



Risks and consequences of the misuse of pesticides in the treatment of stored products

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Preface

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Information campaigns on the safe use of pesticides are promoted by numerous national and international organisations and also by representatives of the industry. The documents made available through these campaigns generally deal with the safe use of pesticides and usually suggest the best ways to use these products. Publicity material from the Industry itself, although often emphasising the need for the user to follow the safety guidelines while using them, highlight the qualities of the pesticides by presenting them in the best light, i.e. their ability to protect agricultural products and foodstuffs essential to humans.

Despite all these information campaigns on the safe use of pesticides and the focus, particularly by representatives from the industry, on safety measures to be taken when using them, these products are still at the source of many accidents, the causes of which are often linked to incorrect use.

It is for this reason that the authors of this paper have chosen to show pesticides in their worst light, i.e. their danger to humans. Convinced that pesticides will be indispensable in the protection of

agricultural products and more especially of stored products for a long time to come, the authors thus hope to contribute to a real awareness of the risks involved in the use of pesticides.

The intention is not to provoke a phobia about pesticides or even a reduction in the treatment of stored products, but the very opposite, to encourage better protection of stocks without endangering human health and safety.

This paper is aimed at advisers to the general public, educators and store managers as well as representatives of the industry, so that they can become actively involved in encouraging better use of pesticides.

WHY STORED PRODUCTS MUST BE TREATED

Records show that between and of world harvests are destroyed or made unsuitable for consumption during storage. The causes of these losses are insects (weevils, borers, flour beetles, moths etc.), rodents (black rats, brown rats, mice) and fungi and bacteria which cause rotting and mould and produce substances which are toxic for humans and animals (aflatoxins, fumonisins, patulin etc.).

This is why pesticides are essential for the protection of stored products.

Choosing the treatment product

1. Using products which are of doubtful origin or have been repackaged

In many tropical countries the pesticide trade is hardly or not controlled at all, which opens the way for all sorts of products of dubious quality. Any pesticide user should first avoid choosing products whose origin is not guaranteed, which are often less expensive but of uncertain composition. The efficacy of these products cannot be guaranteed and they can be more toxic to humans and the environment than products from a bona fide source as they contain toxic impurities normally eliminated by reputable manufacturers.

Counterfeit products can be recognised by their labels, which are often photocopies of original labels or even bad imitations. In particular, care should be taken with products with simple black and white photocopied labels (fig. 1). Preference should be given to products sold in containers which are difficult to re-use and bear multicolor labels which are much more difficult to fake. As a safety measure one should as far as possible avoid using products whose packaging or labeling give rise to doubts about the genuine origin of the product. In the same way, products which have been re-packaged in unsuitable containers should not be used (fig. 2). The quality of these pesticides cannot be guaranteed and they risk being mistaken for other products such as foodstuffs, especially when the container used is an old food container

2. Using unsuitable products

The choice of a pesticide to protect stored products should take into account the goods in question and what hazards they are to be protected from. So in the first place great care should be taken to identify what pests are likely to attack the product.

A lot of informative material exists for this purpose, such as the poster published by the NRI or the CSIRO pocket book on stored grain pests, which is particularly aimed at store managers to help them

to identify the pest accurately.

Once the pest has been identified, the next question is what active agent(s) and formulation to choose. It is a fact that not all the active agents offer the same spectrum of efficacy (table 1).

[Figure 1. The label, easily reproduced by photocopying, and the easily re-usable aluminium container mean that counterfeits of this insecticide are possible and difficult to identify \(Photo CIRAD\)](#)

[Figure 2. An insecticid sold repackaged in fruit juice bottles, in this case in the Caribbean. This product could easily be mistaken for a drink \(Photo MCP\).](#)

The wrong choice of active agent or formulation may result in poor protection of the produce and their destruction or contamination making the produce unfit for human consumption.

To choose a product, help should be sought from advisers or the information distributed by national and international co-operation agencies should be consulted, e.g. the leaflet "Recommendations for the choice of insecticides for the protection of stored goods in the tropics" published by GTZ in 1994.

