

LOUIS SCHWARTZ

SKIN HAZARDS FROM FERTILIZERS AND PESTICIDES

The author discusses the problem of skin hazards from fertilizers and pesticides which occur among farmers, florists and cattle breeders. The pathology and measures for prevention of occupational hazards are described.

The hazards described apply chiefly to farmers, florists and cattle breeders.

Many of the chemicals used as fertilizers and pesticides are not only skin irritants but also systemic poisons.

FERTILIZERS

Fertilizers must be used in order to grow good crops and dermatitis is not infrequent from them.

The natural fertilizers are manure, Poudrette, guano, dried fish refuse, dried blood, ground bone and vegetable refuse such as the pumice of castor bean and linseed.

The chemical fertilizers are the nitrates, phosphates and calcium cyanamide.

Manure consists of the excreta of horses, cattle and the dung of barnyard fowl. Handling manure, especially hand scattering, may cause a systemic disease resembling anthrax in which there is edema of the face, neck and chest and a rise in temperature.

Tetanus may also be contracted from manure.

Poudrette is a powdered fertilizer made from a mixture of night soil, charcoal, gypsum, phosphates and quick lime. It can cause dermatitis especially if spread by hand.

Guano is composed of the partially decomposed excrement of sea fowl. It is rich in phosphates and nitrogenous matter. It has not been reported as causing dermatitis.

Handling fish and animal refuse for fertilizer may cause erysipeloid. Castor bean pumice and linseed pumice are made from the husks after the oil has been pressed out of the bean and seed.

The husk of the castor bean contains an irritant principal »ricin« which can cause dermatitis and asthma not only among those handling it, but also among those living in the surrounding areas, where it may be windborne.

The nitrate and phosphate fertilizers may cause dermatitis, fissuring and ulcers of the hands and arms.

CALCIUM CYANAMIDE

Calcium cyanamide CaCN_2 is made by burning calcium carbide in an atmosphere of nitrogen. It is formed in the ovens in one large dark lump called a »pig«. This is broken up and crushed into a powder. Before it is bagged and shipped to the farmers, it is hydrated to slake the lime impurity and eliminate the calcium carbide which may remain. It is then oiled to allay dust. Despite these precautions, dermatitis occurs not only among workers making it, but among those using it as fertilizer. The dermatitis among farmers who use it can be caused not only by the CaCN_2 itself, but by the lime and carbide remaining in it, and the products of decomposition in the soil, namely ammonia, phosphine, hydrogen cyanamide and hydrogen sulfide.

The dermatitis usually affects the face and mucous membranes of the eyes, nose and mouth. The face becomes red, swollen, the eyes are red and swollen, so are the lips and tongue and even the throat may be affected. These symptoms are especially likely to occur if alcoholic liquors are taken, much as they do if alcohol is taken by workers exposed to tetra methyl and tetra ethyl thiuram disulfides.*

If the dust penetrates the clothing, the genitals, waistline, ankles and wherever there is friction and perspiration may become inflamed. Systemic symptoms such as headaches, dyspnoea and tachycardia may also occur.

PESTICIDES

Agricultural pesticides are materials used to treat crops for protection against insects and plant diseases. In the present agricultural era they are necessary in order to raise crops.

The old reliable comparatively innocuous pesticides such as water soluble oils, lime, copper sulphate, sulfur, pyrethrum, derris, etc., are no longer sufficient to cope with the plant pests and parasites which now attack the crops.

* Used under the name »Antabuse« to cure the chronic alcoholism.

The old definitely toxic pesticides such as the arsenates and nicotine are still extensively used, but many new highly toxic ones, such as the organic phosphates, benzene hexachloride, parathion, etc., have come into use. Even the solvents used to place them in solution for spraying are toxic and skin irritants.

These new pesticides are in many respects superior for killing certain pests than the older insecticides, but the inexperienced small gardener should avoid using them because they require special knowledge for safe handling.

Not only may they cause dermatitis and respiratory symptoms among workers making and using them, but the population of surrounding areas have developed asthmatic symptoms from windborne pesticides.

Pesticides may be classified as natural and chemical.

The principal natural insecticides are pyrethrum, cubé, derris and nicotine. Hellebore root, delphinium seed, quassia extract and sabadilla seed have some insecticidal properties but are rarely used.

Pyrethrum: Pyrethrum is a widely used ingredient of fly, mosquito, ant and cockroach sprays and powders as well as agricultural insecticides and cattle sprays. It is obtained from the chrysanthemum pyrethrum and pyrethrum cinerarisfolium which are cultivated for insecticides in Europe, Asia, Australia and America. The active insecticidal principal the pyrethrum I and II.

Pyrethrum paralyzes the neuro-muscular system of insects. When used as an insect powder it is mixed with borax, sodium fluoride, naphthalene, arsenic, etc. When used as a spray it is dissolved in a petroleum distillate and mixed with such chemicals as Lethane, derris, citronella, pine oil, cedar oil, etc.

Pyrethrum is a powerful skin sensitizer and has caused dermatitis among workers making, bottling and packaging insecticides as well as among those using them.

It is also a fish poison and has killed fish in ponds which were located in sprayed areas. It is toxic for rabbits and dogs when given hypodermically or intravenously.

Cubé: Cubé, Cuyi, Cume, Barbasco, Haiari, Neko, Timbo and Stinkwood are names applied to several plants used as fish poisons in tropical American Countries. They belong to the family Fabaceae or Leguminosae or Papilionaceae and the genus Lonchocarpus. The species Jacquirita and some plants of the family Sapindaceae are also called by these names. A few plants belonging to the genus Lonchocarpus are also found in Australia and Africa.

Among the indentified species of Lonchocarpus the *L. nicon* is the richest in insecticidal principal. It is a climbing shrub or liana and may attain a height of 12 feet. It has alternate leaves about 12 inches long and has 7 to 9 leaflets 4 to 5 inches long. The lower surface of the leaf is covered with light brown hairs. The active principles are concentrated in the milky pungent juice obtained from the root and stem. The leaves of the plant has a purgative action. The sap is diluted and

used as a cattle wash to kill ticks. The powdered stems, when dusted on cats and dogs will kill or drive off parasites. A hot water extract of the stems and root will do the same. The milky pungent root juice when placed into still waters cause the fish to rise to the surface with the gills wide open gasping for air. The natives then catch them. The chief active ingredients are Rotenone ($C_{23}H_{22}O_6$), Deguelin and Tephrosine, but there are other unrecognized toxic ingredients.

