KEY POINTS TO REMEMBER

- **Always wear the best protective clothing available**
- **Always hold the sprayer downwind.**
- **Always start at the downwind edge of the field**
- **Only spray if there is a cross wind**
- **Never spray if there is no wind**
- **Walk every three lines**
- **Apply 10 litres (2 backpacks) of spray per hectare**
- **Always clean the sprayer and remove the batteries after use**

MICRON

ULVA+

TRAINING NOTES FOR WATER BASED SPRAYING

ADVANTAGES OF THE ULVA+

- **Only 10 litres water needed per hectare**
- **Only 1 hour to treat 1 hectare**
- **Light to carry - only 5 Kg on back**
- **No pumping needed**

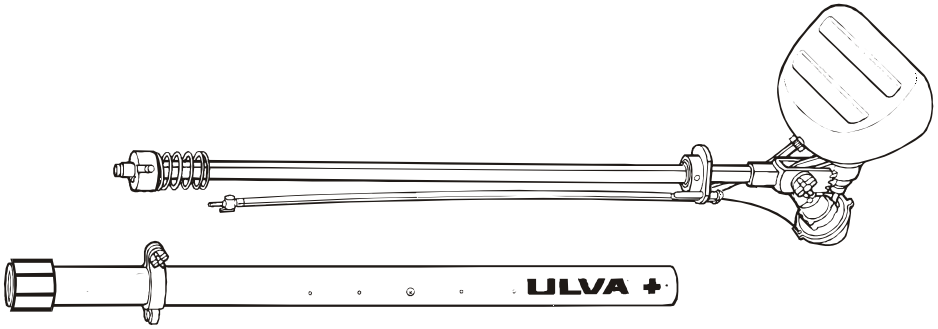
To check contacts and connections

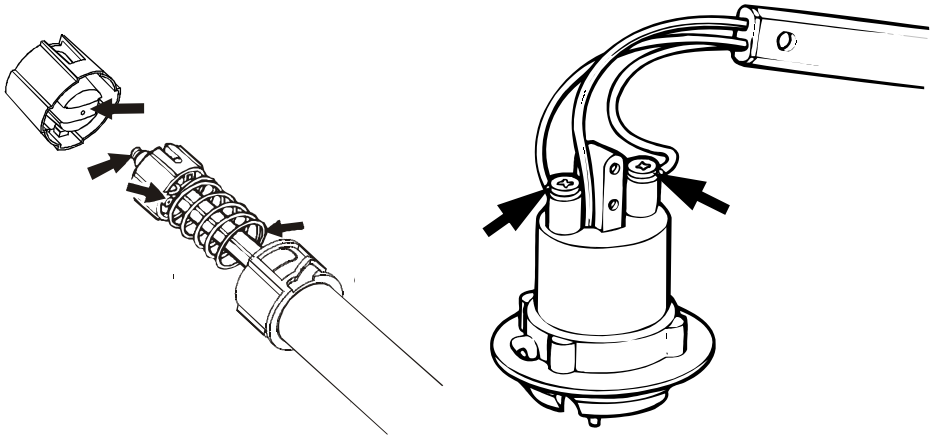
Check that the switch, switch end piece and centre connector are clean and free of corrosion. Clean with a wire brush or knife if necessary. If the brass screw on the switch is worn rotate it slightly to expose an unworn part of the thread.

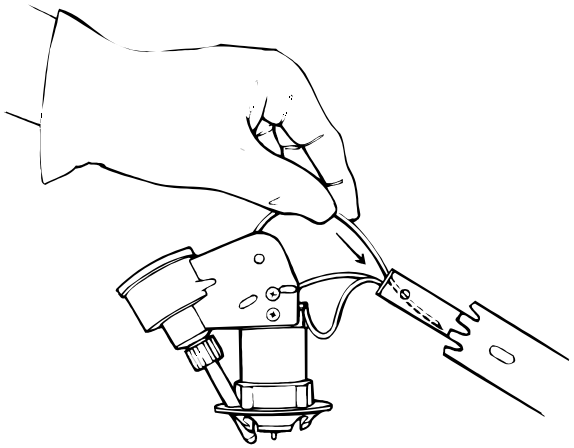
Check that the large spring which connects to the battery case is free from corrosion. Clean if necessary.

Check the connections between the wires and the connecting screws at the base of the motor. Clean if necessary.

When replacing the spray head ensure that the small nylon air vent tube is correctly replaced within the extension tube.







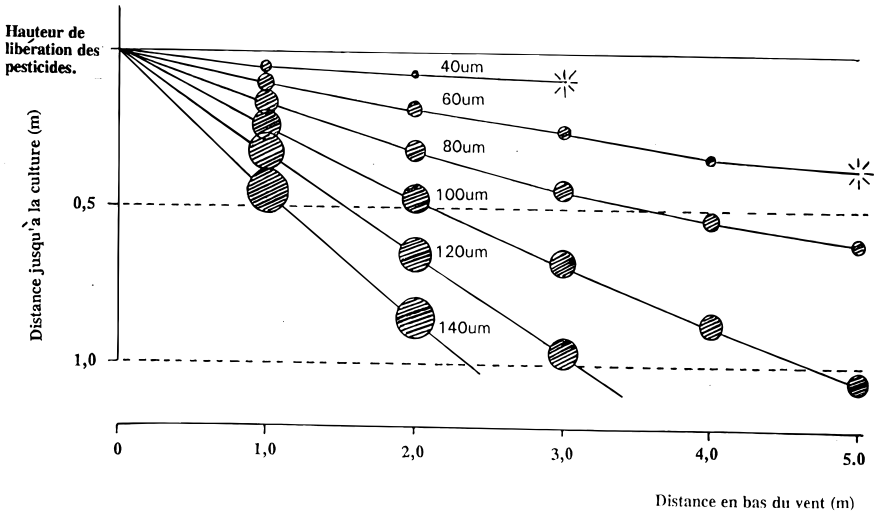
1. Introduction and advantages of ULVA+

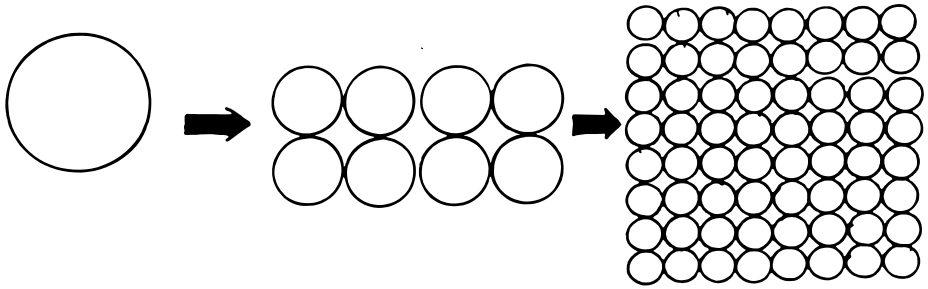
The ULVA+ is a new type of sprayer which is robust and easy to use.

Compared with a knapsack pump type sprayer the ULVA+ has several important advantages.

