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AGRO-INPUTS BUSINESS MANUAL – PART 2

SEED AND CROP PROTECTION PRODUCTS

AGRICULTURAL GROWTH PROGRAM – AGRIBUSINESS AND MARKET DEVELOPMENT (AGP-AMDE ETHIOPIA)

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CONTENTS

CHAPTER 1.

IMPORTANCE OF IMPROVED SEEDS

THE PROVERB "YOU REAP WHAT YOU SOW" SIGNIFIES THE IMPORTANCE OF SEED.

Seed is living matter, the starting point in crop production and one of the most important agricultural inputs. Yields of crops can be doubled or tripled by using recommended improved seeds, particularly in the case of hybrid seeds, instead of traditional seeds retained and replanted by farmers from their previous harvests.

Improved seeds are those with production potential enhanced through breeding, and other favorable characteristics added such as disease resistance.

It is important to remember that improved seed alone is not sufficient to give the desired increased crop yields. Farmers should also use a package of modern agricultural practices and yield-enhancing inputs, such as fertilizers.

While the seed is central to plant reproduction, there are several parts of the plant that can act as the "seed" and, when planted under favorable conditions, are capable of reproducing the parent plant. It must be remembered that the basic objective of a plant is to reproduce.

Maize grown using improved seed.

PLANT REPRODUCTION

Reproduction is the basic objective of the plant. Other than seed, several parts of the plant can also reproduce the plant as outlined below.

GRAIN

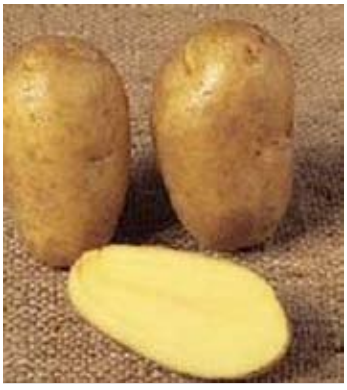
Matured and fertilized ovule (grain) used as food is often replanted as seed.

STEM

Part of the stem (stem cutting) can grow into a plant, as in cassava and sugarcane.

UNDERGROUND STEM

Underground stems, which grow horizontally in the soil and send up leaves and flowers at intervals, also yield new plants. Examples include ginger and flowers like the iris.



TUBERS

Tubers are another type of underground stem developed by certain plants such as yams and potatoes, for food and water storage.

SUCKERS

Small offshoots or "suckers" from the lower part of the plant grow into new plants, e.g., pineapples, plantains and bananas.

DIFFERENCE BETWEEN SEEDS AND GRAIN

All seeds are grains, but all grain is not seed. Key differences are outlined in the table below.

Table 1. Differentiating Seed From Grain

S/N	SEED	GRAIN
1	Used for planting	Used for food
2	Must remain alive at all times	May or may not be alive
3	Must germinate and produce a normal seedling	May or may not germinate and produce normal seedling
4	Must be uniform in color and other genetic characteristics	Not necessarily uniform in color and other characteristics
5	Good characteristics must be reproducible in subsequent generations	Good traits are not necessarily reproducible
6	Normally treated with toxic chemicals	Not treated with toxic chemicals
7	Must be packaged and sold in closed containers, properly labeled at all times	Not applicable

TYPES OF SEED

OPEN-POLLINATED VARIETIES (OPV)

An open-pollinated variety seed is one in which pollination is carried out by wind, insects, birds or other natural agents. In this process the pollen from either the same (parent) plant or from other plants of the same species gets transferred. Improvements are brought about in desirable traits like adaptability to climate and soil conditions, disease resistance, taste, sugar contents, etc. Examples include maize, sorghum and some vegetable crops.

SELF-POLLINATED CROPS

Those plants that pollinate themselves by accepting pollen from within the flower before it opens are called self-pollinated plants. These crops remain true to type and their purity can be easily maintained. Examples are beans, groundnuts and rice. Crop improvement is achieved by repeated selections.

HYBRID SEEDS

Hybrids (F1) are the first generation of seed developed through controlled cross pollination of one specific variety of a class of plant with the pollen of another genetically different variety of that class. This process enables the seed to be more productive and vigorous – referred to as hybrid vigor. Examples are hybrid maize, sunflower, tomato and vegetables. Seed collected and saved from a hybrid variety is not suitable for use in subsequent years.

