Responsible use of crop protection products

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villa

Potatoes Aartappels SA

RESPONSIBLE USE OF CROP PROTECTION PRODUCTS

Introduction

Villa Crop Protection is a market leader in the South African crop protection industry. With more than 300 product registrations and nearly 900 on-farm research and development trials conducted each year, this ISO-accredited company has a reputation for high quality and innovative products that help local growers achieve their goals.

Through Villa's recently acquired partnership with US based Land O'Lakes, Inc., a Fortune 250 global agribusiness and food company and its leading crop inputs business, Winfield Solutions, Villa has access to new capabilities and levels of agronomic expertise.

Many of Villa's products are manufactured by its own product formulation facility called Fountain Chemicals. Furthermore, the company also provides a very unique educational offering through its educational arm, the Villa Academy. Agriculturalists, producers and sales people attend courses and workshops to learn how to use the latest product developments and in-field experiences to enhance service delivery, decision-making and productivity.

The crop chemicals business is rapidly evolving, and during the past decade it has become highly technical. Villa has identified a need amongst agrochemical sales professionals and growers for high quality education on all aspects of crop protection and established the Villa Academy to fulfil this need.

In order to also ensure that students, growers and technical advisors in local agriculture do have access to handbooks and relevant literature Villa embarked on a program to sponsor the compilation and publishing of handbooks, such as the Responsible Use of the Handling of Crop Protection Products, earmarked for local agriculture.

Villa Crop Protection

CONTENT

CROP PROTECTION PRODUCTS (CCPs) AND THE LAW IN SOUTH AFRICA

The first and most important legislation dealing with agrochemicals in South Africa is called the Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, also known as Act 36 of 1947.

This Act contains a number of definitions, of which the following are specifically applicable:
"agricultural remedy" – means any chemical substance or biological remedy, or any mixture or combination of any substance or remedy, attended or offered to be used -.

"sell" – includes agrees to sell or to offer, advertise, keep, expose, transmit, convey, deliver or manufacture for sale or to exchange or to dispose of to any person in any manner for any consideration whatever, or to transmit, convey or deliver in pursuance of a sale, exchange or disposal as aforesaid, and **"sale"** has a corresponding meaning.

The Act specifically prohibits any person from selling any fertiliser, farm feed, agricultural remedy or stock remedy unless it is registered, packed in such manner and mass or volume as prescribed, the container in which it is sold complies with the prescribed requirements, it is of the composition and efficacy specified in an application for registration thereof, it possesses all chemical, physical and other properties so specified, and complies with the prescribed requirements. In addition, it provides that no person shall reward, or in the course of any industry, trade or business, use or recommend the use of any agricultural remedy or stock remedy for a purpose or in a manner other than specified on the label of a container thereof, or described on such container.

CropLife South Africa

CropLife South Africa is a non-profit company and an association representing the plant science industry, including the majority of responsible manufacturers, suppliers and distributors of crop protection products. The company strives to ensure that farmers and other end-users are at all times provided with a professional and efficient service through the training and accreditation of members' sales personnel.

CropLife South Africa has instituted a code of conduct setting out the industry and trade standards for research, development, manufacturing, production, marketing, handling, warehousing and distribution, including importation and/or exportation of CPPs. This code was created due to the fact that the products are potentially hazardous in misuse, and a high standard of conduct is required in order to minimise the risk of negative results and misuse, thereby protecting the interest of the users, the public at large, and the environment.

This code of conduct requires, inter alia, that members ensure that all persons recommending and/or selling the products have successfully completed the association-prescribed course in crop protection, and members are required to provide all reasonable assistance in training and advising the end-user in the storage, transportation and end-use of their products.

CropLife South Africa furthermore provides documentation, guidelines and training aimed at educating CPP users regarding best practices. For more information, please visit www.croplife.co.za.

Qualified advisors

CropLife South Africa places great emphasis on training for its members. Members are required to complete the crop protection course, not only for accreditation purposes, but also to improve and maintain their technical knowledge base in respect of crops, products, best practices and regulatory topics. An ongoing professional development program was therefore implemented to encourage all sales members to strive for and maintain high levels of competency and professionalism.

The training programme to be followed by sales personnel includes topics on crop production, crop pests and diseases and the control thereof, weeds and weed control, crop fertigation, the use and application of crop protection products and other agricultural chemicals, business management topics, as well as industry-related legal aspects. Professional development points are allocated for training completed on all the above topics, with a prescribed number of points to be earned to maintain accreditation. Successful members are rewarded with an accredited membership card.

Clients and farmers may ask for proof of membership and accreditation whenever needed for purposes of certifying produce for marketing or export purposes. Well-trained and competent members can produce their membership cards as proof of competency to their clients.

Information resources

CropLife South Africa has the over years invested in a number of information resources applicable to the industry, including a database of all registered products in PDF format on the CropLife website, as well as compendiums that can be ordered from the website:

- The Chemical Control of Plant Diseases (2nd edition.)
- A Guide for the Control of Weeds in South Africa (2nd edition.)
- A Guide to Crop Pest Management in South Africa
- Problem Plant Control Compendium
- A Guide to the Use of Plant Growth Regulants, Defoliants and Desiccants in South Africa
- Household Remedies

CropLife South Africa has also taken the initiative to develop Agri-Intel, a web-based agrochemical database of all crop protection products registered for use in South Africa. All products can be listed, and copies of the labels of all trade names are available on the database and can be downloaded from the website. This was made possible thanks to the efforts of a consortium of agricultural specialists working in close alliance with industry organisations to provide up-to-date and accurate agrochemical information to the various stakeholders in the agricultural and export industries. The database offers registered users a wide range of information on crop protection products and their uses, as such testifying to CropLife's ongoing commitment to providing its clients with efficient and professional service at all times.

