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Pesticide safety

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Pesticide safety

A.J. Cessna
Research Station
Regina, Sask.

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IMPORTANT NOTICE

This bulletin is intended to help farmers use pesticides safely and has been written from the perspective of prairie agriculture. It covers essentially all aspects of pesticide use. The recommendations outlined in this bulletin to help farmers minimize their exposure to pesticides mean that more time will be required for spraying operations. Much of the extra time required involves personal hygiene and the care of safety equipment after each day's spraying is completed. The use of the recommended safety equipment may result in some personal discomfort. However, because the long-term effects of pesticides on applicators are not well understood, such recommendations are good common sense.

In case of a pesticide spill or fire, call the following number collect:

(613) 996-6666

INTRODUCTION

The Prairie Provinces have large areas of land under cultivation. In 1981, approximately 33.4 million hectares of cultivated land was distributed as follows: 10.7, 17.7, and 5.0 million hectares in Alberta, Saskatchewan, and Manitoba, respectively. Although most of this area is used to produce cereal and oilseed crops, a wide variety of forage legumes and grasses, pulse crops, vegetables, special crops, and some fruits are also grown. In their efforts to prevent yield losses many prairie farmers regularly use herbicides to reduce weed competition with crops, insecticides to reduce or eliminate damage due to insect infestations, and fungicides to prevent or control crop diseases. All three types of chemicals, along with several others, have been categorized under the general heading of pesticides.

The diversity of crops produced in the Prairie Provinces has resulted in the use of several pesticides. Of the three classes of pesticides, herbicides are available in the greatest number and are the most extensively used. Currently a total of 66 herbicides are recommended for various uses in the Prairie Provinces and, in 1987, approximately 12.9 million kilograms of these herbicides were used collectively in Alberta, Saskatchewan, and Manitoba. In contrast, only 21 insecticides are currently recommended for use to control various grasshoppers, beetles, aphids, cutworms, and moths in field crops. The total hectarage treated annually with insecticides depends upon the extent of insect infestation. Fungicides, which are generally used as seed treatments to control both seed- and soil-borne disease organisms, are the least used and only 14 are currently recommended for use.

TOXICITY OF PESTICIDES

All pesticides are toxic chemicals or poisons. By their very nature they must be toxic in order to control or kill the organisms for which they are targeted. Thus, all pesticides exhibit toxic effects to humans at some dose level by some kind of exposure. Collectively, pesticides encompass a whole range of toxicities: some are extremely toxic and only very small doses are required to produce toxic effects, whereas others are essentially nontoxic and very large doses are required before toxic effects are exhibited.

Toxicity is the capacity of a chemical to produce injury to or have a toxic effect on a living organism. The toxicity of a pesticide can vary with the type of formulation, the route of entry into the body, and the age, sex, and nutritional status of the person exposed. There are two types of toxicity that result from exposure to pesticides, or to any chemical for that matter. These are acute and chronic toxicities.

Let us look briefly at acute toxicity first. Acute toxicity usually results from an accidental single exposure to a pesticide; for example,

being drenched with a pesticide, or swallowing some. Acute toxicity is said to produce acute toxic effects or injuries, which are those observed soon after exposure to the pesticide. They include burns, inflammation, allergic responses, damage to eyes, lungs, or the nervous system, and death. The dose, or the amount of pesticide required to produce an acute toxic effect, depends not only on the toxicity of the pesticide but also directly on the body weight of the person exposed: the smaller the body weight, the less the chemical dose required to produce the equivalent toxic effect. For example, let us compare a 7-kg child with the child's 70-kg father. Since the weight of the child is one-tenth that of its father, the child would only require approximately one-tenth the amount of pesticide that the father would need to experience the same toxic effects. Consequently, farmers who use pesticides must take special precautions to ensure that children are kept away from areas where pesticides are being stored or used.

Chronic toxicity results from a low level of exposure to a pesticide or chemical over a long period of time; for example, several years. The effect of chronic exposure is a mild, slow poisoning. The symptoms are less severe than in the case of acute poisoning and they are often difficult to isolate as having been caused by pesticides. In fact, the effects may only appear after a long latency period. Some chronic effects are reversible if the exposure to the pesticide is removed; others are irreversible.

All pesticides are thoroughly studied toxicologically, using test animals, before they are registered by the regulatory agencies for use in Canada. Since these studies are not carried out on humans, the regulatory agencies generally use a safety factor of 100 times when determining acceptable exposure levels for humans to pesticides. They also assume pesticide users will take the necessary safety precautions as described on pesticide container labels. Unless proper safety precautions are taken, these acceptable exposure levels can be exceeded.

LABELING ON PESTICIDE CONTAINERS

To help pesticide users know what safety precautions to take, four self-explanatory symbols and their corresponding signal words are used on container labels to indicate the primary hazard of a given chemical or pesticide. These are as follows:

CORROSIVE

POISON

EXPLOSIVE

FLAMMABLE

To indicate just how acutely toxic, corrosive, flammable, or explosive a chemical is, these primary hazard symbols are placed within three precautionary symbols. These precautionary symbols and their corresponding signal words indicate the degree of hazard as follows:

The octagonal shape indicates high hazard and is used with the word DANGER.

The diamond shape indicates moderate hazard and is used with the word WARNING.

The triangular shape indicates low hazard and is used with the word CAUTION.

Pesticides that are considered nonhazardous do not require a precautionary symbol or a signal word. These chemicals would be classified as nontoxic, noncorrosive, nonflammable, and nonexplosive.