- Only 10 litres of water are needed to treat one hectare of a crop such as cotton. This compares with between 200 and 300 litres generally needed if using a knapsack sprayer.
- Using the ULVA+ a single person working alone can treat one hectare in around only one hour. This compares with around 8 hours needed if using a knapsack pump type sprayer.
- The ULVA+ is very light to carry and easy to use as you carry only 5 litres on your back (compared with 15 using a knapsack sprayer) and no pumping is needed.

Déplacement théorique des gouttelettes d'eau
qui s'évaporent sous un vent de 1 m/sec.
[(Temp. 30°C HR 50% (ΔT = 7,7)]





240um 120um 60um

16. Basic Repairs

To replace the motor

Remove the atomiser disc and the nozzle.

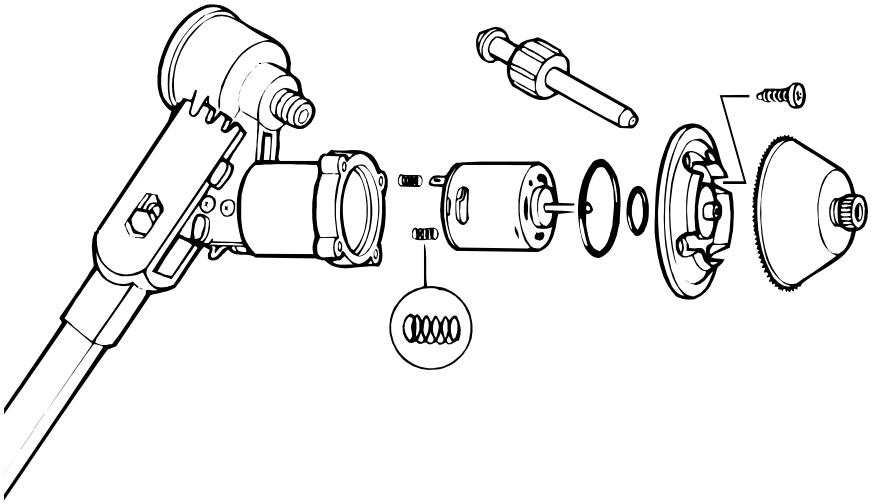
Remove the motor front plate by undoing the four screws in the motor housing and detach the front part of the motor housing.

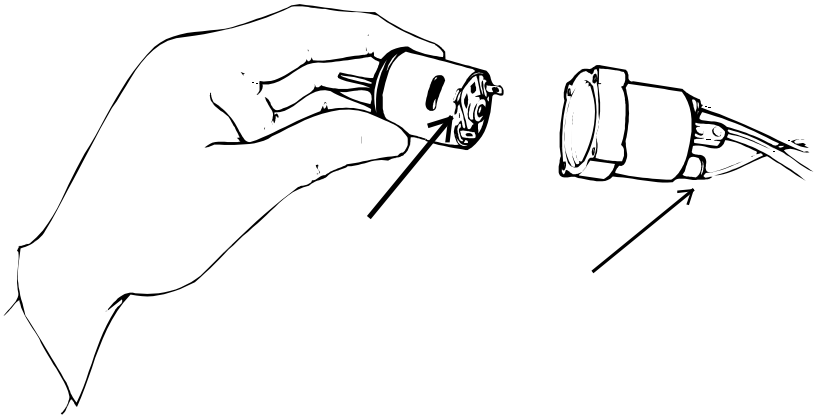
Grip the motor by the shaft and pull to remove from the motor housing.

Check the motor for signs of corrosion. The motor can be checked using a battery.

If necessary replace the motor and, the two o-rings which seal the motor and the two terminal connecting springs. When refitting the motor make sure that the positive terminal (indicated by a small mark) connects to the red wire and the terminals are correctly aligned with the terminal connecting springs in the motor housing. Replace the motor front plate, nozzle and atomiser disc.

To prevent corrosion of the motor during storage, after the spraying season has finished, remove the motor and dry it by leaving in the sun for a few hours. Put **one** small drop of oil on the bearing of the shaft and reassemble, making sure that the motor housing is dry and the o-rings and terminal connecting springs are in good condition.

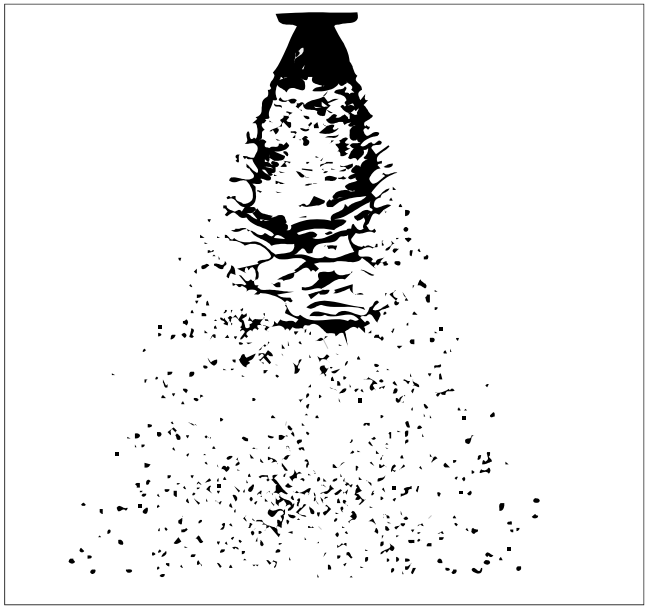


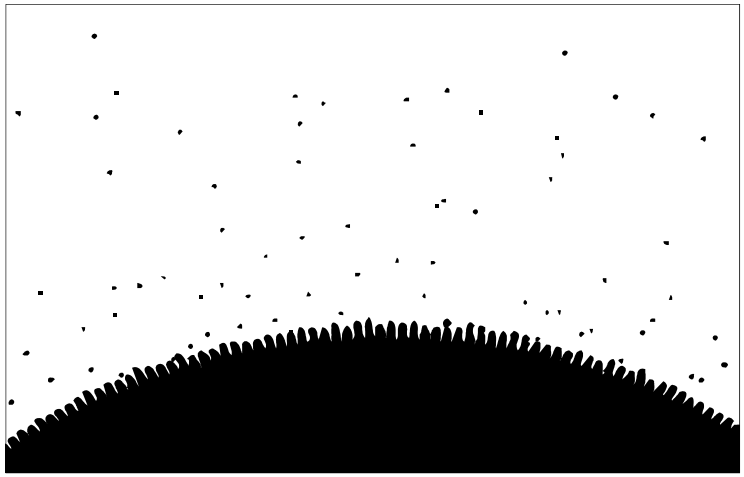


2. Background to droplet size and importance

The object of any chemical application is normally to spread evenly a relatively small quantity of chemical over a relatively large area of crop. To do this two things are generally used water and a sprayer. The job of the water is to allow a small amount of chemical to be spread. We must remember that water in itself does not kill insects or weeds. The job of the sprayer is to break up the spray mix (water plus chemical) into droplets so that it can be spread around the field more easily. The smaller the size of droplet used the more droplets can be obtained from the spray used.

However, the size of droplet also determines how far it is carried in the wind with smaller droplets being carried further than larger droplets. Smaller droplets, however are also more prone to evaporation if a water based spray mix is being used and hence we must select a droplet which is small enough to give us good coverage of the crop and be carried by the wind to the crop but not so small that it will evaporate before reaching the plant canopy.





