

FARMERS' HEALTH AND LIFE HAZARDS RESULTING FROM THE CONTACT WITH PLANT PROTECTION PRODUCTS

Summary

Conducting plant protection operations belongs to the most unhealthy jobs from among a range of agricultural activities. A direct contact with chemical substances negatively influences the functioning of the digestive and respiratory systems. In extreme cases it results in poisoning and even death of the person who had a direct contact with the chemical. The objective of the article was to evaluate the application of safety rules when dealing with pesticides both when preparing a liquid form of the active substance and while spraying plants and conditioning seeds for sowing. The research was conducted by interviewing people directly on their farms. Based on the collected data connected with the application of pesticides, the operations were identified where a direct contact of the chemical substance with the farmer's skin or an internal organ was observed. Health side-effects were also presented in dealing with pesticides as a result of neglecting the application of personal protection measures. It was also described how to store plant protection products on farms and which protection measures should be taken to avoid uncontrolled contact with the pesticide while applying it. It was reported that about 40% of farmers do not follow the safety rules while applying or preparing chemical substances for usage. Consequently, it results in the irritation of skin, eyes and the whole respiratory system, and in some cases to nausea and headaches.

Key words: pesticides, poisoning of the organism, farming, protective clothing

ZAGROŻENIA ZDROWIA I ŻYCIA ROLNIKÓW JAKO SKUTEK KONTAKTU ZE ŚRODKAMI OCHRONY ROŚLIN

Streszczenie

Wśród szeregu prac związanych z działalnością rolniczą do najbardziej niebezpiecznych dla zdrowia należy przeprowadzenie zabiegu ochrony roślin. Bezpośredni kontakt z substancjami chemicznymi negatywnie wpływa na funkcjonowanie układu pokarmowego oraz oddechowego człowieka. W skrajnych przypadkach prowadzi to do zatrucia, a nawet do śmierci osoby, która miała bezpośredni kontakt z substancją chemiczną. Celem artykułu było dokonanie oceny poziomu przestrzegania zasad bezpieczeństwa w kontakcie z pestycydami zarówno w fazie przygotowania cieczy roboczej, jak również podczas zabiegów opryskiwania roślin i zaprawiania nasion do siewu. Badania wykonano za pomocą wywiadu przeprowadzonego bezpośrednio w gospodarstwach rolnych. Na podstawie danych zidentyfikowano te prace związane z wykorzystaniem pestycydów, w których nastąpił bezpośredni kontakt substancji chemicznej ze skórą bądź narządem wewnętrznym rolnika. Przedstawiono także skutki zdrowotne pracy z pestycydami jako konsekwencję nie stosowania środków ochrony indywidualnej. Opisano także w jaki sposób powinny być przechowywane środki ochrony roślin w gospodarstwach rolnych oraz jakie środki ostrożności należy podejmować, by nie doprowadzić do niekontrolowanego kontaktu z pestycydem podczas jego stosowania. Stwierdzono, że około 40% rolników nie przestrzega zasad bezpieczeństwa w fazie stosowania oraz przygotowywania substancji chemicznych do użycia. W konsekwencji prowadzi to do podrażnienia skóry, oczu oraz całego układu oddechowego, a w kilku przypadkach odnotowano także nudności i bóle głowy.

Słowa kluczowe: pestycydy, zatrucie organizmu, rolnictwo, odzież ochronna

1. Introduction

Plant protection products are perceived as one of the most dangerous for health because of chemical substances. They should be stored in separate rooms, in places away from residential buildings and livestock. They must be labeled and inaccessible for unauthorized persons to use them; in addition the place should be locked and well ventilated. The temperature inside of that storage facility should not fall below 0°C and, if in the building there are windows, limited exposure to sunlight should be provided. In some cases, if farmers have small amounts of these substances, it is possible to store them in small boxes or cabinets, but such a place should be properly labeled. Such facilities are required to be equipped with a bottom layer which prevents the penetration of chemi-

cals into the ground. Pesticides stored in specific rooms should be kept in original packaging and properly labeled by the producer. The room for the storage of plant protection products should meet the following conditions:

- a) be labeled,
- b) be well-ventilated,
- c) maintain the temperature above 0°C,
- d) provide grouping of plant protection products according to their use and toxicity [5, 6, 7].

