



SPRAY APPLICATION MANUAL FOR GRAIN GROWERS

Module 6

Pre-operational checks

Keeping everything running smoothly

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Key points

- **Never assume that a new sprayer is ready to spray when it is first delivered**
- **Make sure the sprayer is free of residues and debris before operating the spray system**
- **Always do a thorough check of all systems and inputs to the rate controller when the sprayer arrives**
- **Ensure the sprayer is fully calibrated before its first spraying job**
- **Plan to include checks as a part of your spraying process: some of these can be done while you are spraying, others should be done at the end of every load, or at the end of every job**
- **Undertake a thorough annual check of the sprayer**

Tank calibration and markings



Calibrating all components before operating the sprayer ensures the accuracy of future jobs. ►

Photo: Graham Betts

1. Reason for completing pre-operational and regular checks

The reason for conducting pre-operational and regular checks is to reduce the potential for time out of the paddock due to maintenance issues, and to ensure the spray system is working correctly and efficiently.

Good maintenance and regular checks can help to resolve minor problems before they lead to the need for major repairs. Unexpected downtime at critical periods in the season can be especially frustrating when conditions are good for spraying.

There are many things the operator should check on a regular basis. Some of these will be quick checks while spraying, others may be at the end of the tank or the end of a day's spraying.

The most important of all checks the operator can do is when the sprayer is first delivered. Never assume that a new sprayer is ready to spray when it arrives on-farm.

This module refers specifically to checks of the spraying system itself. Spray operators should always perform checks on other mechanical components of the sprayer, as and when recommended by the manufacturer.

2. Checks to do when the sprayer is first delivered

If the sprayer is not new, always clean the sprayer externally with appropriate decontamination agents before doing any checks, measurements or adjustments.

- **Read the sprayer operation, maintenance and rate-controller manuals before operating the sprayer.**
- **Check the manufacturer's maintenance requirements and replacement schedules for items such as filters. Note these in a prominent place or in a maintenance register.**
- **Check and record the current rate controller settings before doing anything else. Ideally these would be recorded in the rate-controller manual (and electronically), along with the date they were checked, before operating the sprayer.**

2.1 Checks and measurements to do before you operate the spray system

2.1.1 Checking the boom

Check that the nozzles are mounted level across the boom.

Look from each end of the boom to make sure that the end nozzle on the boom wing is level or slightly elevated compared with the nozzles on the boom centre.

Boom level



Starting with a level boom means less wear and better nozzle overlap. ►

Photo: Graham Betts

Check boom stability, roll and yaw

Push down on the ends of the boom and ensure the boom returns to a level position. Adjust dampeners as required. Also check that the yaw (forward and backward movement) is not excessive – adjust tensioning devices where you are able to.

Check wear pads

Check that the wear pads on the boom mounting frame are not rubbing aggressively on the boom centre. If the wear pads are rubbing, adjust the boom wing(s) forward or back to relieve the pressure off the wear pad(s).

Check the boom's ability to fold and unfold easily, ensuring no components are catching on boom supports, no hoses are crimping and that there is no damage to any of the nozzle bodies near the boom supports.

Check nozzle spacing and section widths

Depending on where the sprayer was manufactured nozzle spacing may be an imperial measurement, (e.g. 20 inches), but these are often entered into the rate controller as a metric unit, (e.g. 50 centimetres or 0.5 metres). A measurement of 20 inches is actually 0.508m, which introduces an error of 1.6 per cent to the applied rate before you even operate the sprayer, and the nozzles may not align correctly with rows planted on metric spacings in some situations.



**Boom stability -
adjusting boom
wear pads**

Measure nozzle spacing



Not all machines arrive with uniform nozzle spacings, and often the distance between them is not what you expect. This sprayer is meant to have a 0.5 metre nozzle spacing. ►

Photo: Graham Betts

Measure the exact spacing between all of the nozzle bodies. Also measure the distance from the centre of the boom to the outer nozzle body; for example for a 36.0m boom at a 0.5m nozzle spacing this measurement should be 17.75m. The accurate measurement of the sprayed width of the boom is important to ensure that the hectares recorded by the rate controller match the GPS.