The choice of formulation will depend on the methods available to the user. Generally, products applied as a powder (DP formulation) are better for small-scale use (treating crops harvested in villages).

Care should also be taken to use good quality products with easily understood directions for use and to avoid using products with labels in a language not understood in that country.

Using the products preparation and application

The first effective and safe step to take when treating stored food is to work in a clean environment as to prevent any re-infestation.

The pesticides used to protect stored products are dangerous chemicals. The directions for use of these products should be followed carefully.

Particular care should be taken to avoid direct contact with the pesticides, specially when preparing mixtures. Too many users still mix pesticides with their bare hands (fig 3). These products can in fact cause burns to the nails, skits or eyes which can lead to irritation (fig 4) or irreversible blindness.

This is why it is necessary to scrupulously follow the safety instructions on the labels every time. These directions for use are often in the form of pictograms which in theory are international recognised. However, it is believed that their significance is often little understood by the user. It is therefore essential that all pesticide users are taught how to interpret the symbols on labels.

As this has been previously mentioned, the most suitable formulation for small scale use is the dustable powder. To handle such products, it is necessary to wear a respiratory protective equipment such as a mask or a handkerchief. For the application, a bag made of tissue or an empty food can with holes at the bottom are convenient and enable to get an even distribution of the pesticide. All this equipment can be found very easily, even in very remote villages.

TABLE 1: SOME EXAMPLES OF THE EFFECTIVENESS OF ACTIVE AGENTS USED AGAINST PESTS IN STORES

ACTIVE INGREDIENT EFFECTIVE AGAINST

	<i>Prostephanus truncatus</i>	<i>Rhyzopertha dominica</i>	<i>Sitophilus zeamais</i>	<i>Tribolium castaneum</i>
bioresmethrin	X			
bromophos				X
chlorpyrifos methyl				X
cyfluthrin	X	X		
deltamethrin	X	X		X
fenitrothion			X	X
iodofenfos			X	X
pirimiphos-methyl			X	X

Results obtained in humid laboratory conditions, source GTZ, 1989.

[Figure 3. A worker mixing a insecticide with his bare hands. An example of unsatisfactory preparation of a mixture \(Photo World Bank\).](#)

[Figure 4. Conjunctivitis caused by splashing the eye with insecticide. The user should have worn goggles or a protective mask \(Photo World Bank\).](#)

STORING PESTICIDES AND DISPOSING OF CONTAINERS

Bad storage conditions are often the source of accidents or more simply the failure of the treatment used.

Thus the stock of rat poison in figure 5 is in part unusable In addition, uninformed people who might have access to the store face a very real danger.

Also, the period of viability of pesticides is dependent on the conditions in which they are kept. They should all have the date of preparation on the label or container This date should always be checked before using the product. Products in damaged containers should be avoided as it can be assumed that they have been stored poor conditions or for too long.

In the same way, products with traces of leaks on the packaging should not be bought, even if these products are from a respectable source. Leaks should arouse doubts about the storage age conditions of the pesticide and therefore about quality.

Empty containers are also often the cause of accidents. In effect, there are always traces of pesticide inside an apparently empty can. If re-used, there is a risk that these residues will be ingested, thereby causing poisoning

[Figure 5. Poorly stored rat poison in a West African country \(Photo MCP\).](#)

[Figure 6. Small insecticide containers thrown in a dustbin with no extra precautions taken, in this case in South East Asia. An example of unsuitable disposal of containers \(Photo World Bank\).](#)

In the many countries containers are in short supply it is often tempting to re-use pesticide bottles to

store various products often foodstuffs or even water. This is why it is essential to destroy empty containers and bury them and above all not to throw them into a dustbin as it is seen in certain cases (fig 6).

The precautions to be taken when storing pesticides and the instructions for the disposal of empty containers should be written on the labels of these products They are often in the form of internationally recognised pictograms. Here again it is essential to teach all users the meaning of the symbols. A pesticide whose label does not give information on storage and disposal of containers should be considered risky and as a consequence not used.