15. Troubleshooting

Atomiser disc spins but does not spray or sprays irregularly	
Cause	**Solution**
Feed nozzle blocked	Remove feed nozzle and check and clean if necessary. Use a piece of grass or soft wire - **Do not blow through nozzle**
Atomiser disc is caked with dried chemical	Remove and clean as necessary
The spray bottle is incorrectly fitted or over-tightened	Remove and refit correctly
The threads in the spray bottle holder and spray bottle are damaged	Check and replace if necessary

Liquid leaks from the spray head	
Cause	**Solution**
Spray bottle not fitted properly	Remove and refit correctly
Flow valve from backpack is open (if refilling system used)	Close flow valve
Feed nozzle or nozzle seal damaged or incorrectly fitted	Remove, check and refit or replace as necessary
Filling cap (on twin neck bottle) is incorrectly fitted or cap seal	Refit bottle or replace cap seal as necessary

Troubleshooting

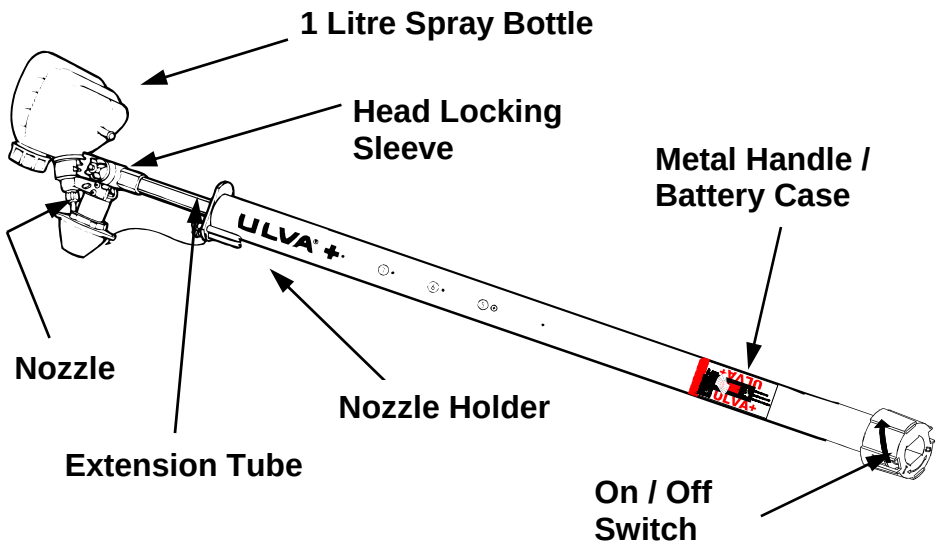
Atomiser disc fails to spin or spins intermittently or slowly	
Cause	**Solution**
Batteries incorrectly inserted	Check all batteries are fitted negative (i.e. flat) end first
Batteries low or dead	Replace batteries
Worn switch screw	Check switch screw for wear and rotate using to expose new thread if necessary
Worn switch end piece	Check switch end piece for corrosion and clean if necessary
Corroded or loose terminal connections	Check and clean terminal connections
Corrosion on battery case spring	Check battery case spring and clean if necessary
Atomiser disc rubbing on motor base plate - either atomiser disc or motor damaged	Check disc and motor and replace if necessary
Motor damaged or corroded	Remove motor - check and replace if necessary
Motor terminal springs corroded	Check and replace if necessary
Wiring loose or corroded	Check and replace wiring if necessary

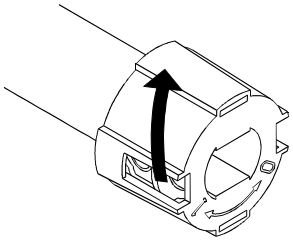
Atomisation appears poor or intermittent with irregular or overlarge droplets being produced	
Cause	**Solution**
Motor turning slowly	Check batteries and connections as described
Atomiser dirty or caked with dried chemical	Remove and clean as necessary
Teeth on atomiser disc worn or damaged	Replace atomiser disc

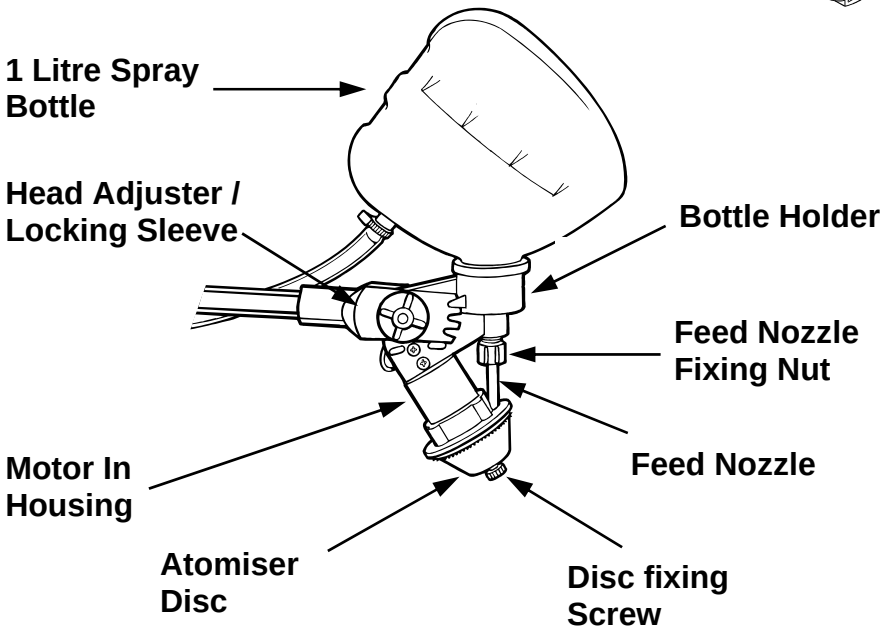
3. CDA - Principle and Advantages

A knapsack type of sprayer breaks up the spray liquid into droplets (a process known as atomisation) using what is known as a hydraulic nozzle. With this type of nozzle it is difficult to control the size of the droplet produced. A large number of big droplets are produced and hence in order to get enough droplets to give good coverage all over the field a high volume of water is needed - generally 200-300 litres per hectare.

The ULVA+ uses a different method to break up the spray liquid into droplets. It uses a rotary atomiser or spinning disc and the principle is the same as a car tyres on a wet road which produce a fine mist of spray. This method of producing droplets means that they are all around the same size. The faster the speed that the disc rotates, the smaller the size of droplet is produced. By spinning the disc at a fast speed we can produce only small droplets which give better coverage of the crop and field than large droplets. Because the coverage from smaller droplets is better this means that the amount of water needed to spread the chemical around the field is less and instead of 200-300 litres of water being needed to spray a hectare, we normally only need 10 -25 litres of water. The amount of chemical needed, however, remains the same - only the amount of water used is decreased.







14. Cleaning storage and maintenance

After spraying it is important to clean the ULVA+ properly. If the ULVA+ is looked after properly it will last for many years.

First spray out any remaining chemical into the crop or dispose of it as you have been instructed by your extension staff.