GENETICALLY MODIFIED ORGANISMS (GM OR GMO) SEED

Genetic modification is the transfer of specific genes into the plant in a laboratory. These genes may come from distant species of plants, bacteria or even animals. The genes introduced in the plants include the capability to resist herbicides and attacks from certain pest insects. The genes are then inherited by the progeny as if they belonged to the parent plant. An example is biotech cotton.

FARMER SAVED SEED (FSS)

Most farmers save their own seed from their harvests. This should, however, only be done for self or open-pollinating crops. In most cases, FSS is not well cleaned, graded and treated, which leads to problems with weeds, plant diseases and, consequently, low yields. Such farmers continue to use their own saved seed for many years. Through repeated cultivation, seed quality deteriorates from crossing with surrounding inferior varieties, or becomes susceptible to diseases. Seed renewal is therefore critical every three to four years if the farmer is to continue to sustain his/her level of production, and/or profitable farming.

Table 2. Merits of Hybrid Seed Compared to Farmer-Saved Seeds

SEED CHARACTERISTICS	HYBRID	OPV
Yield	Higher crop yields	Lower crop yields
Response to fertilization	Better response to fertilizers	Low response to fertilizers
Disease resistance	Better resistance to disease	Lower resistance to disease
Price of seed	More expensive seed	Less expensive seed
Re-use value	Cannot be re-used due to quick seed deterioration	Can be used for a few (2–3) years

SEED PROCESSING: INTRODUCTION

Seed has to be processed before it is packaged and distributed for sale to the farmers. The four steps in the processing of seed are:

1. **Drying:** Seed received from the field is dried to the required moisture content.
2. **Cleaning:** Seed generally contains a considerable amount of extraneous matter such as pieces of leaves, twigs and other seed, which is removed by sieving, winnowing and other methods. The basic seed cleaning processes are:
    - Pre-cleaning.
    - Fine cleaning.
    - Grading according to shape and/or size.
3. **Treatment:** Seed is treated to protect it during storage and immediately after planting. It is treated with fungicides and insecticides for protection against:
    - Pathogens on the surface of the seed.
    - Soil-borne pathogens.
    - Internal seed-borne fungal pathogens.
4. **Bagging/Packaging:** Processed seed is appropriately packaged in bags and labeled.

SEED TREATMENT

Seed treatment is the application of chemicals on seed to provide protection from disease and pest attacks. It is done for several reasons:

- To preserve the "food value" in the seeds.
- To prevent attack by rodents or insects during storage.
- To protect the embryo in the seed.
- To control some soil-borne bacteria, fungi, nematodes, etc.
- To enhance marketing value of seeds.

CAUTION: TREATED SEED SHOULD NOT BE USED FOR FOOD OR FEED!

SEED PACKAGING

Seed packaging is the packing of seeds to maintain their quality and provide necessary information through labeling. Packaging enhances seed marketability if the right packs are used. Sometimes the attractiveness of the packs also attracts the farmers. Packaging is done for a number of reasons:

- To protect seed against the attack by insects and exposure to moisture.
- To make seed available in quantities suitable for various farm sizes.
- To preserve the efficacy of protective chemicals applied on seed.
- To facilitate seed handling during storage and transportation.
- To permit affixation of identification tags on each seed pack.
- To provide necessary information on the seed pack – seed labeling.

SEED LABELING OR TAGGING

The label is a most important document identifying seed (Table 3) because it provides the quality attributes accompanying the certification tags and seed labels on each pack. All certified seed is tagged or labeled. The following information is mandatory:

- Name of the crop species and variety.
- Lot number and name of producer.
- Purity or the percentage by weight of the named seed.
- Percentage by weight of crop seed (this must be very low or zero).
- Percentage by weight of inert material, non-seed matter.
- Percentage by weight of seeds.
- Germination percentage, or the percentage of pure seed.
- Net weight of the bag or container.
- Date when material was tested.
- Origin or where the seed was grown.
- That the seed is treated, especially when the chemical used is toxic.