The place for plant protection products should not be allowed to store food and feed. According to the instructions, the boxes completely emptied of pesticides should be rinsed three times with water which will later be used in the field. The emptied and washed containers should be collected in a plastic bag or plastic container and stored in a place away

from unauthorized persons, food and fodder. Then the emptied, cleaned and secured containers should be brought to the place of plant protection products from which they were purchased if such an obligation results from the label.

Generally, safe storage of plant protection chemicals consists of three basic elements: a place with special equipment, sufficient knowledge about proper storage of plant protection products and the farmer's ability to handle crisis situations. The greatest danger for storage is fire, which may occur inside or outside the storeroom. Flood is also dangerous because it can lead to uncontrolled spread of chemicals and serious environmental pollution [6].

Pesticides are harmful to all the important parts of the human body. The range of the risk due to pesticides results from several factors:

- the type of pesticide - the most harmful pesticides are classified in terms of class I and class II toxicity,
- the form of the preparation - preparations of liquid are more dangerous and more quickly penetrate through clothing to the skin than formulations in the form of powders or granules,
- concentration of active substance - the more concentrated preparations generate the greater risk to health and life,
- the type of crop - the use of pesticides in high crops is associated with a greater threat to humans than in low crops,
- the time of exposure - the longer contact with the product the greater the risk to human health,
- the type of equipment - less modern equipment and technology of preparations causes less safe conditions of working with them [2, 3, 4].

Plant protection products are usually stored in the form of concentrated preparations. Thus, any spill or scatter generates a high risk of local contamination. Therefore, the effects of these accidents should be eliminated in each storeroom. The principles applied in the elimination of consequences of a sudden spill are following:

- cleaning equipment to remove spills such as a brush, shovel, bucket of sawdust or sand, plastic bags and containers for contaminated materials must be kept ready to use in a specially marked area,
- spilled pesticides should be immediately collected with caution,
- do not flush spilled or scattered pesticides with water. In the case of fire call the fire brigade immediately and take action to reduce fire effects. During the fire-fighting action, avoid using huge amounts of water in order to minimize the contamination of water and the environment, and then, contaminated leavings should be turned over to the safety management team.

Using the described principles of the legislation and the recommendations it is possible to keep the storage of pesticides safe, without affecting the environment, and to implement an effective protection of plants [1, 6, 7]. Protective clothing should be clean and made of closely woven fabric or waterproof material. Uniforms, both single- and multiple-use, have different degrees of durability and provide adequate protection. They are usually sufficient to wear while working with the majority of plant protection products. Waterproof clothing should be used whenever haze or spray liquid can wet the clothing or overalls.

Waterproof aprons and clothes should be made of rubber or synthetic materials, resistant to solvents used in

commercial forms of plant protection products. Usually a set of such clothing and personal protective equipment designed to such work includes: trousers, shirt, hat or overalls with a hood, shoes and rubber gloves, goggles or protective screen, respirator or mask. Depending on the type of crop where pesticides are used protective clothing might consist of:

- overalls (designed to work in plant protection),
- gloves, rubber boots and headgear (hood, fishing hat) - for the chemical treatment of low crops with all preparations,
- goggles or protective screens to effectively protect the air-passages and eyes,
- waterproof clothing, rubber boots, gloves, goggles or screens, protective headgear and a respirator required in orchards.

While working with pesticides, it is required not to eat. Additionally you must not drink alcohol before, during and after work. Be sure to observe a waiting period and the period of prevention for people and bees. Chemical plant protection treatments should be done with a spraying machine [2, 4, 5]. Every time before filling the tank you need to check the tightness and condition of the rubber hose. For the safety of the general public the sprayed field should be labeled with some information about the pesticide, the date of the spraying and long waiting period [6, 7]. Farmers using pesticides on their farms are exposed to a direct contact with the substances at the time of trial on plants and also as a result of accidents and failure of the equipment used for application. In some cases, contaminating farmer's food with pesticides leads to pesticide consumption.

