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## 'Spray technique'

### Downy mildew control in African roses

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## 1. Pests and diseases

Below short descriptions of the most common pests and diseases in rose are given.

### *Powdery mildew*

Powdery mildew in roses is caused by the fungus *Sphaerotheca pannosa*. Infected plants show white powdery spots on the leaves and stems. Unlike downy mildew the fungal threads can easily be wiped off the leaves in an early stage of infection, because powdery mildew produces mycelium that grows only on the surface of the leaves. Therefore the original colour of the leaves is not affected. As the disease progresses, the spots get larger and denser and the mildew may spread up and down the length of the plant. Powdery mildew grows well in warm environments. For sporulation the fungus prefers a dry climate. However, for germination of the spores the relative humidity needs to be high. Therefore the disease is common in crowded plantings where ventilation is poor and in damp, shaded areas. Incidence of infection increases as relative humidity (RH) rises to 90%, but it does not occur when leaf surfaces are wet. Young succulent growth is more susceptible than older plant tissues. The pathogen can be controlled using chemical methods, genetic resistance and careful farming methods.



*Powdery mildew*

### *Downy mildew*

Downy mildew in rose is caused by the fungus *Pseudoperonospora sparsa*. This fungus grows predominantly at the underside of the leaves, but can be observed as well on stems and on sepals and petals. Infested areas show purple red to grey black spots. At the underside of the leaves develops a grey white fungal mold. As the disease progresses the leaves may turn brown and fall off. Downy mildew develops well in cool and moist conditions. Germination of the spores and penetration of the plant requires a thin layer of water on the leaf surface. The production of spores is favoured by a high relative humidity (> 85%) and the optimal temperature for sporulation is 18°C. There is no development of the disease if the temperature is below 5°C and the spores die if the temperature is more than 24 hours above 27°C. The best way to control the disease is to avoid these climatic conditions. Infested plants cannot be cured, because the mycelium grows inside the plant tissue. Therefore infested plant parts need to be removed and destroyed. Fungicides can be used to prevent the spread of the downy mildew.



*Downy mildew*

### *Botrytis*

All aboveground parts of the plant can be infested with *Botrytis cinerea*, the fungus that causes botrytis in many different plant species. Usually the fungus infests plants via wounds or decaying plant tissue, but flowers can be infested directly if the RH is above 90%. At 20 °C and a RH of 90% it takes 6-8 hours for spores to infest a flower, while it takes more than 20 hours at a RH of 95% to infest a leaf. On infested spots develops a grey brown mold. Conditions that favour infestation are a high RH, a dense crop, a low temperature, too little light and a too high gift of nitrogen. A good climate control (RH < 90%) combined with hygienic measurements provides the basis for the control of this disease.



*Starting botrytis infection*

### *Crown gall disease*

The bacterium *Agrobacterium tumefaciens* is the causal agent of the crown gall disease. This disease causes gall formation, particularly at the lower parts of the plant. The bacterium enters and infects the plant via a wound in the plant tissue. The bacterium induces unlimited cell division, whereby callus formation develops in the form of crown galls. The infested plant parts remain vital, but serve only the bacterium. Severely infested plants are withering, because water transport to higher plant parts is hampered by the galls. Hygiene is very important in the prevention of this disease and damage to the roots and stems needs to be prevented.



*Crown gall disease on rose stem*

### *Aphids*

Nymphs and adults feed on sap of phloem vessels in plants. They puncture a vessel, after which the phloem sap is forced into the aphid's food canal by the high pressure in the phloem vessel. The growth of the plant is reduced by the withdrawal of the nutrients. Aphids excrete honey dew on which sooty molds can grow. Aphids can be controlled by biological control. However, because of their explosive population growth sometimes the use of insecticides is needed.