While dried roots are exported from Peru, exportation of the plant for cultivation is prohibited. Cubé and rotenone are sensitizers and dermatitis has been reported among workers making and using insecticidal sprays containing it.

The natives use the juice from the leaves as a remedy for snake bites and the smoke from burning roots as a treatment for colds. The oil expressed from the leaves is used as an anthelmintic. Rotenone is also used to destroy lice and their eggs and for the treatment of mange.

Derris: Derris is derived from the roots and stems of the plant *derris elliptica* (family Fabaceae) growing in East India and neighboring islands. It contains rotenone, a poisonous crystalline ketone, and toxic resins. Derris is used for the same purpose as Cubé and has the same toxic action.

Nicotine: Nicotine is an oily colorless liquid ($C_{10}H_{14}N_2$). It is made by treating tobacco stems and refuse in which it is present in 0.5 to 9 per cent. It is sold as nicotine sulfate in 40 per cent solution.

Nicotine has not been reported as a skin irritant but ingestion or skin absorption has caused many cases of systemic poisoning and fatalities. Especial care should be exercised to prevent spilling the solution on the skin or clothing as serious symptoms can rapidly ensue. If the skin is soiled with nicotine insecticide it should immediately be flushed with cold water, the clothing changed and the patient be kept at rest for several hours and watched for symptoms of weakness, dizziness, lack of co-ordination, convulsions and collapse.

Scabrin: Scabrin is a thick yellowish oily liquid isolated from the genus *Heliopsis* (oxeye) which is said to be more deadly against the housefly than pyrethrum. It is a recent insecticide and cases of dermatitis have not as yet been reported from it.

CHEMICAL PESTICIDES

These may be classified as inorganic and organic.

The principal inorganic pesticides are the arsenicals, the fluorides, hydrocyanic acid and the cyanides, copper salts and lime.

ARSENICALS

Arsenic is an ingredient of a great many insecticides and fungicides and is one of the principal ingredients of agricultural sprays and powders.

The principal arsenicals used in insecticides are calcium and sodium arsenate and arsenite, arsenic trioxide, manganese arsenate, and Paris or Schweinfurt green, a double arsenite plus copper acetate ($3\text{Cu}(\text{AsO}_2)_2 + \text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_2$), Scheel's green (copper arsenite) and lead arsenate.

Many observers have reported that exposure to arsenic causes dermatitis, melanosis, epidermal hyperplasia, particularly in the form of keratoses of the palms and soles, although they may occur elsewhere on the body. The keratoses may in rare instances undergo malignant changes.

Vesicular or vesico-bullous dermatitis with crusting, localized especially on the lower part of the abdomen, groins and the thighs have been reported. Ulceration of the skin and of the nasal septum have also been reported among many arsenic workers.

Workers loading arsenic or its compounds into railroad cars, bags or barrels, sometimes suffer with generalized dermatitis, melanosis or hyperkeratosis similar to that seen following the ingestion of arsenic. Those engaged in mining and smelting arsenic ores may also be similarly affected.

In studies in a chemical plant making arsenical insecticides and employing about 65 workers, 4 cases of dermatitis of the hands and forearms were noted. There were erythematous, papular, vesicular and scaly lesions. Patch tests performed with white arsenic, lead arsenate, and calcium arsenate in pure form showed a positive reaction after twenty-four hours only to calcium arsenate. The calcium arsenate contained from 10-12 per cent of lime as an impurity from its manufacture, and it was likely that the dermatitis and patch test reaction may have been due to the lime.

Dermatitis from arsenic occurs among the handlers and users of arsenicals. Cases of arsenic poisoning resulting from eating vegetables sprayed with arsenic have been reported, but there have been no such cases reported from eating fruit sprayed with the arsenicals. In the citrus growing States the use of arsenicals on citrus trees is forbidden because it masks the sugar content. Some States have passed stringent laws for the removal of insecticide sprays from fruits and vegetables before they are shipped to market.

The arsenical insecticides are used not only as sprays for fruit and vegetables but also to combat locusts, treat mange among domestic animals and kill cockroaches and bed bugs.

Cases of dermatitis have been reported among the users of insect powders containing arsenic and among men employed in spreading arsenic for the destruction of grasshoppers. The arsenical insecticides are also used for the destruction of mosquitos by spreading over swampy areas and dermatitis has been reported from Paris green among workers employed in such work.

FLUORIDES

Sodium fluoride is used in cockroach powders, moth killers and ant poisoning. It can cause inflammation of mucous membranes and ulceration and perforation of the nasal septum. It can also cause deep ulcers of the hands and fingers which are difficult to heal. The treatment for these ulcers is curettage of the base to remove all traces of fluoride and a covered aseptic dressing. Injections of calcium gluconate under the burned skin formerly advocated by some have not proved of any value.

Sodium silico fluoride is used for agricultural sprays although its use is prohibited in some parts of the U. S. because of the danger of poisoning to consumers.

HYDROCYANIC ACID AND CYANIDES

Hydrocyanic acid and the cyanides are used to destroy rodents and insects on ships and houses and to fumigate trees and vineyards.

The principal danger from hydrocyanic acid and the cyanides is systemic poisoning and death. However, copper cyanide, calcium cyanide, potassium and sodium cyanide are primary skin irritants and can cause dermatitis and ulceration.

LIME

Quick lime (CaO) is highly caustic and can cause dermatitis and ulcers, but it is not used as such in agriculture. Slaked lime, Ca(OH)_2 is used and while it can cause dermatitis, it is not as caustic as is the unslaked or quick lime. When exposed to the air as it is when dusted or sprayed on plants it is slowly converted into the harmless calcium carbonate.

ORGANIC INSECTICIDES

The principal organic insecticides are the organic phosphates, the chlorinated hydrocarbons, the thiocyanates and the phenyl mercuric salts.

THE ORGANIC PHOSPHATES

The organic phosphates are widely used and highly toxic.

Parathion (o. o.-diethyl o-p-nitrophenyl thiophosphate) is an organic phosphate used to spray or dust plants and trees against agricultural pests. It is toxic to workers who make it and to those who spray or dust it. It can be absorbed through the skin and mucous membranes and in the body destroys cholesterinase activity permitting the accumulation of acetylcholine. It irritates the skin and mucous membranes. The symptoms of poisoning consist of lacrimation, visual disturbance, contracted pupil, headache, dizziness, dyspnoea and sweating.

The suggested treatment consists in subcutaneous injection of 1/60 gr. of atropine. Plasma cholesterinase determination should be made periodically in workers exposed to the organic phosphates.