Chemicals that are highly corrosive, highly toxic, highly explosive, or highly flammable are indicated by the following symbols:

DANGER
CORROSIVE

DANGER
POISON

DANGER
EXPLOSIVE

DANGER
FLAMMABLE

Chemicals that are a moderate hazard are indicated by the following symbols:

WARNING
CORROSIVE

WARNING
POISON

WARNING
EXPLOSIVE

WARNING
FLAMMABLE

Chemicals that are a low hazard are indicated by the following symbols:

CAUTION
CORROSIVE

CAUTION
POISON

CAUTION
EXPLOSIVE

CAUTION
FLAMMABLE

The primary hazard symbols that generally appear on the container label of a pesticide registered for use in Canada are those indicating corrosive or toxic materials. The primary hazard symbol for a corrosive pesticide inside the appropriate precautionary symbol indicates the extent of irritation that can be caused to the skin, eyes, and respiratory system, whereas that for a toxic pesticide indicates the toxicity of the pesticide and reflects the dose required to produce an acute toxic effect. Let us look briefly at the different hazard levels of acute toxicity.

High hazard

DANGER
POISON

This symbol and these signal words on a container label indicate a very toxic pesticide. A lethal oral dose for a 70-kg person would be in the order of a few drops to 5 mL or 5 g.

Moderate hazard

WARNING
POISON

This symbol and these signal words indicate a moderately toxic pesticide. A lethal dose for a 70-kg person would be in the order of 5 mL or 5 g to 30 mL or 30 g.

Low hazard

CAUTION
POISON

This symbol and these signal words indicate a slightly toxic pesticide. A lethal dose for a 70-kg person would be in the order of 30 mL or 30 g to 500 mL or 500 g.

For a nontoxic pesticide, no symbols or signal words are used and the lethal oral dose for a 70-kg person would be in the order of 500 mL or 500 g to 1 L or 1 kg.

For each level of hazard, certain safety precautions to minimize exposure are required and specific first aid steps should be taken in the case of an accidental poisoning.

Read the label

All this information, level of hazard, safety precautions, and first aid, is included on the pesticide container label. So, the first step in effectively and safely using any pesticide is to carefully read the information printed on the pesticide container label. This is important because most farmers use a number of pesticides and it is difficult to remember specific use, safety, and first aid directions for all products. Even if you have used the pesticide previously, read the label again as the information may have been changed or updated since you last used it. Farmers who would like information on the toxicology and safe use of a pesticide in greater detail than that written on the container label may obtain *Material Safety Data Sheets* (MSDS) from the pesticide manufacturer, usually free of charge. Technical data sheets, which are also available from the manufacturer, usually provide more toxicological data than the pesticide

container label. Canutec, a national service operated by Transport Canada in Ottawa, also provides toxicity-related information. Simply telephone (613) 992-4624, indicate the pesticide and the type of information you need, and your call will be returned promptly.

Generally speaking, of the three major classes of agricultural pesticides used in Canada, insecticides pose the greatest hazard from acute toxicity. For example, of the 21 insecticides collectively recommended for use in the Prairie Provinces, 16 are rated as presenting a high hazard. In contrast, of the 66 herbicides and 14 fungicides recommended for use in the same area, only six herbicides and one fungicide present a high hazard.

APPLICATOR EXPOSURE AND SAFETY EQUIPMENT

Prairie farmers generally use tractor-pulled sprayers to apply pesticides. Studies have shown that during spraying, farmers cannot completely avoid exposure to the chemicals which they are applying. This exposure can occur during any of the many activities involved in the spraying operation: transporting the pesticide, tank filling and mixing, container rinsing, spraying, sprayer maintenance, and pesticide storage. The exposure can involve contact with pesticide vapors and aerosols, the concentrated pesticide formulation in a liquid, granular, or powder form, and the spray mixture itself.

Since the pesticides that farmers use are poisons, and since farmers cannot avoid exposure to these chemicals with the sprayers currently available, it is in their best interest to minimize that exposure. Farmers must not only adopt adequate protective measures but also show a responsible attitude toward pesticides. Farmers who make the decision to use pesticides in their farming operations must assume the responsibilities that come with that decision. They must make not only themselves but also their families and employees aware of the potential health and environmental hazards associated with handling and using pesticides. All must understand that pesticides are poisons and that they must be treated with caution and with respect.

A responsible attitude toward pesticides should manifest itself in the example set by farmers:

- spraying during favorable weather conditions
- keeping sprayers in good operating condition
- triple rinsing or pressure rinsing containers
- properly disposing containers
- properly storing pesticides
- consistently using proper protective equipment and good personal hygiene.

Safety equipment to minimize exposure is available from safety equipment suppliers, farm supply stores and service stations, elevators, and some hardware stores.

Generally speaking, there are four routes by which exposure to the body can take place.

- Ocular exposure: exposure to the eyes.
- Oral exposure: exposure to the gut via the mouth.
- Inhalation exposure: exposure to the respiratory system.
- Dermal exposure: exposure to the skin.

Let us look at each of these routes of exposure in turn, first to see how the exposure to a pesticide applicator could occur, and second to learn what to do in order to minimize or prevent the exposure.

Ocular exposure

As mentioned previously, exposure can involve contact with several different forms of a pesticide. These forms include powders, granules, vapors, aerosols, and liquids. Since the eyes make up a very small portion of the total surface area of the body, the amount of pesticide entering the body through the eyes as vapors or as aerosols would also be very small and toxicologically of minor concern. However, the user must avoid direct chemical damage to the eyes by accidental contact with liquid, powder, or granular formulations, or with the spray mixture itself. Such accidental exposure can occur during mixing and tank filling, during container rinsing, or during sprayer maintenance and could result in permanent vision impairment and, possibly, blindness.

Such exposure can be avoided by wearing appropriate goggles during these operations (Fig. 1a). Pesticide label instructions advise the use of goggles when handling high or moderate hazard pesticides. However, a good rule of thumb is to wear goggles when handling any pesticide. Do not wear gas permeable and soft contact lenses because they may absorb pesticides and concentrate them next to the cornea. Although eye glasses give some protection, they do not provide protection from all directions as do goggles. Goggles are now designed to be worn comfortably over eye glasses and can be purchased with specially treated lenses or covered vents to reduce fogging. The straps on the goggles should be made of plastic or rubber so that they can be readily washed. Finally, in case of accidental exposure to your eyes, carry a supply of fresh water with you to use as an eye wash solution.

