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### **Pesticide Contamination in Land Reform Settlements in Brazil: The Case of 'Cachoeira Bonita' in Caiaponia, Goiás State**

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#### **Introduction**

Brazil is the largest consumer of pesticides in the world, especially products that are no longer used in developed countries. Public health studies in Brazil show that inadequate use of pesticides increases the incidence of accidents and contamination of poor rural communities in Brazil.

The indiscriminate use of pesticides has been contributing for the environmental quality degradation, as well as it increases the occupational exposures to these products, determining a serious public health problem in rural areas (Oliveira-Silva et al., 2001). The authors identified the importance of educational level in the prevalence of intoxication, while others indicators studied did not showed any significant and evident correlation.

Nogueira et al. (2012) studied the presence of the pesticides atrazine, chlorpyrifos,  $\alpha$ -endosulfan,  $\beta$ -endosulfan, flutriafol, malathion and metolachlor in water matrices in urban and rural areas of Campo Verde and Lucas do Rio Verde Cities, Mato Grosso State, Brazil. Their findings revealed the vulnerability of water systems in these areas and point to the risk of pesticide contamination in important headwater streams.

Dasgupta et al. (2001) examined the trend in pesticide use in Brazil in the 1990s in the context of agroindustrialization and globalization (trade liberalization), trying to document the environmental costs and human health hazard associated with pesticide use in Brazil. Their results indicate that agricultural trade liberalization has led to increased pesticide use in Brazil, particularly in export crops. Additionally, the authors obtained results from cross-section municipality-level data point to higher incidence of pesticide use in municipalities with high income, higher levels of education, large-size farms, predominance of export crops, and with high prevalence of sharecropping. The authors also found that Brazil's agricultural growth in the era of trade liberalization has been clouded by serious human health problems and environmental damage caused by pesticide use.

According to Orozco et al. (2011), a range of determinants at multiple socio-ecological levels operate in small farm households' use and handling of hazardous pesticides, suggesting the need

for integrated health and agriculture promotion approaches. In their study in Ecuador, the authors aimed to assess changes in health promotion outcomes relevant to highly hazardous pesticide use associated with a multi-component community program. According to the authors, information on pesticide health impacts and the pesticide use and handling, shared in focus groups, showed substantial improvement, as a result of health promotion activities though people were still observed to engage in risky practices in the field. In the case of Ecuador, integrated, community programs could promote pesticide-related risk reduction among small farm households.

A study by Karunamoorthi et al. (2012) assessed knowledge and practices of Ethiopian farmers about pesticide management and their implications for human health. The authors found that the great majority of farmers had ample awareness about pesticide impact on human health. However, according to the authors, various hazardous practices have also been documented, e.g. farmers making use of the empty pesticide containers for various household purposes. The authors found a strong association between the farmer's educational status and reported toxicity symptoms.

In the case of Brazil, only a few studies on toxicity problems at farm level were done, mainly in the South and Southeastern regions. Thus, this study aimed to identify factors that determine the occurrence of problems with pesticides in a typical Brazilian land reform settlement.

## **Material and Methods**

The study was carried out in the land reform settlement of 'Cachoeira Bonita' in Caiaponia, Goiás state, Brazil. Families from different origins received a piece of land for cultivation in year 2000. Since then, some gully erosion problems occurred, mainly in degraded pasture areas. This land reform settlement is now being considered as emancipated by the land reform authority i.e., settlers are considered as family farmers from now on. Families receive health assistance inside the community. Main on-farm activities are dairy cattle, chicken, grains (maize and rice), fruits (pineapples) and vegetables. Main markets are public acquisition programs and local market in the city of Caiaponia municipality. The community comprises 64 families.

A survey has been carried out with random sample of 28 farmers using a structured questionnaire. In the empirical analysis the econometric model probit was used. The dependent dichotomous variable 'AGROTOXICO' was the existence of health problems in the family setting that are caused by the use of pesticides. The independent variables were the family size ('FAMILIA'); the attendance to any church, whether Catholic or Protestant ('IGREJA'); if farmers received any technical assistance ('AT'); the current health condition of the family ('SAUDE'), and if there are exacerbated erosion problems on the farm ('VOCOROCA').

## **Results and Discussion**

The probit model results are shown in Table 1. The probit model showed good fit of 0.5694 by the McFadden R-squared statistic and of 20.02 by LR statistic.