Tetra ethyl pyrophosphate, tetra ethyl tetraphosphate, and hexa ethyl tetraphosphate are organic phosphates used for the same purposes as is Parathion. They are just as toxic as Parathion causing similar symptoms. Airplane pilots spreading them have been poisoned and crashed. Pilots spreading the organic phosphates should not expose themselves by assisting in loading hoppers. They should inspect the hoppers for leaks before filling. They should wear clean dustproof or waterproof clothes everyday and immediately change contaminated clothes. They should wear gas masks or respirators while spreading the pesticides and fly crosswind beginning at the end of the field toward which the wind is blowing and working upwards. After work they should bathe and change to clean clothes. Gas masks should be inspected to see that they fit and that they do not leak, because workers wearing ill fitting gas masks while spraying an aerosol spray of 10 per cent TEPP in 90 per cent methyl chloride were poisoned.

CHLORINATED HYDROCARBONS

The chlorinated hydrocarbon insecticides are systemic poisons and skin irritants.

The principal chlorinated hydrocarbon insecticides are D.D.T., D.D.D., T.D.E., Lindane, Chlordane and Toxaphene.

D.D.T. (dichlor diphenyl trichlor-ethane) is the most frequently used household pesticide. During World War II it was used for delousing purposes by dusting into the clothing while being worn. It is effective against mosquitoes, bed bugs, fleas and flies, although it has not a rapid knock down power. It is of relative low toxicity, but can cause allergic dermatitis.

Clothes and bedding sprayed with it have been the cause of dermatitis. Patch tests performed on 200 random subjects with D.D.T. powder showed reactions on 3 per cent of them. Mixtures of D.D.T. and Lindane used in electric vaporizers may cause dermatitis and respiratory symptoms. Food contaminated by the spray has caused poisoning. The solvents used in D.D.T. sprays may also cause toxic symptoms and dermatitis. D.D.D. is dichloro-diphenyl-dichloro ethane and T.D.E. is tetrachloro diphenyl ethane. They have toxic properties similar to D.D.T.

BENZENE HEXACHLORIDE (LINDANE)

Gamma benzene hexachloride (BHC) may be used as dusts, wettable powders, in solutions of organic solvents and as a constituent in paints. It is an insecticide, insect repellent and delousing agent used on cattle.

Cutaneous absorption from oil solutions can occur. Absorption from dusts on the skin can also occur. This should be borne in mind when using it as a powder on the skin for delousing purposes.

The gamma isomer is twice as toxic as D.D.T. The other isomers are less toxic, but the gamma isomer is more quickly eliminated from the body and beta is longest stored.

Lindane is a primary skin irritant and mucous membrane irritant. Death of cattle from sprays and dips of Lindane have been reported. Liver damage is the most prominent feature.

Workers exposed to the dust of bagging operation have had irritation of the skin and mucous membranes.

Workers applying a solution of Lindane in a petroleum solvent have been affected with systemic symptoms from inhalation of the spray.

Dermatitis has been reported in about 20 per cent of workers grinding and mixing the chemical, but recovery took place in all and »hardening« in most of them.

Chlordane, (C₁₀H₆Cl₈), is a viscous liquid especially recommended to kill grasshoppers. It is a powerful skin irritant and systemic poison.

Toxaphene, C₁₀H₁₀Cl₈, is similar to chlordane and has caused the death of some people who ate vegetables that had been sprayed with it.

Other less used but toxic chlorinated hydrocarbon pesticides are: hexachloro-cyclohexane, x,x, dichloro diphenyl ether, Aldrin and Dieldrin.

THIOCYANATES

The thiocyanates are powerful insecticides. In strong concentration they are primary skin irritants and in lower concentration they are sensitizers. They are often mixed with pyrethrum and derris and used as cattle sprays.

The principal thiocyanates are:

Lethane (Butyl carbitol thiocyanate)

Thanite (Isobornyl thiocyano acetate)

Kessocide (Alphanaphthyl isothiocyanate)

Beta thiocyanooethyl laurate

PHENYL AND ETHYL MERCURIC SALTS

These are used principally as anti-mildews, seed disinfectants and wood preservatives. They are primary skin irritants, sensitizers and systemic poisons.

MISCELLANEOUS PESTICIDES

Besides the classified pesticides described above, the following are used in considerable quantities.

Di nitro orthocresol (Antinonin) is used in solutions of its ammonium, potassium and calcium salts, as a weed killer and insecticide.

Exposure to it causes the skin to become yellow and dermatitis may follow. It is also a systemic poison causing rapid pulse and respiration, high basal metabolism and dyspnoea.

Benzol is used chiefly as an insecticide on tobacco. Dermatitis may be caused by it, but the more serious hazard is systemic poisoning.

Nitro and azo benzols are extensively used insecticides and are skin irritants and systemic poisons.

INSECT REPELLENTS

Insect repellents are used to repel insects from cattle and humans.

There is no single chemical or mixture which is a universal insect repellent. Since they are used directly on the skin of humans and animals and on clothing they must not be skin irritants, they must be low in toxicity and low in allergenicity. The same is true of the vehicle in which they are used, whether ointment, liquid or powder.

Before any new pesticides or repellents are placed on sale, the manufacturer should do studies on animals, to determine their toxicity by way of ingestion, skin absorption, inhalation and injection. If found to be toxic or irritant, it should be so labelled and directions for safe use should be included as well as directions for first aid. If they are to be used on the skin or clothing, skin patch tests should be done on animals and humans to determine their possible skin irritant and sensitizing properties.

In performing patch tests with insect repellents it must be remembered that the vehicle may be a primary skin irritant, especially if it is a solvent. Therefore covered patch tests sealed on the skin should not be performed with solutions in irritant solvents, but rather open patch tests from which the solvents can evaporate, or a piece of gauze or flannel immersed in the solution and then allowed to dry before being used as a covered patch. Insect repellents in powder and ointment vehicles can be used as covered patch tests.

Comparatively safe insect repellents.

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|--|---|------------|
| 1. Dimethyl phthalate | } | Mosquitoes |
| 2. Dimethyl carbate | | Flies |
| 3. Indalone | | Gnats |
| 4. Rutgers 612 (2-ethyl-1, 3-hexanediol) | | Chiggers |
| 5. Phenoxy-ethyl acetate | | |
| 6. Diethyl phthalate (on clothing against ticks) | | |
| 7. Rotenone (on clothing against ticks) | | |
| 8. N-hexyl mandelate | | |
| 9. N-n-butylacetanilide | | |
| 10. N-n-amyl carbamide | | |
| 11. N-propyl-N,N-diethyl succinamate | | |

PREVENTION OF DERMATITIS FROM PESTICIDES
AND FERTILIZERS

1. Manufacturers of these chemicals should have studies made of their toxic and skin irritant properties. Those found to be toxic or skin irritants should be so labelled and directions for safe use, the antidote if any as well as directions for first aid should be printed on every container.