The potato industry will most assuredly also benefit from all the information available.

CROP PROTECTION PRODUCTS (CPP)

Most available remedies can be categorised into the following broad categories:

- Herbicides for the control of unwanted weeds.
- Insecticides for the control of insect pests.
- Fungicides for the control of fungal diseases.
- Bactericides for the control of bacterial diseases.
- Nematicides for the control of microscopic nematodes.
- Rodenticides for the control of unwanted rats and mice.
- Adjuvants that are chemicals added to agricultural spray mixtures for a variety of reasons, such as improving the efficacy of agricultural remedies.

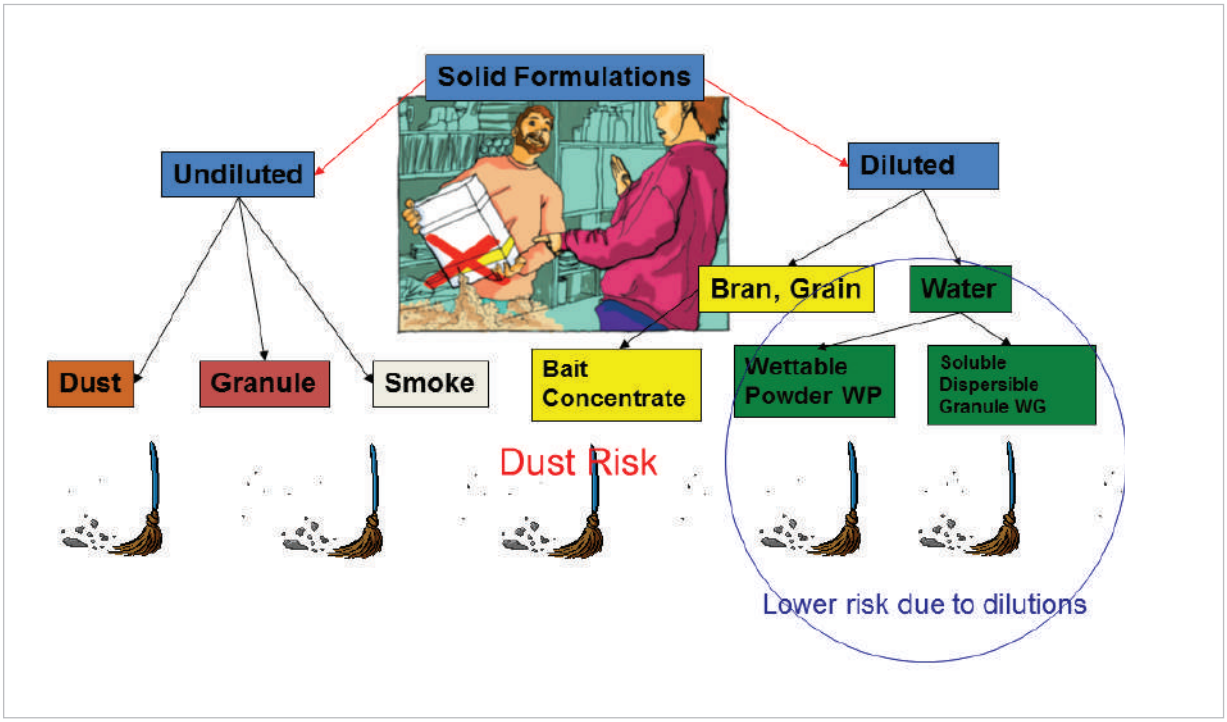
Formulations and containers

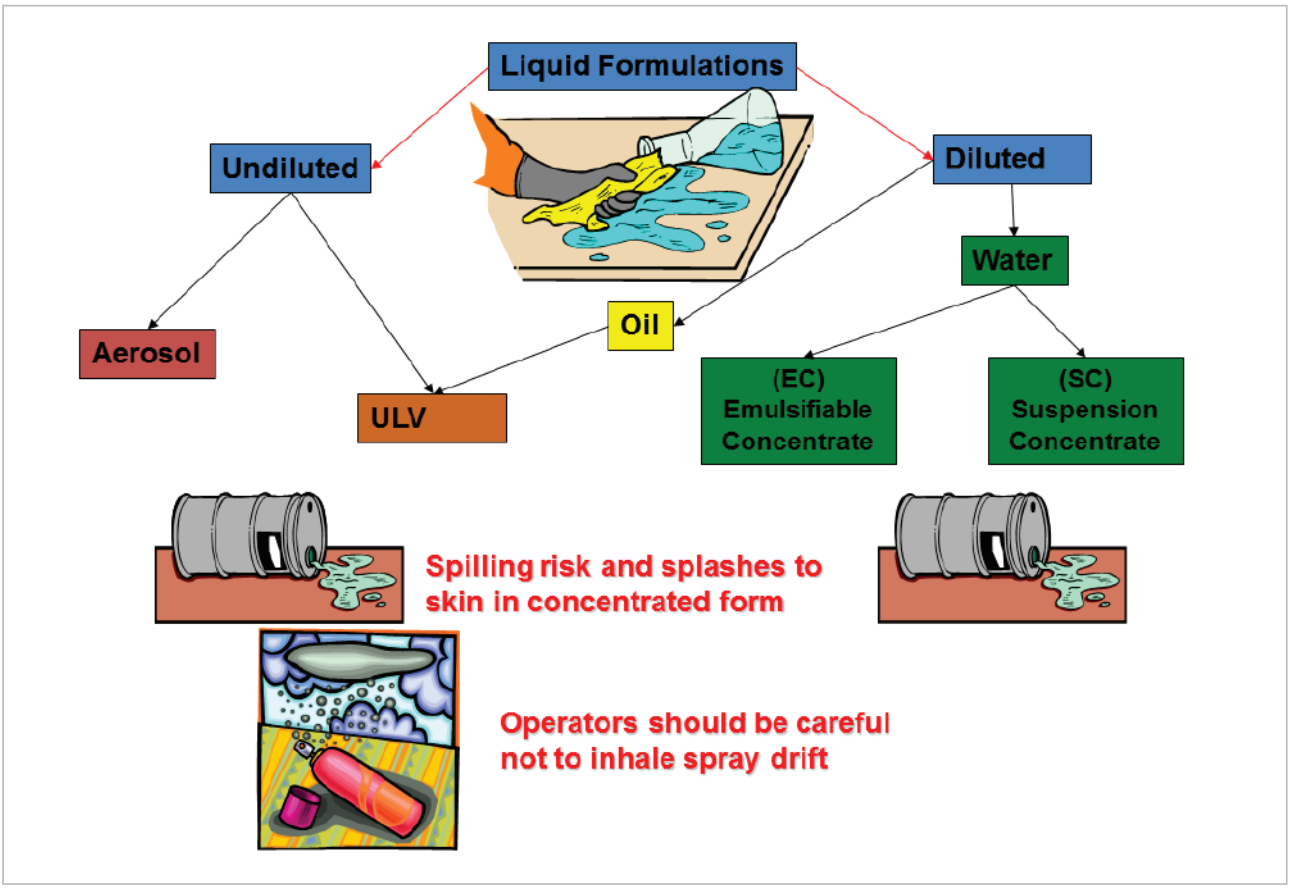
CPPs are formulated to optimise the efficacy, safety and stability of the chemical. Many different formulations exist, but the basics are either liquids and powders or granules. In most cases the formulated products are mixed or diluted with water before use.