*Aphids*

### *Spider mites*

Spider mite is one of the main pests in roses. Usually it concerns *Tetranychus urticae*. Because of their enormous reproductive capacity spider mites can cause much damage over a short period of time. The development of the spider mites is dependent on temperature. They prefer dry and warm conditions. Typically nymphs and adults live predominantly at the underside of the leaves. Spider mites suck from the underside of the leaf, causing yellow spots on the leaves. In case of large numbers of spider mites the plants are covered by webs, the leaves turn yellow



*Damage caused by spider mites*

and finally fall. The damage to the crop can be severe: growth and production decline and ultimately the crop can die. Spider mites can be controlled by biological control. In case chemicals are used, preferably those ones are selected that have minimal negative impacts on natural enemies. For an effective chemical control the spray solution should come at the underside of the leaves.

## 2. Scouting

### *Importance and frequency*

Scouting is the monitoring of disease and pest populations and crop development. Good scouting is crucial in crop protection. Pests and diseases are easiest to control when they are observed in an early stage of infestation. Scouting should be done regularly, to get a good impression of the development of the pest or disease.

### *Observation*

The main part of scouting is monitoring of the crop. Besides crop monitoring there are some other methods which support scouting. These methods include:

- Sticky traps
- Catch lamps
- Pheromone traps
- Indicator plants

Sticky traps are used to signal flying insects. There are sticky traps in different colours. Yellow traps attract amongst others thrips, whitefly and winged aphids. Blue traps are specific for thrips.



*Yellow sticky trap in crop.*

### *Registration*

Good registration can give insight in how infestations in the future will progress. The next things should be reported in case of infestation:

- Date and location
- Species
- Stage of development
- Degree of infestation

With the scouting results decisions can be taken whether it is necessary to take control measures. If so, the proper pesticide should be selected for the stage and type of organism that has to be controlled. Sometimes spot spraying is sufficient to control the pest.

### *Marking*

By marking the spots where a pest or disease was signalled it becomes easier to observe the progress of the infestation. For workers the location of the pest or disease is clear, so they can give a different treatment. Marking needs to be done by the person responsible for the crop protection, but actually all workers should be involved. As soon as an infestation is found somewhere, a clear visible marking should be placed there. This can be a sign board, a brightly coloured clip or a red and white tape.

### 3. Plant protection products

#### *Integrated Pest Management*

In integrated pest management (IPM) prevention of pests and diseases comes first. This is done by good hygiene and the use of clean plant material and resistant varieties. If pests occur, in many cases it is possible to control them biologically with the use of natural enemies. Next to that there are different mechanical control methods. If these methods do not help chemical products can be used. Sometimes it is wise to use pesticides in an early stage of infection to prevent the outbreak of a pest or disease.

#### *Biological control*

In biological control living organisms are used to control pests and diseases. The term biological control has also been applied to the use of natural products. Biological control agents of pests include predators, parasitoids and pathogens.

**Predators:** Predators are mainly free-living species that consume a large number of preys during their whole lifetime. Predators are often less host-specific than parasitoids. Some predators can be introduced preventively, because they can survive on alternative food like pollen.



*A predatory mite attacks a spider mite*

**Parasitoids:** The group of parasitoids consists of small wasps and flies. Parasitoids develop in a single host which is killed. The larval stage is parasitic, while adults are free-living and actively searching for hosts in/on which to lay eggs. In general parasitoids are very host-specific.





*Parasitic wasp on a caterpillar*

Pathogens: Micro-organisms that cause disease in their host resulting in the death or weakening of their host. An example is the bacterium *Bacillus thuringiensis* which excretes a product which is toxic for insects and their larvae.

Biological control agents of diseases are usually referred as antagonists. Antagonism is an interaction between two species, resulting in a negative outcome for one of the species. The antagonist excretes for instance antibiotics, predate the pathogen or competes with the pathogen for nutrients. An example of an antagonist is *Trichoderma harzianum*. This fungus competes with soil pathogens for nutrients and space near the roots.