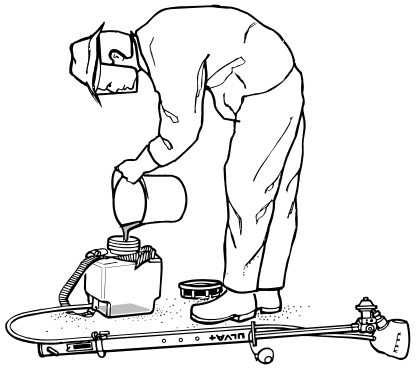
To clean the sprayer half fill the backpack with water and shake it to clean. Then half fill the spray bottle from the backpack to clean the refilling tubes and, holding the head of the sprayer close to the ground, spray out for a minute or two to clean the nozzle and disc. Empty out the backpack and repeat using clean water.

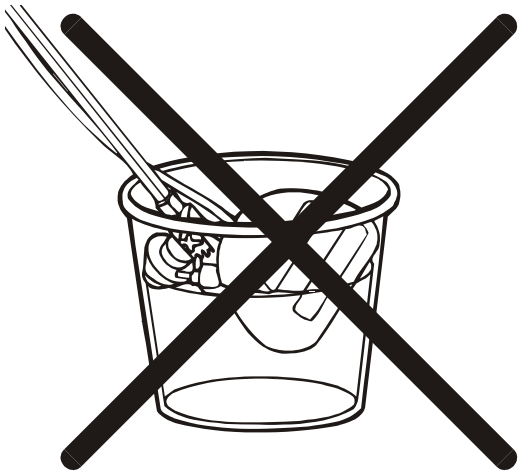
From time to time remove the nozzle and disc in clean using water. The grooves in the disc should be cleaned using an old brush particularly if powders have been used through the sprayer.

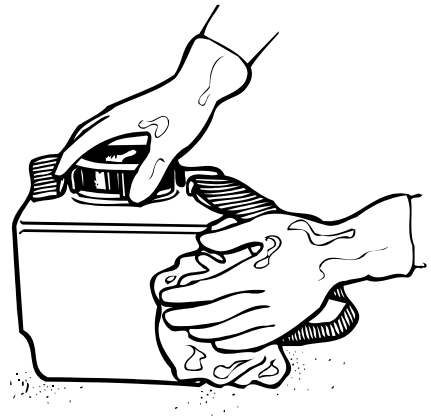
You should never try to clean the head of the sprayer by putting it in water as this will destroy the electric motor.

Wipe down the sprayer completely using a damp cloth and make sure that the bottle and backpack are completely empty.

After spraying the batteries should be removed otherwise they could leak and damage the sprayer. After removing the batteries collapse the sprayer and replace the protective cover on the atomiser disc. The sprayer should then be stored in a dry place, out of direct sunlight.







4. Main features of the ULVA+

The accompanying diagram shows the main features of the ULVA+

The *spray head*

An aluminium *handle* which carries the batteries and

The *extension tube* which joins the spray head to the handle

The most important part of the ULVA+ is the spray head where the spinning disc is located. This disc breaks up the spray liquid into small droplets a process known as atomisation and hence it is called the atomiser disc. Spray liquid flows from a one litre spray bottle by gravity through the feed nozzle onto the atomiser disc. The disc is rotated by an electric motor, and the spray liquid is thrown off the edge of the disc in the form of fine spray droplets.

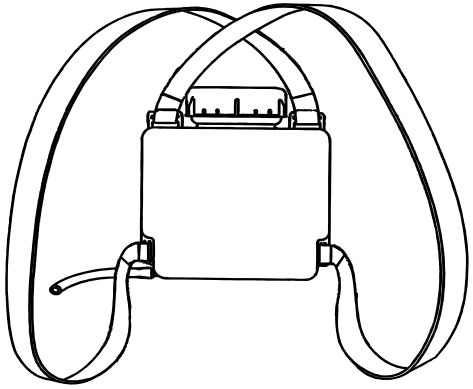
The atomiser disc has small teeth around its edge in order to help droplet production and it is important that these are not damaged. For this reason you should always fit the protective cover when the sprayer is not being used and the batteries are removed. The atomiser disc can be removed by unscrewing the plastic screw which fixes it in place with one hand while stopping the disc from turning with the other.

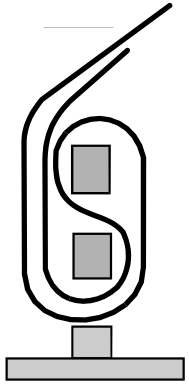
The feed nozzle can be removed by unscrewing the fixing nut. If doing this take care to ensure that the nozzle seal stays in position.

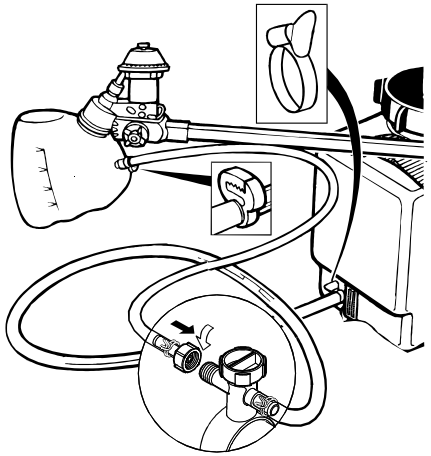
The angle of the spray head can be adjusted depending on the height of the crop and locked into place by using the head locking sleeve.

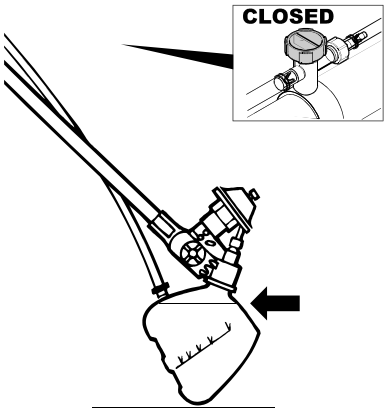
The spray head is attached to the handle by an extension tube, which allows the ULVA+ to be collapsed for transport.

The handle is an aluminium tube which contains the batteries and at the end of which is the on/off switch for the sprayer. Spare nozzles are kept in a holder on the handle.









13. Spraying - Very Low Volume

Go to the downwind edge of the field and count three rows from the edge.

If using a backpack, fill the one litre spray bottle from the backpack.

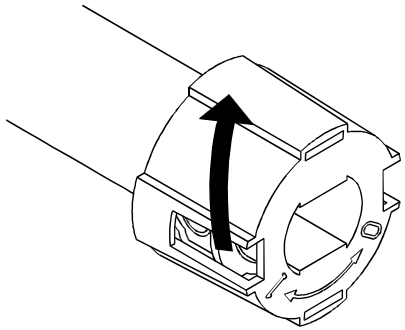
Switch the sprayer on and check that the disc is spinning. It should be possible to hear this.

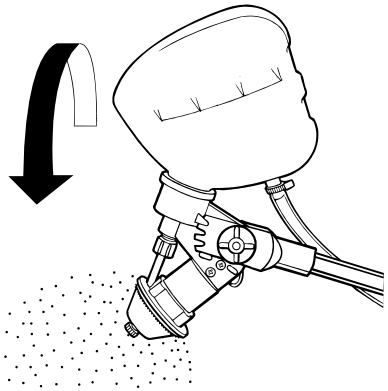
Hold the sprayer downwind with the spray head between 75 cm and one metre above the top of the crop. It is important to hold the sprayer well above the top of the crop as this ensures that several rows are covered with each pass. If the spray head is not held high enough above the top of the crop then some rows will not receive enough spray and others will receive too much. Remember, although generally we spray every three lines, ideally the wind will take the spray four or five lines so that good overlap occurs and all the cotton rows are sprayed.