Oral exposure

Eating, drinking, or smoking with pesticide-contaminated hands can result in oral exposure. Good personal hygiene is the best prevention. Many farmers carry a container of soapy water with them

so that they can wash their hands before such activities. Other common practices that can lead to oral exposure are using the mouth to blow out plugged nozzle tips and drinking from the hose used to fill the sprayer tank. Finally, remember that food carried on your person, such as candy bars and so forth, will also become contaminated and, if eaten, will result in oral exposure. AVOID THESE PRACTICES.

Inhalation exposure

Inhalation exposure results from breathing air containing pesticide aerosols, vapors, or particulates. Pesticide aerosols, which consist of tiny droplets of spray mixture suspended in air, are formed during spraying; vapors result when pesticides evaporate or volatilize at temperatures encountered during spraying; and pesticide particulates form when the solvent portion (usually water) of very small droplets completely evaporates. Some pesticides are formulated as powders. The concentration of pesticide in powders and aerosols is much greater than the concentration of pesticide in vapors. All may make up part of the spray cloud put out by an operating sprayer.

Although a spraying operation can be done in a manner such that prevailing winds carry pesticides away from the operator's breathing zone, inhalation exposure is most efficiently minimized by using a chemical cartridge respirator. A respirator is a device that covers the mouth and nose to prevent the inhalation of vapors, powders, and aerosols. Pesticide label instructions require the use of respirators only for high hazard pesticides. However, a good rule of thumb is to use a respirator to minimize inhalation exposure when handling all pesticides, especially during tank filling and mixing, container rinsing, and sprayer maintenance.

The chemical cartridge respirator (Fig. 1b), recommended for outdoor protection from pesticides, is equipped with one or more filtering elements (Fig. 1c), each of which consists of a fiber filter to remove dusts, and a cartridge containing activated charcoal to remove vapors and aerosols. Purchase the correct fiber filter and cartridge for use with pesticides. Change the fiber filter daily or whenever resistance to breathing develops. The cartridge should be changed whenever vapors are detected by taste or smell, whenever breathing is restricted, or as frequently as the manufacturer advises. Even when not being used, chemical cartridges continue to absorb vapors until they are saturated or deactivated. Once they are deactivated they offer no protection to the user. Store chemical cartridges in a closed container such as a glass jar or a plastic bag to prevent such deactivation.

Various models of chemical cartridge respirators are available. To ensure an accurate fit, read the manufacturer's instructions carefully before using a respirator. The model shown in Fig. 1b is designed to fit tightly to the contours of the face so that, during

Figure 1 Goggles, hat, chemical cartridge respirator, and filtering elements.

breathing, air is drawn in only through the two replaceable filtering elements. This model is also available with a full-face piece that provides both face and eye protection. Straps on these respirators should be made of plastic or rubber so that they can be washed easily. These two models are, however, warm to wear, they are difficult to fit tightly over beards, mustaches, or sideburns, and unless equipped with a speaking diaphragm, they prevent normal conversation. Other chemical cartridge respirators are available that overcome these disadvantages and as well provide face, eye, and head protection. These models are known as airstream-type chemical cartridge respirators (Fig. 2). With these types of respirators, air is drawn through the filtering elements by a battery operated pump (Fig. 2a). The air is then pumped through a hose (Fig. 2b) into the headpiece and over the face such that filtered air is always supplied to the breathing zone of the wearer (Fig. 2c).

Dermal exposure

Not only are pesticides absorbed through the skin and into the body but an operator using a tractor-pulled sprayer absorbs more pesticide through the skin than by breathing. Different areas of the body absorb pesticides at different rates. For example, assuming that the forearm is given an absorption rating of 1.0, Fig. 3 illustrates the relative absorption rates of pesticides or chemicals through the skin at different points on the body. Notice the extreme vulnerability of the scrotal area, ear canal, forehead, and scalp. For some pesticides, dermal absorption at the scrotal area is equivalent to an injection directly into the blood stream.

Clothing is your main defense against dermal exposure to pesticides, and because pesticides can be absorbed through the skin in all areas of the body it makes sense to cover as much of the body as possible during all spraying operations. Exposure can be further minimized by working such that prevailing winds carry pesticide vapors or aerosols and dusts away from your body.

The following articles of clothing help farmers minimize their dermal exposure to pesticides. Basically, the clothing should consist of head cover, long-sleeved coveralls over normal clothing, and appropriate gloves and boots.

Head The recommended head gear is a waterproof, wide-brimmed hat or hard hat equipped with a plastic sweat band (Fig. 1a). Do not use leather or fabric sweat bands. They readily absorb pesticides and thus the scalp and forehead, two areas of the body that quickly absorb pesticides, would be continually exposed. In addition, pesticides are not readily removed from such sweat bands when the hat is washed. For these reasons, the cloth baseball-type caps commonly worn by