The next points are essential to pay attention to in biological control:

- Take care that the quality of the material is good.
- Follow the instructions for the storage of the biological control agents.
- Start with IPM when incidence of pest infestation is still low. In that way the use of pesticides can be limited and natural enemies will have a greater chance of establishment in the crop.
- Become acquainted with the biology of the beneficial organisms.
- Promote the spontaneous occurrence of natural enemies in the crop by creating optimal conditions for them. Banker plants can be used to attract natural enemies.
- Take care that operations in the crop do not reduce the number of natural enemies too much.
- If a chemical correction is inevitable, use as much as possible selective chemical crop protection products. Try to apply chemical corrections locally.

#### *Chemical control*

The general name for chemicals which are used for pest and disease control is pesticide or plant protection product. The main subclasses which are named after their target organism include:

- Insecticides
- Fungicides
- Herbicides
- Rodenticides
- Bactericides

Contact pesticides control a pest as a result of direct contact. An example is when insects are killed after being sprayed directly, or are killed after coming on a surface covered by spray solution. Systemic pesticides are pesticides which are absorbed by plants and move to untreated tissues. Some pesticides only move in one direction within the plant, either up or down. Knowing which direction the pesticide moves will help guiding your decisions where to spray and what technique to use. Some pesticides are considered locally systemic. These will only move a short distance in a plant from the point of contact.

### *Resistance*

Within a population not all individuals are similar, because there is natural variation in properties. This means that there can be differences as well in sensitivity of a pest or disease to a crop protection product. Within a population there are always a few individuals that are less sensitive or insensitive for a product. If this product is applied several times an undesired selection process takes place, because only these individuals stay alive and are in the opportunity to develop a new population of resistant individuals.

The more specific a pesticide works the higher the chance for development of resistance. Therefore products should be alternated with products with a different mode of action. The following measures should be taken to prevent development of resistance:

- Follow the prescribed dosage on the label. Do not use higher or lower dosages.
- Do not apply a product more often than necessary.
- Take care that the product doesn't end up in the near environment.
- Alternate products. In case of fungicides products with different chemical groups should be used.
- In case (development of) resistance is observed stop with using the product.

#### 4. Spray technique

##### *Technique*

Spraying in Africa is usually done by means of a spray gun or a trolley. The main drawback of spraying with a spray gun is the irregular spray pattern. How well spraying is done is very much dependent on the skills of the person who sprays. Chance on crop damage is lower than for the trolley technique.



Spraying with the spray gun

The trolley sprays two sides simultaneously. This method is less laborious than spraying with the gun and a more equal leaf coverage is obtained. The disadvantage is a higher chance on crop damage compared to the spray gun.



*Trolley spraying*

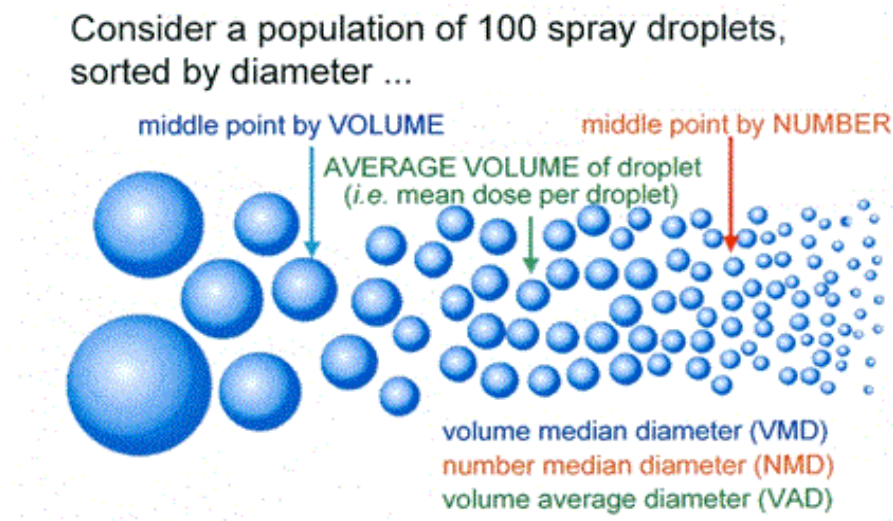
### *Walking speed*

The spray solution released by the nozzles moves into the direction of the crop and the walking direction. The walking speed during spraying should not exceed 30-35 m per minute. With a higher speed the penetration in the crop decreases, because the spray solution moves preliminary in the walking direction. A low speed gives a large amount of spray solution per hectare for the same nozzle and pressure. Walking speed, pressure, nozzle size and operation width determine the required amount of spray solution for a hectare.