As a handler of CCPs, you need to understand:

- The formulation type and the risks associated with different types of formulations
- The containers that contain the CPPs and the associated risks of the container for the handler.

The following two flowcharts indicate the type of formulation and associated risks involved





The type of packaging used by manufacturers varies across formulations and is related to: Volume / dose relationship, liquid or solid formulation, and conditions under which the chemical will be stored and transported.

It is important to never use or purchase containers with broken seals, and to always inspect the seals before use.

Never repack or purchase any product that has been repacked from anyone other than the original manufacturer.

Measuring and preparation of spraying mixes

There are four important elements of preparation prior to the actual mixing of the product:

- Always read the label first.
- Make sure that all the relevant equipment such as measuring devices (scales, beakers, etc.) are ready for use.
- Any other equipment for dealing with emergencies or spillages should be close at hand.
- Protective clothing, as recommended by the label, should be used at all times during the measurement and mixing operation.

Additionally, during the mixing operation, always remember to:

- Wear protective clothing as recommended on the product label.
- Keep children and animals away.
- Take care not to contaminate water supplies, or puddles from which animals may drink.
- Use suitable equipment, i.e. measured or graduated jugs for liquids and scoops for powders, etc.
- Use the cleanest water available.
- With liquids, avoid spillage and splashes by using a funnel. Rinse measuring cylinders and add to the spray tank.
- Handle wettable powders carefully to avoid dust.
- Clean all contaminated equipment after use.
    - Surplus and unwanted products should, wherever possible, be retained in the container it was purchased and subsequently included in a future spray application involving the same type of product.
    - With liquid formulations, the containers should be triple-rinsed with water, and the rinsing added to the spray tank for application. After use, close packages carefully to prevent leaks or contamination, and store safely. Always keep crop protection products in their original containers and do not transfer into bottles for beverages or containers for food.

- If a CPP spillage occurs, deal with it in the following way:
    - Keep people and animals away.
    - Do not smoke or use a naked flame near the spillage.
    - Wear protective clothing during clean-up operations.
    - Remove damaged packages and place them on a non-absorbent surface or bare ground, away from dwellings and water supplies.
    - Use soil or sawdust to absorb liquids; sweep up carefully and dispose of appropriately so that there is no possibility of contamination of wells and waterways.
    - Thoroughly wash down all contaminated parts of the vehicle where applicable, away from wells and waterways.
    - Dispose of the wash water appropriately.

THE LABEL PROVIDES A WEALTH OF INFORMATION

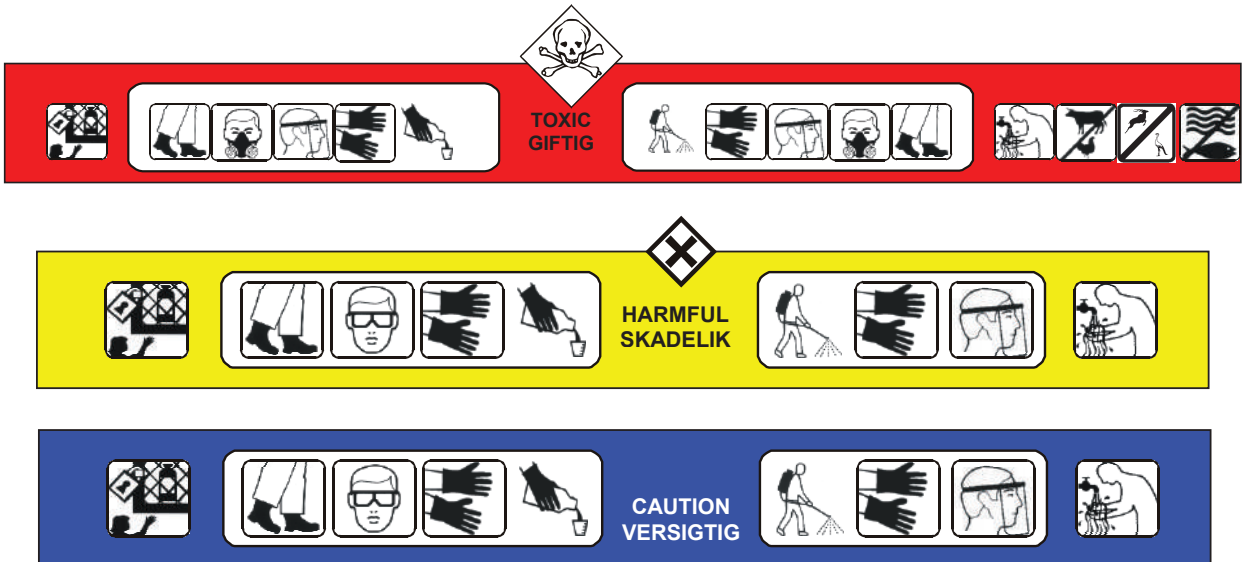
The basic information reflected on the label includes:

1. **Brand name** – Usually appears in bold print on the label. It is the name by which the product is advertised. For example: Cantron®, Amistar®.
2. **Active ingredient** – Listed by either chemical name or common name. The concentration is also listed as gram active ingredient per kg or ℓ formulation.
3. **Common name** – Sometimes used for a chemical. For example: Strobilurin is the common name for Azoxystrobin fungicide
4. **Registration code** – Allocated by the registrations authority of a country. For example: Reg. No. L117;4 Act / Wet No. 36 of / van 1947.

5. **Manufacturer's (registration holder's) information** – Including the address, as printed on the label.
6. **Formulation type** – Identified on the label. The following types of formulations are usually indicated
   - EC – emulsifiable concentrate
   - SC – suspension concentrate
   - WP – wettable powder
   - WDG – water-dispersible granule
   - GR – granule formulation
   - EW – emulsion oil
   - CS – encapsulated suspension.
7. **Product description and group coding** – This description is also found on the front page of most labels.

8. **Statements and pictograms** - these statements usually refer to hazards associated with the product, especially:
   - Human and domestic animal poisoning risks.
   - Environmental and wildlife risks.

Pictograms are small pictures or icons that communicate these hazards and are usually found on the front of the label.



9. Information on **worker protection** requirements.
10. **Directions for use** (how a product is to be used).
11. **Pre-harvest intervals.**
12. **First aid** treatments in case of poisoning.
13. **Batch numbers** and **expiry dates.**
14. **Anti-resistance practices.**

APPLICATION CAN MAKE OR BREAK A PRODUCT

Mixability of remedies

Mixing of remedies can reduce input. However, it is important to make sure that products can be mixed:

- Not all remedies can be mixed. Always read the label, as the ability to mix would usually be indicated in sections dealing with restrictions. Alternatively consult your AVCASA-accredited agent or supplier for further details.
- Two remedies may be mixable in terms of physical compatibility, but their biological mode of action can be affected in the process and cause both products to be ineffective.
- Never mix remedies in concentrated form; each remedy should be diluted separately before being added to the spray tank. This is especially applicable to wettable powders where it is necessary to first make a suspension using a small amount of water before slowly adding it to the spray tank while stirring.
- Always read the label carefully for mixing instructions.
- If there is any uncertainty concerning the compatibility of remedies, contact the relevant chemical company.
- On page 12 is a guideline for tank-mixing procedures:

Water quality

The general guideline is that clean water of a high quality should be used. However, this is not always possible due to:

- Water containing too much suspended soil and organic matter, which can adversely affect the efficacy of a product.
- Hard water containing high levels of calcium and magnesium salts (>500 ppm), which can bind with the active ingredients of a product and often result in a subsequent decline in efficacy.

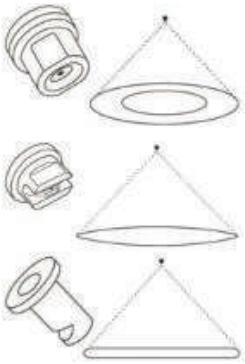
Adjuvants are available for the correction of water quality to ensure the optimum efficacy of remedies. Contact your advisor for more information.

Spraying equipment

Always consider equipment types, nozzles and droplets, calibration principles and thorough cleaning of the equipment after applications are made.

1. Spray application equipment is used to deliver the CPP to a target area, usually with water as the carrier. Application equipment varies and is designed for specific crop types:
   - Hydraulic sprayers.
   - Motorised mist blowers.
   - Controlled droplet applicators / Ultra low-volume applicators.
   - Foggers.
   - Granule applicators.
   - Dust applicators.
   - Equipment for seed treatment, electrostatics, chemigation, etc.
2. When selecting the equipment and nozzle type, always consider how the product is intended to be used. This information is usually found on the label under the section on product uses and recommendations. The recommended uses would consider the following:
   - Whether application is systemic (highest possible level of coverage not necessary).
   - Whether application is contact (thorough coverage necessary).
   - Target organism and where it occurs (top or bottom / underside of leaves).
   - Whether application is pre- or post-emergent (soil or foliage application)
3. Almost all types of application equipment make use of nozzles to deliver the pesticide accurately. The main types of nozzles are:

Hollow cone (Typically used with fungicides and insecticides)



Standard flat fan (Typically used with herbicides)

Deflector (Typically used with herbicides)

4. Droplet size is one of the most important aspects of the effectiveness of any application. The size of a droplet is a function of the pressure and the type of nozzle used. Advances in adjuvant technology may further enhance the deposition of droplets through the effect it may have on droplet size.
5. Spray nozzle problems typically manifest in changes in the rate of flow. The rate of flow will increase as the surface of the orifice and/or internal vane or core begins to deteriorate. Increased flow rates or lower spraying pressures may also result in larger droplet sizes. When the spray pattern uniformity is affected streaks of uncontrolled weeds or the occurrence of pests or diseases typically develops. It is therefore vital to maintain and replace worn nozzles frequently.

