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Determination of Nutritional Contents and Sensory Attributes of Two Cucumber Varieties Grown with Cow and Pig Dungs in Nsukka Soil

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Abstract

The study determined the nutritional contents and sensory attributes of two cucumber varieties grown with cow and pig dungs in Nsukka soil. Specifically, the study determined the effect of pig and cow dungs on the nutritional contents of cucumber varieties cultivated in Nsukka soil; and on the sensory attributes of cucumber varieties cultivated in Nsukka soil. The study adopted experimental research design. The study was carried out in University of Nigeria, Nsukka, Enugu State, Nigeria. The population for the study consisted of 40 cucumber fruits and 7 panel members for conducting the organoleptic evaluation. The 40 fruits were randomly assigned to four treatment groups- T1, T2, T3, and T4; and each treatment group was further replicated into three. The nutritional contents were determined in Food Science Laboratory, Department of Food Science Technology, University of Nigeria, Nsukka. Data analysis was carried out with Mean. The results revealed that T3 (that is Poinsett 76 cucumber variety grown with pig dung) recorded the best mean organoleptic attributes when compared to other treatment groups. T3 got the highest mean cucumber taste of 7.45, highest mean cucumber appearance of 8.19, and highest mean cucumber acceptability of 8.32 which indicated "like very much". The result further showed that T3 performed best on the mean nutritional contents of cucumber with highest mean vitamin A content of 33.90 mg, highest mean vitamin C content of 3.50 mg, highest mean vitamin K content of 18.11 mg among others. Based on the result, the study concluded that pig dung may offer superior benefits in terms of enhancing the sensory appeal and nutritional contents of cucumbers compared to cow dung.

Keywords: Cucumber, Cucumber Varieties, Nutritional Contents, Sensory Attributes, Cow dung, Pig Dung, Nsukka Soil

Introduction

Cucumbers (*Cucumis sativus L.*) are among the most widely cultivated vegetables globally, prized for their refreshing taste and high water content. In Nigeria, cucumbers play a significant role in both local

diets and agricultural economies. The nutritional properties of cucumbers are enhanced by the growing medium and fertilization practices employed during cultivation. Organic fertilizers, such as cow and pig dung, are valuable for promoting sustainable agricultural practices due to their potential to improve soil fertility and crop yield (Ogunlade et al., 2020). Recent studies have demonstrated that the application of organic fertilizers can significantly affect the sensory attributes and nutritional quality of crops. For instance, organic amendments have been shown to enhance the flavor, texture, and overall acceptability of vegetables (Ibrahim et al., 2021). Furthermore, the use of cow and pig dung, which are rich in essential nutrients, can lead to superior growth performance compared to synthetic fertilizers (Akinola et al., 2022).

In the context of Nsukka, a region characterized by its unique soil types and climatic conditions, there is a pressing need to explore the impact of different organic fertilizers on cucumber production. The integration of local waste materials such as cow and pig dung into agricultural practices not only supports sustainable farming but also addresses the challenges of soil degradation and nutrient depletion (Oguike et al., 2020). Hence, this research study aimed to determine the nutritional contents and sensory attributes of cucumber varieties cultivated with cow and pig dungs in Nsukka soil.

Statement of Problem

Cucumbers (Cucumis sativus) are widely consumed vegetables known for their refreshing taste, low caloric content, and potential health benefits due to their nutritional properties. In Nigeria, the cultivation of cucumbers is increasingly gaining attention due to its economic significance and the growing demand for fresh produce. However, the nutritional quality and sensory attributes of cucumbers can be significantly influenced by the type of fertilizers used in their cultivation. Organic fertilizers, such as cow dung and pig dung, are often employed by farmers, particularly in regions like Nsukka, where soil fertility may be constrained by various factors, including nutrient depletion and poor soil structure (Adeleke et al., 2020).

Despite the widespread use of these organic fertilizers, there is limited empirical evidence on how they impact the sensory attributes such as taste, texture, and overall acceptability and the nutritional properties like vitamin content, mineral composition, water and fibre contents of cucumbers grown in Nsukka soil. Previous studies have indicated that organic amendments can enhance soil quality and crop yield; however, the specific effects of cow dung and pig dung on cucumber sensory and nutritional profiles remain underexplored (Olaniyi et al., 2021).