2. *Dusts and powders:* Special care should be taken to avoid excessive inhalation or skin contact when handling, mixing or applying toxic dusts and powders. Protective measures sufficient to keep the material out of the eyes and mouth and away from the sensitive parts of the body should be used. A change of the clothing after each days operation and the usual practice of washing the face and hands after using these formulations and before eating should be rigidly followed. Containers in which they are kept or stored should be plainly labeled and kept out of the reach of children, animals and irresponsible persons. Unused portions of these preparations and the containers in which they have been mixed should be treated in the same fashion.

3. *Emulsions and liquids:* Persons handling toxic emulsions and liquids (especially concentrates) should wear protective clothing and use suitable equipment. In formulating and mixing operations, the user should combine adequate ventilation with protective equipment and clothing, including respirators, goggles, solvent-resistant gloves, aprons and boots. In field mixing operations, he should wear protective gear to prevent excessive skin and respiratory exposure. Material splashed or spilled on the clothing, on exposed portions of the body, or in working areas should be removed immediately. When inflammable or volatile solvents are present in the formulation, the customary precaution concerning smoking, exposed flames, and defective electrical equipment should be observed.

4. *Sprays and mists:* Persons engaged in extensive spraying or fogging operations should wear respirators which protect the vulnerable parts of the face. Protective clothing should be supplemented with skin lotions or ointments on body surfaces exposed to solvents and other irritants in the formulation.

Clothing wetted with mists or sprays should be changed immediately, and a bath, followed by a complete change of clothing, is advised after each day's operation. Residual liquid in spray tanks and the washings from spray equipment should be emptied in places where they will not drain into wells, streams, or ponds accessible to human beings, animals or fish.

5. The consumers of fresh vegetables and fruits should be aware of the fact that they have been treated with pesticides and that small amounts are still adhered to them even as sold in the markets. Therefore, fresh vegetables and fruits should be washed by the consumer before they are eaten raw or cooked.

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OŠTEĆENJA KOŽE UZROKOVANA SREDSTVIMA ZA GNOJENJE I ZA UNIŠTAVANJE ŠTETOČINJA

Ovdje se u prvom redu radi o opasnostima, kojima su izvrgnuti zemljoradnici, cvječari i stočari.

Mnoge kemikalije, koje se upotrebljavaju kao gnojiva i sredstva za uništavanje štetočinja, ne podražuju samo kožu, nego su istovremeno i otrovne za organske sisteme.

GNOJIVA

Gnojiva su doduše potrebna za poboljšanje usjeva, ali ona često uzrokuju dermatoze.

Prirodna gnojiva su stajski gnoj, pudreta, guano, sušeni riblji otpaci, sušena krv, mljevene kosti i biljni otpaci kao komina pri proizvodnji ulja iz ricinusovih zrna i lanenog sjemena.

Kemijska gnojiva su nitrati, fosfati i kalcijed cijanamid.

Pod *stajskim gnojem* razumijevamo izmetine konja, stoke ili peradi. Rukovanje gnojivima, naročito razbacivanje rukom, može izazvati bolest sličnu antraksu s edemom na licu, vratu i prsima i s porastom temperature. Od stajskog gnoja može se dobiti i tetanus.

Pudreta je gnojivo u prahu napravljeno od mješavine ljudskih izmetina, drvenog uglja, gipsa, fosfata i živog vapna. Može izazvati dermatitis, naročito ako se sipa rukom.

Guano se sastoji iz djelomično istrulih izmetina morskih ptica. Bogat je fosfatima i dušičnim tvarima. Nema podataka o tome, da izaziva dermatitis.

Rukovanje *ribljim i životinjskim otpacima* kao gnojivom može izazvati erisipeloidna oboljenja.

Komina od ricinusovih zrna i lanenog sjemena proizvodi se iz preostalog tvrdog materijala, pošto je ulje potpuno istisnuto iz zrna, odnosno sjemena. Lupina ricinurova zrna sadržava »ricin«, podražujuću tvar, koja može izazvati dermatitis i astmu ne samo kod onih, koji njome rukuju, već čak i kod onih, koji žive u susjednim područjima, u koja je može prenijeti vjetar.

Nitratna i fosfatna gnojiva mogu uzrokovati dermatitis, ispućanu kožu i čireve na rukama.

Kalcijev cijanamid (CaCN₂) dobiva se paljenjem kalcijeva karbida u dušičnoj atmosferi. Pravi se u velikim pećima u obliku tamne mase zvane »pig«. Ta se masa razbija i drobi u prah. Prije nego se stavlja u vrećice i transportira zemljoradnicima, miješa se s vodom, da bi se smanjila količina vapna i eliminirao kalcijev karbid, koji je možda zaostao. Zatim se miješa s uljem, da bi se vezala prašina. Usprkos tim mjerama opreza javlja se dermatitis ne samo među radnicima, koji proizvode kalcijev cijanamid, nego i među onima, koji ga upotrebljavaju kao gnojivo. Dermatitis kod zemljoradnika, koji upotrebljavaju kalcijev cijanamid, može biti uzrokovan kako njim

samim, tako i vapnom i karbidom, koji u njemu ostaju, a i proizvodima raspadanja u flu, naročito amonijakom, fosfinom, cijanovodikom i sumporovodikom.

Dermatitis se obično proširi na licu i na sluznicama očiju, nosa i ustiju. Lice postaje crveno i oteče, a isto tako i oči, usne i jezik. Čak i grlo može biti zahvaćeno. Ti se simptomi naročito lako javljaju kod onih, koji istovremeno piju alkoholna pića. Slično se događa i kod radnika, koji su izvrnuti tetrametil- i tetraetil-tiuramsulfidu (koji se upotrebljava pod nazivom TTD ili antabuse za liječenje kroničnog alkoholizma).

Prodre li prašina kalcijeva cijanamida kroz odijelo, mogu nastati upale spolovila, struka, zglobova i svih dijelova tijela, gdje ima trenja i znojenja. Mogu se javiti i simptomi kao što su glavobolja, dispnoa i tahikardija.

SREDSTVA ZA UNISTAVANJE ŠTETOČINJA

Poljoprivredna sredstva za uništavanje štetočinja su tvari, koje se upotrebljavaju za zaštitu usjeva od insekata i bolesti bilja. U današnjem razvoju poljoprivrede ona su potrebna za razvoj usjeva.