### *Droplet size*

For an efficient application of a pesticide the droplet size is important. The droplet size is determined by the nozzle (size opening, pressure, type nozzle and spray angle). Droplets released by a nozzle are not equal in size. To compare the droplet spectra of different application techniques this spectrum receives a value. This can be done in two ways.

- Volume Median Diameter (VMD): This is the diameter for which half of the amount of spray solution is contained by larger droplets and half by smaller ones.
- Numeric Median Diameter (NMD): This is the diameter for which half of the droplets has a larger diameter and half a smaller diameter. In this situation the largest amount of the spray solution is contained by droplets with a larger diameter than the median.



Source: <http://www.iparc.org.uk>

### *Nozzle selection*

For every type of nozzle there is a sequence of nozzle sizes available. A nozzle with a specific size gives a specific reference flow rate. These references are established in an international standard (ISO) and are used by many manufacturers. The material of which the nozzles are made largely influences the sustainability of the nozzles.

### *Release*

The amount of spray solution which is released per nozzle per minute is dependent on the nozzle size and the pressure. Another walking speed requires another release of the spray solution to release

the same amount of spray solution per hectare. Nozzles should be cleaned regularly, because polluted nozzles release too little spray solution.

### *Spray angle*

The angle under which the solution is released from the nozzle is called the spray angle. Usually the spray angle is displayed on the nozzle.

## 5. Targeted application

### *Technique selection*

Which spray technique is selected is dependent on the location of the pest or disease. If for instance the organism is located on the underside of the leaves, you have to take care that the chemical ends up there. This succeeds best with spraying directed to the crop. In case of space treatments the pesticide comes slowly down upon the crop. As a result the pesticide ends up on the upside of the leaves. Not each chemical can be applied in every way. Information about appropriate application techniques can be found on the pesticide label.

### *Product selection*

Take into account the following factors in selection of a product. Prior in selection of a product is that the product works against the organism that has to be controlled.

- Effectiveness
- Effect on natural enemies
- Mode of action
- Alternation with regard to resistance
- Effects on the environment
- Effect on operator and workers
- Mode of application
- Price

### *Mixing*

Do not mix pesticides preferably. Mixing has the following disadvantages:

- Chemicals may react with each other. This can result in damage to the crop, or the chemicals lose their effect by the reaction.
- Almost all pesticide products contain a spreader. If you mix different products it is possible that too much spreader ends up in the spray solution. This can result in damage to the crop.
- Different organisms may be located at different locations in the crop.

Be careful with mixing and read the label in advance.



### *Application time*

Preferably pesticides are applied at the end of the day. This prevents crop damage and increases the efficiency. Moreover there are no people in the greenhouse anymore.

- Prevent crop damage by irradiation
- With a low RH the spray evaporates more quickly, whereby the uptake by the leaves and the efficiency decreases.
- The position of the leaves can change enormously during the day. If you need to spray the underside of the leaves, choose the time that the leaves have a more upright position.
- Crops that are susceptible to fungi should be sprayed in the morning so that the crop is dry during the night.

### *Amount of spray solution*

By use of the following formulas you can calculate the needed amount of spray solution. Hereby you prevent having an excess of spray solution.

