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## Process of physical, chemical and nutritional characterization of morphotypes

### Proceso de caracterización físico química y nutricional de los morfotipos

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#### **Abstract**

In the present research work, the main physical, chemical and nutritional characteristics of Sambo (*Cucúrbita Ficifolia*) harvested in the Province of Imbabura, Cotacachi Canton, San Francisco Parish, Turuco Community were analyzed. Twelve morphotypes of native Sambo are known in this sector, studied by the Instituto Nacional Autónomo de Investigaciones Agropecuarias (INIAP). Three morphotypes were selected for the research: Ecu 15369, Ecu 15379, Ecu 15371. A completely randomized block experimental design was developed, in which 15 replicates or measurements were used for each physical parameter. The results of the physical, chemical and nutritional analyses were analyzed in the STAT GRAPHIS PLUS 5.1 program.

**Keywords:** Characterization, cultivation, nutrition, plant, process.

### Resumen

En el presente trabajo de investigación se analizaron las principales características físicas, químicas y nutricionales del Sambo (*Cucúrbita Ficifolia*) cosechado en la Provincia de Imbabura, Cantón Cotacachi, Parroquia San Francisco, Comunidad Turuco. En este sector se conocen doce morfotipos de Sambo autóctonos, estudiados por el Instituto Nacional Autónomo de Investigaciones Agropecuarias (INIAP). En la investigación se seleccionaron tres morfotipos: Ecu 15369, Ecu 15379, Ecu 15371. Se desarrolló un diseño experimental de bloques completamente al azar, en el cual se trabajó en 15 repeticiones o medidas por cada parámetro físico. Los resultados de los análisis físicos, químicos y nutricionales fueron analizados en el programa STAT GRAPHIS PLUS 5.1.

**Palabras clave:** Caracterización, cultivo, nutrición, planta, proceso

### Introduction

This article was created to contribute to the dissemination of the physical, chemical and nutritional characteristics of three different morphotypes of Sambo cultivated in Cotacachi Canton. For Velázquez et al. (2017) it is established that they increase the uptake of soluble phosphates, while phosphorus solubilizing fungi (S) promote the solubilization of insoluble phosphate complexes, together benefiting plant nutrition. p. 1. At present, there is a technical standard for fresh Sambo that does not contemplate the different morphotypes that the National Autonomous Research Institute. For Nava et al. (2012) it is established that the changes also affect other systems, such as vascular and central nervous, which concur in the damage along with sarcopenia and suggest a common trait. This fact supports that the alteration of such systems may be incorporated into the frailty phenotype. That is why Agropecuarias (INIAP) brought to light after a study of autochthonous morphotypes of the Canton. These are twelve which have been coded and analyzed.

For Rentería-Chávez et al. (2017) the present study was carried out the characterization of three morphotypes that have the highest demand in consumption throughout Ecuador. With the results, it is desired to obtain basic information for updating the technical standard for fresh Sambo, considering that the characteristics of the three morphotypes under study: Ecu 15369, Ecu 15370 and Ecu 13371. The characterization process will be carried out to obtain the aforementioned. Such changes also affect other systems, such as the vascular and central nervous systems, which concur in the damage together with sarcopenia and suggest a common trait. For (Canton et al., 2005, p. 22) states that the regulation of ion transport channels. Their alteration determines an abnormal transport of ions in a large number of epithelial cells in different systems and organs, mainly in the gastrointestinal and respiratory tract 2,3. This leads to dysfunction of various exocrine glands and the most important manifestations are increased electrolytes in sweat, pancreatic insufficiency, and inflammation and infection of the respiratory tract. Initially, a high percentage of patients with CF died from the digestive system alterations associated with the disease, and 70% of affected children died before their first birthday 4,5.

The physical, chemical and nutritional characterization of Sambo (*Cucúrbita Ficifolia*) will provide the basis for INEN to update the Ecuadorian Technical Standard for the fresh product in question. Clemente et al. (2014) establishes the origin of the physical-mechanical disintegration of the rocks of the Andean orogen and the Interior Cordillera, probably during the Late Pleistocene. The clays consist of quartz and kaolinite, with minor amounts of illite, muscovite, chlorite, vermiculite and montmorillonite. A detrital origin is postulated for some of these minerals since kaolinite, vermiculite and montmorillonite may also be neoformed from the chemical alteration experienced by micas and feldspars during the Late Pleistocene-Holocene. It is concluded that the origin and composition of the sediments of these deposits are closely related to their source area and climatic conditions.

The research will be carried out using a completely randomized experimental design, in order to carry out the process and measure the variability of the physical, chemical and nutritional characteristics of three morphotypes of Sambo.