Table 3. Information to be Provided on Certified Seed Pack

SEED LABEL	CERTIFICATION TAG
Name of seed producer	Tag number
Seed kind	Seed kind
Class of seed	Emblem of certification agency
Variety name	Name and address of certification agency
Lot number	Variety
Inert matter (maximum)	Lot number
Other crop seed (maximum)	Name and address of registered agency
Weed seed content (maximum)	Seed class
Date of test	Certificate number
Net weight (when packed)	Date of issuance
Seed moisture content (maximum)	Date of test
Germination percentage (maximum)	Validity of certificate
Purity % (minimum)	Extension of validity of certificate (where applicable)

AGRO-ENTERPRISES MUST LOOK FOR ALL OF THE ABOVE SEED QUALITY ATTRIBUTES BEFORE PURCHASING, STOCKING AND MARKETING SEED!

SEED DETERIORATION

Because seed is living, if not handled and stored properly, it "dies" and can no longer function as viable seed that will germinate and grow into healthy plants. The main reasons for seed deterioration are:

- High temperature in the seed storage area.
- High humidity in the storage area.
- High moisture content of the seed itself.

- Storage in improper packaging that allows moisture and dust into the seed package.
- Storage of uncleaned and untreated seed.
- Presence of pests and diseases.
- Natural short-lived seed variety.
- Use of incorrect chemicals for seed treatment.

SEED CERTIFICATION

This is a third party guarantee, issued to a seed lot in the form of a certificate exemplifying certain minimum quality standards under which the seed lot was produced. Seed certification is done in six phases or stages:

1. Receipt and checking of application for certification.
2. Verification of seed source and other requirements of the seed being used.
3. Field inspection to verify if the seed fields met the expected standards.
4. Supervision of postharvest activities including processing, seed treatment and packaging.
5. Seed sampling and testing.
6. Issuance of a certificate to the seed lot and affixing of certification tag and seal to successful containers.

TIPS FOR SEED HANDLING AND STORAGE

Seed is live material and must be handled carefully. Any damage during handling, storage or transportation can adversely affect the seed quality and its germination. Seeds are stored to preserve their planting ability (germination) and vigor.

In order to achieve this, the following guidelines can be used during handling and storage:

- Seed stores should be organized to allow easy access to seed packages at any time.
- Always keep the seed store clean.
- Treat all seeds with chemicals before putting in storage.
- Keep the seed store cool, dry and free from moisture at all times.

- Prevent entry of rodents into seed store.
- Fumigate the seed stores periodically.
- Do not store diseased or insect-infested seed.

IMPROVING HANDLING AND STORAGE OF FARMER-SAVED SEEDS

Most farmers use seed saved from their own crops. To improve the usefulness of FSS, the following steps should be taken by farmers:

- Obtain starting seeds (certified seed) from reputable agro-dealers.
- Plant seeds following the recommended agronomic practices.
- Apply the required amount of fertilizer.
- Control weeds by applying herbicides or by manual weeding.
- Identify the most vigorous/desirable plants during vegetative growth, select the best, well-filled cobs/panicles/pods at maturity and harvest them first to preserve seeds.
- Dry the seed portion of the harvested crop.
- Shell or thresh the dry seed portion first and clean the seeds. Further drying may be necessary after shelling/threshing to reduce moisture to between 12 percent and 14 percent.
- Store the seed in proper packages and treat seed with preserving chemicals.
- Tightly close the seed bags and keep the seed under good ventilated conditions.
- Store away from rain and avoid excessive heat during storage.
- Periodically check seed packages in the store to ensure that insect or rodent attacks are prevented.

TIPS FOR AGRO-ENTERPRISES ON SEED MARKETING

Agro-dealers wishing to improve their turnover from seed business should note the following:

- Know the type and variety of seeds in demand in your area. Such varieties should have the recommendation from the Ministry of Agriculture/research centers.
- Buy seed from reputable seed companies or accredited seed agencies.
- Check the seed packages properly for seed identification labels, which should be affixed on each seed package.
- Check and take note of all the quality characteristics and standards on the label and be sure they are what you require.
- Seed is a living matter; store the seed well, making sure that it is protected from rain and excessive heat.
- Know your seed varieties well (product knowledge) and advise farmers on how and when to plant.
- Provide promotional materials, e.g., brochures and posters to stimulate the farmers' interest in improved seeds.
- Do not sell seed in open containers because most seed is treated with pesticides and herbicides.
- Avoid false or mislabeling information on seed.

Bags of seed properly stored in a warehouse.