TANK MIXING GUIDELINES

Tank mixing procedure:

(This is a general procedure and must be followed when in doubt. The pesticide label must be followed as a primary guideline).

Step 1

Fill the spray tank with water to the required label recommended volume (at least half full). The spray mixture must be continually agitated and each product must be fully dispersed or solubilized before the next is added.

Step 2

Add any water conditioners like **buffers** and salt adjuvants that contain **ammonium sulphate**.

Step 3

Add products that are contained in **water-soluble sachets**.

Step 4A Step 4B

Premix water dispersible granules (WG) or wettable powders (WP) with a small amount of water.

Step 4C

Add the pre-mix in 4B to the spray tank.

Step 5

Ensure that these products are thoroughly dispersed in the spray solution before the other products are added.

Step 6

Add suspension type products (**SC & SE**).

Step 7

Add emulsion type products (**EW; ME; EC**).

Step 8A

Add water soluble products (**SL; SG; SP**).

Step 8B Step 8C

Please ensure that powders and granules are pre-solubilized in water before addition to the spray tank. Failure to do so may cause unwanted physical interactions.

Step 9

Wetter/spreader and **sticker** adjuvants are normally added last.

Step 10

Fill the tank to the desired volume.

Guidelines in this brochure have been formulated to ensure optimal efficiency of spray solutions, and cater for most conditions. However, Villa Crop Protection does not presume responsibility for effectiveness under all conditions. Incompatible spray mixtures could render the product ineffective. Refer to the pesticide label for primary guidelines to effective spray mixtures.

Calibration principles

Sprayer preparation and required information:

1. Thoroughly clean the sprayer. Check for signs of rust, leaks or other problems.
2. Check all nozzles on the spray boom for signs of wear, and confirm the nozzle size. Replace worn nozzles and nozzles of the wrong size for the desired application.
3. Determine the litres needed per hectare based on the rate recommended on the label.
4. Determine the number of nozzles on the sprayer, and the flow rate of each.
5. Is there an optimum speed known for the field where application is due?
6. Half-fill the spray tank with water and go to the prepared field.
7. Be sure to take with you a stop watch, as well as stakes to mark out distance travelled, and a measuring beaker.

There are many different methods for calibrating sprayers. Some examples are given below:

Example 1: The equipment remains stationary

- Determine the total boom output in litres per minute.
- Determine in metres the effective spraying width of the boom sprayer.
- Determine the operating speed to be used in kilometres per hour.
  - This is done by selecting a gear that is at the rpm used to operate the pump.
  - Then record the time taken to travel over a measured distance, towing the boom sprayer.
- Apply the following formula:

$$\textbf{Speed(km/h)} = \frac{\textbf{distance travelled (m) x 3.6}}{\textbf{time taken to travel that distance (sec)}}$$

- Then apply the following formula to find the volume:

$$\textbf{ℓ/h} = \frac{\textbf{600 x boom output (L/min)}}{\textbf{spray width (m) x speed (km/h}}$$

Example 2: The equipment travels over a measured distance

- Select the gear that is at the rpm used to operate the pump.
- Measure off a 100 m run, preferably on a surface the same as, or similar to, that on which the actual spraying will be done.
- Record the time taken to travel the 100 m run, towing the boom sprayer, using the gear and rpm already determined.
- Operate the boom and check that it is operating at the correct pressure. Select a level spot and completely fill the tank with water (to the point of overflow). Ensure that the supply line to the shut-off valve is full.
- Turn on the boom and operate at the determined rpm for the exact time taken to travel 100 m.
- Carefully measure the amount of water required to refill the tank to the original level. Determine in metres the effective spraying width of the boom sprayer (number of nozzles x distance between each nozzle). Apply the following formula:

$$\textbf{ℓ/ha} = \frac{\textbf{100 X ℓ used in the time taken to travel 100 m}}{\textbf{spray width (m)}}$$

Many types of internet calculators and apps are available to assist in calibration, for example: www.teejet.com

Cleaning equipment during the spraying season

Even very small amounts of some products (for example sulfonylurea and growth-regulator-type herbicides can cause damage to susceptible crops if the unit is not thoroughly cleaned.

- Regularly flush out equipment with clean water after use (preferably once a day) to prevent chemical residues drying out on filters and in the nozzles.
- If changing products, decontaminate the sprayer. Follow label instructions when this is required.

Guidelines for cleaning and decontaminating spraying equipment:

- Drain spray unit and flush thoroughly with clean water.
- Rinse the tank with clean water and detergent.
- To decontaminate (e.g. cleaning a herbicide from the tank), fill the tank with clean water and add 1 ℓ of household ammonia or 1 kg of washing powder to each 100 ℓ of water. Rinse the tank thoroughly and then leave the cleaning mixture in the tank and lines overnight.
- The next day, drain the unit and flush thoroughly with clean, preferably hot, water.
- Remove nozzles and filters and clean separately.

The Weather: to spray or not?

The most important factor determining effective CPP application is the weather. The decision to be made by a farmer is whether the application can be safely and effectively made under the prevailing weather conditions. The aim is to avoid spraying under conditions that increase the risk of drift. In doing so, understanding how weather affects spraying, and how a farmer can monitor the weather, can assist in the decision-making process.

Consider local forecasts and consult the label for product specifications such as optimal application conditions, drying time, absorption rate and retention time. If conditions become too windy or too hot, or it starts to rain, stop spraying until conditions improve.