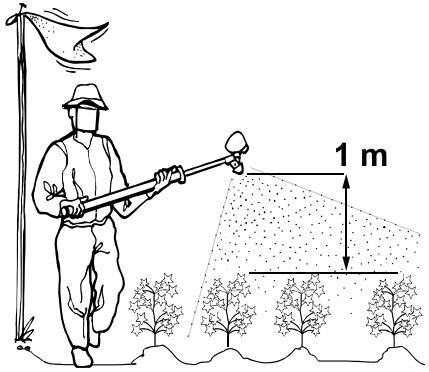
Turn the sprayer over so that the bottle is above the disc. Spray mix will then flow through the feed nozzle and onto the disc. It should be possible to see a spray cloud form which is carried by the wind into the crop. Start walking. From time to time check that the spray is being carried away from you into the crop by the wind. If the wind stops or changes direction then stop spraying **immediately**.

At the end of the row stop spraying by first turning over the sprayer so that the spray bottle is underneath the disc and the spray liquid stops flowing and then turn off the sprayer at the switch.

Move three rows upwind and turn to pass back down the field. Change the direction of the sprayer to make sure that the spray head is again pointing downwind. This is done by swapping over the position of your hands so that it points downwind and resume spraying. Continue in this way until the whole field is covered.







5. The refilling system

If the ULVA+ is being used for very low volume treatments spraying a water-based spray mix it is normally supplied with a quick refilling system. This consists of a five litre backpack and a refilling tube with tap which connects to the refillable 1 litre bottle on the spray head.

The backpack has a wide neck to make it easier to fill without spilling and a filter. The cap is fitted with an air bleed which allows air to enter the tank without liquid escaping and a cork seal to prevent spillage.

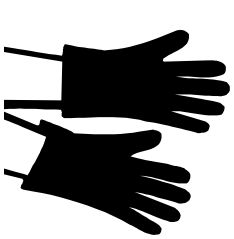
When the backpack is supplied the refilling tubes and the straps are inside the tank and these must be fitted before use.

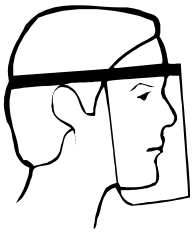
Fit the wider tube (with the tap at one end) to the outlet at the bottom of the backpack and secure it using the metal clip provided.

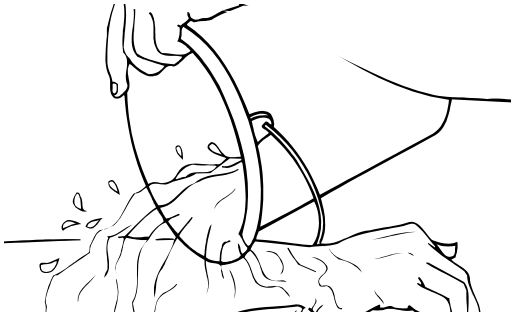
Then connect to the narrow tube to the other end of the tap and the refilling point on the bottle and clamping it to the bottle using the small plastic clip provided.

The straps do not need buckles but are fitted through the attachment loops on the backpack as shown. It is generally more comfortable to cross the straps as shown.

To fill the 1 litre spray bottle from the backpack, hold the sprayer so that the bottle is on the ground and open the tap. Liquid will flow by gravity from the backpack into the bottle. Close the tap before the spray bottle is completely full.



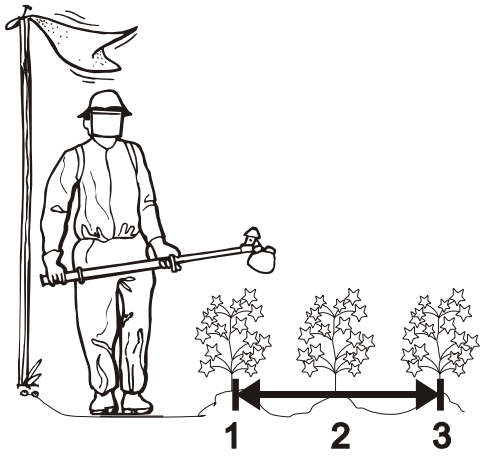


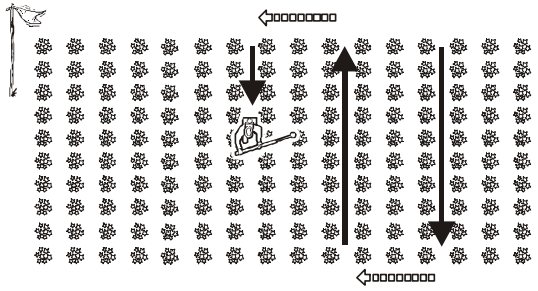


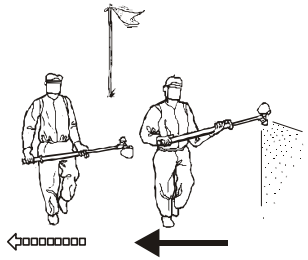
In general if spraying with 5 batteries and applying at a volume of 10 litres per hectare it will be possible to cover 2 to 3 metres with each spray pass. If spraying cotton planted in rows of 75-90 cm spacing this will mean that it should be possible to spray three rows with each pass. Ideally although we only walk every three rows the spray will be spread over four or five rows. This ensures that we get good overlapping coverage and that every part of the field is sprayed.

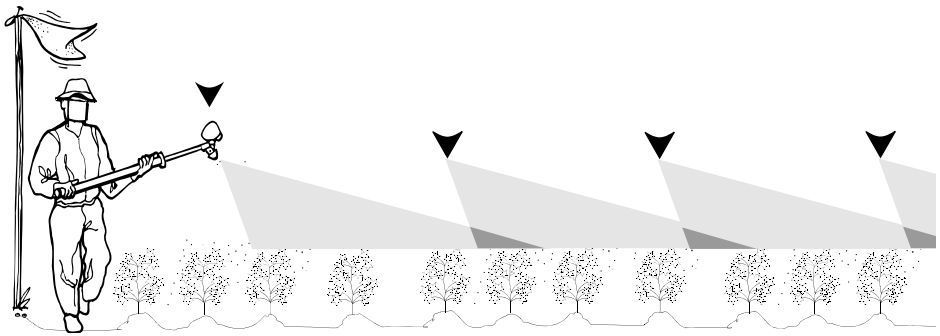
You should always start spraying at the downwind edge of the field and work progressively upwind with each spray pass. This means that you are always walking in cotton which has not yet been sprayed and you do not contaminate yourself from chemical already sprayed on the cotton.

Remember although you walk and spray down every third line the aim is to cover more than three lines to ensure an overlap of successive sprays and no gaps in coverage over the field.









6. Chemical handling and safety

Chemicals used to control pests and diseases of crops are poisons and care must therefore be taken when handling them. This includes transport, storage, mixing and spraying.

