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XIX REUNIÓN INTERNACIONAL ACORBA T 2010

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Physical-chemical chaf"aclerization *01* banana varielies resislanllo Black-sigaloka for ilduslrial purposes

caraclerización fisicoquímica de las variedades de banana resislenles a la Sigaloka-oegra para uso ilduslrial

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Abslracl

The adoption of a new banana variety resistant to black-Sigatoka depends on its agronomical and physical-chemical characteristics. The potencial of a new cultivar can only be known upon evaluation. The objective of this study was to characterize seven banana varieties that were resistant to the diseaseby comparing them to a variety which is traditionally used by industries. The following variables were evaluated: pH, TIA, TSSITTA, total sugars, reducing sugars and non-recuclnqsuqars, humidity, total solids and yield. lhe data were evaluated by single and multivariate ~nalyses. Thap variety showed a better performance çompared tolhe Grande Nainevariety, surpassing it,ln the leveis oftotal soluble soJids,reducing sugars, total $ugars and humidity. The Caipira and FHIA2 varíetles also stoocout In the correlation analysis the pH Vias the significant and high correlation variable. The greatest diversity among these varieties occurred in regard to sugar composition and the total solids. The (3rande Naine variety was found to be close to the varieties of the Gross Michel subgroup (Bucaneiro, , Ambrosia and Calipso) and the Caipira variety in the cluster analysis, since they ali come from the same AAAgenomic group.

f(ey-words

Musa spp, postharvest, raw material, aptitude, multivariate analysis.

Resumen

La adopción de uno nueva variedad de banano resistente a la Sigatoka negro depende .de sus características agronómicas y físico químicos. Sólo mediante la evaluación es posible conocer el potencial de nuevas variedades. El objetivo dei estudio fue caracterizar siete variedades de banano resistentes a la Sigatoka negro y compararias con la variedad tradicionalmente utilizada por el sector industrial. Las vaiiables determinadas fueron: pH, TIA, SST, SSTITTA, azúcares totales, reductores, non reductores, humedad, sólidos tota/es y el rendimiento. Los datos fueron evaluados mediante análisis univariado y multivariado. La variedad Thap Maeo. mostrá un mejor desempeno que la variedad Grande Naine, superando en el contenido de sólidos SQlubles, azúcares reductores, totales y la humedad. También se destacaron las variedades Caipira y FHIA 2. En el análisis de correspondencias el pH es la variable de correlaciones altas y significativas. ,La,. mayor diversidad entre las variedades ocurrió en función de la composición de azúcares y sólidos totales. En análisis de agrupamiento la variedad Grande Naine está cerca de las variedades dei subgrupo Gross Michel (Bucaneiro, Ambrosia y Calip5O)y la variedad Caipira, ya que todos 50n dei mismo grupo genomico,AAA.

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Inlroduclion

The low genetic variability of an agricultural cultivation of bananas .represents an eminent risk of losses or decimation of the cultures, regarding diseases, such as black-Sigatoka which is caused by *Mycospharella fijiensis* Morelet and considered to be the most severe disease in cultivated bananas. This disease, of wlde geographic distríbution, can generate losses of banana production greater than 50% (Mourichon, X., J. Carlier, E. Fouré, 1997).

Thus, crop management, using information on the genetic variability, should be adopted highlighting the use of resistant varieties (Cordeiro *et al.,* 2005). The worldwide banana cultivation is basically founded on one banana clone from the Cavendish subçroup, the Grande Naine (Janick, J., 199~). The problem is that this variety is highly prone to black-Sigatoka. Therefore, in order to guarantee the continuation of the banana productive chain, it is necessary that new varieties resistant to this disease can be made available.

The objective of the present study was to evaluate the physical-chemical characterization of banana varieties resistant to black-Sigatoka, recommended by Embrapa Cassava and Tropical Fruits for industrial purposes, by comparing them to the Grande Naine (Cavendish subgroup), generally used for processing.

Malerial anel melhods

Banana varieties evaluated and their characteristics were Grande Naine (subgroup Cavendish) susceptible to black-Sigatoka. Varieties resistant to black-Sigatoka according to Silva, S. O., J.A. Santos-Serejo y Z.J.M. Cordeiro (2004) and Silva *et al.* (2001): Caipira (Ibota subgroup); FHIA02 and FHIA 18 (Prata subgroup) from Federación Hondureüa de Investigación Agrícola; Thap Maeo (Mysore subgroup); Bucaneiro, Calipso and Ambrosia (Gross Michel subgroup). .

The physical-chemical evaluation was carried out in stage 6 of maturation, with fruits completely yellow. Five repetitions of each variety were used, whereas each repetitíon originated from one single plant.

The pH was evaluated by direct reading in a pHmeter method; the total soluble solids (TSS) levei was carried out by direct reading in a table refractometer; the results of the . TSS were expressed in °Brix and the total tritable acidity (TIA) was carried out by tritation with 0,1 N, sodium-hidroxide with the results expressed malic acid % and the sugars/acidity by the TSSITTA ratio. The total solids and the humidity were obtained by incubator drying at 70°C until constant weight. The reducing sugars and total sugars were determined by spectophotometry using the DNS (3,5 -Dinitrate - Salicilic), reagent, reading at 540 nm (Miller, G.L., 1959). For total sugars, hydrolysis was carried out with dilute hydrochloric-acid (0,1 N) in a heating system with an extractor. The non-reducing sugars were obtained by the difference between total sugars and reducing sugars multiplied by the 0.95 factor (conversion for sucrose). The reducing and total sugars were expressed in % of glucose and the non-reducing sugars in % of sucrose. The mass yield evaluation was obtained by gravimetry (weight of peeled bananalweight of banana with peel x 100) and the results expressed in percentage.