Furthermore, with the rising interest in organic farming practices and the health-conscious consumer market, understanding the relationship between soil amendments and crop quality becomes crucial. This knowledge gap poses a challenge for farmers aiming to maximize both crop yield and quality, ultimately impacting the economic viability of cucumber production in the region. Therefore, this study aimed at evaluating the nutritional contents and sensory attributes of cucumber varieties grown with cow and pig dung in Nsukka soil.

Objectives of the Study

The study aimed at evaluating the nutritional contents and organoleptic evaluation of cucumber varieties grown with cow and pig dungs in Nsukka soil. Specifically, the study evaluated the:

1. effect of pig and cow dungs on the nutritional contents of cucumber varieties cultivated in Nsukka soil; and
2. effect of pig and cow dungs on the sensory attributes of cucumber varieties cultivated in Nsukka soil.

Research Questions

The study was guided by the following research questions:

1. What are the effects of pig and cow dungs on the nutritional contents of cucumber varieties cultivated in Nsukka soil?
2. What are effects of pig and cow dungs on the sensory attributes of cucumber varieties cultivated in Nsukka soil?

Literature Review

Cucumber Morphology and Varieties

Cucumber (*Cucumis sativus*) is one of the vital vegetable crops cultivated in Nigeria. It belongs to the family Cucubitaceae and is one of the three most economically important cucurbits (Akinwole, et al., 2019). As stated by Oladejo and Adegbenro (2019), cucumber is a creeping vine with lobed leaves and yellow flowers; and the fruit is typically cylindrical in shape with a green skin and edible seeds inside. The most commonly consumed part of the cucumber is its fleshy skin and inner flesh. The flesh is crisp, hydrating, and low in calories, making it a popular ingredient in salads, sandwiches, and smoothies (Martínez-Valverde et al., 2015). Cucumber is an annual crop which is widely cultivated vegetable crop. Its production encompasses various agronomic practices, such as soil preparation, irrigation, pest and disease management, and harvesting. Cucumber cultivation is also significantly affected by factors such as temperature, humidity, and the use of hybrid varieties, which enhance resistance to diseases and pests (Tao et al., 2021). Cucumber require a warm climate with an optimum day temperature of 30ºC, and optimum night temperature of 18-21ºC (Gruda *et al*., 2017); with high amount of water for proper growth and production. The soil for growing cucumber as noted by Akinwole et al. (2019) should be fertile, with good number of organic matters, well-drained with a pH of 6.0-7.0. Ingestad (2019), stated that cucumber plant requires nitrogen, potassium, phosphorus, calcium and magnesium to grow well. This can be achieved through the use of organic manure to grow cucumber.

There are various cucumber varieties grown, but some of the noted cucumber varieties commonly grown in Nigeria as opined by Ojo (2020) include Ashley, Marketmore 76, Poinsett-76, Supermarketer, Beit Alpha, Stilo (F1), Katrina (F1), Mona Lisa F1, Macario (F1), among others. This study focused on Marketmore 76 and Poinsett 76 cucumber varieties commonly grown in Nsukka and different parts of Nigeria. As stated by Ojo (2020), Marketmore 76 is widely cultivated due to its adaptability to the region's tropical climate. The variety is a popular cucumber variety known for its high yield, disease resistance, and excellent market quality. Poinsett 76 on the other hand is a cucumber variety known for its high yield, and attractive fruit quality (Ojo, 2020).

The Use of Organic Manure in Growing Cucumber

Organic manure plays a crucial role in sustainable agriculture by providing a balanced source of nutrients for plant growth (Liu & Chen, 2017). Organic manure such as pig and cow dungs have proven to be effective in cucumber production. According to Zhou (2019), pig dung contains high levels of nitrogen, phosphorus, potassium, and other micronutrients that are beneficial for crop production. Liu (2019) stated that pig dung typically contains a nitrogen content of 1.5-2.5%, phosphorus content of 0.6 - 0.8%, and potassium content of 0.5 - 1.0%. The organic matter in pig dung helps improve soil structure, water retention, and microbial activity (Liu, 2019). Cow dung on the other hand is a natural fertilizer and soil conditioner that has been used for centuries in agriculture. It is rich in essential nutrients such as nitrogen, phosphorus, and potassium, and beneficial microbes that help improve soil health (Sharma, et al., 2019). The use of pig and cow dungs in cucumber production can reduce production costs, and enhance the nutritional and organoleptic attributes of cucumber varieties.

