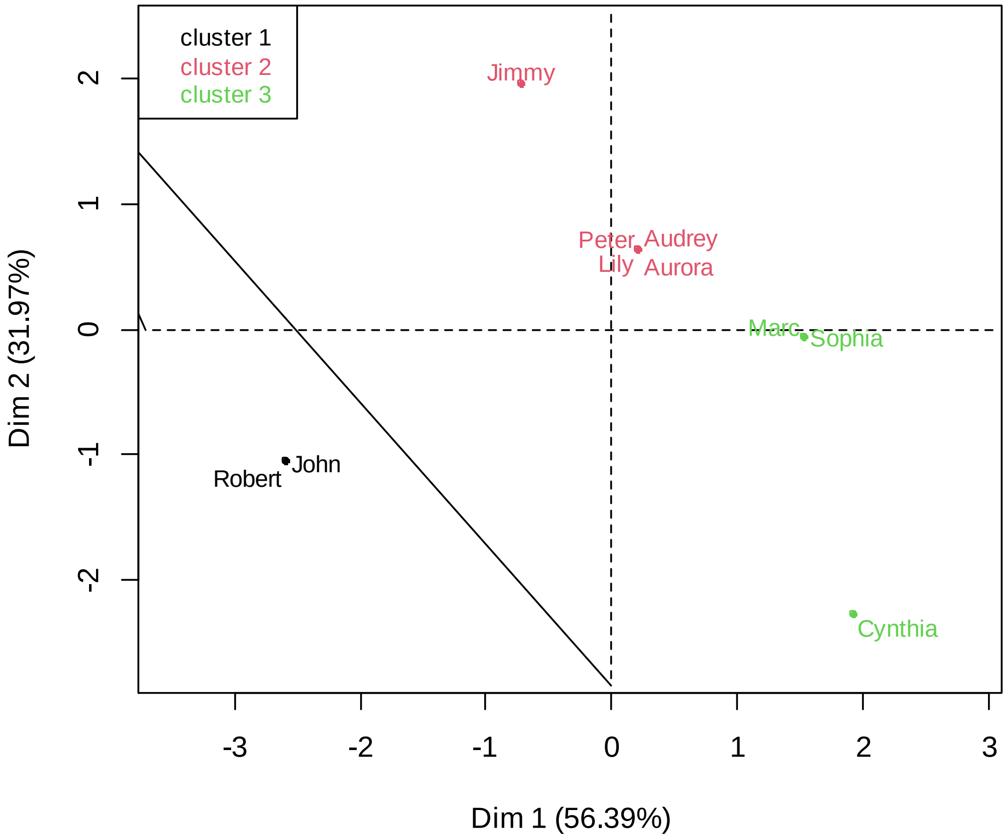

Figure 6. Clusters detection

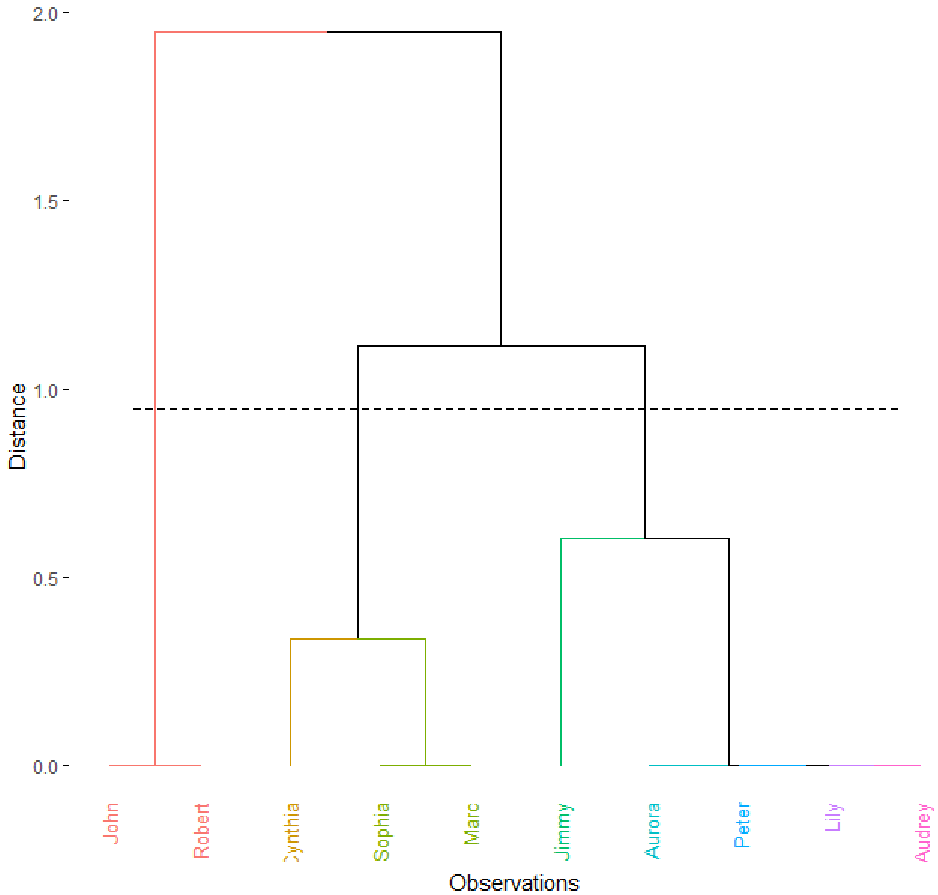

Figure 7. Dendrogram

4. DISCUSSION

Findings showed that applying vermicompost at an optimal dose of 210 g led to the higher vitamin C concentration (41.1 mg/100 g). However, applying vermicompost at the same dose led to the protein concentration of 18.9 (%). Tomatoes should therefore be consumed in the event of a vitamin C deficiency and other products such as meat and beans in the event of a protein deficiency. Based on our findings, the use of vermicompost significantly improved the nutritive quality of tomatoes, notably increasing the concentration of protein (20.70±1.57) and vitamin C (31.18 ± 7.07 mg/100 g). These observations align with the study conducted elsewhere which demonstrated that vermicompost can be recommended as a fertilizer to improve tomato fruit quality and yield, as well as soil quality, particularly for soils with no prior tomato planting history (**Wang *et al.*, 2017)**.

Additionally, our results indicate that chemical fertilizers had variable effects on tomato quality. While they can rapidly increase nutrient availability, a study suggests that overfertilization degrades soil fertility, reducing crop growth and promoting the development of soil-borne diseases (**Li *et al.*, 2022)**. Our findings suggest a superiority of vermicompost in enhancing the nutritional quality of tomatoes. This conclusion is supported by the meta-analysis which found that organic fertilizers can enhance tomato yield by 42.18% and improve quality attributes such as soluble solids, soluble sugar, lycopene, and vitamin C (**Gao *et al*., 2023)**.