Stara, pouzdana, razmjerno bezopasna sredstva za uništavanje štetočinja kao na pr. ulja topljiva u vodi, vapno, modra galica, sumpor, buhač, deris i t. d. nisu više dovoljna da suzbiju štetočinke i bolesti, koje napadaju usjeve.

Stara, nesumnjivo otrovna sredstva za uništavanje štetočinja, kao na pr. arsenati i nikotin, još se uvijek mnogo upotrebljavaju, a pridošla su sada i nova, vrlo otrovna sredstva, kao na pr. organski fosfati, benzol-heksaklorid, paration i t. d. Čak i otapala, koja se upotrebljavaju, da bi se od njih napravile rastopine potrebne za prskanje, također su otrovna i podražuju kožu.

Ta nova sredstva su u mnogom pogledu efikasnija za uništavanje izvjesnih štetočinja nego stari insekticidi, ali neiskusni, mali vrtljar treba da ih izbjegava, jer iziskuju specijalno znanje za bezopasno rukovanje.

Ta sredstva ne samo što mogu uzrokovati dermatitis i respiratorne simptome među radnicima, koji ih proizvode i upotrebljavaju, nego se čak i simptomi astme pojavljuju u okolnim predjelima zbog prenošenja vjetrom.

Sredstva za uništavanje štetočinja mogu se podijeliti na prirodna i kemijska.

Glavna prirodna sredstva su buhač, deris i nikotin. Korijen kukurijeka, sjeme delfinija, kvasia-ekstrakt i sjeme sabadile imaju, istina, izvjesne insekticidne osobine, ali se rijetko upotrebljavaju.

Buhač. Buhač se mnogo upotrebljava kao sastavni dio sredstva za prskanje i prašenje protiv muha, komaraca, žohara, ali i poljoprivrednih insekticida i sredstava za prskanje stoke protiv gamadi i bolesti. Dobiva se iz *Chrysanthemum pyrethrum* i *Pyrethrum cinerarisfolium*, koji se uzgajaju zbog svog insekticidnog djelovanja u Evropi, Aziji, Australiji i Americi. Aktivni insekticidni principi su *pyrethrum* I i II.

Buhač paralizira neuromuskularni sistem insekata. Kad se upotrebljava kao prašina protiv kukaca miješa se s boraksom, natrijevim fluoridom, naftalinom, arsenom i t. d. Kad se upotrebljava u tekućoj formi za prskanje, otapa se u destiliranom petroleju i miješa s kemikalijama kao što su letan, deris, citronela, borovo ulje, cedrovo ulje i t. d.

Buhač je jak senzibilizator kože i može uzrokovati dermatitis među radnicima, koji proizvode, stavljaju u bočice i pakuju insekticide, kao i među onima, koji ih upotrebljavaju.

On je isto tako i otrov za ribe i često je uzrokovao ugibanje riba u ribnjacima u prskanim područjima. Otrovan je za kuniće i pse, ako se daje hipodermalno ili intravenozno.

Kube: Cubé, Cuyi, Cume, Barbasco, Hairi, Neko, Timbo i Stinkwood su imena raznih biljaka u tropima američkog kontinenta, koje se upotrebljavaju kao otrovi za ribe. One pripadaju porodici *Fabaceae*, *Leguminosae* ili *Papilionaceae*, a rodu *Lonchocarpus*. Ta se imena daju katkada i vrsti *Jacquirita* i nekim biljkama iz porodice *Sapindaceae*. Neke biljke iz roda *Lonchocarpus* nalaze se i u Africi i Australiji.

Među identificiranim vrstama roda *Lochocarpus* najbogatiji je na insekticidnom principu *L. nicon*. To je grm, koji se penje ili povija, a može postići visinu od 4 metra. Ima naizmjenice raspoređeno lišće, dugo oko 30 cm, i 7 do 9 manjih listova

dugih 10–13 cm. Donja površina lista pokrivena je svijetloplavim dlačicama. Aktivni principi koncentrirani su u mliječnom, ljutom soku, koji se dobiva iz korijena i stabljike. Lišće biljke ima purgativno djelovanje. Sok se razrjeđuje i upotrebljava za pranje stoke radi odstranjivanja krpelja. Smrvljenim stabljikama praše se mačke i psi, da bi se otjerali paraziti. Isti učinak ima ekstrakt napravljen s vrućom vodom od stabljike i korijena. Kad se mliječni ljuti sok iz korijena stavi u mirnu vodu, on primorava ribe, da isplivaju na površinu i da s otvorenim škrgama hvataju što više zraka. Na taj ih način urođenici hvataju. Najvažniji aktivni sastavni dijelovi su *Rotenon* ($[C_{23}H_{22}O_6]$), *Deguelin* i *Tephrosine*, ali ima i drugih nepoznatih toksičnih sastojina.

Iz Perua se izvozi sušeno korijenje, ali je zabranjen izvoz biljke za uzgajanje u inostranstvu. Kube i Rotenon su senzibilizatori, pa ima podataka o dermatitisu kod radnika, koji ih proizvode i koji prskaju insekticidne rastopine, u kojima se ta sredstva nalaze.

Urođenici upotrebljavaju sok iz lišća kao sredstvo protiv zmijina uboda, a dim pri sagorijevanju korijena kao sredstvo za liječenje prehlada. Ulje, koje se preša iz lišća, upotrebljava se kao sredstvo protiv crijevnih parazita. Rotenon se također upotrebljava za uništavanje ušiju i njihovih jaja kao i za liječenje šuge.

Deris. Deris se dobiva iz korijenja i stabljike biljke *Deris elliptica* (porodica *Fabaceae*), koja raste u Istočnoj Indiji i na susjednim otocima. Sadržava rotenon, otrovni kristalasti keton i toksične smole. Deris se upotrebljava u iste svrhe kao i Kube i ima isto otrovno djelovanje.

Nikotin. Nikotin je uljata bezbojna tekućina ($C_{10}H_{14}N_2$). Dobiva se prerađivanjem stabljike i otpadaka duhana, u kojem je ima od 0,5–9 %. Prodaje se kao nikotinsulfat u 40% otopini.