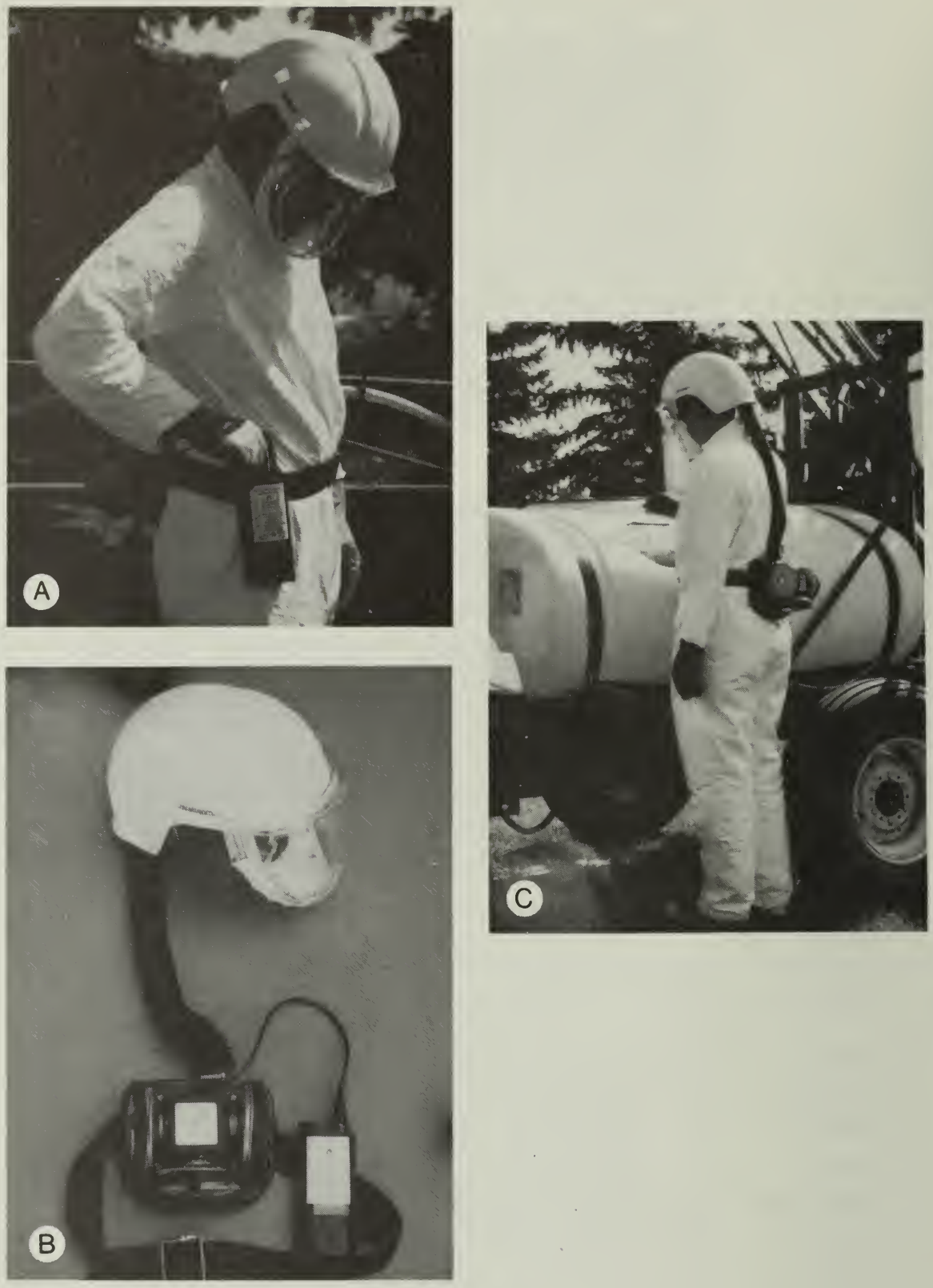

Figure 2 Example of an air-stream chemical filter.

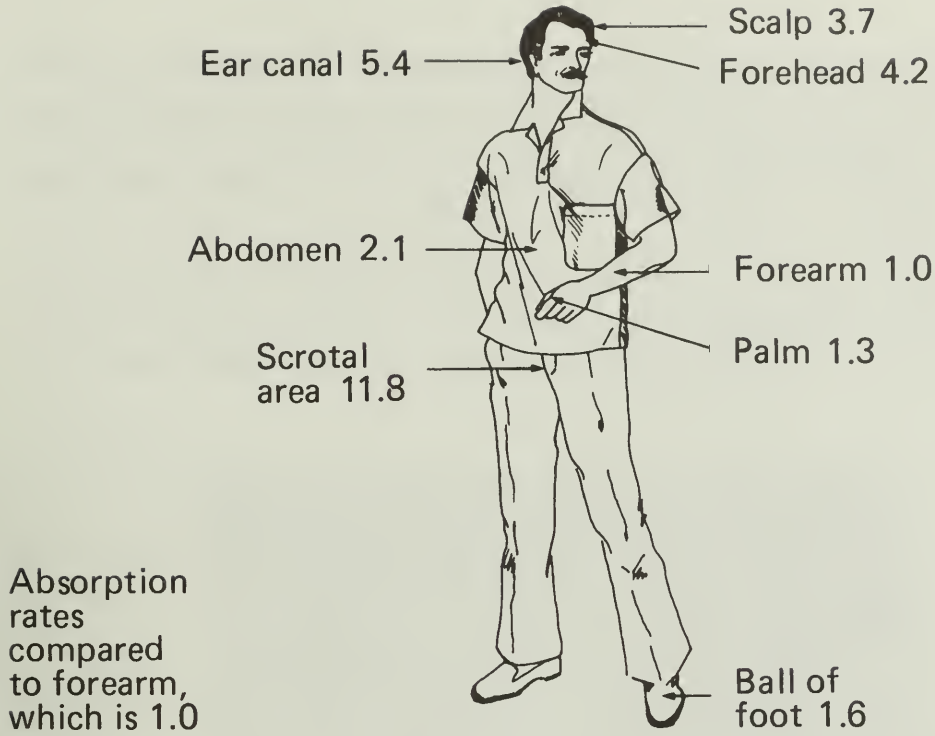

Figure 3 Relative absorption rates of pesticides or chemicals through the skin. (Maibach, M.D.; Feldman, R.J.; Milloy, T.H.; Serat, W.F. 1971. Arch. Environ. Health 23:208–211.)

farmers should not be used. Alternatively, adequate head protection can be achieved by wearing an airstream-type chemical cartridge respirator (Fig. 2).