The section widths to be entered into the rate controller should be the number of nozzles multiplied by the nozzle spacing on each section. If the nozzle spacing is not consistent, have this rectified by the dealer. If you have to use the sprayer before this can occur, use the number of nozzles multiplied by an average nozzle spacing. Average nozzle spacing can be calculated by measuring the distance between outside nozzle centres on the section and dividing by the number of spaces between the nozzles.

Ensure you record this information and check that the section widths entered into the rate controller are correct.

Check the range of boom heights available (up and down travel)

Many booms will have a minimum height that they can be lowered to, ideally considered before purchase. However, if after delivery you discover the boom cannot be lowered below a minimum height of 0.7m or 0.8m above the ground, consider using narrower-angled nozzles for some applications to match the height above the actual target or top of the stubble, as well as the actual nozzle spacing.

For trailing rings, check the boom mount frame is vertical

If using a trailing sprayer, check that the boom mount frame on the back of the sprayer is perfectly vertical. If it is not, adjust the pull on the sprayer or tractor. This is very important to allow the boom to function at its best. Having the boom frame vertical should automatically make the main tank level.

For some trailing rigs used in row crops where the sprayer wheels follow the tractor wheels, the drawbar length should also be checked to ensure it matches the manufacturer's specifications.

Height control (where fitted)

Check that the auto height control is responding to stimulus by placing your hand under each of the sensors. Make sure you are in a position where the boom cannot strike you if it raises suddenly.

Perform the auto-calibration function for the height controller to make sure it is able to perform as designed.

Checking the height control response



When doing a check on the height control response, ensure the boom can't strike you if it raises suddenly. ►

Photo: Graham Betts



Auto height control – checking response and calibration requirements

Height control systems are only as good as the boom centre and the auto calibration of the boom-height controller.

The ideal boom centre will allow the boom to be as independent from the sprayer as possible, so the boom can roll and stability is not affected when the terrain is uneven. It is useful to have some way to dampen the boom centre roll when the boom wings are being raised or lowered automatically or manually.



TIPS

Check the auto boom-height control manual because each sensor brand has its own optimum sensor-mounting position. It is amazing how well the auto-boom height works after performing an auto calibration.

To assist in setting the boom to the correct height, install a piece of hose (not chain) between the last two nozzle bodies on the end of each boom wing. Cut the length of the hose to match how high the nozzle needs to be above the target (or false target) to achieve a double overlap.

Fitting a guide for suitable boom height



Attaching a hose of the correct length allows you to quickly set the height at double overlap for the nozzles. ►

Photo: Graham Betts

2.1.2 The pump (before operation)

Diaphragm pumps: check if a protectant has been placed in the pump and drain if necessary. Use an appropriate oil to fill the pump, and check the oil level and condition in the oil bowl. For some pumps this may also require that bearings have been greased (e.g. some models of Hardi diaphragm pumps).

Centrifugal pumps: check if a protectant has been placed in the pump and drain if necessary before use. Check the requirements for hydraulic oil flow, and consider temperature impacts on the oil flow and pump RPM.

2.1.3 The plumbing

Ensure that all hose clamps and fittings have been tightened before operating the spray system to prevent potential leaks.



TIP

Use a lubricant on the hose clamp worm/thread before adjusting the hose clamp. Undo the hose clamp a bit before trying to tighten.

Check the nozzle bodies and diaphragms in the non-drip valves for debris and clean where required.

Ensure the spray lines and hoses are not interrupting the flow and nozzle spray pattern for example drooping hose at boom folds. Also check that hoses at the boom folds are not kinked or being pinched during folding and unfolding.

2.1.4 Electrical connections

Use a contact cleaner on all electrical connections that you have access to. This process may save a lot of troubleshooting time during the initial checks and during the season.

2.1.5 The tank

Inspect the tank to make sure it contains no debris. The tank of new sprayers should be flushed and drained before operating the spray system.

For used sprayers you will need to conduct a complete decontamination before inspecting the tank.

Check that the main tank and return lines to the tank can be isolated from the rest of the spraying system. This will be important when doing repair and for flushing lines independently of the tank contents.

Ideally the tank design would be considered before purchase, ensuring there are no internal ledges or areas where products can become trapped. This includes the sump and drain outlets at the bottom of the tank.