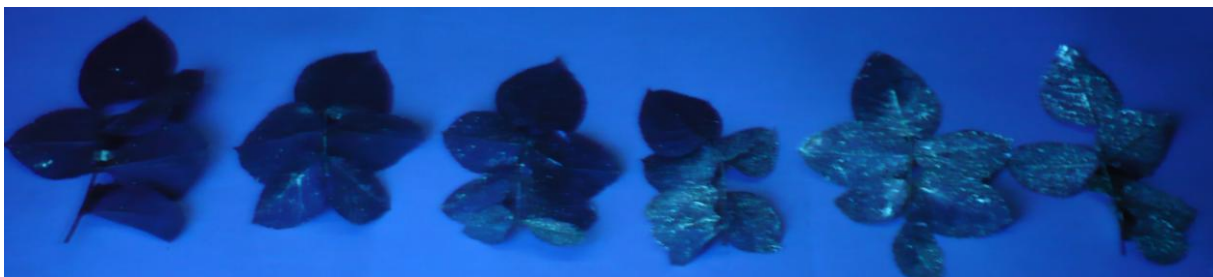
- Litres of spray solution = Total spray time (min) \* total release (L min<sup>-1</sup>)
- Total spray time (min) = Number of running meters (m) / walking speed (m min<sup>-1</sup>)
- Number of running meters (m) = Area (m<sup>2</sup>) / operation width (m) and/or number of paths \* length path (m)
- Total release per minute (L min<sup>-1</sup>) = number of nozzles \* release per nozzle (L min<sup>-1</sup>)

Take into account the leaf area index of a crop. A crop with a high LAI needs more spray solution for a similar coverage.

### *Check spray efficiency*

The working of the spray equipment can be checked during and after application. During application the spray pattern can be observed. If there is run-off the droplet size is too big or too much water is used.

There are two ways to check the penetration of the spray solution into the crop and the coverage of the underside of the leaves. This can be done using fluorescent powder or water sensitive paper. With fluorescent powder added to the spray solution it is possible to check where the spray solution ended up. The powder lights in blue under a UV-lamp. Water sensitive paper discolours at spots where droplets spray solution end up.



*Leaves after spraying with fluorescent powder under a UV-lamp.*

## 6. Adjuvants

### *Surfactants*

A water droplet which is applied on a flat surface will stay there as a little ball and will easily roll off the leaves. For a pesticide to perform its function properly, a spray droplet must be able to wet the foliage and spread out evenly over a leaf. Surfactants decrease the surface tension of spray solutions. Hereby they enlarge the area of pesticide coverage and consequently increase the pest's exposure to the chemical. Too much surfactant, however, can cause excessive runoff or deposit loss, thus reducing pesticide efficacy.



*Spray solution with (left) and without (right) surfactant.*

### *Thickeners*

As the name suggests, thickeners increase the viscosity of spray mixtures. These adjuvants are used to control drift or to slow evaporation after the spray has been deposited on the target area. Slowing evaporation is important when using systemic pesticides because they can penetrate the plant cuticle only as long as they remain in solution. Once water has evaporated, any unabsorbed pesticide will remain on the leaf surface and can be taken up by the plant only if it solubilises again.

### *Behavioural substances*

These substances can lure insects from their hiding places.

### *Stickers*

A sticker is an adjuvant that increases the adhesion of solid particles to target surfaces. These adjuvants can decrease the amount of pesticide that washes off during irrigation or rain. Stickers also can reduce evaporation of the pesticide and some slow ultraviolet (UV) degradation of pesticides. Many adjuvants are formulated as spreader-stickers to make a general purpose product that includes a wetting agent and an adhesive.



### *Penetrants*

These adjuvants enhance the penetration of some pesticides into plants. Systemic herbicides, auxin-type herbicides, and some translocatable fungicides can have their activity increased as a result of enhanced penetration.