Our findings are consistent with those found by other researchers, suggesting that vermicompost can improve the nutritive quality and organoleptic quality of tomatoes compared with chemical fertilizers. These findings support the adoption of sustainable agricultural practices, favoring organic amendments for high-quality tomato production.

Tomatoes obtained using chemical fertilizers showed lower mean score (2.1) for these sensory qualities and suboptimal nutritional concentrations, indicating a clear differentiation between the amendments. The application of 210 g of vermicompost (treatment T2) resulted in the highest mean tasting score (3.7 ± 0.484), indicating a notable enhancement in the organoleptic qualities of the tomatoes. This observation aligns with the study conducted in Burkina Faso which demonstrated that the use of bio-fertilizers, such as vermicompost, not only improves productivity but also enhances the nutritive quality of tomatoes by increasing their taste and size (**Coulibaly *et al.*, 2021)**. Furthermore, our results indicate that the use of chemical fertilizers (treatment T3) led to a lower mean tasting score (2.1 ± 1.104), suggesting a less favorable influence on the tomatoes' taste qualities. This finding is corroborated by the study of **Wako *et al***., **(2022),** who highlights that the exclusive utilization of mineral fertilizers can negatively impact crop quality, notably by diminishing the flavor of tomatoes (**Wako *et al*., 2022)**.