Hands Exposure studies have shown that when an operator is using a tractor-pulled sprayer, the hands receive the largest exposure to pesticides. Gloves should therefore be used when handling all pesticides, regardless of hazard. Gauntlet-type or elbow length gloves are preferred because they protect the wrist area as well (Fig. 4a). Fold the tops of the gloves to form a cuff such that, when the hands are in an elevated position, pesticides are prevented from running off the gloves and onto the arms. For best results use gloves made of neoprene or nitrile. These can be purchased in a variety of thicknesses, depending on the need for sense of touch or feel, wet grip, and cut and abrasion resistance. The gloves should be unlined so that both sides can be easily and thoroughly washed after use. Preferably, the outside of the gloves should be washed before the gloves are removed. Never wear leather or fabric gloves because they readily absorb pesticides and once contaminated will cause a continual exposure to the hands. Washing does not readily remove pesticides from such materials.

Because the hands receive the largest exposure to pesticides during spraying, protecting the hands greatly reduces total body exposure.

Feet Wear knee-length boots made of rubber or neoprene (Fig. 4b). Knee-length boots are also available with safety toes for added protection. Do not use footwear made of leather or canvas (for the same reasons the use of leather or fabric gloves and sweat bands is not recommended).

Body To protect the remainder of the body wear water-repellent or fabric outer garments over normal clothing. Recommended normal clothing would include a long-sleeved shirt and full-length trousers.

Figure 4 Rubber gloves and boots.

There are three types of water-repellent garments available: unlined rubber and those made of woven or nonwoven synthetic polymer. All types provide effective protection against dermal exposure resulting from pesticide drift, splashing, or spills. Unlined

rubber garments (Fig. 5a), which are available as jackets, pants, and aprons, are heavy and warm to wear but can be used and washed many times. The woven and nonwoven synthetic polymer garments (Fig. 5b) are lightweight; for example, a complete set of coveralls weighs about 200 g. Various synthetic fabrics (polyethylene, polypropylene, and polyamide) are available and farmers should carefully check manufacturers' instructions regarding use of synthetic polymer protective garments with pesticides. For example, some are only recommended for use with dry particulate formulations, whereas others are recommended for use with emulsifiable concentrates. With regard to reuse, some garments made of synthetic fabrics are intended to be disposable; they are to be used only for a single day's spraying operation and a new set used the following day. Others may be washed and used several times. Put contaminated disposable garments in a plastic garbage bag and take them to a local waste disposal site.

Fabric coveralls are also available (Fig. 5c). Studies show that long-sleeved cotton coveralls over normal clothing provide increased protection. A tightly woven material such as denim is preferred. However, a rubber or synthetic polymer apron (Fig. 5c) should be worn to protect the groin area. Wash fabric coveralls and clothing normally worn under any protective garments before beginning each day of spraying. If under clothing is worn unlaundered, a continual dermal exposure to the pesticide will result. Contaminated clothing should be washed separately from other clothing because pesticides can be transferred during washing. Check cuffs and pockets of contaminated clothing for pesticide granules before the garments are washed. Granules are best removed outdoors at the location of application before the clothing is removed.

Regardless of the choice of material, wear coveralls completely buttoned or zippered up with the sleeves rolled down. The sleeves should be worn outside the gloves and the trousers should be worn outside the boots and held snugly against them with rubber bands. This will prevent the pesticide from running into the gloves or boots in the event of a severe spill. Clothing worn when spraying should be used for that purpose only, because some pesticides are difficult to remove by laundering.

PERSONAL HYGIENE

When you have finished spraying for the day, take a shower as soon as possible. The longer a pesticide resides on your skin, the greater the probability it will be absorbed into the body. When showering, use plenty of soap and shampoo to thoroughly clean your body, and pay special attention to your hair and the undersides of your fingernails.