2.1.6 Controller inputs

Check all devices that provide inputs to the controller (e.g. speed, flow, pressure, width) or those that may affect the accuracy of the calibration.

Speed

Even where a GPS is used for the speed input, it is useful to have a back-up method for speed input, just in case you lose the GPS signal and need to finish a job.

- **Where wheel sensors are fitted, ensure all magnets are in place and the sensor is intact.**
- **Check the tyre circumference is correctly entered into the rate controller.**
- **Make sure the tyre pressure is set to match the tyre manufacturer's specifications and the actual weight and balance of the sprayer.**



TIPS

Radar-based speed sensors are not always reliable in situations where ground cover or crop density is variable; having an alternative system for measuring speed is a good idea.

If using magnets, the speed calibration figure should ideally be below 0.5metres, so the speed in the controller is stable when driving slowly. Some controllers require the magnets to be set up so that one attracts and the next one repels.

**TIP**

Impeller-based flow meters should be mounted vertically (with the impeller horizontal or parallel to the ground). The liquid flow should enter from the bottom and exit at the top. This reduces air in the line and prevents the build-up of solid materials in the flow meter itself. Ideally there will be a straight length of hose before the inlet to reduce turbulence; the length of straight hose should be about 10 times the diameter of the inlet.

Flow rate

Check how the flow meter is mounted and note the direction of flow. This will be important for later checks when you operate the sprayer.

Check and record the information on the flow meter (tag, stamp or sticker). The information on the flow meter should indicate a calibration factor (PPU or UPP) from the factory. This information should be recorded in the controller manual and will need to be checked against what has been entered into the rate controller when calibrating the sprayer output.

The calibration factors from a flow meter tag

All flow meters should have a calibration factor attached, either as a stamp or sticker, or on a tag attached to the flow meter. ►

Photo: Graham Betts

**Width**

Ensure that the number of sections and the section widths that were measured when the sprayer was first checked match the section widths entered into the rate controller.

The total boom width entered into the rate controller should match the GPS.

2.1.7 GPS and auto-steer settings

Check that the distance between the sprayer tyres (centre to centre) matches the wheel tracks of other equipment. If this does not match it can affect boom stability and lead to poor auto-steering. Problems can often occur when operating machines based on metric measurements with other machines or equipment based on imperial measurements.

Operate the sprayer at different speeds to ensure the auto-steer performs well and identify where it may struggle, such as at lower or higher speeds.

Check that the physical boom width in the controller and the GPS settings match.



TIP

Care must be taken to carefully evaluate the accuracy of the GPS and the sprayed width of the boom. Nozzle spacing, position and number of nozzles must allow enough overlap of the spray patterns from the end nozzles. For example, when using a 36.0metre boom and a GPS with 2centimetre accuracy, plumbing the boom with 73 nozzles at a 0.5m spacing (with a nozzle in the centre and 36 nozzles on either side of this) would give a sprayed width of 36.5m, which should be enough to provide a useful overlap of spray patterns. If you are operating with a less accurate GPS, for example 10cm or 30cm, an overlap of just 0.5m (or 25cm at either end) may not be enough to ensure you get sufficient overlap of the sprayed width, leading to possible misses in the paddock.

Be exact in your measurements: 3.0m is not 120 inches, it is 118.1 inches. This can make a lot of difference to how auto-steer performs.



Weighing the sprayer – ways to do it



► For more information on this process go to Module 15: Weight, balance and tyres

2.1.8 Weight and balance

Weigh and record the sprayer weights (per wheel) with the main spray tank empty and boom folded and unfolded, then repeat with the main spray tank full with boom folded and unfolded.

Record the information and specifications from the tyre, such as the tread width, ratio, size, load index and speed symbol, and then, with all the weights you have measured, work out the required cold tyre pressure for the sprayer.



TIPS

Use websites such as www.tirepressurecalculator.com as a guide to what cold tyre pressure is required.

Have a calibrated tyre pressure gauge that stays in the sprayer, so that the tyre pressure can be checked regularly.

3. Checking the accuracy of the output from the boom

Where diaphragm pumps are fitted, always check the oil level and condition, and that the bearings are greased (where required) before operating the pump.