Furthermore, the correlation matrix analysis reveals a significant negative correlation between the tasting scores of tomatoes from the treatment T2 and those from the treatment T0 (no amendment) ($r = -0.77$, p-value=0.009), indicating that the improvement in taste qualities with vermicompost is inversely proportional to the absence of amendment. This relationship underscores the importance of the use of vermicompost while optimizing the organoleptic qualities of tomatoes, as also suggested other researchers (**Sawadogo *et al*., 2021)**.

Our analyses show varied relationships between tasting scores (positive, negative, significant). For example:
A significant negative correlation between Score_T2 and Score_T3 ($r=-0.77$, p-value<0.05) suggests an opposition between these two sensory evaluation dimensions. A moderate positive correlation between Score_T0 and Score_T2 ($r = 0.39$) could indicate some consistency in initial and intermediate perceptions of sensory qualities.

Sensory perceptions can be influenced by complex interactions between volatile compounds and sugars/acids as shown by a study on tomato flavor enhancement (**Klee and Tieman's., 2013).** Our findings which showed an opposition between Score_T2 (potentially linked to sweet/acidic compounds) and Score_T3 (possibly linked to volatile aromas) could reflect this type of interaction. This is in line with their conclusions indicating that sensory preferences fluctuate according to the dominance of these compounds.

Principal Component Analysis showed that the first two dimensions explain 88.36% of the total inertia, which reflects a strong structuring of the data. Besides, dimension 1 (first factorial axis)

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opposes Score_T2 and Score_T3, with Score_T3 having the largest contribution (CTR=42.537) and a strong representation (COS2=0.959). Dimension 2 (second factorial axis) opposes Score_T0 and Score_T1, with Score_T1 contributing the most (CTR=67.867) and being the best represented (COS2 = 0.868).

The results concerning Score_T3, which is strongly opposed to Score_T2, could be linked to the observations of **Tieman *et al.*, (2012),** who showed that volatile compounds responsible for aromas are often perceived negatively when they dominate other sensory characteristics, such as acidity or sweetness. This opposition is consistent with their work. Furthermore, the high contribution of Score_T1 on the second dimension could reflect a transition phase in sensory perception, as suggested by **Lawless and Heymann (2010),** who pointed out that intermediate sensory scores (such as T1) often capture transient changes in perception. Cluster analysis showed the formation of three distinct groups of individuals, with marked oppositions: group 1 (John, Robert) strongly opposed to Cynthia on axis 1, group 2 (Cynthia, Sophia, Marc) dominant on axis 2 and group 3 (Aurora, Peter, Lily, Audrey, Jimmy) relatively homogeneous, but distinguished by Jimmy, who positions himself differently with a strong contribution on axis 2.

The inter-individual differences in our results could be compared with the work of **Lawless and Heymann (2010)**, who showed that sensory preferences often vary according to individual experiences or cultural expectations. For example, the homogeneous group (Aurora, Peter, Lily, Audrey, Jimmy) may reflect a collective preference for specific characteristics (sweetness or moderate acidity), while Cynthia and the John/Robert group may have different sensory expectations. Moreover, Cynthia's key role in the construction of axis 2 (CTR=40.215) could be associated with a heightened sensitivity to certain sensory characteristics, as discussed in the work of **Dorais *et al.*, (2018)** on the variability of individual perceptions as a function of nutritional and aromatic compounds.

5. CONCLUSION

The evaluation of the nutritional quality and the organoleptic quality of tomatoes grown with vermicompost and chemical fertilizers revealed significant differences. Results showed that vermicompost improves not only concentration of vitamin C particularly at an optimal dose of 210 g, but also the taste qualities of tomatoes. Moreover, while chemical fertilizers provide rapid availability of nutrients, their long-term effects seem less favorable for overall fruit quality. This study confirms that vermicompost is a sustainable and effective alternative to chemical fertilizers, increasing the nutritional value and organoleptic characteristics of tomatoes while contributing to soil health. Our findings, corroborated by previous studies, reinforce the idea that organic soil improvers such as vermicompost can be useful in promoting sustainable agriculture and satisfying consumer demands in terms of product quality. However, further researches are needed to refine doses and assess long-term impacts on other crops and in various agroecological contexts.

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