The experiment was installed in complete random blocks. For the obtained data, the analysis of variance was carried out and averages of the treatment were grouped by the Duncan test at 5% probability. Multivariate cluster analyses and principal component analyses techniques were carried out. The statistical analyses were carried out using the computer programs,

STATISTIC and GENE - Computer Software for Genetics and Statistics (Cruz, C.O., 2001).

Resulls and discussion

Physical-chemical comparative profile of the resistant varieties in comparison to the traditional varieties

It was assumed that the banana varieties with substitution potential for the Grande Naine, in the agroindustry, would be the ()r'les that presented the highest leveis of t9tal tritable acidity, total soluble solids, r~ducing sugars, total sugars, highest mass y!eld and lowest humidity leveis.

rhe highest number of competitive ªfb'ibutes were presented by the Thap Maeo yanety, showing good performance for six Q~teria; total soluble solids (2.8%), total tntable acidity (68.5%), reducing sugars .(~6.7%), total sugars (10.4%), mass yield ~~:(2%) and humidity (reduction of 2.0%).

!::ilhe Caipira variety presented four desired ~f:laracteristics compared to the Grande ~f>,Iaine variety, being the following; total i>IPluble solids (2.8%), total sugars J5.9%), ~mass yield (12.5%) and humidity (réduction -••,~!1.9%). The FHIA 02 variety finds itself in a rsirnilar situation with four competitive items: ti:>tal tritable acidity (87%), reducing sugars 1(49.7%), totalsugars (11.7%) and humidity .(reductionofO.4%).

'ihe Bucaneiro variety was superior to the ~rande Naine in the following aspects: total t.fritable acidity (23.6%), reducing sugars "(20.8%) and mass yield (7.9%). The Calipso :varietypresented thesame performance as ,fffieBucaneiro: total tritable acidity (22.7%), rréducing sugars (23.8%) and mass yield ···(0.7%).

The varieties FHIA 18 and Ambrosia had similar behaviorwhen compared to the Grande Naine. They showed to be more competitive than the traditional variety for the total tritable acidity, with increments of 46.1% (FHIA 18) and 23.5% (Ambrosia). The leveis of reducing sugars were 34.8% higher than the sugars of the Grande Naine for the FHIA 18 and 13.1% for the Ambrasia.

Principal component analysis, correlation and cluster analysis

It is shown that the total tritable acidity had a negative moderate correlation with the pH. The TSSmA ratio had a higher correlation with the TTAand pH and lowerwith the TSS. The total solids had a high perfect negative correlation with the pH being strongly associated with the TSS, which make up most of the solids.

The humidity correlated negatively·with the pH and total solids, which is makes sense in this case, once the humidity is obtained from the total solids difference. In the study of different characteristics in the chemical composition of bananas from Tenerife and Ecuador authors verified that humidity had a low correlation with the following variables: proteins, total fibers, insoluble fibers, leveis of ashes, ascorbic acid, sucrose, glucose, and fructose (Forster, M.P., E.R. Rodriguez, C.D. Romera, 2002).

The reducing sugars presented a moderate negative correlation with the pH;;n relation to the remaining of the variàbles, the correlations were low. The total sugars had a moderate positive correlation with the TSS, with the TS and with the reducing sugars. With the humidity, the correlation was moderate negative. The total sugars had a strong correlation with the sucrose and a weak one with the glucose and fructose (Forster, M.P., E.R. Rodriguez, C.D. Romera, 2002).

The non-reducing sugars presented a high negative correlation with the total sugars, and it makes sense, forthe non-reducing

sugars were determined by the difference between total and reducing sugars. The yield did not present correlation with the other evaluated variables.

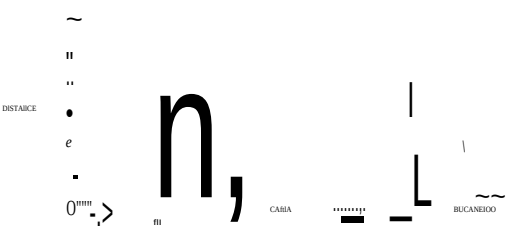
For the cluster analysis, the formation of two large variety elusters that presented some degree of similarity, was verified (Figure 1). Cluster 1 is formed by the Bucaneiro, Calipso, Ambrosia, Grande Naine and Caipira varieties. It is worth mentioning that these genotypes presented the A genome in their constitution, despite the fact of the Grande Naine and Caipira being triploids and the other three tetraploids. The association of the Bucaneiro and Calipso varieties and its proximity to the Ambrosia variety, can be observed, for the three are complete siblings, that is, Gros Michel hybrids, progenies of the same parental genotypes. In cluster 2, the FHIA 18, FHIA 2 and Thap Maeo can be found. The varieties FHIA 18 FHIA 2 and Thap Maeo are probably associated, for presenting the B genome. It was verified, by the Mahalanobis distance (0^2) that the varieties closest to the Grande Naine were the Ambrosia and the Bucaneiro and the most distant variety was the Thap Maeo.

In comparison to the traditional variety, the Thap Maeo presented the highest number of advantages for the processing. The Caipira and FHIA 02 also presented a series of interesting competitive attributes.

Within the studied varieties the pH was associated to the total tritable acidity, the TSSmA ratio, to the total solids, the humidity and to the reducing sugars.

The greatest diversity among the varieties occurred in regard to their sugar composition and total solids. In the eluster analysis of the varieties, the Grande Naine was found to be elose to the Gross Michel (Bucaneiro, Ambrosia and Calipso) subgroup and the Caipira variety.

Figure 1. Cluster analysis of different banana varieties



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