Nutritional Contents of Cucumber

The flesh contains essential vitamins such as vitamin K and vitamin C, making it beneficial for overall health (Martínez-Valverde et al., 2015). Cucumbers are good source of vitamins K, C, and A, as well as minerals like manganese and potassium. These nutrients play a crucial role in various bodily functions, including bone health, immune function, and electrolyte balance. Cucumbers are rich in vitamin K, which plays a key role in bone health and blood clotting (Esfahani et al., 2017). The skin of cucumber is edible and contains dietary fiber, which is essential for digestive health, and various antioxidants that help in neutralizing free radicals in the body (Wang et al., 2020). The seeds of cucumber are edible, and are source of healthy fats, protein, and micronutrients like magnesium and potassium (Choi et al., 2019).

According to Esfahani et al. (2017), the fiber content in cucumbers promotes the growth of beneficial gut bacteria, which is essential for maintaining a healthy digestive system.

Organoleptic Evaluation of Cucumber Fruits

The test of cucumber varies from one variety of cucumber to another. Aside the variety being one of the contributing factors to the taste of cucumber, the manure type(s) used in the cultivation is also a significant factor that affects the taste of cucumber. Lawless and Heymann (2020), defined organoleptic evaluation as a subjective evaluation of a product's appearance, aroma, flavor, and texture. According to Meilgaard et al. (2017), organoleptic evaluation is an essential tool for evaluating product quality and consumer acceptance. In cucumber production, organoleptic evaluation plays a vital role in assessing the taste, flavor, aroma, texture, and appearance of cucumbers. Organoleptic evaluation is essential for evaluating the sensory profile of cucumbers, thereby helping cucumber farmers in optimizing cultivation practices and improving product quality. Some of the sensory attributes to be determined in cucumber through organoleptic evaluation may include appearance, firmness, bitterness, sweetness, texture, aroma, flavour and colour (Martínez et al., 2017).

Materials and Methods

The study adopted an experimental research design. The study was carried out in University of Nigeria, Nsukka, Enugu State, Nigeria. Nsukka is located in the southeastern region of Nigeria and experiences a tropical climate characterized by two main seasons: the rainy season (April to October) and the dry season (November to March). The average annual rainfall ranges from 1,200 mm to 2,000 mm, with peak rainfall occurring between June and September (Ugbaja et al., 2020). The temperature typically ranges from 20°C to 30°C, with humidity levels often high during the rainy season, which is conducive to the growth of various crops, including cucumbers (Okunlola et al., 2021). The Nsukka soils often exhibit low nutrient content, particularly in nitrogen, phosphorus, and potassium, making them less fertile without proper amendments (Nzewi et al., 2020). However, the application of organic fertilizers such as cow and pig dung has been shown to improve soil fertility and enhance crop yields.

The population for the study consisted of 40 cucumber fruits and 7 panel members used for conducting the organoleptic evaluation. 12 of the cucumber fruits were used to determine the nutrient contents, while the remaining 28 fruits were used to carried out the sensory evaluation, that is 7 fruits were selected from each treatment group. Data on organoleptic properties were collected using hedonic rating scale. The scale has 9 ratings as follows: LE = Like Extremely (9 score), LV = Like Very Much (8 score), LM = Like Moderately (7 score), LS = Like Slightly (6 score), NLD = Neither Like or Dislike (5 score), DS = Dislike Slightly (4 score), DM = Dislike Moderately (score 3), DVM = Dislike Very Much (score 2) and DE = Dislike Extremely (score 1).

The scale was given to the 7 panel members to rate the cucumber fruits on the basis of its' appearance, texture, flavour and general acceptability of fruits. While the data on vitamin contents (Vitamin K, C, and A), mineral contents (calcium, phosphorus, iron, manganese and potassium), water content and fiber content of cucumber were collected on nutritional properties. This was collected via the laboratory analysis of the cucumber fruits in Food Science Laboratory, Department of Food Science Technology, University of Nigeria, Nsukka.