Temperature and relative humidity

Temperature and relative humidity determine the rate of evaporation of droplets:

- The ideal condition for spraying is when the temperature is <25°C, relative humidity is >40%, and there is no strong wind. Such conditions reduce the chance of drift due to temperature inversions or evaporation.
- Optimum spraying conditions are usually in the early morning and in some cases, after sunset.
- If a CPP must be applied in small droplets to reach inside the canopy and the undersides of leaves, it is critical to ensure that the droplets do not evaporate before reaching their target.

Wind

Wind direction determines whether droplets travel in the direction of the target crop, or drift downwind to unintended areas such as open water, sensitive crops or areas of human activity. Wind speed affects the distance a droplet will travel before it is deposited on the target. The impact of wind is particularly significant when performing directed (e.g. airblast) spraying, and it is therefore important to position nozzles and deflectors to direct the spray into canopies, not over them.

Spray only when the wind direction is consistent, the wind speed measures between 2 and 15 km/h, or as indicated on the product label.

Rain and dew

Rain can have either a positive or negative effect on spraying:

- Some products work best when rainwater carries them into the soil after application.
- Depending on the rain-fastness of the product, rain soon after application may wash the product from leaves and reduces the level of protection.
- Rain can also redistribute certain products over the target, but do not rely on this for effective distribution.

Effective application

- Monitor weather forecasts and understand the impact of rain on the product being applied.
- Avoid spraying when foliage is still wet after rain or dew, unless indicated on the label.
- Keep in mind that a leaf can retain only a limited volume of spray, and therefore a limited amount of product before it runs off. Once wetted, deposition of pesticide will not increase beyond the tank concentration, and the surplus will run off to the lower leaves and onto the soil.

Spray drift

Droplets produced by the spray equipment can be so small that they stay suspended in air and are carried by air currents until they contact a surface or drop to the ground. There are two kinds of spray drift:

- Particle drift is the movement of the liquid spray particles, or droplets.
- Vapour drift is the movement of vapours, after evaporation (or volatilisation) has occurred.

Always consult the pesticide label for specific instructions related to weather conditions.

Weather guidelines for CPP application

- Spray when wind is steady and ideally at 2–15 km/h. Avoid variable or gusty wind conditions.
- Avoid calm conditions – small droplets may remain suspended for long periods.
- Look out for inversion layers.
- Spray when wind blows away from sensitive areas.
- Avoid spraying in temperatures above 28˚C.
- Avoid spraying when humidity is too low.
- Most chemicals require a rain-free period – check the label.
- Record on-site weather conditions at spray time.

Application rate

CPP application rates are important for several reasons:

- Efficacy against the target organism.
- Resistance management.
- Residue management.
- Toxic effects to operator, environment and the crop itself (phytotoxic effects).

The recommended rates at which any CPP is to be applied are available on the product label. Below is an example using the Mycoblock fungicides label:

Crop / Disease	Dosage rate	Remarks
Potatoes Early blight *(Alternaria solani)*	300 ml / ha	**Ground application:** Alternate with Oronil 720 SC as recommended, in not less than 500 litres water per hectare.
	330 ml / ha	**Aerial application:** Alternate with Oronil 720 SC as recommended, in 30 to 40 litres water per hectare.

Additional information, such as number of applications as well as volume of applications, will also be indicated on the label. These recommendations must be followed closely in order to achieve optimal efficacy and resistance management.

What happens to a CPP after application?

- The highest concentration levels are observed on the plant surfaces or within the plant shortly after any remedy is applied.
- In most cases the initial concentration levels are in excess of what is actually necessary to control the pest or disease.
- The concentration of the remedy decreases hereafter (washing off by rainfall and irrigation, translocation, plant metabolism and dissipation due to other factors including environmental factors) to levels below what is necessary, until replenished by means of a follow-up application.
- Rainfall shortly after application can have a negative effect on both systemic and contact remedies, depending on the intensity of the rainfall.
- With time, the systemic remedies are taken up by the plant and diluted.
- Contact remedies are redistributed from top to bottom on the outside of the plant. A useful characteristic of these types of remedies is that they can be distributed to other plant parts by means of water (rainfall or irrigation) if the initial spray application was uneven in dense plant canopies.
- Two follow-up applications of the same remedy lead to higher levels of concentration in or on the plant compared to a single application of two remedies that are chemically unrelated to each other.
- Selection for resistance occurs more readily where the residue levels of a remedy are too low to be effective.

SAFE HANDLING OF CROP PROTECTION PRODUCTS (CPPs)

Safe storage

The purpose of storage facilities is to keep CPPs away from unauthorised handling by people, to prevent spillage and to prevent contamination of the environment.

Requirements of the storage facility:

- Must comply with all the appropriate current national, regional and local legislation and regulations.
- Must have a physical barrier (wall, sheeting, etc.) to prevent cross-contamination between crop protection products and other materials.
- Be built in a manner that is structurally sound and robust.
- Products must be kept secure under lock and key, with physical access granted only in the presence of persons who can demonstrate formal training in the safe handling and use of crop protection products and be built of materials that are fire resistant (minimum requirement RF 30, i.e. 30 minutes resistance to fire).
- Have sufficient and constant ventilation of fresh air to avoid a build-up of harmful vapours.
- Be located in areas with sufficient illumination by natural or artificial lighting to ensure that all product labels can be easily read while on the shelves.
- Be equipped with shelving that is non-absorbent in case of spillage (e.g. metal, rigid plastic, or covered with impermeable liner, etc.).
- Have retaining tanks, or products must be bunded according to 110% of the volume of the largest container of stored liquid, to ensure that there cannot be any leakage, seepage or contamination to the exterior of the facility.