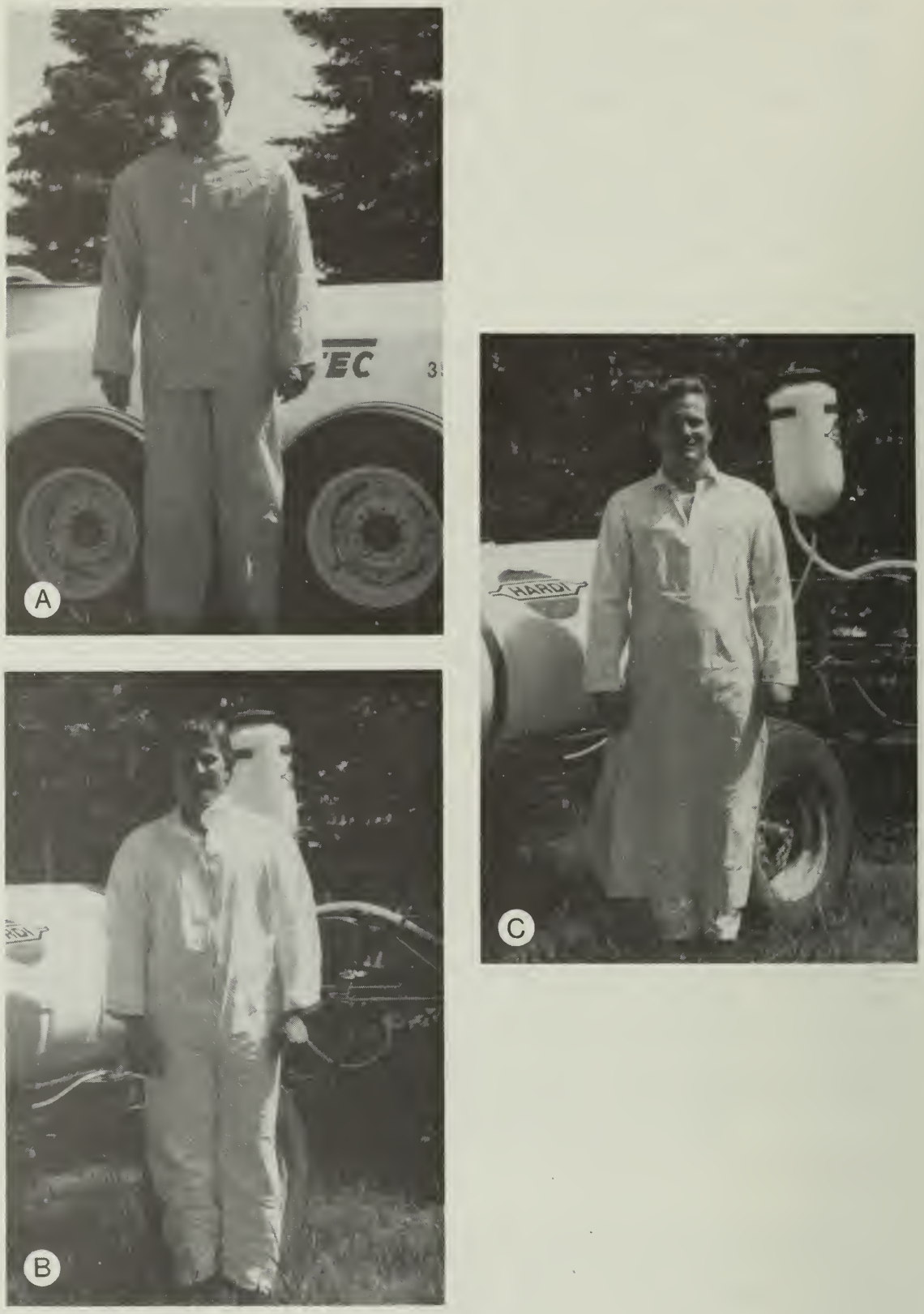

Figure 5 Various water-repellent or fabric coveralls and other outer garments.

SAFETY EQUIPMENT MAINTENANCE

Notice that the recommended safety equipment is constructed of materials from which pesticide residues can be readily washed. Therefore leather or fabric straps on respirators and goggles, and leather or fabric gloves, footwear, and sweat bands in hats should not be used. These materials not only readily absorb pesticides, but even after being washed they tend to retain pesticide residues. Thus, each time equipment containing these materials is worn, the wearer is exposed to the pesticides absorbed by them.

Clean safety equipment should be worn each day. This means that safety equipment must be washed after each day of spraying. Wash goggles, hard hats, gloves, boots, and rubberized clothing in warm water and detergent, then rinse and dry them. Remove the filtering elements from the chemical cartridge respirators and wash the respirators, using warm water and detergent. Rinse them and then air-dry them. Air-drying prevents the inlet and outlet valves from being damaged. Wash the helmet and hose from the airstream-type chemical cartridge respirator in a similar way, but wipe the motor and battery pack clean, using warm water and detergent. Use rubber gloves for all these washing procedures.

Wash cotton and polyamide coveralls and clothing normally worn under any protective garments after each day of spraying. The following washing procedure is suggested:

- Use disposable plastic garbage bags for temporary storage of pesticide-contaminated clothes prior to washing.
- Use rubber gloves to handle clothing.
- Use a prewash additive on contaminated areas.
- Avoid overcrowding clothes in the washing machine.
- Prerinse clothing, using the presoak cycle.
- Use hot water.
- Use a full water level.
- Use the normal wash cycle.
- Use a heavy-duty detergent.
- If clothes are heavily contaminated, repeat the wash cycle two or three times.
- Hang clothes out to dry to prevent possible contamination of the dryer.
- Run the washing machine through a full cycle again after use, using hot water, to rinse it thoroughly.

If the clothing is completely drenched, do not attempt to launder it; dispose of the contaminated clothing by burying it.

EXPOSURE INCURRED BY OTHERS

Pesticide use sometimes results in exposure to persons other than the applicator, and also to livestock. Exposure can occur when people

and livestock use water from wells or dugouts that have become contaminated. When the sprayer tank is being filled and the filling operation is left unattended, the sprayer tank can overflow, causing the spillage to seep into a well or dugout; or power to the pump can be interrupted, causing the contents of the tank to back-siphon into the water supply. Install a check valve between the sprayer tank and the water supply to prevent contamination of the water supply, or fill a large tank with water and transport it by truck or trailer to the sprayer in the field.

If your water supply has become contaminated with pesticide, contact the local public health inspector to have the water analyzed. Contamination may be evident by a color, taste, or odor to the water. If the water supply is found to contain unsafe amounts of pesticide, the Spill Report Centers associated with the various provincial departments of environment can provide information regarding methods of decontaminating the water supply.

Humans and livestock can also be exposed to pesticides when pesticide containers are reused. No matter how thoroughly a farmer rinses a container (see Appendix I for proper rinsing procedures), it is virtually impossible to remove all the pesticide residue, especially from plastic or plastic-lined metal containers. Use of such containers to carry animal feeds, garden produce, or potable water supplies can result in oral exposure. Pesticide containers must be properly disposed of and never reused (see Appendix II for proper methods of pesticide container disposal).

Stockpiling pesticide containers in the farmyard, in slough bottoms, or in bushes instead of properly disposing of them may lead to dermal or oral exposure. Such containers present a risk to children, livestock, or wildlife, and risk of exposure is greatly increased if the containers have not been properly rinsed. Unrinsed containers usually contain between 1% and 5% of the original contents. Pesticide containers should be rinsed either by the triple-rinsing procedure or by using one of the various pressure rinsers that are currently available (see Appendix I). A 30-second rinse with any of these pressure rinsers is just as effective as triple rinsing and both methods leave pesticide containers more than 99% free from residues. However, even triple-rinsed containers may still have sufficient pesticide residues to constitute a health hazard to children and animals.

