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Water Protection



Prevent water contamination through point sources

## **Cleaning of sprayers**

# TOPPS

TOPPS is a 3-year, multi-stakeholder project covering 15 European countries – it stands for **T**raining the **O**perators to prevent **P**ollution from **P**oint **S**ources. TOPPS is funded under the European Commission's Life program and by ECPA, the European crop Protection Association.

TOPPS is aimed at identifying Best Management Practices and disseminating them through advice, training and demonstrations at a larger co-ordinated scale in Europe with the intention of reducing losses of plant protection products to water.

This brochure hopefully supports and complements guidance provided by the manufacturers of equipment, plant protection products and national/international regulations.

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## Cleaning of sprayers

### Practical options - Best location - Required efficiency

#### Practical options

1. [Sprayers without dedicated cleaning equipment](#)
2. [Sprayers with clean water tank](#)
3. [Sprayers with clean water tank and rinsing nozzle](#)
4. [Sprayers with 'continuous' cleaning equipment](#)

#### Best location

Plant Protection Product remnants and deposits - inside and outside of the emptied used sprayer – are preferentially and routinely removed by rinsing and/or cleaning in the **last field of use**.

Sprayer cleaning must be done in areas that will not cause ground or surface water pollution.

Sprayer cleaning must not cause localised Plant Protection Product dose levels to exceed that for which it is approved.



*Plant Protection Products that are removed by cleaning in the field are metabolised '[broken down]' by micro organisms in the soil. Do not clean the sprayer in the farm yard or over any unbunded, uncontained hard surface area that is without biologically active soil capable of metabolising the washed off residues.*

#### Required efficiency

Sprayers are cleaned to ensure continued safe functioning of equipment, safety to operators, the public, environment and subsequently sprayed crops. Methods that ensure acceptable levels of sprayer cleaning will vary with machine design, equipment efficiency and required level of final cleanliness.

**Minimal internal** surface cleaning requirements may be varied to meet specified needs and/or may be a 'label' stated requirement.

**'Rinsing'** of sprayers internal surfaces may be adequate for 'follow on' treatments within the same crop type or when in daily use.

**'Cleaning'** of sprayers internal surfaces may be demanded when spraying a contrasting crop type to that just treated [such as when moving from cereals to sugar beet] or when the equipment is being stored or maintained.

**Minimal external** cleaning must ensure sprayers [and any used prime movers and associated equipment] can be safely used, maintained and stored.

## General Information

This information from TOPPS hopefully supports and complements guidance provided by the manufacturers of equipment, plant protection products and national/international regulations. They should be seen as being supportive to – rather than as an alternative source of advice.

## In-field cleaning rather than banded collection systems

Benefits if in-field cleaning include:

- the ability to confine all the PPP to the area for which it has been approved.
- less risk of taking contaminated equipment away from immediate site of use.
- less concern with containing, transporting and treating waste.

**Internal Rinsing:** Appropriate when sprayer is to be soon used again or for identical or similar crop uses

**Rinsing is quicker and easier than a full cleaning [decontaminating] routine.** This simpler method may also reduce risks to the environment through use of less cleaning water and its greater acceptance to operators who may follow the practice more routinely. Rinsing is, however, only appropriate immediately after some spraying activities but not all. These occasions must be recognised. After internal rinsing, the next use of that sprayer must be in the same crop or a crop that will tolerate [or not be tainted by] the previously used plant protection product.

Rinsing dilutes the residual volume in the sprayer to avoid the formation of a residual, tenacious film of a more concentrated product on internal surfaces of the sprayer tank, hoses and nozzles. Do note that internal surfaces of sprayers may get very warm when left outside and this heat may evaporate solvents to both concentrate and increase tenacity of retained spray solution.

Rinsing efficiency is optimised only when residual spray solution volumes are minimal. When the spray tank has a prominent sump and if agitation is turned off, then limited volumes of clean water are much more effective. Similarly, spraying until spray patterns collapse [and air emitted by the nozzle] further ensures most solution is expelled.

**Disposing of used rinsing water must be done safely.** To avoid any possibility of over dosing, reduce spraying pressure and use higher speeds when spraying the diluted spraying solution onto the treated crop/field.

Further help protect the sprayers internal surfaces from dried deposits by adding more water and leaving it within the tank ready for use in the next treatment.