For new sprayers fully flush the spray system with water to remove possible debris from the tank, filters, lines and nozzle bodies.

Even with new sprayers it will be important to fully flush the spray system to ensure they are clean and free of metal and plastic fragments from drilling, grinding and cutting operations that may have occurred at the factory or at the machinery dealer.

For used sprayers fully decontaminate the machine before conducting any checks of the sprayer output.

When you are not sure what the sprayer has been used for in the past, or how clean it may be, treat it as if it has had Group B herbicides in the tank. Decontaminate using chlorine-based products, followed by an alkaline detergent or tank and equipment cleaner. The cleaning process must be thorough.

Check all filters and screens, spray lines, boom sections and end caps or taps, nozzle bodies and non-drip diaphragms for debris or residue and clean as required.

Always check for residues in blindspots



When reassembling components that have seals, use rubber grease to lubricate all of the gaskets and o-rings.

For diaphragm pumps, check the oil level and condition, and, where required, grease the bearings before you start the spray system.



► **For more detail on decontamination procedures and cleaning agents, go to Module 7: Mixing and decontamination**



When checking the sprayer after a decontamination, always check blindspots, such as the boom ends. ►

Photo: Graham Betts

For all sprayers, check and service all of the nozzle bodies

If there are multiple outlet nozzle bodies on the sprayer and they are not easy to rotate they should be serviced.

- **Remove the nozzle cap, nozzle, nozzle gasket, non-drip check valve, diaphragm and turret.**
- **Put all parts in a bucket of hot, soapy water. Clean parts with a toothbrush. Turn the check valve upside down, put under water and push the plunger many times to flush any dust, grit etc. from under the spring.**
- **Compare non-drip check valve diaphragms with a new diaphragm: if they appear buckled or distorted, replace them.**
- **Use rubber grease or similar on all rubber components when putting the nozzle body back together again.**

3.1 Initial test drive (operate with water in the tank)

The initial test drive should be used to check what a suitable spraying speed will be and that these speeds align with the spray plan. This test should also be used to check that all of the systems fitted to the sprayer are functioning correctly.

Make sure you fill the tank to evaluate how the sprayer and systems perform with the tank at different levels.

Before you start the drive test, check diaphragm pumps again for oil level and condition.

While driving the machine, check:

- **that the desired rate (litres per hectare) can be achieved;**
- **that systems are communicating correctly – e.g. GPS and rate controller are ‘talking’ to each other (where separate);**
- **auto-steer responses at different speeds**
- **that the auto section control is turning on and off as required;**
- **boom stability and that auto-height control (where fitted) responds correctly; and**
- **that the desired application rate (L/ha) is stable at a range of speeds.**

**TIP**

If litres per hectare (L/ha) fluctuates while you are spraying, put the rate controller into ‘manual’, operate the sprayer at your constant spray speed and check that the L/minute and kilometre per hour reading are steady. If they still not steady in ‘manual’ check what is causing them to fluctuate. If they are steady in ‘manual’, lowering the regulating valve setting may improve this when operating the rate controller in ‘auto’.



► For more information about preparing a spray plan, go to Module 5: Spray plans

At the end of the drive test

For sprayers fitted with diaphragm pumps, replace the pump oil and check bearing grease (where required).

3.2 Do a complete calibration

Once the sprayer is clean, the spraying speed has been established and you are confident the major systems are operating correctly, it is time to ensure the accuracy of the output of the sprayer.

Never assume that the sprayer has been correctly calibrated, even if it is new.

Before undertaking the calibration it is a good idea to know what products are likely to be used and how these will need to be applied. Preparing spray plans will help to identify the types of nozzles to be used, along with appropriate settings for the controller, as well as the figures to check during calibration and spraying.

Many new sprayers are supplied without the nozzles fitted. Generally the operator must nominate what nozzles he/she requires. This can be difficult to determine if you have not established a range of suitable spraying speeds for your situation.

It is important to establish the spraying speed before you select nozzles and calibrate the sprayer output.

Operators should allow enough time between delivery and operation to ensure they can choose the right nozzles, based on their actual spraying speeds.