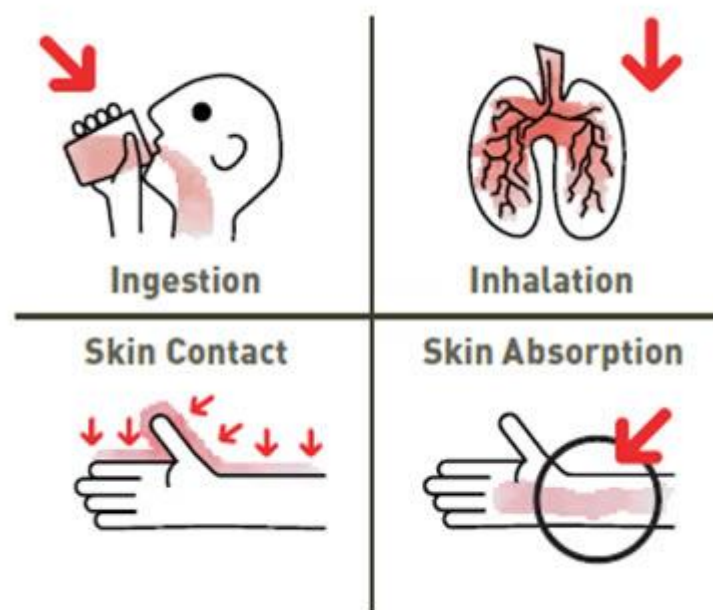
## 7. Safety

Plant protection products are meant to control pests and diseases. Unfortunately most products harm humans as well if they are absorbed by the body.

### *Exposure routes and times*

There are three ways in which a chemical agent can enter the body.

- Via the lungs: By inhalation of mist, gasses or powder
- Via the skin: By direct contact with the chemical or contact with treated crop, or by contaminated clothes or personal protective equipment.
- Via the mouth: By eating, drinking and smoking at a location which is contaminated by plant protection products, or by not (or poorly) cleaning of hands.



*Different exposure routes in which a chemical can enter the body*

There are different moments at which you can be exposed to pesticides. This can happen during:

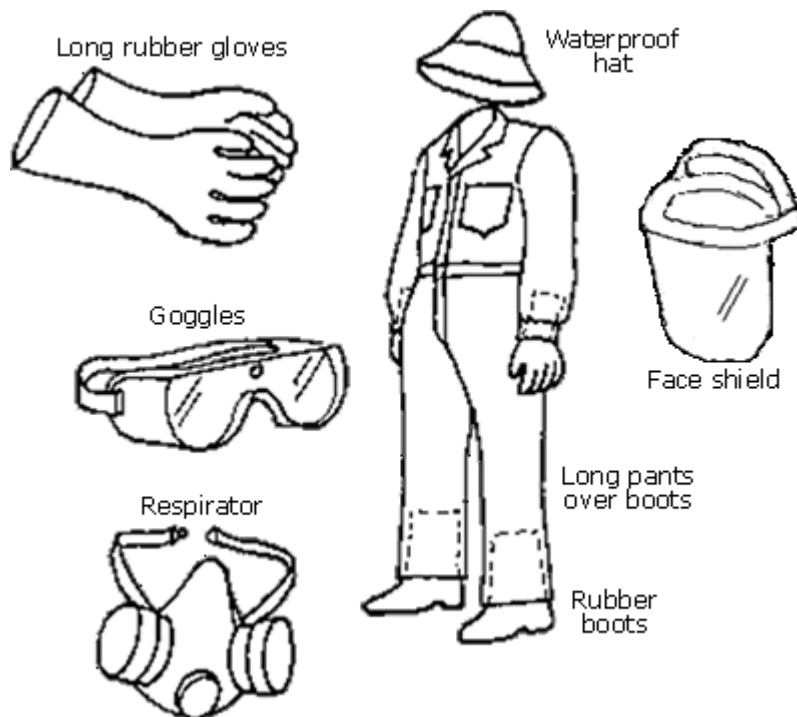
- Delivery or storage of chemicals
- Preparation, transportation or application of the spray solution
- Re-entry of the greenhouse and crop after application
- Cleaning and repairing of spray equipment
- Disposal of empty containers

### *Protective equipment*

Personal protective equipment prevents pesticides from coming into contact with the body or clothing or being inhaled. Equipment includes clothing that covers arms, legs, nose and head. Gloves and boots are used to protect the hands and feet, and hats, helmets, goggles and face masks to protect the hair, eyes, and nose. Respirators are used to avoid breathing dust, mist or vapour.