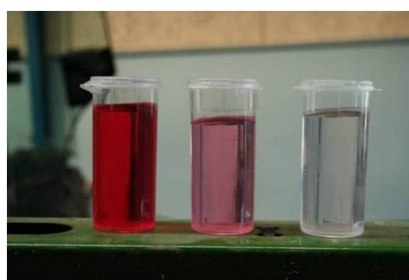
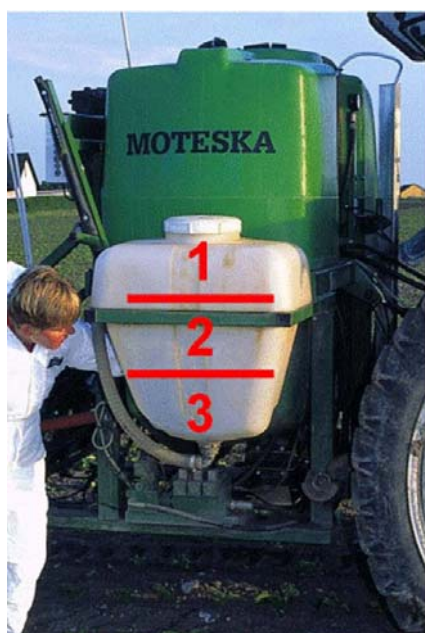
**Internal Cleaning:** Necessary when sprayer is a risk to next crop sprayed, stored or maintained

Plant protecting products can be retained within used sprayers by physical or by chemical means. Simple hold back of spray liquids can be minimised with improved machine designs and methods of use. Thus, modern sprayers have better tank sumps, smooth

tank surface walls and fewer 'dead' liquid areas. Plant protecting products can also chemically bond to sprayer structures and can be retained – despite considerable use – in that form until it is released with the subsequent use of a suitable solvent. Considerable crop damage prompted label recommendations to specify how the sprayer must be cleaned as a condition of their approval. Sprayer cleaning – rather than rinsing - is necessarily more thorough when changing sprayer use from a sulfonylurea herbicide in cereals treatment to a later application in a broad-leaved crop.

Mist blowers have also carried over insecticide/fungicides to taint subsequently sprayed crops and introduce unacceptable residue concerns. Although much more is now known on how to avoid chemical bonding – label procedures must still be fully followed.

Cleaning is necessary before used sprayers are maintained and/or stored when risks to people, livestock and the environment are to be minimised.



*Triple rinsing is much more effective at diluting residual spray solution than the use of the same total clean water volume in one action. Effective triple rinse methods may permit the final sump remnants to be drained in the field but these diluted remnants must be dispersed whilst driving. Photos: Eskil Nilsson and Jens Tønnesen.*

### **External cleaning**

Spray deposits readily accumulate on the outer surfaces of the sprayer and its prime mover. Greatest deposits on field crop sprayers occur at the points closest to the nozzles and are worsened by finer spray use. Most accumulation is on the nozzles and booms with a strong tendency towards the central structures. Finer sprays are induced into local air currents around moving sprayers so that the centre of the boom and the rear end of the spray tank is, usually, the most contaminated. Wider, higher booms and faster spraying speeds probably worsen this problem. Do note also that the front of prime movers/sprayers may also be contaminated with airborne spray when the machine turns at the end of swath sprayed. Dried plant protecting products on the sprayers outer surfaces are also better binding surfaces for further contamination.

Mist blowers may direct finer sprays upwards and/or laterally within a wind free zone. In addition, they apply mainly insecticides and fungicides with a tendency to be inherently more toxic than other plant protecting products. The combination of these spraying methods and products on the type of resultant external deposit presents a serious threat to people and the environment.

These deposits must be removed if the sprayer is to be safe and less risk - when not in use – to the environment. Best practice is to clean the sprayer in its last field of use or at

the end of every day of use. In addition, they must not be stored, outside or inside such that, for example, rain could wash the exposed surfaces to release products that could contaminate the immediate environment.

### **Adapting equipment for easier, more effective in-field cleaning**

Kits may comprise a clean water tank, tank rinsing/sprinkler nozzle, small pump, necessary hoses and valves. External cleaning kits may include high or low pressure pump, brushes and/or lances.

