Applied Ergonomics 42 (2011) 321–330

Contents lists available at ScienceDirect

Applied Ergonomics

journal homepage: www.elsevier.com/locate/apergo

Ergonomics contribution to chemical risks prevention: An ergotoxicological investigation of the effectiveness of coverall against plant pest risk in viticulture

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ARTICLE INFO

Article history:
Received 14 October 2008
Accepted 3 August 2010

Keywords:
Agriculture
Pesticides
Ergonomics
Chemical risk
Ergotoxicology
Activity analysis
Trans-disciplinary research

ABSTRACT

The purpose of this article is to present the contribution of a trans-disciplinary approach focused on ergonomics and chemical risk control. We shall more precisely discuss how such an approach carried out in the field of agricultural work has made it possible to highlight serious shortcomings in the effectiveness of the coveralls that are supposed to protect vineyard workers from pesticides. The study results, as well as the whistle-blow that followed have questioned the control and prevention measures used until then. The aforementioned trans-disciplinary approach gathers knowledge and methods from epidemiology, industrial hygiene, occupational health and safety and ergonomics. Ergonomics were central in the development of the approach as it connected task and activity analysis with contamination measurements. Lastly, the first results that were obtained have been confirmed and reused by the AFSSET (Agence Française de Sécurité Sanitaire Environnement et Travail, the French governmental agency in charge of environmental health and occupational health and safety issues) regarding the agricultural sector but also for all other situations in which workers use coveralls as protection against chemical risks.

1. Introduction

Occupational health and safety organisations have tackled chemical risks, and more precisely the risks posed by plant protection products for a number of years now. However the recommended control measures rely too heavily – if not only – on the use of Personal Protective Equipment (PPE) rather than on measures designed to reduce the risk at the source through the implementation of engineering or administrative controls. What is supposed to be, according to all risk prevention bodies, the last line of defence is often the *only* barrier between the protection products (which we shall call pesticides from now on) and the worker. A study led on French wine-growers has highlighted serious shortcomings in the efficiency of the protection equipment used by vineyard workers.

The project presented is largely based on what we shall call an ergotoxicological approach. This means that the study uses ergonomic analyses of work tasks and activities, observations of real-life working situations but also more toxicological data and measurements. Contamination levels were measured in different stages of the work such as preparing, dosing, applying and cleaning. The study shows that the coveralls usually recommended by the health and safety organisations can be ineffective.

2. The use of pesticides in French agriculture

In France, there are over 90 families of pesticides, with over 900 substances, among which 200 are used in the wine growing industry, and more than 9000 commercial products. It is thus extremely difficult to know the exact quantities of products used, their specific effects and their main routes of entry into the body. It must be noted that France is the fourth user of pesticides (see Fig. 1 below).

In France, from the farm owner and farm worker database, it is estimated that there are 1.3 million people potentially exposed to pesticides in the course of their jobs. This estimate should be doubled to take into account the agriculture pensioners. The importance of pesticide risk on public health then becomes apparent.

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doi:10.1016/j.apergo.2010.08.001