Measurements of air pollution due to pesticides during a typical work demonstrate that concentrations of toxic substances under given conditions exceed several times the maximum acceptable concentration admitted as safe for humans [8].

2. The research objective and methodology

Due to highly toxic properties of pesticides applied in farming and the conditions to be observed while applying and storing the chemicals, research was conducted on farms in order to determine the level of safety in application of the chemical substances. The research took form of a direct interview on 50 separate farms in randomly selected locations in the Lower Silesian and Łódź Provinces. The questionnaire consisted of 5 open and 5 closed questions. The age of the surveyed farmers ranged from 25 to 50 years.

The intermediate target of the research was to specify those personal protection measures which are used by the farmers each time while performing chemical treatment. The range of medical disorders experienced by the farmers as a direct result of conducted chemical treatments was also determined. Based on the collected data, those activities were identified during which the direct contact of an unprotected body part with a pesticide occurred most frequently.

3. The analysis results

Safe handling of pesticides involves not only a proper technical condition of the applied equipment but also protection of the body against a negative effect of toxic substances on the farmer's health and life. The most important aspect is the usage of protective clothing and observing of

the safety rules while performing such activities as spraying or seed conditioning. The highest percentage of farmers (about 83%) pointed out to wearing a headgear as an important issue while handling pesticides. The usage of protective gloves was reported on 75% of farms. The least popular protective measures were half-masks and protective overalls used respectively by 30% and 40% of farmers (Fig. 1).

When protective masks are not used, there is a risk that the spray particles will directly enter the respiratory system, which may lead to problems with breathing and nausea caused by the toxic substances.

Pesticides used in agriculture are very dangerous for human health and life. This is due to a high level of their toxicity. Plant protection products are present in different forms and therefore have different effects on different organs of the human being. Body parts that are most exposed to pesticides are primarily the limbs, eyes, face, trunk and feet. Depending on the type of work and forms of preparation, pesticides can penetrate the skin, respiratory system (through the nose) and less frequently the gastrointestinal tract. Skin absorption is the easiest because of the direct presence of the preparation on the skin surface and direct contact with the skin. It is even easier to absorb the pesticide in the areas of injury.

Often plant protection products are absorbed by the respiratory system and from the lungs they enter the circulatory system. It is the reason why it is particularly important

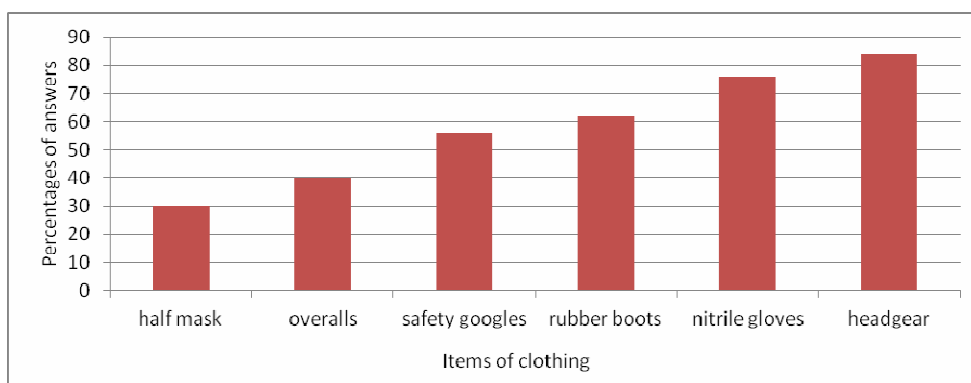
to use protective clothing and other items which will greatly reduce the risk of getting pesticides into the human body.

Based on the examined sample, the most frequent medical disorders resulting from the use of pesticides are skin reddening in the area of hands, face and legs. The lack of protective goggles frequently led to irritation and, consequently, tearing of the eyes. As it turned out, such a situation most often occurred while spraying, when the spray mist reached the working area of the driver of the tractor that was connected to a field sprayer (7 incidents).