The Sambo has two stages of maturity that can be consumed, tender and ripe, and for the study was carried out in the mature state, the raw material was provided by the Union of Peasant Organizations of Cotacachi (UNORCAC).

Samples were taken from Sambo (Ecu 15369, Ecu15370, Ecu 15371). Each plot was divided into two lots and samples were taken from each.

The variables evaluated are divided into:

#### Independent Variables

- Sambo Morphotypes
- Lot

#### Dependent Variables

The samples were immediately transferred to the food chemical analysis laboratory of the Universidad Tecnológica Equinoccial and the following analyses were performed.

- Physical Composition:
  - Size
  - Volume
  - Weight
- Chemical Composition

The chemical analysis of the samples was carried out in the laboratory of Chemical Sciences of the Universidad Central del Ecuador immediately after the harvesting of the vegetables in the field in order to know the chemical properties of the Sambo.ç

The proximate analysis was performed in the LABOLAB certified laboratory, for

For this purpose, an analysis of all the chemical parameters required by INEN was requested, as well as functional parameters as a contribution from the Universidad Tecnológica Equinoccial to the community, providing reference data for the subsequent elaboration of the Sambo Technical Standard.

- Calories
- Carbohydrates
- Fiber
- Ashes
- Acidity
- Protein
- Analysis of Vitamins and Minerals:
- Vitamin A
- Phosphorus
- Vitamin C

## **Materials and methods**

The samples taken for the characterization of Sambo (*Cucúrbita ficifolia*) were of three morphotypes or varieties mentioned above. The three morphotypes were collected from the same edaphoclimatic soil, which is Imbabura, Cotacachi canton. Therefore, a completely randomized block experimental design was developed comprising a total of fifteen replicates or measurements for each physical, chemical and nutritional parameter to be analyzed in the statistical program STATGRAPHICS PLUS 5.1.

- Scientific methods
- Scientific observation
- Research Sources and Techniques
- Literature review
- Internet
- Sample

A representative sample will be used to guarantee results for the general population.

## **Data Processing**

Quantitative and qualitative analysis of the data. Ordering and classification of data (tables, figures, photos).

## **Result**

The results of the process carried out by physical and chemical analysis of three morphotypes of Sambo are presented below.

According to the analysis of variance for Sambo weight, there are no statistically significant differences for morphotype and lot at a 95% confidence level. The morphotype Ecu 15370 has the highest percentage of 57.8% of weight in shell compared to the other two morphotypes. The analysis of variance for shell weight shows that there are statistically significant differences at a 95% confidence level. The morphotype Ecu 15370 has the highest percentage of husk weight 57.8% compared to the other two morphotypes. In the analysis of variance for seed weight, it can be observed that there are statistically significant differences at a confidence level of 95%. The morphotype Ecu 15369 has the greatest amount of seeds with a percentage of 38.94%.

While the morphotype Ecu 15370 contains a percentage of 6.1% being the best as it contains a higher percentage of pulp. The weight of Sambo pulp is statistically different between the morphotype Ecu 15369 and the morphotypes Ecu 15370 and Ecu 15371. Ecu 15369 and morphotypes Ecu 15370 and Ecu 15371 at 95% confidence level. The morphotype Ecu 15371 presents the highest percentage of pulp with 40.18%, being the most yielding morphotype due to its high pulp content. In the yield analysis of the different Sambo morphotypes, it can be seen that the Ecu 15371 morphotype contains 40.18% pulp, which is the highest percentage compared to the other morphotypes.

Morphotype Ecu 15370 shows a low percentage of seed content with

The percentage of peel content was 6.10% compared to the other morphotypes, as well as a high percentage of peel content (57.80%). According to the analysis of variance carried out for the longitudinal diameter, it was determined that there are significant differences at a 95% confidence level among the three morphotypes analyzed. The morphotype Ecu 15369 has a greater length compared to the other two, indicating that it is the largest. The chemical characteristics analyzed in this study are the following:

### **Humidity**

For this moisture analysis, two measurements were taken, obtaining an average and standard deviation of the samples. According to the analysis of variance for Sambo moisture, it is observed that there are statistically significant differences at a confidence level of 95%. The morphotype with the highest percentage of moisture is Ecu15371 with respect to the other two morphotypes.

### **Proteins**

The moisture results of the three morphotypes analyzed were obtained statistically with a standard deviation. By means of the statistical analysis carried out, it was determined that the protein content of the three morphotypes of Sambo does not exist between the three morphotypes.

### **Ash**

Two measurements were taken for ash analysis, where an average and standard deviation were obtained for the ash content of the three Sambo morphotypes, among which there are statistically significant differences. The morphotypes Ecu 15370 and Ecu 15371 have higher ash content than Ecu 15369.