Clean water tanks need to be capable of containing enough clean water for internal cleaning and, increasingly, external cleaning too. Typically, their volume is at least 10% of the main tanks capacity. Tank rinsing/sprinklers must be capable of effectively rinsing all the internal structures of the main tank so their design, numbers and fitting location may need to be considered. Most advice, states the need to use the available clean water for internal rinsing, in three distinct cycles rather than in one. New developments suggest that continuous rinsing may be both more effective and make better use of limited water volumes.



*Manufacturers supply kits for sprayer rinsing and cleaning in the field.*

### **Spraying disrupted**

Be prepared for unexpected disruptions caused by rain, wind or mechanical failures.

Note, for example, if some prepared plant protecting product solutions are stable when diluted or require constant agitation.

Ensure sprayer is safe if left unattended.

Agitate spray solution for 15 minutes every 4 hours if no specific guidance given.

Ensure all nozzles have complete spray patterns when spraying continues.

### **Delays caused by emergencies**

Never drain off the prepared plant protection product solution onto any unbunded, uncontained surface. Preferably, pump solution into another sprayer for immediate use.

If not possible then transfer solution to a safe, labeled holding tank. If these tanks cannot later re-agitate the liquid into a homogeneous [uniform] spray solution then decant off the solution and apply in its approved manner and as if it were the full dose.

Very carefully [using full PPE and ensuring adequate ventilation] remove solid precipitates from holding tanks and dispose by authorised means.

## 1. Sprayers without dedicated cleaning equipment: Guidance on Use

**Internal Rinsing:** Appropriate when sprayer is to be soon used again or for identical or similar crop uses

**Minimise tank remnants.** Close agitation – when tank content is low - and continue spraying the treated area until the sprayer is empty.

**Dilute remnants.** Rinse the tank internal walls as about 100 litres of clean water are being added.

**Safely dispose diluted spray solution within treatment area.** Spray the diluted spray solution over an unsprayed or under-dosed area.

**Further dilute remnants.** Repeat rinse of tank internal walls with another 50-100 litres of water.

**Leave sprayer in safe location.** Leave the water in the sprayer in a safe, frost free area.

**Internal Cleaning:** Necessary when sprayer is a risk to next crop sprayed, stored or maintained

**Minimise tank remnants.** Close agitation – when tank content is low - and continue spraying the treated area until the sprayer is empty.

**Dilute remnants.** Rinse the tank internal walls as about 100 litres of clean water are being added.

**Clean internal surfaces of components and pipes.** Activate all valves as pressurised cleaning water circulates.

**Safely dispose diluted spray solution within treatment area.** Spray the diluted spray solution over an unsprayed or under-dosed area.

**Repeat this cleaning and disposal process.** Further dilution reduces spray concentration levels and allows, for example, filters and nozzles to be more safely cleaned.

**Empty the tank** within the treatment zone through the bottom valve. Do use an area that is safe from any risks and do not use the same place each time.

**Repeat this cleaning and disposal process for the third time.** Follow any specified label requirements. Use of cleaning and/or deactivating products may be a label recommendation. Typically, main spray tank is half filled with clean water, cleaning product added, solution agitated and all valves activated to clean all contaminated internal surfaces. Spray tank filled with water and circulated for 10-15 minutes. Diluted spray solution must be safely disposed. Diluted spray solution may be sprayed over an unsprayed or under-dosed area or use of dedicated facilities such as bunded holding tanks or 'Biobeds' may be permitted.

Empty the tank within the treatment zone through the bottom valve. Do use an area that is safe from any risks and do not use the same place each time.

Remove nozzles, filters and strainers. Clean using a solution of cleaning and/or deactivating product.

Rinse the tank with clean water and flush through the boom and hoses using at least one-tenth of the tank's rated capacity. Drain tank completely.

### **External cleaning**

**Clean sprayers external surfaces** in the last field of use or over a 'Biobed' or an area covered by topsoil and grass or on an area where washing water is collected. If possible use separate high pressure clean water washers and/or brushes.

**Never clean sprayers where there is a risk** of pollution to ground or surface water.

**Minimise external spray deposits.** Prevent long-term accumulation of plant protecting products on any exposed surface of sprayers and their associated equipment. Clean external surfaces of used sprayers on a regular basis and immediately after use.

### **Adapting equipment for cleaning**

Suitably sized and fitted clean water tanks are needed to contain the clean water needed to dilute the residual spray solution in the field immediately after spraying. Rinsing nozzle[s] within the main tank increase the effectiveness of cleaning by flushing the clean water over the tanks inner surfaces. The sprayers main pump - or a separate dedicated one - pressurises the clean water so that it can be directed through the rinsing nozzles and spray lines.