A complete calibration means checking:

- the flow meter and calibration;
- the speed sensor and speed calibration;
- the main spray tank volume and graduations;
- pressure at the nozzle and gauge accuracy;
- controller settings against a spray plan; and
- nozzle outputs (check every nozzle).

Where calibration factors need to be adjusted, record any changes made and the date they were made in the controller manual or a logbook that remains with the sprayer at all times.



TIPS

For second-hand sprayers, pull the flow meter apart and wash all the components to remove any foreign material, e.g. iron, surfactants, chemical etc.

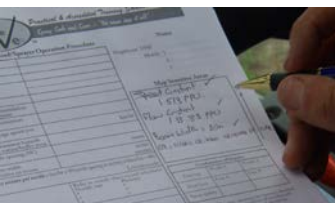
Put the flow meter back together, checking that the impeller is spinning freely and that there is a slight noise when you shake the flow meter. This will be the impeller float moving from end to end.



Servicing the flow meter is important to ensure the impeller is working properly. This impeller is jammed by residue and debris. ►

Photo: Graham Betts

A flow meter impeller jammed by residue



Checking controller inputs and settings



Pre-operational checks

3.3 Stationary tests using the rate-controller functions and system performance

Use the 'simulated speed' or 'test speed' function in the controller to check that the sprayer is working properly

- Program the maximum spraying speed identified on the spray plan, switch the controller to 'manual' and decrease the pressure until there is no pressure in the system, then increase the pressure until the pressure stops going up. Note these and check against the pump capacity as it may indicate possible restrictions on the delivery side of the spraying system or poor pump performance.
- Put the controller in 'auto' and check that the sprayer can achieve the required L/ha at the intended spraying speed.
- Program the average/constant speed on the spray plan into the controller, put the rate controller into 'auto' and check that all the figures on the rate controller screen (L/min, pressure at the nozzle, L/ha) match the figures on the spray plan (what you calculated them to be).



For more information on calibration, go to **Module 8: Calibration of the spray system**



TIP

If the sprayer is unable to achieve the required litres per hectare, have the sprayer operating with the nozzles turned on and check inside the spray tank. Look for an abnormal amount of flow going back in to the tank. Follow the hose back to the component that is allowing the flow to go back in to the tank.

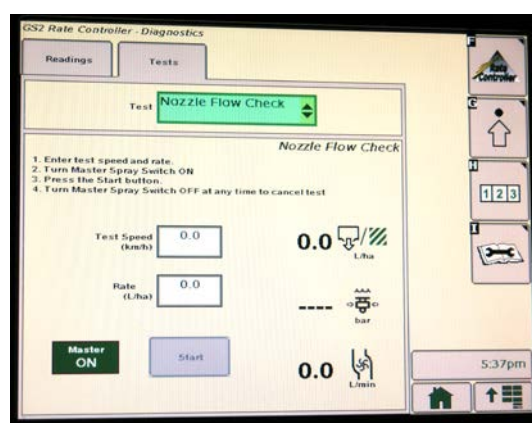
Using the speed simulation function for stationary tests



Other controllers will include a nozzle flow check function, which allows for stationary tests and nozzle checks. ►

Photo: Graham Betts

A John Deere nozzle flow-check screen



Always check and set the minimum hold function. ►

Photo: Graham Betts

Turn each boom section off individually to see if the allocated switch is turning off the correct boom section, to make sure that the L/ha and pressure are correct, that the total flow (L/min) has changed and that the system is regulated quickly. Do this for each boom section and adjust the regulating valve setting if the L/ha does not go back to the programmed L/ha quickly.

- **Enter a speed below the minimum speed on the spray plan, put the controller in 'auto' and check that nozzle pressure does not drop below the programmed setting.**
- **When the sprayer is operating at a simulated speed below the minimum speed it is also a very good time to do a 'physical check' of all the nozzle spray patterns and to make sure all the nozzles bodies are working properly.**
- **Check the accuracy of the pressure gauges fitted to the machine.**

Double-check all the settings in the rate controller, especially the minimum setting (e.g. pressure, speed or total L/min), ensuring that it will hold a minimum pressure to achieve the required spray pattern.

4. Regular checks to perform during the season

4.1 Before you start any job

The following is a list of things that should be checked before you start any spray job.