CHAPTER 2.

CROP PROTECTION PRODUCTS AND SAFE USE

Crop protection products for sale at an agro-dealer shop.

NEED FOR CROP PROTECTION IN AGRICULTURE

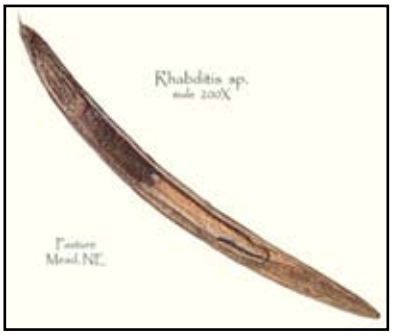
Even if a farmer has used improved seed varieties, applied fertilizers as recommended and irrigated the crop adequately, there is no guarantee that he will be able to reap a good crop. All growing crops are susceptible to damage by pests (insects, diseases, birds, rodents and weeds) and must be protected. If not controlled, pests can cause serious destruction and damage to the crops and thereby loss to the farmer.

There are five main types of pests:

1. **Insects**

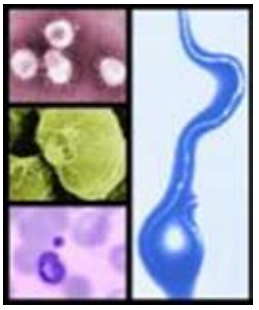
Insects are living organisms without bones and are usually very small in size. They normally have a hard external covering (exo-skeleton), segmented body and jointed legs. Included in this group are beetles, ants, wasps, bees, flies, moths, butterflies, mosquitoes, grasshoppers, crickets, cicadas, aphids, cockroaches, mantids, banana weevils, maize stalk borer, bean weevil, etc. There are about 900,000 known insect species and are found all over the world. They feed on plants, decaying matter and other smaller insects. The plant-eating insects cause enormous damage every year to cereal, vegetable, fruit and other crops.

2. **Nematodes**



Nematodes (worms) are the most numerous multi-cellular organisms and are found in the soil. Some of them are very small (0.3 mm) although there are larger nematodes, 20 to 25 cm, with a few over 8 meters long. Many of them are parasites of insects, plants and animals. While the worms play a beneficial role in the soil through recycling of the nutrients and loosening of the soil, which increases aeration and water retention, the types that are parasites of plants cause considerable damage to crops.

3. **Pathogens**



Pathogens (bacteria, viruses, fungi or parasites) are microscopic organisms that are not normally visible to the un-aided eye. They are disease-causing agents that can infect plants, animals and humans. In the plant, some of the common diseases caused by the pathogens are rust, smut, stalk rot, blight, common scab, canker, leaf spot (necrosis), banana bacterial wilt, maize streak, coffee wilt, etc. These diseases cause considerable loss to the farmers.

4. **Vertebrates**
   These are usually small animals (which have a vertebra or backbone) like rodents (rats, mice), birds, flying-fox and bats. If unchecked, they can cause considerable damage to field crops and fruit orchards. Sometimes larger animals like wild boar, pigs, monkeys and baboons can also damage crops.

5. **Weeds**
   Weeds are unwanted plants that grow in the cultivated area along with the main crop. Weeds compete with the main crop for the available water, space, sunlight and plant foods (nutrients). Weeds can also harbor parasites, insects and pathogenic diseases that are easily passed on to the main crop. Weeds must be controlled or eliminated to allow the main crop to grow and attain its optimum yield potential.

METHODS OF CROP PROTECTION

There are several methods available to the farmer to protect the crop from damage by the pests through all stages of plant growth. However, the effectiveness of various methods differs greatly from one to another.

The methods available for control of pests are summarized:

1. **Agricultural Practices –** Over the years farmers have learned to use agricultural practices (soil tillage and crop rotation) that will make the environment less suitable for pests, planting disease-resistant crop varieties or removing and destroying the pests' habitats (removal of weeds, removal and destruction of plant residues).

2. **Mechanical and Physical Control –** The use of nets, traps, hot water and mechanical aids for weed removal can help control the pests.

3. **Biological Control –** Pests can be controlled biologically through the release of predators or the natural enemies of the pests.

4. **Chemical Control –** The use of toxic chemicals or crop protection products (CPPs) is a very effective and efficient way to control or eradicate pests. Since most of the chemicals used are poisonous, a great deal of care has to be exercised in the use of CPPs.

