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Literature cited

1. AYA, F.O. 1977. Studies on the importance of *Amaranthus spinosus* L. and *Eupatorium odoratum* L. in oil-palm nurseries and plantations. Ph.D. thesis, University of Ibadan, Ibadan.

2. BATES, T.E. 1971. Factors affecting critical nutrient concentrations in plants and their evaluation: a review. Soil Science: 112:116-130.

3. DONALD, C.M. 1963. Competition among crop and pasture plants. Advances in Agronomy. Academy Press, New York. 15:1-118.

4. EL-SHAFEY, Y.H.; EL-HATTAB, H.; MONGED, N.O. 1975. NPK contents of maize plants and associated weeds as affected by nitrogen levels. Indian Journal of Agricultural Science: 45:316-320.

5. GUNN, J.S.; SLY, J.M.A.; CHAPAS, L.C. 1961. The development of improved nursery practices for the oil palm in West Africa. Journal of the West African Institute for Oil Palm Research: 3:198-232.

6. IREMIREN, G.O. 1984. The growth and nutrient content of polybag oil palm seedlings as affected by mulch materials and time of their application. Journal of Agricultural Science, Cambridge: 103:117-122.

7. KING, L.J. 1966. Weeds of the World: Biology and Control. Leonard-Hill Book, London, Interscience Publishers, Inc., New York.

8. VENGRIS, J.; COLBY, W.G.; DRAKE, M. 1955. Plant nutrient competition between weeds and corn. Agronomy Journal 47:213-216.

9. VENGRIS, J.; DRAKE, M.; COLBY, W.G.; BART, J. 1953. Chemical composition of weeds and accompanying crop plants. Agronomy Journal 45:213-218.

pH and acidity of home-canned tomatoes

Resumen. Se estudiaron la calidad y la seguridad sanitaria de tomates de la producción local en Río Colorado, Argentina, envasados en forma casera, a través de la determinación del pH y acidez titulable. Se describen los procedimientos de envasado utilizados en la región para preservación de tomate. Aún para los máximos valores de pH observados, la acidez total inhibe el desarrollo de *Clostridium botullinum*.

Tomatoes are harvested from September to February, depending on the different varieties and climatic characteristics of the country in question. Much of the production is sold fresh, and a large amount is canned by industries, but a considerable quantity is still home-canned, according to long-standing practices.

This home-canning procedure usually involves the use of heat to kill bacteria, molds and yeasts that cause spoilage of the product. In case of sporulated bacteria (e.g. *Clostridium botulinum*), the acidity of the tomato inhibits growth and development.

While the home-canning process for tomatoes has occasionally resulted in outbreaks of botulism, the incidence of outbreaks is negligible when compared with botulism caused by other preserved foodstuffs, and when one considers the great quantity of jars of tomatoes which are preserved annually at home.

pH and acidity of the samples were recorded to evaluate the quality and safety of home-canned tomatoes being grown and processed at Río Colorado, Argentina.

Materials and methods

Several home-canners were asked to contribute to this survey with five bottles of their own production of tomatoes. The samples represented the common processing procedures used, and as additional infor-

mation the following data were recorded: processing time, date of canning, variety and maturity of the tomatoes, additives and procedure used to process the product

There are three common methods used in canning tomatoes: a) heat the tomatoes to boiling temperature in an open kettle, then pour into boiled jars which are sealed with no further heat treatment; b) a water or vapour bath containing jars which are then filled with tomatoes, sealed and heated to boiling temperature for at least 15 – 30 minutes; and c) a water or vapour bath where the sealed jars are pressure-cooked at an average pressure of one atmosphere (14.7 psi) for 15 to 30 minutes.

Our survey showed that process (b) was preferred to both (a) and (c), and the processing time was always 30 minutes; 90% of the answers stated that slightly overripe plum tomatoes were used.

For a measurement of pH, half of the contents of each tomato jar was blended in a household blender for two minutes and pH was read using a Cole Parmer Digi-Sense LCD digital pH meter.

The remainder of each container was thoroughly blended and aliquots of 20 g were removed from each sample to determine the titrable acidity. Eighty ml of distilled water were added to each 20 g sample, and the mixture was titrated with 0.01 M sodium hydroxide (Merck) solution to pH = 8.1 using a digital pH meter and magnetic stirrer. The resultant acidity is expressed as a percentage of citric acid.

Results and discussion

Table 1 shows the results recorded for pH and titrable acidity in 350 jars of home-canned tomatoes. The lower (3.6 to 3.8 units) and higher (4.5 to 4.7 units) pH values were represented by 16 to 20 samples respectively; therefore 314 samples (89.7 percent) showed medium values (3.9 to 4.4 units) with the highest frequency at pH = 4.1 (79 samples). The lowest pH value (pH = 3.6) and highest acidity content (2.113 ± 0.124 per cent) may be attributable to the addition of citric and salicylic acids to the jars, according to statements on the questionnaire. It can be observed that the titrable acidity values decreased slightly as the pH rose from 4.0 to 4.7. Differences in pH and acidity among all tested jars were never greater than a normal Gaussian distribution.