Nema vijesti o tome, da bi nikotin podražavao kožu, ali su ingestija i apsorpcija kroz kožu uzrokovale mnoga otrovanja organskih sistema i smrtne slučajeve. Naročito treba paziti, da se spriječi prosipavanje otopine na kožu i odijelo, jer se brzo mogu razviti teški simptomi. Ako se koža uprlja nikotinskom rastopinom, treba je odmah isprati hladnom vodom, odijelo promijeniti, a pacijent treba mirovati nekoliko sati i paziti da se ne pojave simptomi slabosti, vrtoglavice, nedostatak koordinacije, grčevi i kolaps.

Skabrin. Skabrin je gusta, žućkasta, uljana tekućina, koja se dobiva iz roda *Helipopsis* i za koju se tvrdi, da ima još ubitačnije djelovanje na muhe nego buhač. To je novi insekticid, i slučajevi dermatitisa još nisu zabilježeni.

KEMIJSKA SREDSTVA ZA UNIŠTAVANJE ŠTETOČINJA

Ta se sredstva mogu podijeliti u anorganska i organska.

Glavna *anorganska sredstva za uništavanje štetočinja* su arsenovi spojevi, fluoridi, cijanovodična kiselina i cijanidi, soli bakra i vapno.

Arsenovi spojevi. Arsen je sastavni dio velikog broja sredstava za uništavanje kukaca i gljivica, pa je jedna od glavnih sastojina sredstava za prskanje i prašenje, koja se upotrebljavaju u privredi.

Glavni arsenovi spojevi, koji služe kao insekticidi, su kalcijev i natrijev arsenat i arsenit, arsenov trioksid, manganov arsenat, parisko ili Schweinfurtsko zelenilo, dvostruki arsenit s bakarnim acetatom ($3Cu[AsO_2]_2 + Cu[C_2 - H_3O_2]_2$), Sheelovo zelenilo (bakarni arsenit) i olovni arsenat.

Mnogi promatrači su zabilježili, da izvirgavanje arsenu uzrokuje dermatitis, melanozu, epidermalnu hiperplaziju, naročito u obliku keratoza na dlanovima i stopalima, iako se keratoze mogu pojaviti i na drugim dijelovima tijela. Kod keratoza može u rijetkim slučajevima doći do malignih promjena.

Zabilježeni su vezikularni i vezikobulozni dermatitisi s krastama, naročito na donjem dijelu abdomena, na slabinama i bedrima. Gnojenje kože i nazalnog septuma je također zabilježeno među mnogima, koji rade s arsenom.

Radnici, koji tovore arsen ili njegove spojeve u vagone, vreće ili bačve, boluju katkada od općeg dermatitisa, melanoze ili hiperkeratoze kao poslije ingestije arsena. Kod onih, koji su zaposleni u rudokopima ili topionicama arsenovih ruda, pojavljuju se slična oboljenja.

Pri proučavanju u jednoj kemijskoj tvornici, koja proizvodi arsenove insekticide, a zaposluje 65 radnika, zabilježena su 4 slučaja dermatitisa ruku i podlaktica s critematoznim, papularnim, vezikularnim i ljuskavim povredama. »Testovi krpica« izvršeni s bijelim arsenom, olovnim arsenatom i kalcijevim arsenatom u čistom stanju dali su pozitivnu reakciju poslije 24 sata samo na kalcijev arsenat. Kalcijev arsenat sadržavao je 10–12% vapna kao nečistoće još od proizvodnje, i vjerojatno su dermatitis i reakcija testa krpice bili izazvani vapnom.

Dermatitis uzrokovan arsenom javlja se kod trgovaca i potrošača arsena. Zabilježeni su slučajevi otrovanja arsenom poslije trošenja povrća prskanog arsenovim spojevima, ali nisu zabilježeni slučajevi otrovanja poslije trošenja voća, koje je njime prskano. U državama, u kojima se uzgajaju limuni i naranče, zabranjena je upotreba arsenovih spojeva. Neke države su usvojile vrlo stroge propise o odstranjivanju insekticidne rastopine s voća i povrća prije nego se prodaju na trgu.

Arsenovi insekticidi ne upotrebljavaju se samo za prskanje voća i povrća, nego i za suzbijanje skakavaca, liječenje šuge kod domaćih životinja i uništavanje žohara i stjenica.

Zabilježeni su slučajevi dermatitisa kod ljudi, koji su upotrebljavali prašak protiv kukaca, u kojem je bilo arsena, i kod radnika, koji su prskali arsenove spojeve za uništavanje skakavaca. Arsenovi insekticidi se isto tako upotrebljavaju za uništavanje komaraca i prskanje močvarnih predjela, pa je zabilježen dermatitis od pariskog zečila kod tih radnika.

Fluoridi. Natrijev fluorid upotrebljava se kao prašak protiv žohara, moljaca i mravi. Može uzrokovati upalu sluznica i gnojenje i perforaciju nazalnog septuma. Isto tako može uzrokovati duboke čireve na rukama i prstima, koji teško cijele. Ti se čirevi mogu liječiti kiretažom baze, da bi se odstranili svi tragovi fluorida, i aseptičnim zavojem. Injekcije kalcijeva glukonata pod ispaljenu kožu, koje su se prije preporučivale, nisu imale efekta.

Natrijev silikofluorid upotrebljava se za poljoprivredna prskanja, iako je njegova upotreba zabranjena u nekim dijelovima SAD zbog opasnosti trovanja potrošača.

Cijanovodična kiselina i cijanidi. Cijanovodična kiselina i cijanidi upotrebljavaju se za uništavanje glodavaca i kukaca na brodovima i u kućama i za zadimljavanje drveća i vinograda.

Glavna opasnost od cijanovodične kiseline i cijanida je otrovanje organskog sistema i smrt. Ipak, bakarni cijanid, kalcijev cijanid, kalijev i natrijev cijanid su primarni iritansi kože i mogu uzrokovati dermatitis i gnojenje.

Vapno. Zivo vapno (CaO) je veoma kaustično i može uzrokovati dermatitis i čireve, ali se takvo ne upotrebljava u poljoprivredi. Upotrebljava se gašeno vapno (Ca(OH)₂); iako ono može uzrokovati dermatitis, nije toliko kaustično kao negašeno ili živo vapno. Kad je izvrgnuto zraku kao na pr. pri gašenju ili prskanju po biljkama, ono se polako pretvara u bezopasni kalcijev karbonat.

Organska sredstva za uništavanje štetočinja. Glavni organski insekticidi su organski fosfati, klorirani ugljikovodici, tiocijanati i fenil-živine soli.

Organski fosfati. Organski fosfati se mnogo upotrebljavaju i vrlo su otrovni.