### **Fiber**

According to the analysis of variance carried out for Sambo fiber, it is observed that there are significant differences. By means of the Multiple Range Test, it can be concluded that the morphotype Ecu 15370 has a higher fiber content than the other morphotypes also under study.

### **Total Carbohydrates**

According to the analysis of variance performed for total carbohydrates of Sambo, it is observed that there are statistically significant differences at the 95% confidence level. Ecotype Ecu 15369 has a higher amount of total carbohydrates compared to the other two morphotypes. According to the multiple contrast of ranges with Tukey's test, ecotype Ecu 15369 has a higher carbohydrate content (1.52%), with statistically significant differences with morphotypes Ecu 15370 and Ecu 15371. The analysis for acidity of the Sambo shows that there are no statistically significant differences, according to the multiple contrast of ranges with the Tukey test, the three morphotypes present a similar percentage of acidity.

### **Ph**

According to the bar analysis, it can be observed that the morphotype Ecu 15369 has a higher pH than the other two morphotypes.

### **Soluble Solids**

The analysis of variance for soluble solids of Sambo was carried out observing that there are no statistically significant differences. However, upon analysis, it can be observed that the Ecu 15370 morphotype has a slightly higher soluble solids content than the other two morphotypes.

### **Nutritional characteristics**

The results obtained for the analysis of vitamins and minerals are presented below.

#### **Vitamin A**

According to the bar analysis, it could be observed that the morphotypes Ecu 15371 and Ecu 15370 have a slightly higher vitamin A content in the other motif type.

## **Phosphorus**

According to the graph, it can be observed that the morphotypes Ecu 15370 and Ecu 15371 have a similar percentage of phosphorus compared to the first morphotype whose content is significantly lower.

## **Vitamin C**

Ecotype Ecu 15370 has a higher vitamin C content compared to the other morphotypes.

## **Analysis of the Sambo Pepas**

For each of the morphotypes, 120 samples of seeds were taken for analysis, where the equatorial and longitudinal diameters were measured. The morphotype Ecu 15370 has greater length than the other two morphotypes.

According to the analysis of variance, it was determined that there are significant differences between the dimensions of the seeds of the different morphotypes of Sambo.

The morphotype Ecu 15370 has a larger equatorial diameter, following the morphotype Ecu 15370.

Ecu 15369 and finally the morphotype Ecu 1537. The recommended daily intake of Vitamin A in a 2000 kcal diet is 800 mg/day, therefore the percentage of this vitamin in the Sambo is 8.94 % of the requirement, while Vitamin C requires 50 mg/day contributing 28.42% of the intake.

In the recommended daily intake of Phosphorus is 700 mg/day, Sambo provides 3.65% of this mineral.

In the present research study, the existence of 12 morphotypes was found.

of Sambo cultivated in the Cotacachi canton, San Francisco Parish, in the Turuco community, of which three morphotypes of Sambo were analyzed, Ecu 15369, Ecu 15370 and Ecu 15371, the best known in consumption.

The largest longitudinal diameter and weight is found in the Ecu 15369 morphotype, while the Ecu 15370 morphotype has the largest equatorial diameter. The morphotype Ecu 15369 grown in Cotacachi has a higher content of protein (1.13%), citric acid, p H and total carbohydrates compared to the other two morphotypes, while the morphotype Ecu 15370 has a higher content of ash (1.16%), fiber (7.64) and soluble solids (1.02). Likewise, the morphotype with the highest percentage of moisture compared to the other morphotypes is Ecu 15371 (90.05%).

The morphotypes Ecu 15370 and 15371 have higher phosphorus content, being the percentage relatively low, contributing 1.27% to the requirements of a daily intake of 2000 calories.

Ecu 15371 has the highest vitamin A content while Ecu 15370 has the highest vitamin C content, but its percentage is low, contributing 0.45% of the daily requirement of a 2000 calorie diet, needing 800 mg to cover the daily Vitamin A requirement.

## Conclusions

The morphotype with the highest percentage in length and equatorial diameter of the seeds is Ecu 15370 with respect to the other morphotypes under study. The morphotype Ecu 15370 has the highest percentage in peel (57.80%), the highest percentage in pulp has the morphotype Ecu 15371 (40.18%) while the highest percentage in seeds contains the morphotype Ecu 15369 with a (20.24%). For the characterization of vegetables, it is recommended to analyze the results obtained in the statistical program STATGRAPHICS Plus 5.1 or other statistical programs, since through this it is possible to know the significant differences that may exist between variables under study. Conduct a more exhaustive study on the nutritional characteristics of Sambo seeds and mucilage to determine their benefits and possible industrial uses.

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