- Have eye-washing capacity, a source of clean water no more than 10 metres away, a complete first aid kit, and a clear accident procedure with emergency contact telephone numbers or basic steps of primary accident care, all permanently and clearly indicated.
- Must have designated, fixed areas for filling and mixing of CPPs that may be located inside the CPP storage facilities:
    - Equipped with graduated measuring equipment, calibrated scales and utensils (e.g. buckets, water supply point, etc.) for the safe and efficient handling of all crop protection products; The graduation on containers and calibration verification for scales must be done annually by the producer to ensure accuracy of mixtures.
    - Equipped with a container of absorbent inert material such as sand, a floor brush and dustpan and plastic bags, which must be sign-posted and in a fixed location, to be used in case of spillage of a crop protection product.

Other requirements for safe storage:

- All crop protection products must be stored according to the storage requirements printed on the label.
- All crop protection products currently in the storage facility must be kept in the original containers and packs. Only in the case of breakage, the new package must contain all the information of the original label.
- All crop protection products that are liquid formulations must be stored on shelving that is always lower than shelving carrying products that are powder or granular formulations.
- A stock inventory indicating the contents of the store (type and quantity) must be available and be updated at least once every 3 months.

Safety for people

All CPPs are potentially harmful to people, and special measures must be in place to protect all persons who may be in contact with the products.

- All persons who handle CPPs must undergo regular training in the safe handling of pesticides.
- Although all CPPs must be handled with care, some require particular care. Pesticides are colour coded for that purpose, so it is important to read the label.
- Protective clothing is required for all persons who handle CPPs:
    - The Material Safety Data Sheet (MSDS) or the label of a product (as applicable) may indicate special precautions concerning protective clothing and equipment. This applies irrespective of occasional handling or intensive handling, and irrespective of the quantity of pesticide used.
    - All operators must clearly understand that, even though protective clothing and equipment are used, great care must still be taken, and that no previously used protective clothing or equipment shall be worn unless it has been thoroughly washed or decontaminated.
    - Ensure that no worker removes dirty or contaminated clothing or equipment from the premises.
    - Treat dirty or contaminated clothing or equipment to be disposed of, or washed, or decontaminated outside the premises, as hazardous chemical goods.
    - Provide two lockers for each person, one marked “Protective clothing” and the other marked “Personal clothing”, to ensure that clothing is kept separate.
- All workers who are in contact with crop protection products are voluntarily subjected to annual health checks. These health checks must comply with national, regional or local codes of practice, and use of results must respect the legality of disclosure of personal data.
- All crop protection product/chemical storage facilities and all filling/mixing areas present on the farm

must have an eye-washing facility, a source of clean water no more than 10 m away, a complete first aid kit, and a clear accident procedure with emergency contact telephone numbers or basic steps of primary accident care, all permanently and clearly signed.

- An accident procedure containing all detailed information must visually display the basic steps of primary accident care and be accessible by all persons within 10 metres of the CPPs / chemical.
- Obtain the address and telephone number(s) of the nearest poison centre, and display this information in appropriate locations.
- CPPs must be used in strict accordance with the instructions on the label.
- No eating, drinking or smoking is allowed while CPPs are being applied.

Safe disposal of empty plastic pesticide containers

Procedures for the safe storage and disposal of empty CPP containers must be in place to minimise the risk of physical contact with the empty containers by people and contamination of the environment, watercourses, flora and fauna:

- Empty CPP containers should never be re-used for anything other than containing and transporting identical products to those stated on the original label.
- Empty CPP containers should be clearly labelled, for example by spray-painting a red cross onto the container.
- A designated secure storage point for all empty CPP containers prior to disposal must be in place to isolate empty CPP containers from all other crop and packaging materials. The facility must be permanently signed and with physically restricted access for persons and fauna.
- Make use of official collection and disposal systems where they exist, and keep records of participation.
- Install pressure-rinsing equipment for CPP containers on the application machinery, and make sure there are clear written instructions to rinse each CPP container three times prior to it being stored and/or disposed off.
- All the relevant national, regional and local regulations and legislation regarding the disposal of empty CPP containers must be been complied with, if it exists.
- See also AVCASA's guidelines for disposal of empty containers, and list of reputable recyclers.

Safe disposal of obsolete, redundant, leftover and unwanted crop protection products

Procedures for the safe storage and disposal of CPPs must be in place to minimise the risk of physical contact by people and contamination of the environment, watercourses, flora and fauna:

- Surplus application mix or tank washings must be disposed of in a way that does not compromise food safety and the environment.
- Keep records of the disposal of obsolete CPPs by officially authorised channels. When this is not possible, obsolete crop protection products must be securely stored and marked.
- Apply surplus spray and tank washings to the crop as a first priority under the condition that the overall label dose rate is not exceeded.
- See also AVCASA's disposal of obsolete, redundant, leftover and unwanted crop protection products guidelines and list of reputable disposal companies.

CROP PROTECTION PRODUCTS REGISTERED FOR USE ON POTATOES

Keep an updated list of products that are registered for potatoes in South Africa.

- The list must include the commercial brand names, as well as their active ingredient composition or beneficial organisms that are authorised on potatoes and that have been used on the farm in the last 12 months.
- Ensure that only CPPs that are registered for potatoes in South Africa are applied appropriately for the target as recommend on the product label.
- Ensure that the crop protection products applied are suitable and can be justified (according to label recommendations) for the pest, disease, weed or as target of the crop protection product intervention.
- Keep invoices of the registered CPPs.

RECORD OF APPLICATION

Recordkeeping is not only required by certification bodies, it is also an extremely valuable tool for the farmer to identify possible causes for good, or poor control achieved with CPPs

Cultivar name
Varieties differ in respect of their response to CPP in their susceptibility to pests and their response thereto under different climatic conditions. It is impossible for the agent of cultivars to evaluate new cultivars for all characteristics and interactions with pests and climate. By keeping record of cultivars and the control of the target pest, each farmer builds up invaluable knowledge applicable to his farm.