## **2. Sprayers with clean water tank: Guidance on Use**

***Internal Rinsing:*** Appropriate when sprayer is to be soon used again or for identical or similar crop uses

**Minimise main tank remnants.** Close agitation and self cleaning filter circuits – when tank content is low – and continue spraying the treated area until the sprayer is empty.

**Clean pump and supply hoses to nozzles.** Adjust valves to direct clean water to boom hoses and nozzles.

**Safely dispose diluted spray solution within treatment area.** Spray this cleaning water over an unsprayed or under-dosed area.

**Leave sprayer in safe location.** Add clean water to main tank and leave sprayer in a safe, frost free area.

***Internal Cleaning:*** Necessary when sprayer is a risk to next crop sprayed, stored or maintained

Follow Internal rinsing procedure as above then use additional water supplies to:

**Dilute remnants.** Rinse the tank internal walls as about 100 litres of clean water are being added.

**Clean internal surfaces of components and pipes.** Activate all valves as pressurised cleaning water circulates.

**Safely dispose diluted spray solution within treatment area.** Spray the diluted spray solution over an unsprayed or under-dosed area.

**Repeat this cleaning and disposal process.** Further dilution reduces spray concentration levels and allows, for example, filters and nozzles to be more safely cleaned.

**Empty the tank** within the treatment zone through the bottom valve. Do use an area that is safe from any risks and do not use the same place each time.

**Repeat this cleaning and disposal process for the third time.** Follow any specified label requirements. Use of cleaning and/or deactivating products may be a label recommendation. Typically, main spray tank is half filled with clean water, cleaning product added, solution agitated and all valves activated to clean all contaminated internal surfaces. Spray tank filled with water and circulated for 10-15 minutes. Diluted spray solution must be safely disposed. Diluted spray solution may be sprayed over an unsprayed or under-dosed area or use of dedicated facilities such as bunded holding tanks or 'Biobeds' may be permitted.



Empty the tank within the treatment zone through the bottom valve. Do use an area that is safe from any risks and do not use the same place each time.

Remove nozzles, filters and strainers. Clean using a solution of cleaning and/or deactivating product.

Rinse the tank with clean water and flush through the boom and hoses using at least one-tenth of the tank's rated capacity. Drain tank completely.

### ***External cleaning***

**Clean sprayers external surfaces** in the last field of use or over a 'Biobed' or an area covered by topsoil and grass or on an area where washing water is collected. If possible use separate high pressure clean water washers and/or brushes.

**Never clean sprayers where there is a risk** of pollution to ground or surface water.

**Minimise external spray deposits.** Prevent long-term accumulation of plant protecting products on any exposed surface of sprayers and their associated equipment. Clean external surfaces of used sprayers on a regular basis and immediately after use.

## **Adapting equipment for easier, more effective in-field cleaning**

### **Fit tank rinsing nozzle[s]**

A rinsing nozzle permits more effective cleaning in the field. The clean water supply can be directed through these special nozzles to rinse the tanks internal wall surfaces. Consider – when fitting – their best location within tank; large tanks may demand more than one and the filter basket, under side of filler cap need to be capable of being rinsed too.

## **3. Sprayers with clean water tank and rinsing nozzle: Guidance on Use**

***Internal Rinsing:*** Appropriate when sprayer is to be soon used again or for identical or similar crop uses

**Minimise main tank remnants.** Close agitation and self cleaning filter circuits – when tank content is low – and continue spraying the treated area until the sprayer is empty.

**Clean pump and all hoses.** Adjust valves to direct about 1/3<sup>rd</sup> of available clean water to hoses and through tank rinsing nozzles to wash its internal surfaces.

**Safely dispose diluted spray solution within treatment area.** Spray this cleaning water over an unsprayed or under-dosed area.

**Repeat this cleaning cycle twice more.**

**Leave sprayer in safe location.** Add clean water to main tank and leave sprayer in a safe, frost free area

***Internal Cleaning:*** Necessary when sprayer is a risk to next crop sprayed, stored or maintained

Follow Internal rinsing procedure as above.

**Empty the tank** within the treatment zone through the bottom valve. Do use an area that is safe from any risks and do not use the same place each time.