TYPES OF CPPS AVAILABLE IN THE MARKET

CPPs affect pests in different ways – some are ingested during feeding, others on contact with the skin and some by inhalation. Some insecticides and fungicides applied as granules are taken up by the plant through the roots, and the pest poison is spread throughout the plant (systemic action), which kills the pest when it feeds on the plant. The types of CPPs that can be applied to control the five main groups of pests are shown below.

Table 4. Pest Groups and Types of CPPs

PEST GROUP	CPP	PEST CONTROLLED
Insects	Insecticide	Broad spectrum for all insects
	Acaricide	Narrow spectrum for mites, ticks and spiders
	Miticide	Narrow spectrum for mites
	Molluscicide	Narrow spectrum for mollusks, slugs and snails
Nematodes	Nematicide	For nematodes
Pathogens	Bactericide	For bacteria
	Fungicide	For fungi
Weeds	Herbicide/Weedicide	For weeds
Vertebrates	Rodenticide	For rats and mice
	Avicide	For birds

CPP FORMULATION

CPPs are generally available in concentrated form (active chemical), mostly in small volume, are formulated and made available in a suitable form for application in the field.

This is usually a very strong poison, which cannot be used in the field without a great deal of risk. Therefore, the active ingredient is diluted with the use of solvents or carriers and other products such as surface active agents or special additives where required.

Formulated CPPs are available both in the solid and liquid forms as shown.

SOLIDS

- **Dusts** are finely ground mixtures of active ingredients and fillers that are used for direct application. If the active ingredient is a liquid, it is absorbed in the carrier, dried out and then finely powdered.
- **Granules** are small-sized (2 mm to 5 mm) particles usually made by the absorption of liquid active ingredients on the carrier or filler, granulated and then dried. The granules are used as such in the field.
- **Water-Dispersible Powders** or wettable powders are mixtures of finely powdered active ingredients, fillers and wetting agents, which are intended for mixing with large quantities of water to form suspensions before application.
- **Water-Soluble Powders** are mixtures of finely powdered active ingredients, carriers and surface active agents, which are dissolved in water before use.
- **Baits** are made by mixing the active ingredients with an edible material, which may attract pests, insects or rodents.

LIQUIDS

- **Emulsifiable Concentrates** contain the active ingredient dissolved in a non-water soluble solvent, mixed with an emulsifying agent so that emulsions with water can be prepared before being applied in the field.
- **Suspension Concentrates**, as the name implies, are concentrated suspensions composed of active ingredients (typically insoluble in most solvents) mixed and ground with a solid carrier and then suspended in a small amount of water. This concentrated suspension is diluted with large quantities of water before use.
- **Solution Concentrates** are CPPs that have active ingredients, which are soluble in water or a solvent that is miscible in water. A concentrated solution of the active ingredient is prepared. This solution is diluted with a large quantity of water to form solutions before use.

Various forms of CPPs are available at retail outlets.

SAFETY HAZARDS OF CPPS

CPPs are designed to control or kill living organisms. In addition to eliminating pests, many of them are potent poisons, which can also be very dangerous to:

- People involved in handling, storage, transport and use of CPPs or those who are exposed to CPPs.
- Animals in the field where CPPs are used or are present in the proximity where they can be affected by the drift or they feed on the plants that have been sprayed recently with pesticides.
- Environment.

CPPs can poison human beings or animals in three ways:

- **Dermal** – by coming into contact with the skin and getting absorbed through the skin. This is the most common pathway through which the poison enters the body. The impact of this poisoning is determined by the toxicity of the material, area of skin contaminated, rate of absorption and the time that the material remains in contact with the skin.

- **Nasal** – through inhalation of vapors, dust or mist, the poison enters the lungs and the blood stream. The effect of the poison is more rapid through this route. This occurs mainly when fumes are inhaled during the initial mixing, spraying or dusting of pesticides without adequate protection.
- **Oral** – by the ingestion of the poisonous material through eating and swallowing of contaminated food or drink. Ingestion is the least common means by which poison enters the body. The toxicity of the material and the amount swallowed will determine the seriousness of the impact.

