## **Research Paper**

#### Environment



## Case Study on Habits of Pesticides Use on Small Farms

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#### ABSTRACT

We aim to describe the magnitude of the pesticide use problem in a population living in a rural setting in Transylvania, Romania. The study describes pesticide usage in a sample of 100 randomly selected residents from this population, participating in a questionnaire-based investigation. The most widely used pesticides in the community under study belong to the groups of neonicotinoid and pyrethroid insecticides known to have low toxicity. The most widely used applicators are those in the form of spray devices, and during pesticides application people do not use full protective equipment. In addition, lifestyle influences the vulnerability to toxic substances exposure, especially since the chronic respiratory and cardiovascular pathology is frequent. Results showed that the investigated population is exposed to pesticides due to non-mechanized agricultural activity and limited education on pesticides handling.

### Keywords : agriculture, pesticides, protective equipment

#### INTRODUCTION

As the chemical-synthetic pesticides have been used increasingly worldwide since the 1940s, their extensive use in agriculture is the most important pathway of exposure to pesticides for the rural population. *(Coronado, Thompson, Strong, Griffith & Islas, 2004)* 

There are several ways to describe human exposure to pesticides, e.g., acute or chronic, occupational or non-occupational, intentional or unintentional, accidental or incidental. For each type the exposure can be oral (by mouth), respiratory (by inhalation), or dermal (by skin contact). (*WHO*, 2004)

Any severe adverse effect due to exposure to a pesticide depends on the dose, route of exposure, whether it is absorbed readily, effect types of the pesticide and its metabolites, its accumulation and persistence in the organism and the person's health status. (*Aktar, Sengupta* & Chowdhury, 2009)

A key-role in the intoxication scenario is played by the limited education of rural population, the absence of information and training regarding pesticide safety, poor spraying technology and deficient personal protection during pesticide use. (Hurtig et al., 2003)

Various authors evidenced differences between the pesticides use in different countries. A major difference is determined by the level of education in order to raise the awareness of the rural population regarding the effects of pesticides on health. In a classification of environmental problems that have harmful effects on human health, exposure to pesticides ranks third after degradation of groundwater and surface water sources. (Robson & Schneider, 2001)

At EU level and especially at national level, pesticide exposure in rural areas is a worldwide priority regarding scientific and economic/administrative aspects as well as sustainable development strategy. (Gurzău, Neamtiu, 2010) Romania is confronted with inadequate pesticide safety and hygiene practices. Consequently, millions of people are exposed to these substances, especially farm-workers and their families, pesticide residues in food and in water demonstrate the potential for non-occupational exposure. (Lovász & Gurzău, 2011) A study conducted in a rural setting in Transylvania, Romania determined the magnitude of the pesticide use problem. Areas with environmental and health risks should be identified and assessed in an accurate approach, followed by recommendation of appropriate programs to reduce and control risk sources. (Gurzău, et al., 2008) In this direction, various programs have been made to control the risk of these substances, including some pattern on the spatial and temporal distribution of pesticides and heavy metals in the environment in Romania. (Gurzău, Neamtiu, 2010)

In order to determine the magnitude of the problems related to pesticide use, this study aims to describe the case on habits of pesticide use in a Romanian rural community: Sâncraiu, located in Cluj County, between Cluj-Napoca and Huedin cities, having a total area of 56.83 km<sup>2</sup>.

#### MATERIALS AND METHODS

Our study was conducted during 2011 on the rural population of Sâncraiu, that totals 1,171 inhabitants. The locality was selected considering the following criteria: population in the area deals mainly with agriculture and animal breeding, it is geographically, culturally and economically accessible, it is stable without high rates of migration, industries present in the area are not important for the pesticide exposure assessment.

Out of the total population of the locality we invited 100 people (95% confidence level, 9.38% margin of error) to participate in a questionnaire-based investigation. The questionnaire consisted of a series of open and closed questions, regarding demographic data, data on lifestyle, personal medical history, general information on the activities within the farm, types of pesticides and their application methods and protective equipment used. Databases and processing were performed using Excel software.

#### RESULTS

The investigated sample included 100 adult subjects, residing in Sâncraiu locality, 50 females and 50 males, aged between 22 and 89 years old, the average age being 50.71 years old with a standard deviation of 15.23. Most respondents (81%) were between 30-70 years old, the most active period professionally.