Use additional water supplies to:

**Follow any specified label requirements.** Use of cleaning and/or deactivating products may be a label recommendation. Typically, main spray tank is half filled with clean water, cleaning product added, solution agitated and all valves activated to clean all contaminated internal surfaces. Spray tank filled with water and circulated for 10-15 minutes. Circulate to induction bowl [if fitted] and ensure all internal surfaces are contacted.

Diluted spray solution must be safely disposed. Diluted spray solution may be sprayed over an unsprayed or under-dosed area or use of dedicated facilities such as bunded holding tanks or 'Biobeds' may be permitted.

Empty the tank within the treatment zone through the bottom valve. Do use an area that is safe from any risks and do not use the same place each time.

Remove nozzles, filters and strainers. Clean using a solution of cleaning and/or deactivating product.

Rinse the tank with clean water and flush through the boom and hoses using at least one-tenth of the tank's rated capacity. Drain tank completely.

### ***External cleaning***

**Clean sprayers external surfaces** in the last field of use or over a 'Biobed' or an area covered by topsoil and grass or on an area where washing water is collected. If possible use separate high pressure clean water washers and/or brushes.

**Never clean sprayers where there is a risk** of pollution to ground or surface water.

**Minimise external spray deposits.** Prevent long-term accumulation of plant protecting products on any exposed surface of sprayers and their associated equipment. Clean external surfaces of used sprayers on a regular basis and immediately after use.

## **Adapting equipment for easier, more effective in-field cleaning**

If not fitted then consider use of dedicated external cleaning systems.

### **4. Sprayers with 'continuous' cleaning equipment: Guidance on Use**

Recently introduced - 'continuous' cleaning kits comprise a pump [electric], clean water tank and rinsing nozzle. Independent and commercial claims promise more effective, quicker and easier sprayer rinsing in the field.



*By pumping water continuously into the sprayer, whilst simultaneously spraying out the residual spray solution, achieves the required very high dilution - quickly and effectively. These samples of coloured spray solution [Left to right/ Start to finish] visually demonstrate that benefit.*

*Photo: Harald Kramer. Cleaning test in the TOPPS-project.*

***Internal Rinsing:*** Appropriate when sprayer is to be soon used again or for identical or similar crop uses

**Minimise main tank remnants.** Close agitation and self cleaning filter circuits – when tank content is low – and continue spraying the treated area until the sprayer is empty.

**Clean pump, hoses and nozzles.** Open agitation and circulation through self cleaning filter and run the continuously rinsing process while still spraying in the just treated field.

**Leave sprayer in safe location.** Add clean water to main tank and leave sprayer in a safe, frost free area

***Internal Cleaning:*** Necessary when sprayer is a risk to next crop sprayed, stored or maintained

Follow Internal rinsing procedure as above.

**Empty the tank** within the treatment zone through the bottom valve. Do use an area that is safe from any risks and do not use the same place each time.

Use additional water supplies to:

**Follow any specified label requirements.** Use of cleaning and/or deactivating products may be a label recommendation. Typically, main spray tank is half filled with clean water, cleaning product added, solution agitated and all valves activated to clean all contaminated internal surfaces. Spray tank filled with water and circulated for 10-15 minutes. Circulate to induction bowl [if fitted] and ensure all internal surfaces are contacted.

Diluted spray solution must be safely disposed. Diluted spray solution may be sprayed over an unsprayed or under-dosed area or use of dedicated facilities such as bunded holding tanks or 'Biobeds' may be permitted.

Empty the tank within the treatment zone through the bottom valve. Do use an area that is safe from any risks and do not use the same place each time.

Remove nozzles, filters and strainers. Clean using a solution of cleaning and/or deactivating product.

Rinse the tank with clean water and flush through the boom and hoses using at least one-tenth of the tank's rated capacity. Drain tank completely.

### ***External cleaning***

**Clean sprayers external surfaces** in the last field of use or over a 'Biobed' or an area covered by topsoil and grass or on an area where washing water is collected. If possible use separate high pressure clean water washers and/or brushes.

**Never clean sprayers where there is a risk** of pollution to ground or surface water.

**Minimise external spray deposits.** Prevent long-term accumulation of plant protecting products on any exposed surface of sprayers and their associated equipment. Clean external surfaces of used sprayers on a regular basis and immediately after use.

### **More about safe spraying practices**

TOPPS Best Spraying Practices are freely available to all. Visit: [www.topps.org](http://www.topps.org)