TOXICITY OF CPPS

The toxicity of a CPP (see Table 5) is the extent of adverse effect that it produces when human beings are exposed; the effects could range from a mild headache to acute nausea, bleeding, convulsions and death. If treatment is given quickly, most toxic effects can be reversed.

A one-time exposure or intake leading to poisoning is called acute toxicity. The symptoms of acute toxicity appear in a few minutes and are measured by the amount of the active ingredient per kilogram weight of the test animal that will kill 50 percent of the test animals. Toxicity is expressed as lethal dose (LD50) for oral or dermal toxicity and lethal concentration (LC50) for toxicity through inhalation.

Exposure during a long period of time to non-lethal doses leading to poisoning is called chronic toxicity. In chronic toxicity, the symptoms may appear from one week to one year later. Chronic toxicity is not easily measured.

LEVELS OF ACUTE TOXICITY

Table 5. Measures of Acute Toxicity

LEVEL	SYMBOL OR SIGNAL WORD	LETHAL DOSE	COLOR CODE
I. Highly Toxic	☠ DANGER POISON	From a few drops to 5 mL	
II. Moderately Toxic	**WARNING**	From 5 mL to 30 mL	
III. Slightly Toxic	**CAUTION**	From 30 mL to 500 mL	
IV. Relatively Non-Toxic	**CAUTION**	From 500 mL to 1 liter	

SAFE USE OF CPPS

It is important to remember that the chemicals used in the control or elimination of pests are highly toxic poisons. They can be used safely by carefully following the instructions and guidelines about their proper use. Most of the important instructions are given on the label.

In most countries, CPPs have to be registered and labeled by law. The label should provide all the facts about the product and special instructions to follow for their proper use. If a farmer or a dealer is unable to read or understand the label, it is essential for him/her to request others, including the suppliers, to read the important instructions and to help him understand. Some of the important information provided on the label includes:

- Brand or the name given to the product by the manufacturer.
- List of pests it is to be used to control.
- Chemical name of the active ingredients and their contents by percentage weight and the contents of other material including the filler.
- Formulation type is listed: dust, wettable powder, Emulsifiable concentrate, or granules.

- Signal symbol or word like DANGER POISON (☠), WARNING or CAUTION.
- Net content by weight or volume.
- Name and address of the manufacturer.
- Registration numbers.
- Manufacturing batch/lot numbers with date of manufacture and expiration date.
- Precautionary statements that describe the hazards associated with the active ingredient used in the formulation, the type of protective equipment that must be used for safe handling of that product and symptoms of poisoning.
- Directions for proper use are given in detail to ensure safe handling. It also lists the interval in number of days that must be observed between the date of application and harvest time or pre-harvest interval (PHI).
- Storage and disposal instructions that specify how the product must be stored and the precautions to be observed while disposing of the empty or partly filled packages/containers.

EXAMPLE OF CPP LABEL

FRONT SIDE:

PEST KILL

Emulsifiable Concentrate Insect Spray

Active Ingredient (1, 1 Dimethyl ...).....25%
Inert Ingredient 75%
Total..... 100%

For killing damaging insects on trees, shrubs, flowers, vegetables and fruit.

Keep out of reach of children

WARNING

Store in original container in a secure place out of the reach of children.

Do not re-use container. Rinse several times when empty. Punch a hole in container and dispose in trash.

Hazardous to humans and animals. Do not use, pour, spill or store near heat source or fire.

NET CONTENTS: 500 mL

REVERSE SIDE:

Directions for use:

Mix with 24 liters of water and use with low-pressure sprayers in areas that have been cleared of humans and animals.

Protective clothing – The following must be worn when mixing or spraying PEST KILL:

- Rubber Gloves
- Boots
- Rubber Apron
- Long-Sleeved Shirt and Long Pants
- Goggles

This product is hazardous. If swallowed, induce vomiting to empty the stomach and call a physician immediately. If inhaled, remove victim to an open area with fresh air and call a physician. If it splashes onto skin or into the eyes, wash with plenty of water and get medical attention.