Chemicals can poison the user in various ways, including:

Taking up through the skin

Breathing of spray through the mouth and nose

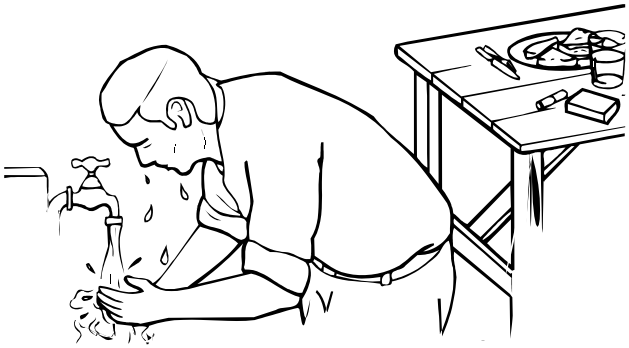
Taking in through the mouth

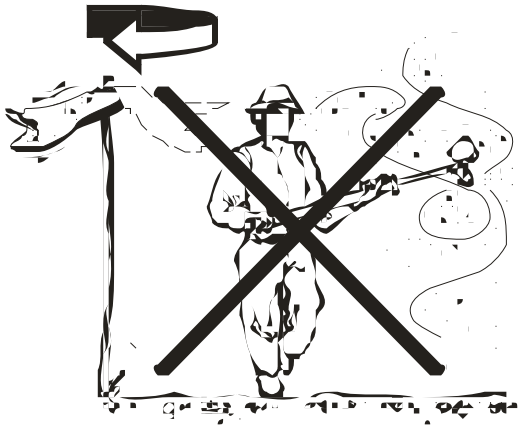
When using chemicals it is very important that you do everything possible to prevent taking in chemical through any of these routes.

To protect the skin make sure that any part of your skin which might become contaminated by chemical is covered. Ideally this means that you should wear gloves, overalls, boots or shoes and a hat. If it is not possible to obtain this clothing then it is important to protect yourself as best as possible. Wear long trousers and a long-sleeved shirt for spraying. If no gloves are available make sure that you wash your hands thoroughly with soap and water both after mixing and after spraying, especially if they have become contaminated. Make sure that all clothing is thoroughly washed after spraying.

To protect against breathing in spray a mask should be worn. If this is not available then a piece of cotton cloth wrapped around the nose and mouth should be worn instead. This should be washed regularly.

To prevent chemicals entering through the mouth make sure that you wash your hands thoroughly before eating or eating or smoking. Remember - any chemical on your hands will be transferred to the





11. Spraying Technique - Very Low Volume

Remember, the droplets produced by the ULVA+ are small and the spray mix is concentrated so care must be taken to avoid contamination. It is important with the ULVA+ that the correct spraying technique is used otherwise contamination will occur.

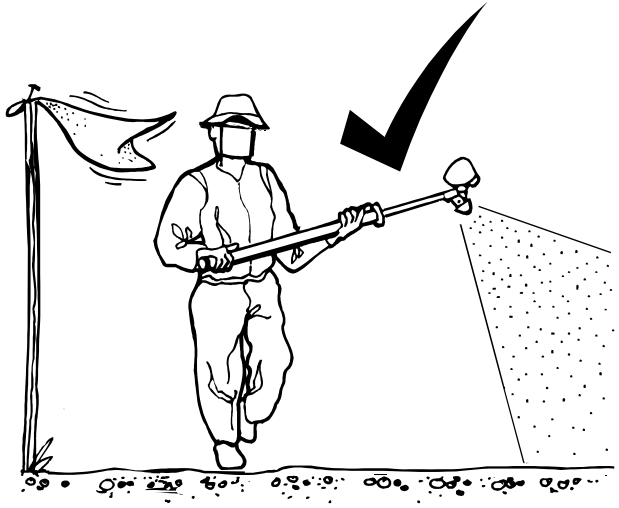
Because the ULVA+ produces small droplets the wind can be used to take the spray into the crop and rows do not have to be sprayed individually. This does mean, however, that spraying must only be carried out when there is a wind blowing.

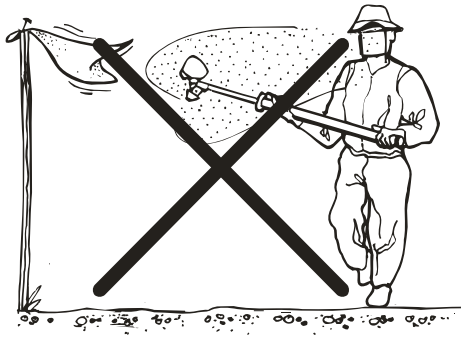
Never spray if there is no wind.

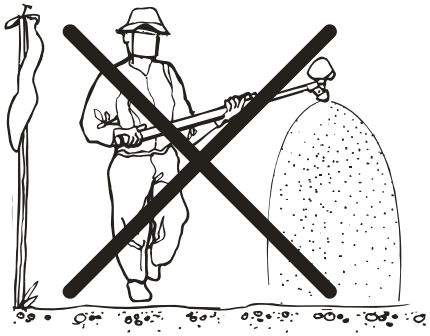
For reasons of both safety and in order to get best coverage of the crop spraying should only be carried out when there is a cross wind. This ensures that the spray is taken away from the operator and best coverage of the crop is obtained.

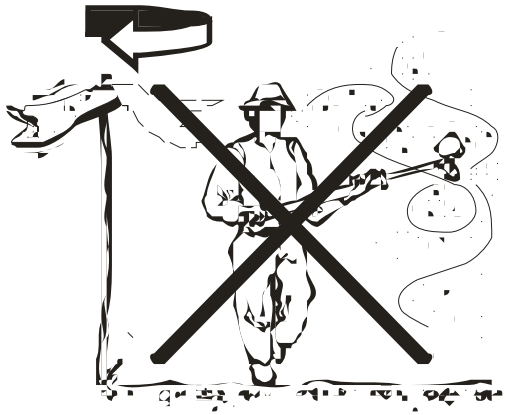
The ULVA+ should always be held downwind when spraying other wise you will contaminate yourself.

Spraying is best carried out either in the morning or the evening as at these times the temperature is cooler and the humidity higher. At these times, also, the wind will probably be steady in both strength and direction.







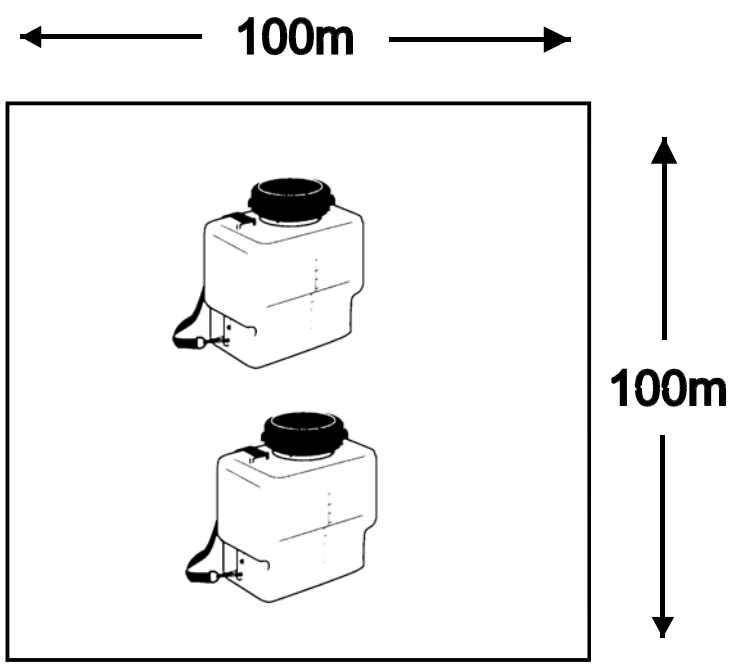


food or cigarette that you touch and go directly into your stomach.