61% of respondents are the owners of the farm where they live and work. Given the specific area and age of respondents, 46% stated that they have worked in their farm for a period longer than 30 years. As for the land cultivation activity within the farm, 26% of respondents declared that they have performed this activity for a month (30 days), 27% between 31 and 100 days and 20% more than 100 days during the last agricultural season.

Regarding the use of harvesters or other farm equipments, 84% of respondents stated that they have never used these. Only 5 respondents declared an intensive use of farm equipments within the farm. Planting is another important activity in the economy of a farm and also as a pathway of exposure. 25% of respondents stated that they have never performed a planting operation, 63% declared that they have planted for 1-5 days and 11% between 6 and 25 days during the last agricultural season.

According to the questionnaire results, the activity in farms is mainly non-mechanized in Sâncraiu area. Manual harvest of crops has been reported in a significant percentage of 49%, leading to an increased risk of pesticide contamination via dermal contact.

Farms in question have an area between 500 and 4900 square meter (37%), in 22% of cases farmlands being larger than 20000 square meters.

75% of the respondents answered YES to the question whether they have personally prepared or applied pesticides during their lifetime and 24% stated that they have applied pesticides for a period of time between 21 and 30 years. (Figure 1.)



Figure 1: Pesticides application by investigated population

Pesticide formulation and application are part of the regular activities of the respondents, besides farming and animal breeding. According to respondents' statements the process of pesticide application is performed over a period of 5-9 days each year (90%). One respondent declared that he uses pesticides for a period longer than 40 days.

With regard to pesticides application, 95% of the respondents (who use pesticides) were using a spraying device with a tank carried on the back of the one applying (Knapsack sprayer). However, some farmers (9%) were using tractor-mounted sprayer and 11% were using manual sprayer. 29% who apply pesticides repair the spraying or preparation equipment themselves, without calling on specialists. Regarding personal hygiene habits, most respondents wash themselves immediately after applying pesticides (57 people out of 75 wash their hands and arms; 37 people out of 75 bath or shower completely). 90% of the 75 respondents who use pesticides change their working clothes immediately after preparation and application of pesticides, even when a small amount of pesticide gets on the clothing. 8 people out of 75 change their clothes only at the end of the workday. More than half of those who apply pesticides (40 persons out of 75) wash their working clothes separately from other clothes, but still a large number of them (15 people out of 75) wash their working clothes together with the family clothes.

Many factors in the work environment like the type of activity performed for pest control, the application method used, personal hygiene habits showed the influence that personal protective equipment has upon operators (Lebailly et al., 2009).

The most commonly types of pesticides used in Sâncraiu were the insecticides for crops (87%), pesticides for weed control (37%) and insecticides for animals (29%), the insecticides for pets ranking last (3%).

All 75 respondents stated that they purchase the pesticides in liquid form, but 36 of these persons purchased pesticides also in form of powders (31 persons), granules (3 persons) and in solid form (2 persons). Respondents store pesticides in various places on their property: 1 person out of 75 stores them in the house, 4 in the garage, 28 in the cellar, 39 in external auxiliary buildings and only 2 respondents do not store them at all in the household.

As shown in Figure 2, Calypso is the most widely used pesticide in Sâncraiu locality followed by Decis. The DDT insecticide widely used for a long time, but already off the market by the "Stockholm Convention" since 2004 because of its side effects was also used by the respondents (36%) in a certain period of time.



# Figure 2: The most widely used pesticides by investigated population

In Sâncraiu locality, the most widely used pesticides are from class II (WHO, 2004) - moderately hazardous - and belong to the classes of neonicotinoid, respectively pyrethroid insecticides with thiacloprid and deltamethrin as active substances. Occupational exposure to thiacloprid may occur through inhalation and dermal contact with this compound at workplaces where thiacloprid is produced or used. (University of Hertfordshire, 2013) Deltamethrin is the most powerful synthetic pyrethroid insecticide which acts via contact and ingestion with repellent and shock effect and additional action as nutrition inhibitor upon insects. Effects of acute exposure of humans to the active substance include: muscle seizures, paralysis, dermatitis, edema, diarrhea, dyspnea, headaches, irritability, rhinorrhea, tremors, vomiting, and death due to respiratory failure. (ATSDR, 2003)

Regarding education, it was observed that 33% of respondents completed eight primary classes, 30% answered with "high school", 6% graduated a faculty, 26% graduated a vocational school and 5% completed less than 4 years of high school. Besides the demographic and identification information in the questionnaire, there is also information about the person's lifestyle. Because pesticides can enter the body via many routes, the questions in this section focused mainly on food, tobacco and alcohol consumption. A percentage of 75% of the respondents declared that they eat vegetables at least once a day both from their own production and from other sources. A variation of vegetable consumption is observed from once a week to 3 times a day (3 persons out of the total respondents answered that they eat vegetables at every main meal of the day, which is 3 times a day). 44% of respondents declared that they eat fruits at least once a day (consumption most commonly reported by respondents).