Manufactured by: PEST KILL Company
220 River Bend, East Trans, Ghana

BATCH NUMBER: 2-02-05
USE BEFORE: 2-02-08
REGISTRATION NUMBER: A-225-CPP

TRANSPORTATION OF CPPS

Special care must be exercised while transporting CPPs. The following points must be borne in mind:

- CPPs should never be transported in the passenger cabin of a vehicle.
- CPPs should never be transported in the same large box or container as food or feed products.
- During transit CPPs should not be left unattended.
- CPP packages should be secured in large containers or boxes and placed in the back corner of a truck fastened with ropes.
- At all times CPPs should bear the proper labels.
- If a spill occurs on the road during transit, it should be reported immediately to local authorities.
- The driver of the vehicle should be informed about the precautions and emergency procedures required in the event of accidents.

STORAGE OF CPPS

KEEP CPPS BEYOND THE REACH OF CHILDREN AND ANIMALS

CPPs can be stored safely by observing a few basic rules:

- In handling and storage, care must be taken to avoid breakage and spills. Protective wear, such as eye protection, gloves and rubber shoes, must be used to avoid accidental contact with skin.
- Product should be stored on dunnage or palettes in a well-ventilated room.

CPPs stored in a safely secured area, out of reach of children and animals.

- CPP containers and stacks must be correctly and properly labeled at all times. If products are transferred to other containers for any reason, these must be promptly labeled and put in a secure place by an experienced person.
- CPPs should never be transferred to food or beverage containers even on a temporary basis and should not be stored with food and feed.
- In the shop, CPPs should be stored on shelves with clear labels identifying the products.
- All containers and packages should be checked frequently for leaks. All spills of solid or liquid material should be removed immediately for disposal using proper precautions and protective equipment.

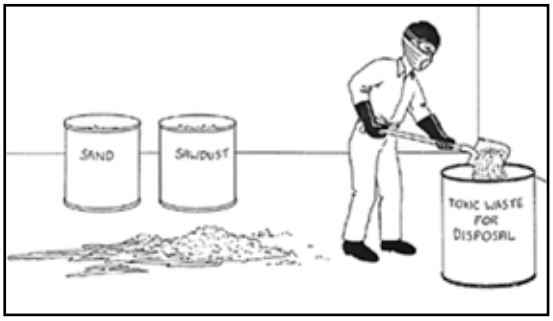
Clearly-labeled CPPs.

- Empty CPP containers should be stored separately for careful and proper disposal later.
- Since some of the CPPs are also flammable, proper fire-fighting equipment should be readily available wherever CPPs are stored.
- The storekeeper's office must be away from the main storage area.
- Proper cautionary signs must be displayed prominently in the store.

MIXING CPPS FOR APPLICATION

CPPs should be mixed for application in the open as near to the place of application as possible. Ensure that the wind does not blow CPPs onto people or animals.

- Proper protective equipment should be worn while mixing CPPs.
- Never eat, drink or smoke while mixing CPPs.



Safe disposal of a chemical spill.

- CPPs should be mixed at or below eye level to ensure that all operations are visible and nothing accidentally falls onto the people who are doing the mixing.
- All containers and other equipment must be thoroughly washed after use at the work site and not near any water sources (wells, ponds, streams) where people may gather water for drinking or washing.

APPLICATION OF CPPS

- Protective wear should be used whenever CPPs are applied.
- The spray pumps and other application equipment must be thoroughly cleaned, without leaks or clogged nozzles and properly calibrated.
- The area where CPPs are to be applied must be cleared of people and animals.
- Operations should not be undertaken when there are strong winds, when it is raining heavily or when there is a possibility of rain.
- Spraying should be done with the lowest pressure possible.
- All equipment must be thoroughly cleaned after each use onsite, ensuring that the drainage does not endanger people or animals.

Farm worker wearing protective clothing.

PRODUCT OR CONTAINER DISPOSAL

- Leftover stocks must be carefully checked to ensure that the stocks, which have passed the expiration date, do not accumulate. Expired or outdated stocks must be segregated for disposal.
- After thorough cleaning, metallic containers should be compacted with a hammer (to ensure that these are no longer suitable, even by mistake, for potable water) and then buried.

Spray pumps should be kept clean and calibrated.

- Plastic and paper containers can be burned only if there are proper incinerators. Otherwise these should also be buried far away from human and animal habitats and water sources.

ADVICE SHOULD BE SOUGHT FROM THE AGRICULTURAL CHEMICAL BOARD (ACB) FOR SAFE DISPOSAL. AVOID PROCURING MORE CPPS THAN CAN BE SOLD IN A SEASON.