Experimental Procedure

The site for this experiment was Department of Crop Science Demonstration Farm, UNN. The land was cleared with cutlass and tilled manually and the vegetation removed from the land. After that, the land was marked out with measuring tape. The land was plotted into four different treatment groups, which were:
Treatment 1 (T1): Marketmore 76 with pig dung
Treatment 2 (T2): Marketmore 76 with cow dung
Treatment 3 (T3): Poinsett 76 Variety with pig dung
Treatment 4 (T4): Poinsett 76 Variety with cow dung
Each treatment group was further replicated into three sub-groups

After plotting, sowing of cucumber seeds for the two varieties- Marketmore 76 and Poinsett-76 were done. After sowing of seeds, the following operations such as watering, thinning, manuring, weed control, pest and diseases control were carried out. For the manure application, pig and cow dungs were applied at equal 15 tons per hectare for both. Harvesting of cucumber fruits commenced immediately the cucumber fruits were matured. After harvesting was completed, organoleptic evaluation of freshly harvested cucumber fruits was carried out with 7 panel members who are cucumber marketers randomly selected from Nsukka urban market.

A total of 28 cucumber fruits was used to conduct the organoleptic evaluation in the Department of Agricultural Education Laboratory, UNN. That is, 7 fruits for each treatment group (T1, T2, T3, and T4). Each panel member was given 4 cucumber fruits, that is one fruit from each treatment group and a copy of Hedonic Scale. The cucumbers were randomly selected from each of the samples, thoroughly washed with a table salt under running water and put in a flat plate with their respective labels. Clean washing and drinking water was adequately provided.

Furthermore, a total of 12 cucumber fruits, that is, 3 fruits from each treatment group were randomly selected for the determination of nutrient contents. Only cucumber fruits with uniform sizes and weights, with the same level of maturation and colour and also free from any form of bruises, rots or insect attacks were selected and used. The cucumber fruits were cleaned by removing every form of dirt and were taken to Food Science Laboratory in the Department of Food Science Technology, University of Nigeria, Nsukka. The nutrients determined were vitamins (vitamin K, C, and A); mineral contents (calcium, phosphorus, and iron), water content and fiber content.

Method of Data Analysis

Data analysis was carried out with Mean. Mean was used to answer the research questions

Results Presentation

Table 1: Mean organoleptic attributes of cucumber varieties cultivated pig and cow dungs in Nsukka Soil

Treatments/ Experimental Groups	Mean Cucumber Taste	Mean Cucumber Appearance	Mean Cucumber Texture	Mean General Cucumber Acceptance
Treatment 1 (T1)	6.80	7.11	7.00	7.18
Treatment 2 (T2)	7.11	6.80	7.12	7.12
Treatment 3 (T3)	7.45	8.19	7.05	8.32
Treatment 4 (T4)	7.26	7.12	7.54	7.43

Key: T1 = Marketmore 76 with pig dung, T2 = Marketmore 76 with cow dung, T3 = Poinsett 76 Variety with pig dung, T4 = Poinsett 76 Variety with cow dung

The data in Table 1 on mean organoleptic attributes of cucumber varieties cultivated with pig and cow dung in Nsukka soil showed that Treatment 3 got the highest mean cucumber taste of 7.45 (that is, like moderately), highest mean cucumber appearance of 8.19 (that is, like very much), while Treatment 4 obtained the highest mean cucumber texture of 7.54 (that is, like moderately). The group with the highest mean cucumber acceptability is found in Treatment 3 with mean acceptability of 8.32 (that is, like very much); while the lowest mean general cucumber acceptance was recorded in Treatment 2 with mean general cucumber acceptance of 7.12 (like moderately).

Table 2: Mean Nutritional Contents of Cucumber Varieties Cultivated with Pig and Cow Dungs in Nsukka Soil

Treatment/ Experimental Groups	Mean vitamin A Content (mg)	Mean vitamin C Content (mg)	Mean vitamin K Content (mg)	Mean Calcium Content (mg)	Mean Phosphorus Content (mg)	Mean Potassium Content (mg)	Mean water Content (ml)	Mean Fibre Content (g)	Mean Iron Content (mg)
Treatment 1	26.02	2.75	16.13	14.86	20.78	144.88	94.11	0.52	0.31
Treatment 2	29.26	2.81	15.28	14.51	23.09	146.54	96.01	0.55	0.35
Treatment 3	33.90	3.50	18.11	17.12	24.90	148.18	98.81	0.51	0.38
Treatment 4	28.90	2.71	16.30	18.17	23.15	143.11	94.01	0.53	0.30

