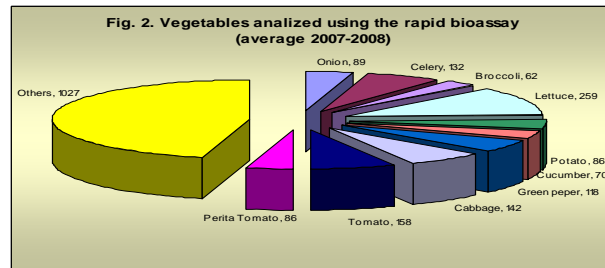
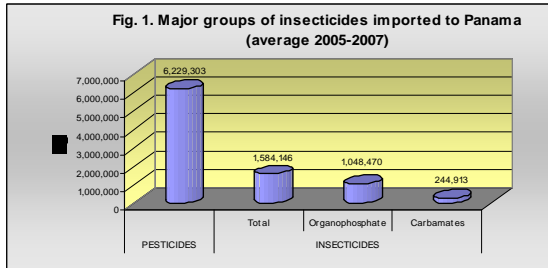


Application of Rapid Bioassay of Pesticide Residues on Fruits and Vegetables as a Complement to Conventional Chemical Analysis Techniques.

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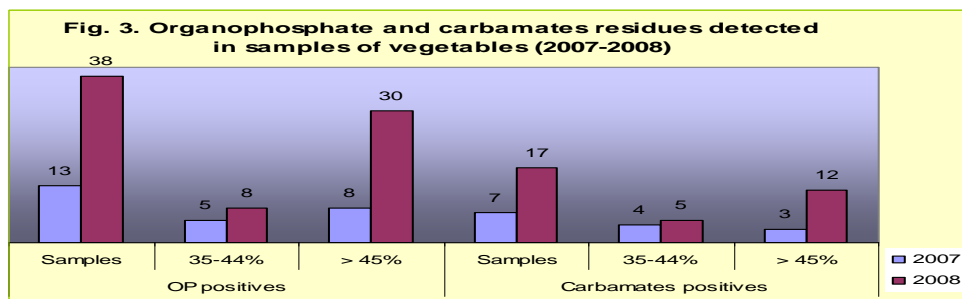
Introduction: In the last three years (2005-2007), the amount of pesticides used in panamanian agriculture has increased from 5.8 to 7.2 million kilograms. Insecticides represented a quarter of the total weight of pesticides imported to Panama; with 66.2% of organophosphates and 23.4 % of carbamates (fig. 1). Both types of insecticides are highly toxic and are in general inhibitors of acetylcholinesterase (AChE).



Objective: To assess the effectiveness of rapid bioassays technique for the detection of residues of organophosphates and carbamates, as a complement to conventional techniques, to ensure an increase in the fruit and vegetables quality.

Materials and Methods: Since 2006, the panamanian Ministry of Agriculture (MIDA) has implemented two new methods in order to establish a National Monitoring of Pesticides Residues in Vegetables and Fruits. **1)** Rapid bioassay based on acetylcholinesterase inhibition AChE [1]. The samples with values above 45 % of inhibition of cholinesterase are considered high risk to health. The sensitivity of the test is 0.05 - 0.1 ppm. **2)** QuEChERS multiresidue method, by the IAEA modified [2]. The samples showing more than 45 % inhibition of the AChE were further analyzed for this method, using ethyl acetate as the extracting solvent, and the quantification was done by gas chromatography coupled with NPD detector for the organophosphates and by HPLC with post column derivatisation for the carbamates.

Results: In the years 2007 and 2008, 2229 samples were analyzed in different vegetables (fig. 2), 11 samples were detected in the first year and 42 samples in the second year as exceeding 45% of the inhibition of AChE. Organophosphate pesticides are the main source of contamination on vegetables (fig. 3). In both years, celery is the vegetable were most residues were found, with an incidence of 8.9 % and 12.6% respectively; followed by the green pepper with an average of 5.7%.



During 2008, 17 celery samples, shown to be contaminated according to the bioassays techniques. These samples were analyzed by the IAEA modified QuEChERS multiresidue method and the contamination was confirmed in 16 samples, out of which 9 were above the maximum residue limits (MRL). According to these results, the correlation between the bioassays techniques and the conventional chemical analysis is about 94%.

Conclusion: Detection of residues, organophosphate and carbamate pesticides in vegetables using the technique of rapid bioassays are high, being confirmed in 94% of cases by the QuEChERS method. The largest amount of pesticide contamination on the analyzed vegetables is caused by organophosphate pesticides.

[1] E.Y. Cheng and C.H. Kao, Rapid Bioassay for Pesticide Residues (RBPR) on Fruits and Vegetables, **1995**.

[2] P.Aysal, A. Ambrus, S. J.Lehotay and A. Cannavan, , J. Environm.Science and Health Part B, **2007** 42, 481-490.