- The personal protective equipment should fit well.
- Take care that at least one extra set of personal protective equipment is available in case of emergencies.

- Check the equipment in advance for damage and/or weaknesses.
- Put on clean clothes each day, because pesticides remain in clothes.



### Overall

Overalls made of cotton are the best but should not be worn without additional protective clothing. When there is a chance of contacting wet spray, large sleeves with cuff-buttons and pants with buttons at the bottom offer good protection. A good spray overall consists of one part and is closed with a zipper. The zipper is covered to prevent leakage. Generally, overalls are meant for single- or multiuse. Do not use an overall for single use multiple times, so use a new overall after a break. Wash multi-use overalls regularly and according to the washing label. Notice that the number of washes is often limited.

### Respiratory equipment

A respirator is a device that offers protection to the lungs and respiratory tract. Different kinds of respiratory equipment are used based on the type and toxicity of pesticides.

### Hand and feet protection

**Gloves:** Dermal exposure occurs the most in the hand region. The use of gloves reduces this risk. Gloves should extend to the mid forearm. Waterproof gloves, such as those made of rubber, latex or PVC are preferable.

**Footwear:** Shoes made of rubber or synthetic materials like PVC and nitrite can be used to prevent dermal exposure of feet. Protective footwear should be high and worn with the legs of the protective pants on the outside to prevent spray from getting in. Leather or fabric shoes should never be worn as they absorb pesticides. Shoes should be checked for any leakage or damage before use.

### *Preparation spray solution*

The preparation of the spray solution doesn't take much time. Yet it is dangerous, because highly concentrated chemicals are used.

- Read the label on the pesticide container carefully.
- Make the calculations required for the solution.
- Put on the appropriate personal protective equipment before you start with preparing.
- Never work alone with highly toxic pesticides and never leave pesticides unattended.
- Mix chemicals in a well-ventilated area.
- Measure and mix quantities accurately.
- Never eat, drink, smoke or rub eyes or face while working with pesticides.
- Do not use the mouth to siphon a pesticide from the container .

### *Application*

- Wear the appropriate personal protective equipment during application.
- Use reliable, inspected and well maintained equipment.
- Don't walk through the crop during spraying. If you use a spray gun or spray boom first walk to the end of the path and walk backwards through the untreated crop.
- Make clear rules about the application (who, what, where and when).
- Agree that the operator reports himself afterwards, so that he will not remain alone in the greenhouse in case of emergency.

### *Re-entry greenhouse and crop*

After spraying there may still be vapour in the greenhouse which can be inhaled. This risk should be taken into account when you re-enter the greenhouse. Stick to the norms mentioned in the table, but the longer you wait the better. If there is no re-entry time mentioned on the label of a product, stick to a term of 8 hours. Place after application a warning sign on the entry doors with the time at which the greenhouse can be entered again without special protection.

- Take the planning of the activities in the crop in account when making the schedule for spraying. If possible carry out first the activities in the crop and thereafter the spraying.
- Cover your body as much as possible to prevent exposure. Work with long trousers and long sleeves and wear gloves if necessary.
- Ordinary clothes do not protect against pesticides in a wet crop. Wait until the crop is dry.
- Alternate the activities as much as possible. Hereby the exposure to pesticides declines, but also the physical workload.
- Clean hands and underarms regularly using soap and cold water.

### *Risks*

Children and teenagers are under extra risk to be exposed to dangerous concentrations of plant protection products, because of their little body weight and playful behaviour. Therefore there are some rules:

- Let never people below 18 years do the application of plant protection products

- Do not let people of 14 years and below work in a crop that is treated less than 14 days ago with plant protection products.