THE CONSUMPTION OF TREATED PRODUCTS

Insecticides which have been ratified or recommended by institutes are slightly toxic to mammals hut highly toxic to insects so that treated grain can he eaten (while still protected against insects) immediately after treatment and well before the effect on insects wears of (a good grain insecticide has an effective residual effect of six months), It is therefore important to keep to the ratified or recommended dose and of course to use ratified or recommended products. Table 2 compares the Acceptable Daily Intake (ADI) of some recommended products with the close of usage.

Fumigants - a special case

Fumigation is a technique commonly used against insect pests in stored produce and can also be used to control rodents. But it is a difficult technique and uses gases that ate e extremely dangerous to

humans.**1. Choosing fumigation**

Fumigation is for clearing stores or grain stocks of infestations but the treatment is not persistent. The treatment leaves no residual effect. As a result unless preventive sanitary measures are taken before or after fumigation (cleaning the environs of the fumigated silos, bag stacks, etc.) there is a risk of rapid re-infestation.

2. The wrong choice of fumigant

Currently there are virtually only two fumigants which can be used for protecting stored products: phosphine and methyl bromide The choice between them should be based on climatic conditions (temperature humidity), the technology available which the personnel have been trained to use and the time available (treatment with phosphine takes at least five days whereas several hours may be sufficient to carry out fumigation with methyl bromide).

TABLEAU 2 ACCEPTABLE DAILY INTAKE OF COMMON PRODUCTS

Active ingredient	ADI mg/kg (1)	Dose of use mg/ kg grain (2)
bioresmethrin	0,03	10
chlorpyrifos methyl	0,01	10
cyfluthrin	0,02	2

deltamethrin	0,01	1
etrimphos	0,003	10
fenitrothion	0,005	10
methacrifos	0,006	10
pirimiphos methyl	0,03	10

Origin

- (1) "The Pesticide Manual" 10th edition
- (2) Recommendations for the choice of insecticides to protect stored products in the tropics GTZ Post Harvest Project, 1994.

The main circumstances in which phosphine or methyl bromide should not be used are given in Table 3.

Other products such as dichlorvos which have a very high vapour pressure can be sold as a fumigant. But these products are not suitable for fumigating stored products.

3. The incorrect use of fumigants

Considering the high toxicity of fumigants and the complex utilisation many mistakes can be made when using them. It is therefore essential to train all the people that have to handle these products. When using them it should always be remembered that bad handling can lead to irreversible consequences (Table 4).

Current precautions in the use of pesticides are generally also applicable to fumigants particularly in relation to the use of protective clothing because these fumigants can be hazardous by even simple contact with the skin (fig 7).

But due to their characteristics special protective equipment is often required to handle fumigants (fig 8).

The key issues for a successful fumigation treatment are the following:

- **respect the rate of use of the fumigant (relying on the volume to be treated rather than the quantity of foodstuff)**
- **respect the duration of treatment (a treatment with Phosphine shall last at least 5 days)**
- **keep silos under airtight condition.**

TABLE 3 - THE WRONG CHOICE OF FUMIGANT

Circumstances Absence of trained personnel	Products not to be used Phosphine and methyl bromide	Reason Hazard to users and to people in the vicinity
Rapid treatment (taking < 5 days)	Phosphine	Treatment ineffective
Treatment of absorbent material such as oilseed or oilcake	Methyl bromide	Risk of staining the goods, high residues and fumigation failure
Populated areas or houses in the	Phosphine and methyl bromide	Hazard to people

vicinity of the area to be fumigated		
Material already treated with methyl bromide	Methyl bromide	Risk bromide residues
Pest resistant to methyl bromide	Phosphine	Treatment ineffective
Low temperature (< 15C)	Phosphine	Risk bromide residues
Low humidity (<30%)	Phosphine	Risk bromide residues
Treatment of seeds	Ethyl bromide	Loss of germination
Personnel with low technical ability	Methyl bromide	More difficult to use than phosphine

[TABLE 4 - The consequences of incorrect procedures when using fumigants](#)

[Figure 7. Allergic reaction to methyl bromide \(Photo SPV France\).](#)

[Figure 8. An airtight mask as well as goggles must be worn when handling methyl bromide \(Photo MCP\).](#)

THE USE OF RODENTICIDES

Observations relating to insecticides are also generally applicable to rodenticides. However given their effect on warm blooded animals particular care should be taken with these products. These are in fact all poisons which are dangerous to humans and domestic animals. Once again, failure to follow safety precautions and directions for use can have fatal consequences (Table 5).