Location
All crop protection product application records must specify the name or reference of the farm, and the field, where the specific crop is located.

Date
Record each actual date of application. If application had to be interrupted, record the date when application started as well as the end date.

Time of day and conditions during application
As temperature, wind, humidity and dew on plants affect the efficacy of application, the time of application can be valuable information if it is necessary to investigate application effectiveness. Records of application will assist in corrective actions and training of operators.

Brand name of crop protection product and active ingredient
All crop protection product application records must specify the complete brand name (including formulation) and active ingredient or beneficial organism with the scientific name. The active ingredient must be recorded, or it must be possible to connect the brand name information with the active ingredient.

Operator
The operator applying the crop protection products must be identified in the records. If a single individual makes all the applications, it is acceptable to record the operator's details only once. If the person who measures and mixes the CPP is not the application operator or the person who gives the technical authorisation, then the names of all responsible persons should be recorded.

Justification
The name of the pest(s), disease(s) and/or weed(s) treated must be documented in all CPP application records. If common names are used, then they must correspond to the names stated on the label.

Technical authorisation
The technically responsible person making the decisions on the use and doses of the CPP(s) being applied, must be identified in the records.

Quantity of the product applied
All CPPs application records must specify the amount of product to be applied in weight or volume or the total quantity of water (or the carrier medium) and dosage in g/ℓ or internationally recognised measures for the crop protection product.

Application machinery used
The type of application machinery (e.g. knapsack, high-volume ULV via the irrigation system, dusting, fogger, aerial, or another method) must be recorded for all the CPPs applied. If there are various units, they must be identified individually. Records will help in identifying machinery that may be faulty or incorrectly calibrated.

Pre-harvest interval
The pre-harvest interval must be recorded for all CPPs applications if it is stated on the product label, or if not on the label, as stated by an official source.

Observations
It is good practice to record any information that may affect the efficacy of an application on a specific pest, as well as the effect of the CPP applied to a specific cultivar under specific circumstances.

CHECKLIST OF GOOD PRACTICES FOR THE HANDLING OF CROP PROTECTION PRODUCTS (CPPs)

Choice of crop protection products

- Are competent persons making the choice of CPPs?
- Is there an updated list of CPPs that are registered for potatoes in South Africa?
- Are only CPPs that are registered for potatoes in South Africa being applied appropriately for the target, as recommended on the product label?
- Are invoices of registered CPPs kept?

Residue analysis

- Has action been taken to meet the minimum residue levels of the market in which the producer is intending to trade the produce?

Storage

- Are CPPs stored in accordance with local regulations?
- Are CPPs stored in a location that is secure?
- Are CPPs stored in a location that is appropriate to the temperature conditions?
- Are CPPs stored in a location that is fire-resistant?
- Are CPPs stored in a location that is well ventilated (in the case of walk-in storage)?
- Are CPPs stored in a location that is well lit?
- Are CPPs stored in a location that is located away from other materials?
- Is all CPP storage shelving made of non-absorbent material?
- Is the CPP storage facility able to retain spillage?
- Are there facilities for measuring and mixing CPPs?
- Are there facilities to deal with spillage?
- Are keys and access to the CPP storage facility limited to workers with formal training in the handling of CPPs?
- Are all CPPs stored in their original packaging?
- Are liquids not stored on shelves above powders?
- Is there an up-to-date CPP stock inventory or record of use available?

Handling

- Are all workers who have contact with CPPs subjected to voluntarily annual health checks?
- Is the accident procedure clearly visible within 10 metres from the CPP/chemical storage facilities?
- Are there facilitates to deal with accidental operator contamination?
- When mixing CPPs, are the correct handling and filling procedures followed as stated on the label?

Empty containers

- Is re-use of empty crop protection product containers for purposes other than containing and transporting the identical product avoided?
- Does disposal of empty crop protection product containers occur in a manner that avoids exposure to humans?
- Does disposal of empty crop protection product containers occur in a manner that avoids contamination of the environment?
- Are official collection and disposal systems used when available?
- If there is a collection system, are the empty containers adequately stored, labelled and handled according to the rules of a collection system?
- Are empty containers rinsed either through the use of an integrated pressure-rinsing device on the application equipment or is it rinsed at least three times with water?
- Is the rinsate from empty containers returned to the application equipment tank?
- Are empty containers kept secure until disposal is possible?
- Are all local regulations regarding disposal or destruction of containers observed?

Obsolete crop protection products

- Are obsolete crop protection products securely maintained and identified, and disposed of by authorised or approved channels?
- Is surplus application mix or tank washings disposed of in a way that do not compromise food safety and the environment?

Equipment

- Is equipment sensitive to food safety and the environment (e.g. fertiliser spreaders, crop protection product sprayers, irrigation systems, equipment used for weighing and temperature control) routinely verified and, where applicable, calibrated at least annually?
- Is the producer involved in an independent calibration-certification scheme, where available?

Records of application

Are records of all crop protection product applications kept and do they include the following criteria?:

- Crop name and/or variety
- Application location
- Application date
- Time of application
- Product brand name and the active ingredient
- Operator
- Justification for application
- Technical authorisation for application
- Product quantity applied
- Application machinery used
- Conditions during application
- Pre-harvest interval

References

CropLife (www.CropLife.co.za)

Global Gap (www.globalgap.org)

FDN Denner. 2012. Chapter 17: Crop protection programmes for potatoes. In: Guide to potato production in South Africa. Eds: FDN Denner, SL Venter & JG Niederwieser. ARC-Roodeplaat Vegetable and Ornamental Plants Institute, Pretoria.

Potatoes Aartappels SA

www.potatoes.co.za