Transporting pesticides in the family car or in the passenger area of other farm vehicles can cause both dermal and inhalation exposure. An accidental spill onto the upholstery or carpets is impossible to remove completely. If the spilled pesticide is volatile, humans will be exposed to the vapor each time the vehicle is used. Instead, transport pesticides in the open box of a truck; secure all containers to prevent puncturing or breakage, and protect containers constructed of paper or cardboard from moisture. If a spill does occur, this area is much more readily cleaned, and the vapors from any residues are readily dispersed. Do not transport groceries and animal feeds with pesticides.

Pesticides stored in the home can lead to exposure. Generally, they are stored in the home to prevent the pesticide formulation from freezing. However, pesticide containers, especially those from which the contents have been partially removed, may not be completely sealed and pesticide vapors may be released into the home. Since the home is essentially a sealed unit during the winter months, pesticide vapors will not be readily dispersed. Thus, not only will family members be exposed by inhalation, but the home itself will become contaminated.

Pesticides stored in the home present a serious risk to children. In 1984, 53 persons were hospitalized because of pesticide poisonings in Saskatchewan. Of these, 30 were children under 4 years, 5 were children between 4 and 10 years, and 3 were in the 10- to 20-year age group. Fifteen adults were hospitalized. Oral exposure, especially to children, can also occur when unused left-over pesticides are stored in various beverage bottles or other containers that normally contain food products. Storage of pesticides near food for human or animal consumption can also lead to oral exposure.

To prevent such oral exposure, store pesticides in their original containers in an area specifically allocated only for pesticides. A separate building is preferable, but any area that is isolated from human and livestock food supplies and that can be locked is adequate. The area should be identified with a warning sign. To minimize storage space requirements, buy pesticides only for one spray season and return unopened pesticide containers to the retail outlet.

ACCIDENTAL EXPOSURE

When an accidental exposure or symptoms of pesticide poisoning occur, have handy a doctor's telephone number and the address and telephone number of the nearest major Poison Control Center to obtain first aid information. Some pesticide manufacturers provide their own 24-hour emergency telephone service to advise on treatment of pesticide poisonings involving their products. The telephone numbers for this service are available through the suppliers or from the *Material Safety Data Sheets*.

If an accident does occur and the pesticide completely drenches the skin or clothing, remove the contaminated clothing at once. Clean exposed areas of the body thoroughly by washing the skin immediately with detergent and water. Be sure to scrub thoroughly under fingernails and toenails. Repeat with detergent and clean water and then rinse with clean water. Seek medical attention if the situation warrants it. When in doubt, see a doctor immediately. It is better to be safe than sorry. If you do go to a doctor, be sure you know the name of the pesticide you have been exposed to, or better yet, take the pesticide label or container with you. The common name of the pesticide is printed on the label under the heading GUARANTEE.

SYMPTOMS OF PESTICIDE POISONING

All users should be aware of the symptoms of pesticide poisoning. These can vary with each pesticide and are described on the pesticide container label. Symptoms may be experienced after an accidental exposure or following normal spraying activities if proper precautionary measures were not taken.

Symptoms of mild pesticide poisoning closely resemble those of the flu. These include headache, fatigue, skin irritation, loss of appetite, dizziness, weakness, nervousness, nausea, sweatiness, diarrhea, eye irritation, insomnia, thirstiness, restlessness, nose and throat irritation, soreness of joints, and changes of mood. As the extent of poisoning increases, so does the severity of the symptoms.

With moderate pesticide poisoning, the symptoms include nausea, trembling, muscular incoordination, excessive salivation, blurred vision, vomiting, difficulties in breathing, abdominal cramps, feeling of constriction in the chest or throat, diarrhea, mental confusion, twitching of muscles, weeping, profuse sweating, profound weakness, rapid pulse, persistent cough, flushed skin, and a yellow color or hue to the skin (due to jaundice).

In cases of severe pesticide poisoning, the symptoms include cessation of breathing, convulsions, unconsciousness, vomiting, loss of reflexes, uncontrollable muscular twitching, constriction of pupils (to pinpoints), severe secretion from the respiratory tract, fever, thirst, increased rate of breathing, and death.

Please note that not all of these symptoms may be evident, and they may vary according to the poison and the route of exposure. However, symptoms associated with mild or moderate pesticide poisoning may be the beginning of a progression to symptoms associated with severe pesticide poisoning.

ACCIDENTAL SPILLS

In the event of a pesticide spill, immediately contact your provincial Spill Report Center for information regarding cleanup. Usually, these centers provide a toll-free telephone number. Some manufacturers provide a 24-hour emergency telephone service to advise on procedures to follow whenever pesticide spills or fires occur involving their products. The telephone numbers for this service are available through the suppliers or from the *Material Safety Data Sheets*. In addition, Canutec, a national service operated by Transport Canada on a 24-hour basis, provides information on control procedures when dealing with chemical spills, fires, and so forth.

In the event of a pesticide spill or fire, call the following number collect: (613) 996-6666.

APPENDIX I: PESTICIDE CONTAINER RINSING

Two accepted methods of rinsing used pesticide containers render containers more than 99% free from pesticide residues, in most instances. These are the triple-rinsing and pressure-rinsing procedures. With either procedure, the contents of the container are first emptied into the sprayer tank and the container drained in a vertical position for at least 30 seconds (Fig. 6a).

In the triple-rinsing procedure, a measured amount of rinse water or other diluent is then added to the container so that it is about one-fifth full (Figs. 6b and 6c). The container is closed and shaken thoroughly, and the rinsing drained into the sprayer tank (Fig. 6d). The rinse procedure is then repeated two more times. Approximately 5 minutes are required for the complete procedure.