On three farms, the farmers experienced dizziness and irritation of the respiratory tract as a result of inhaling the spray liquid vapours for a longer period (Fig. 2). Nausea and problems with the digestive system were also reported as a result of staying in the area where the spray liquid, improperly sealed containers with chemicals or empty containers are stored.

Running a farm, the farmer should act with an extreme caution when working with agricultural machinery and chemical products. The research identifies numerous activities which bring about the risk of chemical poisoning or skin irritation as a result of not taking personal protection measures. The farmers enumerated the following tasks which involved a direct contact with a chemical (Fig. 3):

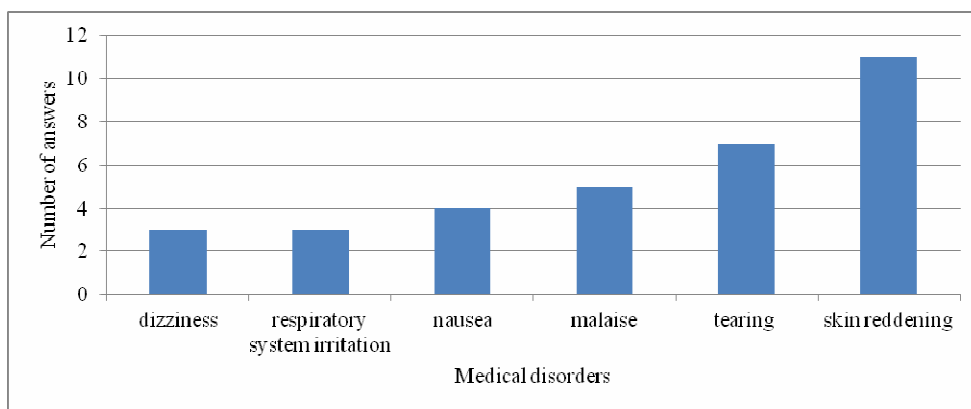
- preparing solutions of commercial preparations, such as a spray for grain treatment (28 responses),
- carrying out spraying hazardous for drivers, tractor operators and feeder operators (19),
- watering plants and spreading granules into the soil (6),



Source: the authors' research / Źródło: opracowanie własne

Fig. 1. Personal protective equipment during contact with pesticides on farms

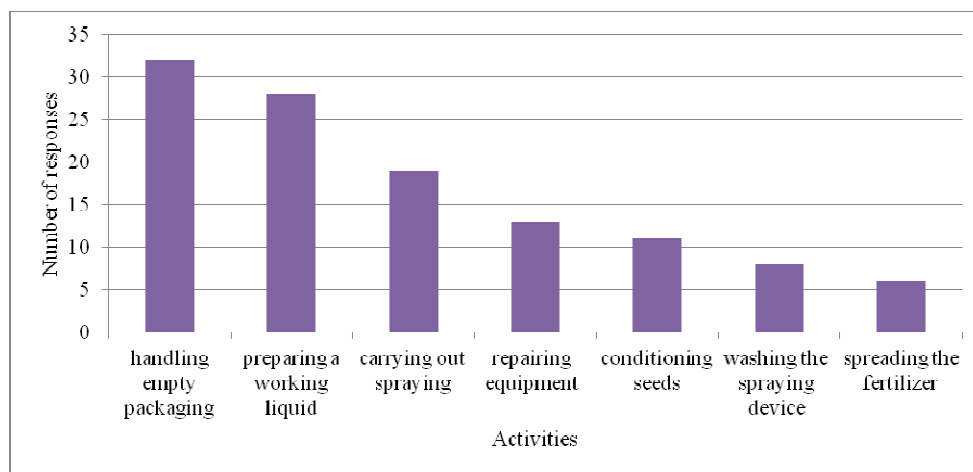
Rys. 1. Środki ochrony indywidualnej podczas kontaktu z pestycydami w badanych gospodarstwach



Source: the authors' research / Źródło: opracowanie własne

Fig. 2. Effects of contact with pesticides on surveyed farms

Rys. 2. Skutki kontaktu z pestycydami w badanych gospodarstwach



Source: the authors' research / Źródło: opracowanie własne

Fig. 3. Activities leading to a direct contact of the skin with a chemical substance

Rys. 3. Czynności, przy których nastąpił bezpośredni kontakt środków chemicznych ze skórą

- working in warehouses where preparations are stored; the simultaneous storage of various preparations significantly increases the risk for humans (11),
- cleaning and repairing the equipment and machines (13),
- handling pesticide wastes, empty and damaged packaging of preparations, wastewater from washing machines and washing clothes, outdated formulations (32).