Before you leave home

- Confirm that the sprayer was decontaminated properly after the last job.
- Always check the product labels and prepare spray plans and mixing plans (work out appropriate rate controller settings, flow rates and pressure, amounts of product to mix, water volumes required and the correct mixing order).
- Always check the weather forecast.

Before you get in the sprayer

- For diaphragm pumps, always check the oil level and condition in the oil bowl.
- Check the tyre pressures and adjust as required.
- Make sure the flush or fresh water tank is full.

Before you mix

- Double-check the products supplied match the recommendation, and the rates to be mixed.
- Make sure that appropriate personal protective equipment (PPE) is available.

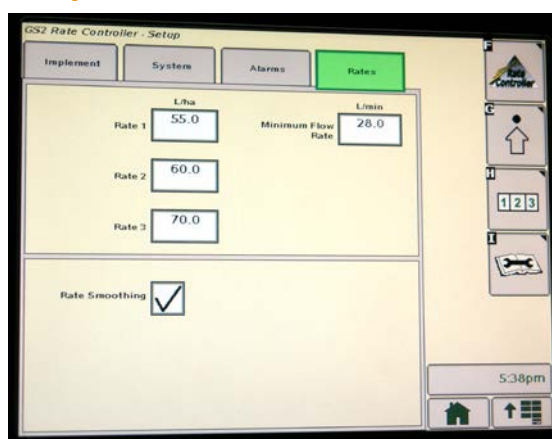
Before you spray

- Check what the flow rate through the boom (L/min) and what the operating pressure should be at your normal spraying speeds. Have these figures easily visible while you spray. Many operators use a whiteboard marker to write these on the cab window, or have the spray plan in a handy spot.
- Check the rate-controller settings, particularly the minimum hold (pressure, flow or speed), have been set to match the nozzles and the job.



**Checks and
Maintenance**

Always check and set the minimum hold function



The minimum hold function may be listed as flow, pressure or speed. It should be adjusted when changing nozzle types or application volumes. ►

Photo: Graham Betts

- Measure and record the conditions at the site of application just before you start spraying.
- Check the boom height (nozzle height) above the target (or false target) matches the job requirements and that the boom is level; check for wear points or if adjustments are required and check the height control is responding to stimulus (where fitted).

4.2 Checks to do during spraying

- Continually check that the pressure and flow rate (L/min) on the rate controller are as calculated in the spray plan (ideally this pressure would be pressure at the nozzle).
- Check height control and section control are working correctly.
- Check nozzle patterns are OK and that there are no nozzle blockages.
- Observe weather conditions and signs of possible changes, such as wind direction or wind speed.
- For centrifugal pumps ensure oil temperature (or pressure) and pump RPM remain suitable for the job.



TIPS

- If the flow rate remains constant but the pressure begins to increase, check filters for blockages.
- If flow rate remains constant and pressure drops dramatically, stop and check for leaks or blown hoses or fittings.
- If pressure appears correct but flow rate is less than anticipated, check all sections are fully engaged and the section control/valves are responding correctly.
- Use a paint pen to number the nozzle bodies across the boom, starting from the left-hand side (as if you are sitting in the cab of the sprayer). This makes it easier to identify which nozzles may need replacing if the pattern appears wrong while you are spraying.

Numbered nozzles on the boom



Numbering the nozzles makes it easier to identify from the cab which ones are blocked or produce poor patterns. ►

Photo: Graham Betts



Plumbing tip – nozzle numbering



4.2.1 Checks at the end of rows or spray runs (as you slow down or speed up)

Check that the nozzles patterns are not collapsing and that the applied rate is not becoming excessive when you slow down to your minimum speed. This will be determined by where the minimum hold has been programmed to engage within the rate controller settings.

As you speed up, check the control valves are responding in a reasonable timeframe, and that the flow rate and pressure respond fast enough for the distance travelled before you get back up to your normal spraying speed.

Where you are having trouble returning to normal operating pressure quickly enough, adjustments to the regulating valve calibration factors or other settings in the rate controller may be required. Operators should consult the troubleshooting section of the rate controller manual or contact the manufacturer if this continues to be a problem. Until such a problem is resolved, operators should consider using wider headlands.