As for the personal history of alcohol consumption, 16% of respondents drink alcohol 2-4 times a week.

Regarding smoking, 28% declared that they have a history of smoking and 21% stated that they still smoke. For smokers, cigarette consumption was, in average, 20 cigarettes a day. 14% of the smokers affirmed that they have been smoking for less than 5 years, 14% between 5 and 10 years, 29% for 10-20 years and 43% have been smoking for more than 20 years. Alcohol and tobacco consumers have a higher vulnerability to pesticide exposure, absorbing larger quantities of toxic substances. Workers who smoke cigarettes while applying pesticides risk to be exposed also via ingestion route.

The personal pathological antecedents reported by persons enrolled in this phase of the study consisted of respiratory (chronic 8%, acute 28%), cardiovascular (28%), renal (5%) and nervous system (7%) diseases.

Following the questionnaire processing, several subjects were identified that relate various symptoms to pesticides use (Table 1).

| Table -1 |         |    |            |     |  |
|----------|---------|----|------------|-----|--|
| Symptoms | related | to | pesticides | use |  |

| Symptoms         |                  |         |                        |                        |                     |                    |                     |                       |
|------------------|------------------|---------|------------------------|------------------------|---------------------|--------------------|---------------------|-----------------------|
|                  | frequency        | fatigue | headache/<br>dizziness | nausea and<br>vomiting | skin<br>irritations | eye<br>irritations | chest<br>discomfort | nervous/<br>depressed |
| No.of<br>persons | never/<br>seldom | 74      | 73                     | 74                     | 70                  | 70                 | 72                  | 74                    |
|                  | sometimes        | 0       | 1                      | 0                      | 4                   | 3                  | 0                   | 0                     |
|                  | frequently       | 1       | 1                      | 1                      | 1                   | 2                  | 3                   | 1                     |

The use of protective equipment in agricultural activities is required, thus they do not prevent accidents, but may prevent or reduce injuries or even death. The protective equipment should be carefully chosen in order to fit the users.



Figure 3: Frequency of using protective equipment by investigated population

76% of all people who use pesticides in agriculture have never used protective equipment, this being due to limited education regarding the use of pesticides. Gloves and protective face masks that are very important for the prevention of pesticides poisoning are used in a small rate (Figure 3)

Education of users should be directed towards avoiding unnecessary use of pesticides, adopting safe practices for their application, and also towards protecting the crops, consumers and the environment as well. This can be achieved through special training, recommended especially for the use of the most dangerous pesticides, for authorized pesticides applicators and/or safe professional sprayers. Educational activities should help farmers understand the hazard that pesticides pose to health, in order to adopt appropriate working practices, use the protective equipment properly, take personal hygiene measures, recognize the early symptoms of overexposure or poisoning and not lastly get help as soon as possible. (Maroni, Fait & Colosio, 1999).

One solution for the pesticides use is represented by organic agriculture, as lately its weight in the total world agriculture is increasingly higher. Also a strict monitoring of the pesticides use and their effects is taken into consideration, their ecotox-icological effects being carefully monitored. (Robson & Schneider, 2001).

#### CONCLUSION

The investigated population has past and present exposure to pesticides mainly due to non-mechanized agricultural activity. The most widely used pesticides in the community under study are Calypso and Decis, which belong to the groups of neonicotinoid and pyrethroid insecticides with low toxicity. Consumers of alcohol, tobacco and food contaminated with pesticides become more vulnerable to toxic substances exposure, especially since the chronic respiratory and cardiovascular pathology is frequent. The most widely used applicators are those in the form of spray devices, particularly for insecticides used on crops. These pesticides are stored in different places on people's property and in time of their application, people do not use full protective equipment. Public education regarding pesticides handling is entirely lacking.

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