The maximum observed pH was 4.7 in 6 samples; similar results were reported by Mundt *et al* (5) in their studies of vacuum, pH and acidity in home-canned tomatoes and tomato juice. Earlier reports on influence of pH on *C. botulinum* development cited a pH value of 4.5 as the limit for toxin production (1, 4, 6). However, in later works by Lamb *et al.* (3) it was found that the minimum pH for germination and development of *C. botulinum* is pH = 4.9.

From the results of this experiment it can be concluded that canning procedures presently used are adequate for home-canning of tomatoes. This conclusion is based on the fact that the observed pH values were sufficiently low to prevent development of *C. botulinum*.

Table 1. pH distribution and average acidity content in a batch of 350 jars of home-canned tomatoes.

pH	Number of samples	Titrable acidity (%)	
		Mean	S.D.
3.6	3	2.113	0.124
3.7	4	1.365	0.091
3.8	9	0.634	0.053
3.9	37	0.517	0.060
4.0	62	0.459	0.037
4.1	79	0.462	0.021
4.2	64	0.431	0.053
4.3	43	0.420	0.040
4.4	29	0.425	0.057
4.5	5	0.401	0.022
4.6	9	0.379	0.030
4.7	6	0.392	0.051

Summary

Quality and safety of home-canned tomatoes were studied through determination of pH and titrable acidity in a batch of tomato jars from Río Colorado, Argentina. Long-standing canning procedures used for tomato preservation are described. At the maximum observed pH, acidity still inhibits development of *Clostridium botulinum*.

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Literature cited

1. BIRD P., A.G.; FVEAME, B. 1967. Journal of Applied Bacteriology 30:420.
2. INGRAM, M.; ROBINSON, R.H.M. 1951. Discussion of literature on botulism in relation to acid foods. Proceedings Society Applied Bacteriology 14:73.
3. LAMB, F.C.; LEWIS, L.D.; KIMBALL, J.R. Jr. 1962. Factors affecting the pH of tomatoes. National Canners' Association, Berkeley, CA, USA. Research Report 61-C-44. p. 1-6.
4. MEYER, K.F. 1953. Food Poisoning. New England Journal of Medicine 249:765, 804, 843.
5. MUNDT, O.J.; McCARTY, I.E.; COLLINS, J.L.; BAILEY, R. 1977. Vacuum, pH and acidity of home-canned tomatoes and tomato juice. Tennessee Farm and Home Science No. 103, p. 1-4.
6. U.S. DEPT. HEALTH. 1963. Morbidity and Mortality Weekly Report. 12:386.

Variabilidade de clones da mandioca em relação à fertilidade e aspectos morfológicos[1] /

Summary. A description of 18 indigenous and synthetic clones of (*Manihot esculenta*) cassava showed very little variability in relation to morphological characters, as well as the absence of some characters of economic value such as dwarfism, leaf immaturity, wrinkled stem and spherical root.

Two distinct categories were observed in relation to flower number per plant during flowering season: 1) indigenous clones with low numbers of flowers, and 2) synthetic clones, produced through selection programs, with high numbers of flowers. Controlled inbreeding in the studied clones revealed the presence of genetic sterility in the indigenous clones, and a high fertility index in the synthetic clones.

A ocorrência de variabilidade genética de uma cultura é básica para o sucesso da seleção. Em mandioca essa variabilidade não tem sido estudada em relação a várias características úteis que poderão ser usadas em programas de melhoramento.

A primeira vista, a mandioca parece ser uma planta alógama, possuindo alta variabilidade e heterozigose em relação à vários genes (2). Este conceito surgiu do estudo de sua estrutura floral que é monóica, um eficiente mecanismo de alogamia. Dentro os poucos estudos feitos sobre a variabilidade em mandioca Nassar e Ohair (6) e Nassar e Dorea (7), concluiram que essa variabilidade' é pequena em relação à germinação das sementes. Pereira *et al.* (8), acharam que o cultivar "Guaxupé" é homozigoto para algumas características da parte aérea e das raizes, uma vez que progênies de certas plantas foram idênticas entre si e com relação às plantas paternas. Este estudo visou estudar a variabilidade de alguns clones da mandioca cultivada no cerrado, em relação à autofertilidade e aspectos morfológicos.

Material e métodos

Foram estudados 18 clones de mandioca, *Manihot esculenta* Crantz durante o período de florescimento a partir de abril de 1983 a dezembro de 1984. Os clones, recomendados pelo CPAC-EMBRAPA para a região dos cerrados foram plantados em novembro de 1982, na Fazenda Agua Limpa da Universidade de Brasilia (UnB).

Para fins de estudo da variabilidade morfológica foi elaborada uma série de descrições em anexo. Para avaliar a variabilidade em relação a fertilidade foi efetuada a autofecundação controlada das flores.

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