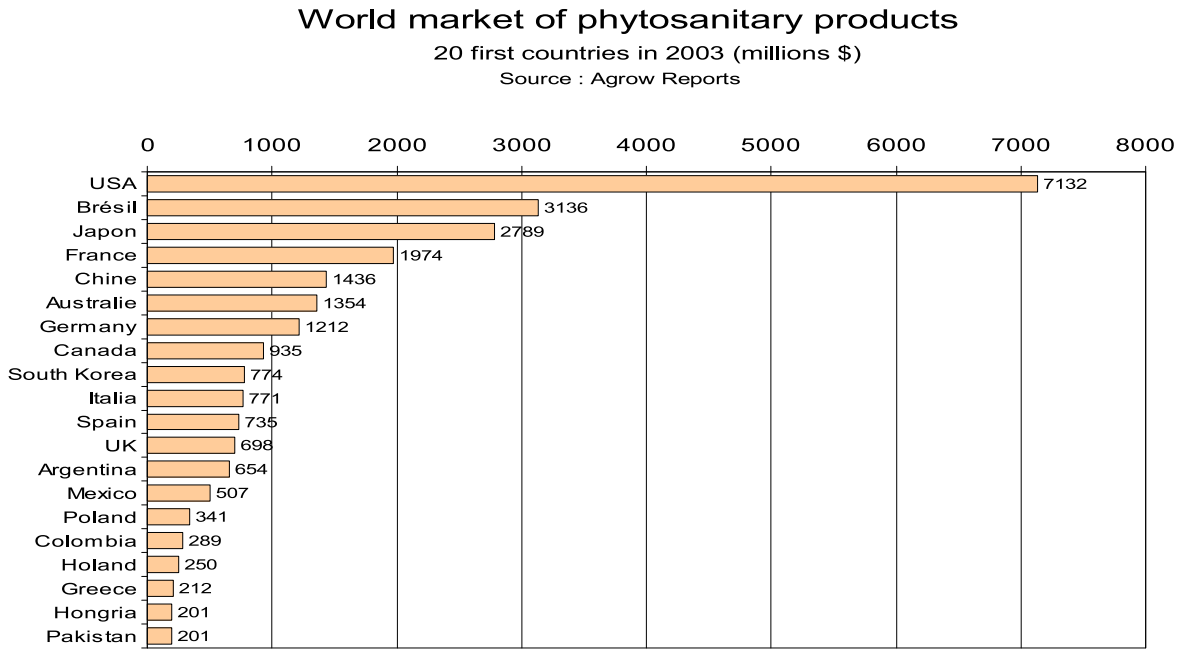

Fig. 1. World market of pesticides.

3. Effects of pesticides on health

As a result of the number of people who are exposed to pesticide substances it seems relevant to recall the different pathologies that can be caused by such exposure. Many epidemiological studies have suggested the possible role of pesticides in the occurrence of cancers (Acquavella et al., 1998; Blair et al., 1992; Dich et al., 1997), neurological diseases (Colosio et al., 2003) or reproductive disorders (Cocco, 2002).

We could detail different types of effects on health (Baldi et al., 1998, 2002, 2006; Ramwell et al., 2004; Alvania et al., 2005; Buckley et al., 2000; Garcia, 2003; Infante-Rivard et al., 1999).

3.1. Short term effects

The short term effects occur generally after poisoning, collective contamination, suicide attempts or occupational accidents. It is difficult to determine the exact number of acute, immediate effects:

- Not all pesticide poisoning cases are reported and investigated;
- Diagnosis may not necessarily identify pesticide exposure as the symptoms can be attributed to a flu or gastroenteritis;
- There is no “pharmacovigilance”, no sufficient awareness focusing on pesticides, which would aim to watch systematically for the ill effects of pesticides.

Since 1997, after an experimental stage, the MSA (French public insurance system dedicated to agriculture) has extended its surveillance network to all French departments. Incidents and accidents involving a professional use of pesticides are now monitored. The Phyt’attitude network reorganised in 2004 is implemented by the local health and safety services of each MSA which collect the incident reports. Those records are analysed by toxicologists to decide whether to link causally the effects and the suspected substances.

3.2. Long term effects

Long term effects occur either long after a peak exposure, or after moderate but frequent and prolonged exposure. Regarding those effects, three major categories have been distinguished and analysed: cancers, neurotoxicity and mutagenesis. The data that were collected mainly originate from the agricultural world.

3.2.1. Cancers

Epidemiologic data on cancers were mainly produced through American and Scandinavian studies. *The global cancer mortality rate is less important among male and female agriculturalists, but some cancers are over-represented in some studies*. These include malignant hemopathy (e.g. leukaemia, multiple myeloma), skin and lip cancers, soft tissue sarcoma, prostate and testicle cancers, intestinal cancers, brain tumours.

Several methodological problems may account for the difficulty in carrying out and interpreting the findings from such studies:

- The effects of pesticides on health are delayed; indeed, in most cases diseases do not appear until fifteen to thirty years after exposure;
- The effects are not always visible and can be cumulative;
- There are many types of pesticides and many different ways to use them, which makes it difficult to analyse them as a single category of substances;
- Individual variability may also explain why some results seem contradictory.

3.2.2. Neuro-pathologies

There are three main types of effects that can occur in the medium to long term:

- Polyneuropathies, characterized by muscular weakness and that can also cause loss of consciousness and severe respiratory failure. Nervous damage has also been observed.
- Some neuropsychological disorders have also been studied after a prolonged exposure to pesticides: for example, mood disorders, anxiety, concentration problems, memory disorders.
- Finally, pesticides could be a risk factor for Parkinson’s disease. Parkinson’s disease affects 1.5 percent of people of both sexes over 65. Parkinson’s is accompanied by a deficit in dopamine, which generates tremor, rigidity, and slowness.