Paration (o-o-dietil o-p-nitrofenil tiofosfat) je organski fosfat, koji služi za prskanje ili prašenje biljaka i drveća protiv poljoprivrednih štetočinja. Otrovan je za radnike, koji ga proizvode, kao i za one, koji ga prskaju ili praše. Može se apsorbirati kroz kožu i sluznice, pa u tijelu razara djelovanje holesterinaze, dopuštajući na taj način akumulaciju acetilholina. Podražuje kožu i sluznice. Znakovi otrovanja su suzenje, vidne smetnje, stisnuta zjenica, glavobolja, vrtoglavica, teškoće pri disanju i znojenje.

Liječi se supkutanom injekcijom $\frac{1}{60}$ g atropina. Određivanje holesterinaze u plazmi treba vršiti u određenim vremenskim razmacima kod radnika izvrnutih utjecaju organskih fosfata.

Tetra-etil-pirofosfat, tetra-etil-tetrafosfat i heksa-etil-tetrafosfat su organski fosfati, koji služe u iste svrhe kao paration. Oni su isto tako otrovni i uzrokuju slične sim-

ptome. Bilo je slučajeva da je kod pilota u avionima, koji su ih sipali, došlo do otrovanja i oni su se srušili na zemlju. Piloti, koji sipaju organske fosfate, ne treba da pomažu pri punjenju rezervoara. Prije punjenja treba da izvrše kontrolu rezervoara, da vide ne propušta li gdje. Oni treba da svaki dan nose čisto odijelo nepropustljivo za prašinu i vodu i da pri povratku s leta odmah svuku zagađeno odijelo. Treba da nose maske ili respiratore za sipanje insekticida i da lete protiv vjetera na taj način, da počnu prskati na onom kraju polja, prema kojem vjetar puše. Poslije završenog rada moraju se okupati i presvući. Maske treba pregledati, da se vidi, da li pristaju i ne propuštaju li, jer se događalo, da su se otrovali radnici, koji su nosili neispravne maske, a prskali su acrosolsku mješavinu (10% tetra-etil-pirofosfata i 90% metil-klorida).

Klorirani ugljikovodici. Insekticidi proizvedeni od kloriranih ugljikovodika su otrovni za organske sisteme i podražuju kožu.

Glavni insekticidi od kloriranih ugljikovodika su DDT, DDD, TDE, Lindan, Klor-dan i Toksafin.

DDT (diklor-difenil-triklor-etan) je sredstvo za uništavanje gamadi, koje se naj-češće upotrebljava u kućanstvu. U toku Drugoga svjetskog rata upotrebljavao se za razušivanje prašenjem odjeće za vrijeme njene upotrebe. Uspješno uništava komarce, stjenice, buhe i muhe, iako nema naročito brzo djelovanje. Relativno je slabo toksičan, ali može uzrokovati alergijski dermatitis.

Bilo je slučajeva, gdje su odijelo i posteljno rublje, koji su bili prskani DDT-jem, uzrokovali dermatitis. Testovi krpica izvršeni s DDT-jem na 200 slučajeva sakupljenih osoba pokazali su reakciju u 3% slučajeva. Mješavine DDT i Lindana (benzen-heksa-klorida), koje se upotrebljavaju u električnim raspršivačima, mogu uzrokovati dermatitis i respiratorne simptome. Hrana zagađena tom mješavinom također je izazvala otrovanja. Otapala, koja se upotrebljavaju u mješavini za prskanje DDT-ja, mogu isto tako uzrokovati toksične simptome i dermatitis. DDD je diklor-difenil-dikloretan, a TDE tetraklor-difenil-etan. Oni imaju slične toksične osobine kao DDT.

Benzen-heksaklorid (Lindan). Gama-benzen-heksaklorid (BHC) može se upotrebljavati u obliku praška u rastopinama organskih otapala i kao sastavni dio boja. To je insekticid, sredstvo za tjeranje kukaca i sredstvo za razušivanje stoke.

Kod uljnih rastopina može doći do apsorpcije preko kože isto kao i do apsorpcije na koži. O tom treba voditi računa, kad se upotrebljava kao prašak na koži za razušivanje.

Gama-izomer dva puta je toksičniji nego DDT. Drugi izomeri su manje toksični, ali se gama-izomer najbrže izlučuje iz tijela, a beta-izomer ostaje najdulje u tijelu.

Lindan je primarni iritans kože i sluznica.

Bilo je slučajeva, da je ugibala stoka od prskanja Lindanom ili umakanja u Lindan. Glavna karakteristika je oštećenje jetre.

Među radnicima izvrnutim prašini pri punjenju vreća bilo je slučajeva iritacije kože i sluznica.

Radnici, koji su prskali rastopinu Lindana u petroleju, trpjeli su od otrovanja organskih sistema zbog udisanja rastopine.

Kod oko 20% radnika, koji su bili zaposleni pri drobljenju i miješanju kemikalije, zabilježen je dermatitis, ali su svi ozdravili, a većina ih je ostala imuna.

Klordan ($C_{10}H_6Cl_8$) je viskozna tekućina, koja se specijalno upotrebljava za uništavanje skakavaca. Jako podražuje kožu i otrovan je za organske sisteme.

Toksafin ($C_{10}H_{10}Cl_8$) je sličan Klordanu i uzrokovao je smrt nekih ljudi, koji su jeli njime prskano povrće.

Drugi toksični klorirani ugljikovodici, koji se manje upotrebljavaju kao sredstva za suzbijanje gamadi, jesu heksaklor-cikloheksan, x-x-diklor-difenil-eter, Aldrin i Dieldrin.

Tiocijanati. Tiocijanati su jaki insekticidi. U jakoj koncentraciji su primarni iritansi kože, a u slabijoj koncentraciji senzibilizatori. Često se miješaju s buhačem i derisom i upotrebljavaju za prskanje stoke.

Glavni tiocijanati su Letan (butil-karbitol-tiocijanat), Tanit (izobornil tiocijano-acetat), Keskocid (alfa naftil-izotiocijanat) i beta-tiocianoetil-laurat.

Fenilne i etilne živine soli. Upotrebljavaju se u prvom redu kao sredstva za suzbijanje snijeti, za dezinfekciju sjemenja i za očuvanje šuma. Primarni su iritansi kože, senzibilizatori i otrovi za organske sisteme.

Razna sredstva za suzbijanje štetočinja. Pored naprijed klasificiranih insekticida ima i drugih, koji se upotrebljavaju u znatnim količinama.