The dependent dichotomous variable 'AGROTOXICO' was the existence of health problems in the family setting that are caused by the use of pesticides. The independent variables were the family size ('FAMILIA', p value = 0.0098); the attendance to any church, whether Catholic or Protestant ('IGREJA', p value = 0.4828); if farmers received any technical assistance ('AT', p value = 0.8251); the current health condition of the family ('SAUDE', p value = 0.0223), and if there are exacerbated erosion problems on the farm ('VOCOROCA', p value = 0.0298).

Among the main findings, larger families show a higher probability (p value = 0.0098) of having health problems in the family setting that are caused by the use of pesticides. The current health conditions of family (p value = 0.0223) and the problems of soil degradation in the farm (p value = 0.0298) imply a reduction in the likelihood of contamination with pesticides in their families. These two results indicate that rural households that have good health condition and have experienced environmental degradation on their farms have higher environmental awareness and are more cautious with pesticides.

Table 1. Probit regression results.

Dependent Variable: AGROTOXICO				
Method: ML - Binary Probit (Quadratic hill climbing)				
Date: 03/13/12 Time: 19:24				
Sample: 1 28				
Included observations: 28				
Convergence achieved after 6 iterations				
Covariance matrix computed using second derivatives				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	2.286797	2.417772	0.945828	0.3442
PESSOAS	1.081881	0.418621	2.584390	0.0098***
IGREJA	0.538177	0.766779	0.701867	0.4828
AT	-0.056952	0.257656	-0.221038	0.8251
SAUDE	-1.847216	0.808227	-2.285516	0.0223**
VOCOROCA	-4.761818	2.191439	-2.172918	0.0298**
Mean dependent var	0.321429	S.D. dependent var		0.475595
S.E. of regression	0.331555	Akaike info criterion		0.969251
Sum squared resid	2.418439	Schwarz criterion		1.254723
Log likelihood	-7.569512	Hannan-Quinn criter.		1.056523
Restr. log likelihood	-17.58236	Avg. log likelihood		-0.270340
LR statistic (5 df)	20.02571	McFadden R-squared		0.569483
Probability(LR stat)	0.001236			
Obs with Dep=0	19	Total obs	28	
Obs with Dep=1	9			

The variable technical assistance also reduces the likelihood of accidents with pesticides, but it was not statistically significant (p value = 0.8251). Finally, the church attendance variable was statistically non-significant (p value = 0.4828) and had an opposite sign to what we expected.

Therefore, the study shows that decision makers must plan and programme policies (technical assistance, adequate handling of pesticide packing, waste control and management and environmental education) with focus on sustainable development, especially in these poor rural communities that are marginalised in the process of economic development.

## Conclusions and Outlook

The main factors that determine the occurrence of problems with pesticides in the land reform settlement 'Cachoeira Bonita' in Caiaponia, Goias state, Brazil, were: (a) the family size, (b) the current health condition of the family and (c) previous experiences with exacerbated soil erosion problems on the farm. Smaller family households, with good health condition and previous experience with environmental degradation on their farms have higher environmental awareness

and are more cautious with pesticides. Policies and programmes dealing with pesticide use should take those aspects into consideration.

## References

- DASGUPTA, S., MAMINGI, N. AND MEISNER, C. (2001). Pesticide use in Brazil in the era of agroindustrialization and globalization. *Environment and Development Economics* 6(4): 459-482.
- KARUNAMOORTHY, K., MOHAMMED, M. AND WASSIE, F. (2012). Knowledge and Practices of Farmers With Reference to Pesticide Management: Implications on Human Health. *Archives of Environmental & Occupational Health* 67(2): 109-116.
- NOGUEIRA, E.N., DORES, E.F.G.C., PINTO, A.A., AMORIM, R.S.S., RIBEIRO, M.L. AND LOURENCETTI, C. (2012). Currently used pesticides in water matrices in Central-Western Brazil. *Journal of the Brazilian Chemical Society*, Epub August 07, 2012. Retrieved September 08, 2012, from [http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0103-50532012005000008&lng=en&tlng=en](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-50532012005000008&lng=en&tlng=en). <http://dx.doi.org/10.1590/S0103-50532012005000008>.
- OLIVEIRA-SILVA, J.J., ALVES, S.R., MEYER, A., PEREZ, F., SARCINELLI, P. DE N., MATTOS, R. DE C.O. DA C. AND MOREIRA, J.C. (2001). Influência de fatores socioeconômicos na contaminação por agrotóxicos, Brasil. *Revista de Saúde Pública* 35(2): 130-135.
- OROZCO, F.A., COLE, D.C., IBRAHIM, S. AND WANIGARATNE, S. (2011). Health promotion outcomes associated with a community-based program to reduce pesticide-related risks among small farm households. *Health Promotion International* 26(4): 432-446.