In the pressure-rinsing procedure, a pressure rinser is used (Fig. 7 shows three types). This device is designed to be thrust through the bottom of a plastic or metal container while attached to a pressurized water source (Fig. 8a). Holes, situated laterally in the rinser tip, direct water from the pressurized source onto the inner surfaces of the container, and residual pesticide is effectively washed into the sprayer tank (Fig. 8b). A 30-second rinse with a pressure rinser is just as effective as triple rinsing. Pressure rinsers have the versatility of being able to rinse all containers that can be lifted into position over the sprayer tank opening and the added advantage of rendering the containers useless for other uses by automatically puncturing them.

Figure 6 Triple-rinsing procedures.

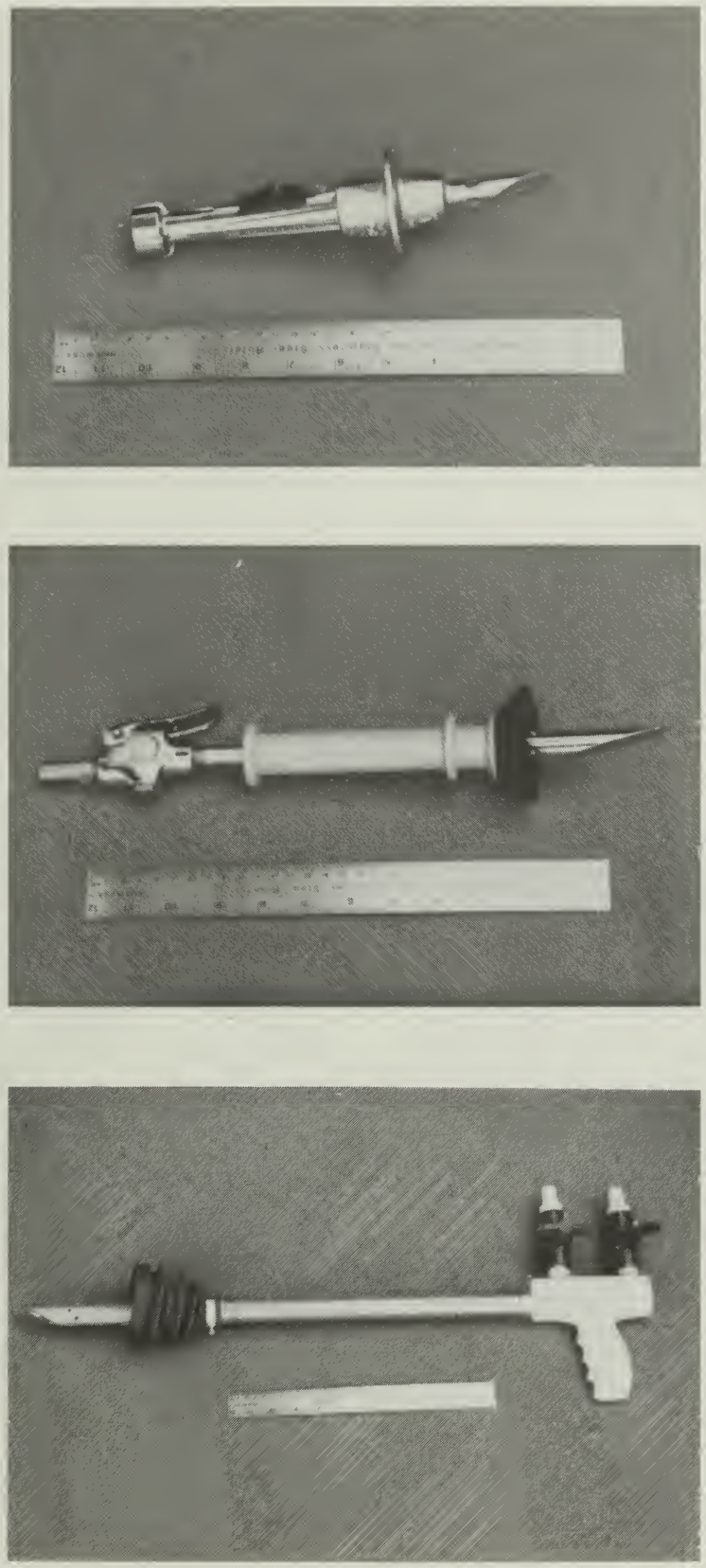

Figure 7 Examples of pressure rinsers.

Figure 8 Pressure-rinsing procedure.

APPENDIX II: PESTICIDE CONTAINER DISPOSAL

On-site disposal

Triple or pressure rinse the container into the sprayer tank and then, after the spraying operations are complete, puncture and crush the container and bury it on your own property. Crushing the container not only renders it useless, but also makes it easier to bury. Glass bottles should also be triple rinsed into the sprayer tank, broken, and then buried. Bags used for powder formulations should be rinsed at least once into the sprayer tank and then buried. Bags used for granular formulations should also be buried.

To select an environmentally appropriate site for container burial on the farm consider the following:

- Choose an uncropped area away from wells, ponds, streams, or livestock feeding areas.
- There should be no runoff from the site.
- The water table in the area should be at least 3 m below the soil surface.
- A clay or loam soil is most suitable for the burial site.

The area of disposal should be marked or recorded and if possible changed every few years. The crushed containers should be buried at least 30 cm below the soil surface and the backfill compacted to retard seepage.

Regional disposal sites

In Alberta, Saskatchewan, Manitoba, New Brunswick, and Prince Edward Island pesticide container disposal programs are available to help farmers dispose of triple- or pressure-rinsed plastic or metal containers in an environmentally acceptable manner. Collection sites designated container disposal areas have been established throughout these provinces. Containers delivered to these sites should be stacked neatly on their sides so that rain water cannot enter them or pesticide residues escape from them.

Pesticide container disposal programs offer farmers two distinct advantages: delivering containers to a collection site is simpler than burying them, and containers are removed from the user's property. However, these programs are environmentally acceptable only if all participating farmers triple or pressure rinse the containers. The programs are intended to work on the honor system.