As a general precaution make sure that chemicals are stored correctly and keep them out of the way of children - in a locked place if possible. Do not put chemical into bottles or containers used for food or drink or use kitchen equipment for mixing or measuring chemicals.

During spraying you must be aware of where the spray is going and who or what it might be contaminating. Make sure that you are not spraying other people or animals by mistake. If the wind changes in direction and you start to get sprayed yourself, stop spraying immediately.

Remember - chemicals are safe if used properly but it is up to you to make sure that you protect yourself



10. Chemical mixing - Very Low Volume

The process of mixing up the spray to use is a potentially dangerous job as concentrated chemical is involved.

You should always wear gloves if available, when measuring out and mixing chemical. If gloves are not available then make sure that you wash your hands thoroughly with soap and water afterwards. Torn gloves should not be used as these can allow chemical to come into contact with the skin and then trap it close to the skin causing greater contamination than if no gloves at all are worn.

To prepare chemicals for use with the ULVA+, using the 5 litre backpack, either use the amount indicated on the label of the chemical bottle for a five litre mix (half a hectare) or else calculate this as described.

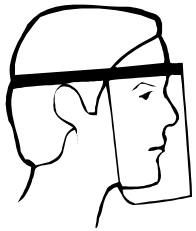
First make sure that the tap in the tube between the backpack and the spray bottle is in the closed position. Half fill the backpack with clean water, making sure that the filter is in the neck of the tank. The filter is important to trap any large particles in the water which might otherwise block the nozzle.

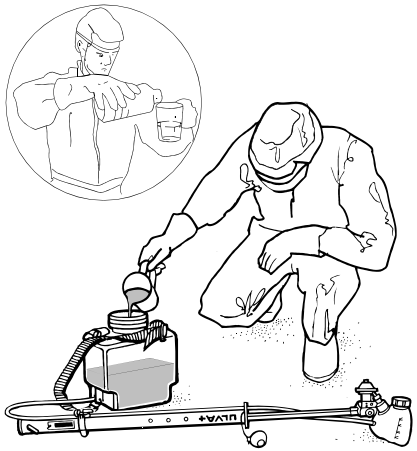
Measure out and add the correct amount of chemical as calculated and fill the backpack up to the 5 litre mark with water and replace the cap making sure that it is well tightened.

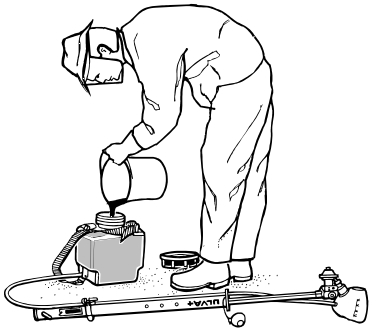
Shake the backpack to make sure that the chemical is well mixed, wipe down the outside and check for leaks.

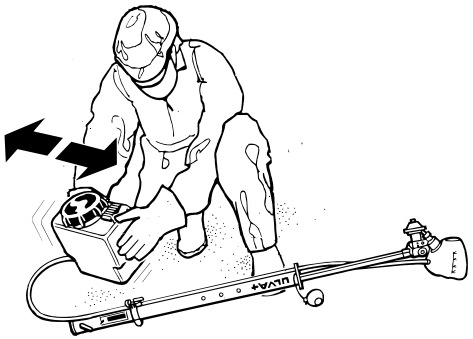
If you are using powder formulations or chemicals which do not dissolve easily these should first be mixed in a bucket before transferring the solution to the backpack and filling with water. It is a good idea to filter the mixture into the backpack through a fine cloth to remove any undissolved powder.

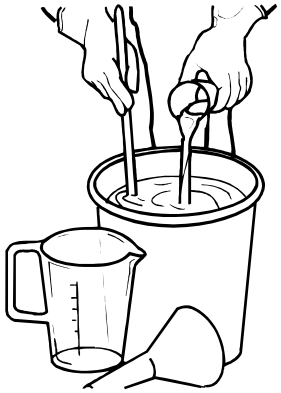
After mixing clean all equipment.

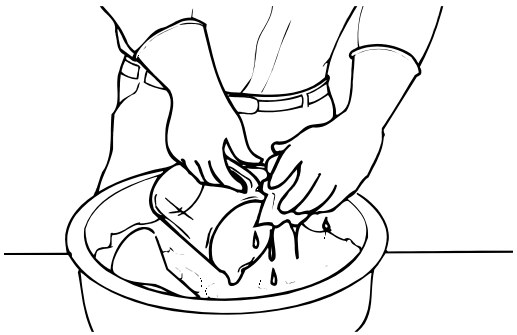












6. Calculating the spray mix

Clear instructions may be available either through the extension service or else on the label of the chemical bottle regarding the amount of chemical needed and the correct nozzle to use. (e.g. put 50 ml of compound X into the 5 litre backpack, fill up with water and fit the black nozzle to spray every 3 rows.)

If not, then you may need to calculate the amount of chemical needed.

In general the ULVA+ is used to spray insecticides using 10 litres of spray mix per hectare. This means that a five litre backpack is enough to spray half a hectare.

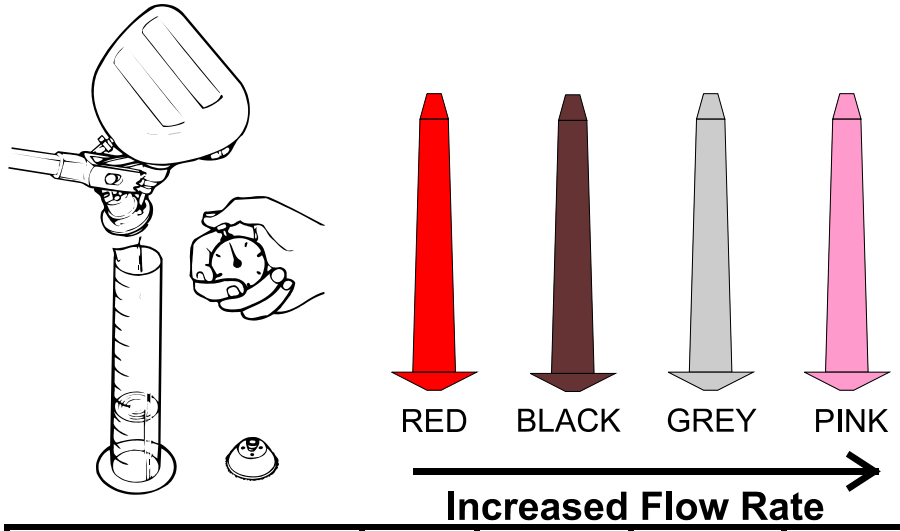
Remember with the ULVA+ we use the same amount of chemical per hectare but reduce the amount of water.