*Rules of thumb for emergencies*

- Inhalation:
  - Take the patient to a fresh and clean environment.
  - Consult a doctor.
- Ingestion:
  - Quickly but carefully read the first aid section of the pesticide label.
  - Immediately consult a doctor and keep the information on the label at hand.
  - The doctor/label will tell you whether the swallowed pesticide should be diluted with water.
  - The doctor/label will tell you as well whether vomiting should be induced.
  - Do not induce vomiting if the patient is unconscious. If necessary, vomiting can be induced by swallowing as much warm water as possible as rapidly as possible.
- Exposure to eyes:
  - Chemicals in the eyes must be removed at once by flooding with large amounts of water.
  - If possible use the eye wash station.
  - Otherwise place the victim on the floor and pour water from a beaker onto the bridge of the victim's nose so that both eyes are flooded.
  - Another person should spread the eyelids of the victim open with thumb and forefinger.
  - After washing take the victim to a doctor for immediate medical attention.
- Skin or clothes:
  - All chemicals that come into contact with the body should be considered toxic and washed off completely with soap and water even if they do not appear to be corrosive.
  - Wash off corrosive substances by flooding with tap water, using the safety shower if necessary and stripping off any clothing and shoes that are soaked with chemicals.

## 8. Storage and maintenance

### *Storage of pesticides*

- Store chemicals in the designated cabinet.
- Hang a warning on the outside of the storage room.
- Lock the storage room well, so that children and unauthorized persons cannot enter the room.
- Place powdery products above liquids.
- Store pesticides in the original packaging.
- Keep the storage room clean and tidy. Clean up spilled pesticides immediately.
- Keep as few chemicals in stock as possible and do not store leftovers.
- Never store your personal protective equipment in the storage room of the chemicals.



### *Disposal empty containers*

All pesticides and pesticide containers must be disposed carefully. Pesticide wastes should be buried. The site must be chosen carefully to prevent contamination of surface water runoff or groundwater.

Pesticide wastes should be buried under at least 0.5 m of soil mixed with lime to enhance degradation.

#### *Storage spray equipment*

After each day's field work and at the end of the season, the spray equipment should be checked thoroughly before storing in a dry place. All spraying equipment should be kept locked and away from children, food, and farm animals, and measures should be taken to prevent rats from nibbling at hoses and other parts. Many small hydraulic sprayers are preferably stored upside down with the lid removed to allow complete drainage of formulation. If engines are to be stored for a prolonged period, the spark plug should be removed and a little oil, preferably formulated with anti-rust additives, poured into the crank case. The engine should be turned over a couple of times to enable the oil to spread evenly. At the end of each day, it is advisable to add some oil to any type of sprayer pump. This is not necessary if the sprayer is to be used again the following day.

#### *Maintenance spray equipment*

Clean and maintain the used spray equipment after every spray turn. Give extra attention to the nozzles, hoses, suction strainer, filters and syringe barrel. Rinse these components with clean water.

Appendix – Scout format

<b>LEGENDA: Use a dot</b>		<b>STAGE</b>			
		One spot	2-5 spots	More	
Downey	<b>D</b>	Alive	<b>D1</b>	<b>D2</b>	<b>D3</b>

Bay nr.	Field 1						Field 2						Field 3					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
1																		
2	D1	D1	D1	D2	D1									D1				
3					D1	D2											D1	
4		D2												D1	D1			
5																		
6	D2			D1														
7													D1	D1	D1			
8													D1	D2	D2	D3	D2	
9																		
10				D1				D1					D2	D1	D1			
11																		
12																		
13														D1	D1	D2	D1	
14																		
15										D1				D1			D1	
16																		
17													D1			D2	D2	
18		D1																
19				D1											D2	D1		
20																		
21									D1	D1				D1				
22														D1	D1	D1		
23																		
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Field 1						Field 2						Field 3						
Plot nr	138	Stage 1	Stage 2	Stage 3	% infected	Plot nr	138	Stage 1	Stage 2	Stage 3	% infected	Plot nr	138	Stage 1	Stage 2	Stage 3	% infected	
	D	9	4	0	9%		D	4	0	0	3%		D	21	8	1	22%	