Dinitro-ortokrezol (Antinonin) upotrebljava se u rastopinama svojih amonijevih, kalijevih i kalcijevih soli za uništavanje korova i štetočinja. Koža, koja mu je izvrgnuta, postaje žuta, a može se pojaviti i dermatitis. On je isto tako otrovan za organske sisteme i uzrokuje nagli puls i disanje, visoki bazalni metabolizam i teškoće pri disanju.

Benzen se upotrebljava naročito kao insekticid na duhanu. Može uzrokovati dermatitis, ali najveća opasnost prijti od otrovanja organskih sistema.

Nitrobenzen i azobenzen se mnogo upotrebljavaju za uništavanje štetočinja. Izazivaju iritaciju kože i otrovanje organskih sistema.

Sredstva za tjeranje kukaca od ljudi i životinja. Nema kemikalije ili mješavine kemikalija, koja bi se mogla upotrebiti kao opće sredstvo za tjeranje insekata. Budući da se upotrebljavaju neposredno na koži ljudi i životinja kao i na odjeći, ta sredstva ne smiju iritirati kožu, moraju biti niskog toksiciteta i niskog alergijskog djelovanja. To isto vrijedi i za sredstva, pomoću kojih se upotrebljavaju, bilo da su to masti, tekućine ili prašci.

Prije nego se koje novo sredstvo za uništavanje ili tjeranje štetočinja stavi u promet, proizvođač treba da izvrši ispitivanje na životinjama, da ustanovi njegov toksicitet prilikom ingestije, apsorpcije preko kože, inhalacije ili injekcije. Ako se ustanovi, da je sredstvo otrovno ili da podražuje, mora se to izvana označiti i priložiti uputa za bezopasnu upotrebu i prvu pomoć. Ako se takva sredstva moraju upotrebljavati na koži ili odijelu, treba izvršiti test krpica na ljudima i životinjama, da bi se ustanovile njihove osobine u pogledu podraživanja i senzibilizacije kože.

Kad se vrši test krpica sa sredstvima za tjeranje insekata, ne treba zaboraviti, da bi i vehikul, pomoću kojeg se takvo sredstvo upotrebljava, mogao i sam biti primarni iritans za kožu, naročito ako je otapalo. Zato pokrivene testove krpica slijepjenih na koži ne treba izvoditi s rastopinama u iritantnim otapalima, nego naprotiv treba izvoditi otvorene testove krpica, iz kojih se otapala mogu ispariti, ili pak pomoću komada gaze ili flancla umočenog u rastopinu, a zatim posušenog prije nego se upotrebi za pokriveni test krpica. Sredstva za tjeranje insekata u obliku praška ili masti mogu se upotrebljavati za pokriveni test krpica.

Razmjerno bezopasna sredstva za tjeranje insekata su ova:

- | | |
|--|--|
| 1. Dimetil-ftalat | } Protiv raznih vrsta komaraca, muha i krpelja |
| 2. Dimetil-karbat | |
| 3. Iudalon | |
| 4. Rutgers 612 (2-etil-1, 3-heksandiol) | |
| 5. Fenoksi-etil acetat | |
| 6. Dietil-ftalat (na odijelo protiv krpelja) | |
| 7. Rotenon (na odijelo protiv krpelja) | |
| 8. N-heksil mandelat | |
| 9. N-n-butilacetanilid | |
| 10. N-n-amil karbamid | |
| 11. N-propil-N, N-dietil sukcinat | |

SPREČAVANJE DERMATITISA UZROKOVANIH SREDSTVIMA ZA GNOJENJE I UNIŠTAVANJE ŠTETOČINJA

1. Proizvođači tih kemikalija moraju izvršiti ispitivanja njihova toksiciteta i iritirajućeg djelovanja na kožu. One, za koje se ustanovi, da su toksične ili iritansi kože, treba tako označiti, a na svakom omotu štampati uputstva za njihovu bezopasnu upotrebu kao i uputstva za prvu pomoć.

2. *Prašci:* Treba naročito paziti da se izbjegne prejaka inhalacija ili dodir s kožom pri rukovanju, miješanju ili primjeni toksičnih prašaka. Treba upotrebljavati zaštitne

mjere, koje će spriječiti ulaz tih prašaka u oči, usta ili druge osjetljive organe tijela. Treba se stoga pridržavati pravila, da se po završetku dnevnog zadatka promijeni odijelo i da se operu ruke i lice, kadgod se ta sredstva upotrebljavaju, kao i prije jela. Omoti, u kojima se ta sredstva čuvaju, moraju biti jasno označeni i držani na mjestima nepristupačnima djeci, životinjama i neodgovornim osobama. S neupotrebljenim količinama tih preparata i posudama, u kojima su bili miješani, treba postupiti na isti način.

3. *Emulzije i tekućine:* Osobe, koje rukuju toksičnim emulzijama i tekućinama (naročito koncentratima), moraju nositi zaštitna odijela i odgovarajuću opremu. Prilikom mjerenja i miješanja treba kombinirati odgovarajuću ventilaciju sa zaštitnom opremom i odijelom, uključujući respiratore, naočari, kecelje i čizme. Pri miješanju na terenu treba nositi zaštitnu opremu, da bi se spriječilo prejako izvirgavanje kože i organa za disanje. Treba smjesta odstraniti materijal, koji se razlije po odijelu ili na izloženim dijelovima tijela i u radnim prostorijama. Ako u formuli ima upaljivih ili hlapljivih otopina, treba se pridržavati uobičajenih mjera opreza u pogledu pušenja, plamena i defektnog električnog uređaja.

4. *Prskanje i zamagljivanje:* Osobe, koje vrše prskanje i zamagljivanje većih razmjera, moraju nositi respiratore, koji pokrivaju sve osjetljive dijelove tijela. Zaštitnim odijelima treba dodati rastopine i masti za površinu kože izvrgnute djelovanju otapala i drugim podražljivim sredstvima u mješavini.

Odijela ovlažena maglami ili prskanjem treba odmah promijeniti, a na kraju radnog dana treba se okupati i potpuno promijeniti odijelo. Preostalu tekućinu u rezervoarima, kao i vodu, kojom se ispire aparatura za prskanje, treba isprazniti na mjestima, gdje ne postoji opasnost da uđe u zdence, rijeke ili ribnjake pristupačne ljudima, životinjama ili ribama.

5. Potrošači svježeg povrća i voća treba da vode računa o tome, da je ono bilo prskano ili prašeno sredstvima za uništavanje štetočinja i da se u tom slučaju male količine tih sredstava drže na voću i povrću još i u vrijeme njihove prodaje. Zato treba svježe voće i povrće oprati, prije nego se jede sirovo ili kuha.

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