For example; if the chemical label states that we use 500 ml of chemical per hectare , for half a hectare mix 250 ml of chemical with 4 750 ml of water in the 5 litre backpack.

Walking speed = WS
Flow rate = FR
Total Spray volume = TSV
Spray pass interval = SPI

$$WS\ (m/s) = \frac{FR\ (ml/min)}{6 \times SPI\ (m) \times TSV\ (l/ha)}$$

$$FR = 6 \times WS\ (m/s) \times SPI\ (m) \times TSV\ (l/ha)$$



Nozzle	Red	Black	Grey	Pink
Flow rate with water (ml/min)	90	150	175	195

9. Preparing for spraying - VLV

Remove the protective cover from the disc and extend the sprayer.

Fit the bottle to the bottle holder taking care not to overtighten. The filling point should line up with the extension tube.

To insert the batteries, first remove the switch end piece. This is done by removing the switch as as shown and then removing switch end piece.

Fit five torch batteries into the handle of the sprayer, making sure that they are inserted flat end, that is negative end, first.

Replace the switch end piece and switch. As there is a spring in the battery case, it will be necessary to hold the switch end piece in place as the switch is reinserted.

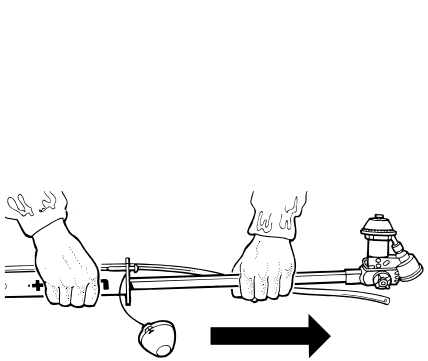
Check that the batteries are fitted correctly by turning the switch to the on position. You should be able to see and hear the disc spinning.

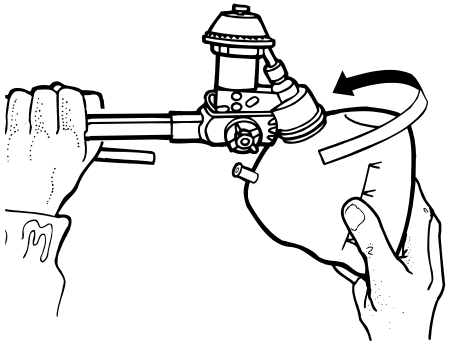
Adjust the angle of the head to suit the height of the crop. This is done by partially unscrewing the wing nut which holds the head fixing mechanism in place and moving the head to a suitable angle before locking it in place and re-tightening the wing nut.

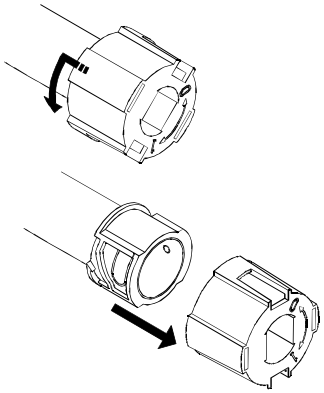
The head should be angled back if the crop is short (i.e. on the top notch of the adjuster) and forwards if the crop is tall (i.e. on the bottom notch of the adjuster) as shown. For best results the nozzle should be kept as close to vertical as possible when the head is in the spraying position.

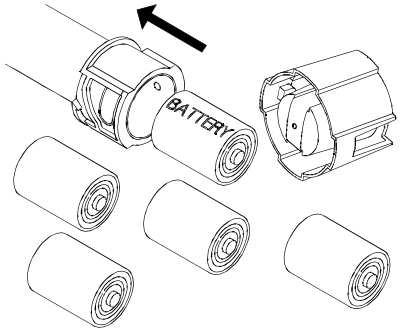
Assemble the tank and mix up the spray mixture as described.

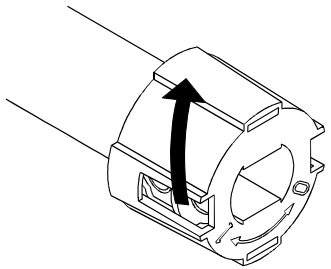
The ULVA+ is now ready to start spraying.

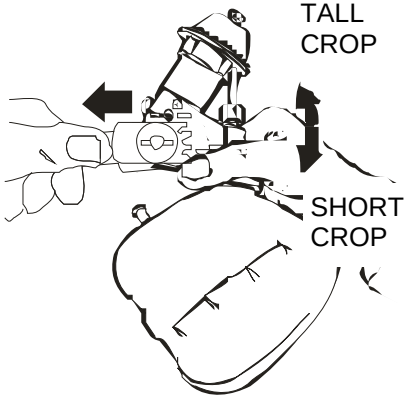












8. Calibration

If clear instructions are not given either on the label or from your extension worker, it may be necessary to calibrate the sprayer.

The amount of spray applied depends on three things:

The *flow rate* of the sprayer - i.e. how much comes out of the sprayer each minute

The *speed* at which you walk

The *distance between successive spray passes*

These are related by the following equation:

Walking speed (m/s) =

$$\frac{\text{flow rate (ml/min)}}{\text{6 x distance between spray passes (m) x total spray volume (l/ha)}}$$

These can all be measured and changed if necessary

Flow rate

The flow rate depends on the colour of the nozzle fitted and the viscosity or thickness of the mixture being sprayed. As chemical mixtures are often thicker than plain water flow rates should be measured using the actual spray mix rather than just water.

To check the flow rate, remove the atomiser disc and measure the amount which flows through the nozzle in one minute.

This table shows the flow rate of the range of nozzles using water only:

Walking speed

A normal walking speed through a crop can be reckoned to be 1 metre per second.

Example 1

Row spacing = 80 cm

Volume application rate = 10 l/ha

Walking speed = 1m/s

If we spray 3 rows at a time the distance between spray passes will be 2.4m

Flow rate needed = 6 x 1 x 2.4 x 10 = 144 ml/min

Select the BLACK nozzle (nominally 150 ml/min with water) and confirm that the flow rate with the spray mix to be used is suitable.

Example 2

Row spacing = 95 cm

Volume application rate = 10l/ha

Walking speed = 1m/s

3 rows sprayed at a time - distance between spray passes = 3 x .95 = 2.85m

Flow rate needed = 6 x 1 x 2.85 x 10 = 171 ml/min

Select the GREY nozzle (nominally 175 ml/min with water) and confirm that the flow rate is suitable

Distance between spray passes

In general this is controlled by the distance between the rows of the crop. For example if the space between the rows is 80 cm, then the distance between spray passes can be 80 cm, 1.6 m, (2 x 80), 2.4m (3 x 80) or 3.2m (4 x 80). In general with 5 batteries fitted, the spray will cover 2-3 m, so we spray 3 rows at a time.

Although the distance between the spray passes and the flow rate can be changed they cannot be controlled absolutely. You must select the most appropriate nozzle and then walk at a speed which gives the correct application rate.

With experience you will learn the correct walking speed for the particular product used, nozzle fitted and row spacing of the crop. For example if after spraying an area known to be ½ a hectare there is still spray mix left in the 5 litre backpack then your walking speed was too fast. Alternatively, if the spray mix runs out before the area is sprayed then the walking speed was too slow.