RECOMMENDED PROTECTIVE CLOTHING AND EQUIPMENT FOR CPPS

Personal protective clothing and equipment should be used whenever handling CPPs – receiving into storage, stacking in the store, removing spills, mixing and applying. The labels on CPPs usually specify when protective equipment has to be used. The following is a list of the necessary equipment:

- **Headgear** – the head should be covered with a waterproof cap or hat to prevent any absorption of poisonous material through the scalp.
- An **apron** will help protect from spills onto the body and everyday clothes.
- Elbow-length rubber or plastic **gloves** should be used to protect the hands and arms.
- Knee-length rubber or plastic **boots** should be used to protect the feet and legs.
- **Goggles** and **face shields** are necessary to protect the eyes and face.
- When handling dusts and spray materials, **respirators with filters** should be used to avoid inhalation of the toxic matter.

Worker wearing protective clothing, including respirator and gloves.

- After use, all the equipment must be **thoroughly washed with water** and then allowed to dry out before being returned to the store.

SIGNS OF CPP POISONING

- **Whole Body** – Serious weakness or tiredness after spraying.
- **Skin** – Uncomfortable feeling, burning, heavy sweating and change in color.
- **Eyes** – Heavy watering, blurred vision, narrowing or widening of the pupils.
- **Digestive System** – Burning of the mouth, vomiting, etc.
- **Nervous System** – Dizziness, restlessness, confusion, headache, uncontrollable movement of muscles, staggering, unclear speech, convulsion and unconsciousness.
- **Respiratory System** – Difficulty in breathing, unpleasant noise in the chest when breathing, coughing and chest pain.

DIFFERENT FORMS OF CPP POISONING

There are three kinds of exposure to agro-chemicals, as summarized below:

- **Acute Exposure** – A typical example of acute exposure is when one swallows some agro-chemicals and immediately loses consciousness and there is no doubt about the cause of illness and hence a proper medication can be given.
- **Chronic Exposure** – A low level of exposure over a longer period of time. The effect is mild and slow poisoning. The symptoms are less severe than in acute cases and are often difficult to isolate as having been caused by agro-chemicals. This type of poisoning is more common in rural Africa due to the level of literacy among the peasant farmers who wish to protect their crops and livestock against insects and diseases.
- **Combination of Acute and Chronic Exposure** – The greatest risk is when an agro-dealer or a farmer gets a combination of acute and chronic poisoning. This can lead to serious illness and even death.

WHAT TO DO IF PESTICIDE POISONING IS NOTICED

If any of the above-mentioned symptoms are noticed in a person who has just finished spraying, the following actions should be taken immediately:

- Move affected person away from the chemicals and sprayed fields.
- Give assurances to the patient.
- Let the patient remain in a lying position.

ACTIONS TO BE TAKEN WHEN SKIN IS AFFECTED

- Remove clothes of the affected person immediately, using hand gloves.
- Wash the contaminated skin with mild soap and water thoroughly.
- Pour cold water on contaminated skin for a minimum of 10 minutes.
- Avoid scrubbing the skin when washing.

ACTIONS TO BE TAKEN WHEN EYES ARE AFFECTED

- Wash affected eyes with cold water for more than 10 minutes.
- Avoid washing chemicals onto unaffected eye.
- Hold the affected person firmly while washing the eyes because he/she could be in pain.
- Cover the affected eye with a sterile pad or clean cloth (treated with boiled water and allowed to cool before use).
- Transfer the affected person to a hospital or clinic for eye examination.
- Take the agro-chemical container with the label intact and show the physician.

ACTIONS TO BE TAKEN IF CHEMICAL IS SWALLOWED

- Induce vomiting. (Note: Never induce vomiting if you suspect that the swallowed pesticide is corrosive or petroleum-based.)
- Use activated charcoal on the affected person if he/she is conscious.
- Do not administer anything on an unconscious patient.
- Cover the affected person with warm clothes in cold weather.

- Fan the affected person and press down on chest several times if heartbeat is not felt.
- Take affected person to the hospital/clinic to see the physician.
- Take the original container of the chemical with the label intact to the clinic.
- The use of milk is not to be encouraged because some chemicals react with milk and could cause more complications.
- Ensure that affected person does not eat, drink or smoke until advised by physician to do so.

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