Certain rodenticides such as zinc phosphide white arsenic or thallium salts are acute poisons. The use of these products is forbidden in many temperate countries and generally discouraged in tropical regions. When using a rodenticide chronic poisons should always be preferred to acute poisons as they are less dangerous to humans and more effective in the long term. Moreover, the conditions of use of rodenticides are such that lethal quantity of products is placed in areas which are easily accessible by people. This makes rodenticides more hazardous to handle than other pesticides.

Rodenticides should be presented in a way that they cannot be mistaken for foodstuffs (Fig. 9).

[Figure 9. Example of a rodenticide which should not be used because it resembles sugar-coated peanuts. This rodenticide was found on sale in a West African market - a gift from international aid. \(Photo MCP\).](#)

[TABLE 5 - The consequences of incorrect procedures when using rodenticides](#)

CONCLUSION

The hazards of misuse of pesticides when treating stored products are very varied and numerous. It is therefore difficult to consider all the situations.

Some examples given in this bulletin might appear like extreme cases of bad use. Nevertheless they are all real cases that have been reported. Therefore potential users of pesticides must always remember these situations in order to take adequate safety precautions when handling these products.

The reader who wishes to get more information about directions for use of pesticides intended for treatment of stored products should reset to the references listed hereafter or contact GASGA members or one of the secretariats.

SOME REFERENCES

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- **Suggested recommendations for the fumigation of grain in the ASEAN Region. Part 1 Principles and General practice. ASEAN Food Handling Bureau, 3G14 and G15, Damansara Town Centre, 50490 Kuala Lumpur; Malaysia. 131p.**
- **Suggested recommendations for the fumigation of grain in the ASEAN Region. Part 3 Phosphine fumigation of bag stacks sealed in plastic enclosures: an operational manual. ASEAN Food Handling Bureau, 3G14 and G15, Damansara Town Centre, 50490 Kuala Lumpur, Malaysia. 79p.**
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Assistance on Systems relating to Grain After harvest vest

ACRONYMS AND ABBREVIATIONS

CIRAD: Centre de cooperation internationale en recherche agronomique pour le dveloppement (France)

CSIRO: Commonwealth Scientific and Industrial Research Organisation (Australia)

GASGA: Group for Assistance on Systems relating ti Grain After harvest

GTZ: Gesellschaft fr Technische Zusammenarbeit (Allemagne)

MCP: Mission de Coopracion Phytosanitaire (France)

NRI: Natural Resources Institute (Royaume Uni)

SPV: Service de la protection des vgtaux (France)

More information on the choice and use of pesticides for the protection of products can be obtained either by directly contacting the various members of GASGA or by writing to one of the offices below:

- **Natural Resources Institute, Central Avenue, Chatham Maritime, Kent ME4 4TB, Grande Bretagne. Tel. +44 (1 634) 88 00 88 - Fax. +44 (1 634) 88 00 66 / 88 00 77 Email GASGA@NRI.org**
- **Mission de Cooperation Phytosanitaire, BP 7309, 34184 Montpellier cedex 4, France. Tel. +33 (0) 4 67 75 30 90 - Fax. +33 (0) 4 67 03 10 21.**
- **GTZ - Post harvest project, OE 4232 Postfach 5180, 65756 Eschborn - Allemagne. Tel. +49 (0)6196-793296 - Fax. +49 (0) 6196-796302 - Email GTZ-POHASY@goed.geonet.de**

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