Key: T1 = Marketmore 76 with pig dung, T2 = Marketmore 76 with cow dung, T3 = Poinsett 76 Variety with pig dung, T4 = Poinsett 76 Variety with cow dung

The data presented in Table 2 on the mean nutritional contents of cucumber varieties cultivated with pig and cow dungs revealed that Treatment 3 got the highest mean vitamin A content of 33.90 mg, highest mean vitamin C content of 3.50 mg, highest mean vitamin K content of 18.11 mg, highest mean phosphorus content of 24.90 mg, highest mean potassium content of 148.18 mg, highest mean water content of 98.81 ml, and highest mean iron content of 0.38 mg. The data further revealed that Treatment 4 obtained the highest mean calcium content of 18.17 mg and highest mean fibre content of 0.53 g

Discussion of Findings

The result presented in Table 1 showed Treatment 3 (Poinsett 76 cucumber variety grown with pig dung) recorded the best mean organoleptic attributes of cucumber when compared to other treatment groups. The group (Treatment 3) got the highest mean cucumber taste of 7.45, highest mean cucumber appearance of 8.19, and highest mean cucumber acceptability of 8.32 which indicated "like very much". The findings are in line with Harrison et al. (2017), who stated that Poinsett 76 cucumber variety showed significantly higher cucumber taste in organoleptic evaluation when compared to other cucumber varieties. Also, Akinwole et al. (2019), revealed that Poinsett 76 cucumber variety had a more appealing appearance than other cucumber varieties such as Martketmore 76 variety. Akinwole et al. (2019) further stated that the texture analysis indicated that Poinsett 76 possessed a crispier and juicier texture compared to its counterpart. The texture of Poinsett 76 cucumbers is described as tender yet crisp, ideal for salads and fresh eating. This variety's robust vines and disease resistance ensure consistent fruit texture.

The data in table 2 also revealed that Treatment 3 (Poinsett 76 cucumber variety grown with pig dung) performed best on the mean nutritional contents of cucumber. The group got the highest mean vitamin A content of 33.90 mg, highest mean vitamin C content of 3.50 mg, highest mean vitamin K content of 18.11 mg, highest mean phosphorus content of 24.90 mg, highest mean potassium content of 148.18 mg, highest mean water content of 98.81 ml, and highest mean iron content of 0.38 mg. The findings strengthen Ogunlade and Akinrinde (2020), who noted that cucumbers cultivated with pig dung showed higher vitamin A, Vitamin C, Phosphorus and potassium contents than those grown with cow dungs due to the enhanced availability of nutrients in pig dung compost, which can be richer in certain organic compounds when compared to cow dung. Pig dung usually contains a more balanced nutrient profile, leading to increased, potassium and other nutrient levels in cucumbers (Martínez-Valverde et al., 2015). Furthermore, Ojo and Olufunmilayo (2021), pointed out that Poinsett 76 cucumber variety grown with pig manure has been known for producing cucumbers with robust nutritional properties, including carotenoids, the precursors to vitamin A.

Conclusion

The determination of sensory attributes and nutritional properties of cucumbers grown with cow and pig dung in Nsukka soil provides valuable insights into organic farming practices. This research

highlights the significant differences in sensory qualities and nutritional content of cucumbers depending on the type of animal dung used as fertilizer. The findings suggest that pig dung may offer superior benefits in terms of enhancing the sensory appeal and nutritional contents of cucumbers compared to cow dung.

The study also reveals consumer preferences that prioritize sensory attributes, indicating a potential market advantage for cucumbers grown with organic fertilizers. The recommendations provided aim to guide farmers, consumers, and policymakers towards practices that not only enhance agricultural output but also promote health benefits associated with organic produce. Continued research in this area can further elucidate the long-term effects of organic fertilization on various crops, contributing to a more sustainable agricultural system in Nsukka and beyond.

Recommendations

Based on the findings, the following recommendations are made:

1. Cucumber farmers should consider using pig dung for cucumber cultivation in Nsukka soil to enhance both sensory attributes and nutritional quality.
2. Organize training workshops for local farmers on effective fertilization techniques and the benefits of using animal dung in vegetable cultivation.
3. Government should encourage agricultural policy that support the use of organic fertilizers in farming practices to promote sustainable agriculture.

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