These activities should be conducted with special caution to prevent accidents and adverse effects. Correct handling of plant protection products will significantly minimize the risk of accidents. Caution should be especially exercised in the storage and transport of chemical product containers to prevent uncontrolled spillage on the floor.

In addition, the storeroom should be equipped with warning signs: a skull and captions: "toxic chemicals" or "stop for persons not authorized" and "careful with fire - flammable materials". Different types of powders should be stored in dry storage or boxes with good ventilation. This kind of chemicals is susceptible to absorption of water from the air, so in some cases its preparations may be limited. In storing liquid substances it is very important to place them far from heating equipment. Moreover, some of these preparations stored at lower temperatures can crystallize from the solvent, making it necessary to heat before use.

4. Summary

Based on the conducted analysis it was observed that farmers on 40% of farms do not follow the safety rules. It is mainly connected with neglecting the usage of protective bodysuits, gloves and goggles. Among the activities which led to a direct contact of the farmer with a chemical substance (pesticides and mineral fertilizers), attention should be drawn to transport, mainly to manual handling, of full and empty containers of plant protection products and of damaged or incorrectly sealed containers.

The research revealed no fatalities but in several situations reddening or irritation of the skin was observed. In numerous cases spray liquid particles were absorbed by the

organism via the respiratory system because the spraying procedure was conducted in a strong wind.

In order to increase the safety level while performing the activities concerning pesticides it is advisable to rigorously adhere to safety rules at work and to conduct technical inspections of the equipment used for that purpose. Manufacturers of plant protection products place detailed instructions on the packaging or information leaflets concerning correct application of pesticides and procedures applied in the case of chemical contamination. Such activities are additionally aimed at reducing the risk of frequently health-hazardous situations.

5. References

- [1] Brzeski Z., Sodolski W.: Profilaktyka zagrożeń chemicznych w rolnictwie, [w] Praktyczne problemy związane z ochroną pracy w rolnictwie, pod red. Soleckiego, Instytut Medycyny Wsi, Lublin, 2013, 159-169.
- [2] Jonderko G., Marcisz C.: Ryzyko zdrowotne związane z zawodowym bądź środowiskowym narażeniem na środki ochrony roślin. [w]: Nazimek T., Solecki L.: Chemiczne zagrożenia w rolnictwie - stan aktualny i perspektywy. Instytut Medycyny Wsi w Lublinie, 2006, 93-101.
- [3] Nazimek T., Solecki L.: Chemiczne zagrożenia w rolnictwie - stan aktualny i perspektywy. Instytut Medycyny Wsi w Lublinie, 2006, 93-101.
- [4] Panasiuk L., Paprzycki P.: Zatrucia środkami ochrony roślin w Polsce, [w] Chemiczne zagrożenia w rolnictwie. Stan aktualny i perspektywy, t. nazimek, l. solecki (red.), Instytut Medycyny Wsi w Lublinie 2006, s. 291-301.
- [5] Pruszyński S., Moczyński W.: Produkcja i dystrybucja środków ochrony roślin. Raport o stanie i potrzebach ochrony roślin w Polsce, IOR, Poznań, 1992, s. 70.
- [6] Rozporządzenie ministra rolnictwa i rozwoju wsi, w sprawie bezpieczeństwa i higieny pracy przy stosowaniu i magazynowaniu środków ochrony roślin oraz nawozów mineralnych i organiczno-mineralnych z dnia 31 marca 2013 r.
- [7] Ustawa z dnia 8 marca 2013 r. o środkach ochrony roślin. Dz.U. 2013, poz. 455.
- [8] Wypadki przy pracy i choroby zawodowe rolników oraz działania prewencyjne KRUS w 2008 roku, KRUS Warszawa, 2009, s. 53.