4.2.2 Checks when spraying point rows or when spraying around/over obstacles for section and height control

Always check that the auto-section control is operating correctly, and that the pressure returns to normal quickly enough as sections turn on and off. Some systems may require the operator to adjust the 'look ahead' function on the section control until they are happy with the performance.

Check the response of the height control system and the stability of the boom. If the boom is continually fighting itself to stay level, adjust the travel speed to see if this improves things, if not this problem may require the operator to check the position of the sensors or to recalibrate the height control system. Always consult the operation manual as different brands of height control may have different requirements.

4.3 At the end of each load

- Check the controller for litres used against actual tank-mix volumes.
- Check that hectares sprayed are as expected and that GPS and controller figures match.
- For diaphragm pumps, check the oil level and condition in oil bowl at the end of each load.
- Check over the spray system for obvious signs of leaks or damage.
- Refill the water in the flush or fresh water tank.
- Measure and record the weather conditions.



Always measure and record the wind speed, direction, temperature and humidity at the end of each load. ►

4.4 End of each day (but continuing the same tank mix)

Plan to finish with the tank as empty as possible by only mixing as much product as is required for the area to be treated. Where a part load is expected, many operators will adjust the application rate or tank-mix volumes so that all loads are equal in volume and the mixing requirements are the same for each load.

It is important to anticipate when conditions are likely to become unsuitable by consulting the weather forecast for the day. Never start a load when you expect the wind speed to drop, the wind direction to become unpredictable or when rain is predicted within the products' rain-fast period.

At the end of the day's spraying activities, always:

- Make sure the sprayer is appropriately flushed with clean water before you leave the paddock and, where required, complete a decontamination.
- Dispose of the tank contents after the cleaning process has been completed.



► **For more information on cleaning and disposal of tank contents, go to Module 7: Mixing and decontamination**

Before you get out of the sprayer, do some mental checks and calculations.

- Check that the amount of product and water used is as expected for the area treated.
- Check the rate controller and GPS records of areas treated and the volumes used match up.
- Make sure all required records have been completed, including spray records.

Check over the sprayer.

- Thoroughly check the plumbing system for leaks and deal with them before the next operation.
- Check the boom for signs of fatigue and wear points, adjust dampeners if required.
- Check the filters and screens (ensuring they have been flushed and PPE is used).
- Check the nozzle diaphragms/non-drip valves are operating correctly.
- Update the product inventory to match what has been used.

Blocked filters are a source of contamination

Regular checking filters reduces contamination risk and keeps the system operating well. ►

Photo: Graham Betts

4.4.1 What to do If the job is interrupted (and product remains in the tank)

Assess what is in the tank mix and the water quality before you consider how to deal with the unsprayed contents of the spray tank. Leaving product in the tank greatly increases the effort required to decontaminate at the end of the spraying process.

It is not a good idea to leave Group B or Group I herbicides – or other products formulated as suspension concentrates, in the tank overnight. Ideally, these products should be pumped out and stored in an appropriate vessel. Some tank mixes may require agitation while in the storage vessel to keep the products dispersed in the spray solution.

For other products, a small amount of a single product or a tank mix of similar formulation types (not a tank mix of different formulations) may be able to remain in the main spray tank. However, the contents of the tank need to be able to be isolated from the rest of the spraying system so all the plumbing can be flushed with clean water.

Ideally, leaving product in the tank would only be considered for soluble liquids, such as products containing paraquat or glyphosate, and where the water quality will not adversely affect the products.

Leaving products formulated as emulsifiable concentrates (ECs) in the spray system for an extended period may 'strip out' herbicide residues from hoses and other rubber components that were not able to be removed during the decontamination process.

Great care is needed when switching from use of a Group B herbicide for cereals to a Group A herbicide (which are commonly EC formulations) in sensitive crops such as canola. If this has occurred it may be necessary to spray out a headland area before spraying any crop area.

4.5 End of one job, but starting another one soon

Always complete a water flush in the paddock immediately after completing the last load. Ensure that the sprayer is fully decontaminated using the correct cleaning agents for the products used.

4.5.1 Before changing products

Ensure decontamination was appropriate and consider the implications that the formulation of the next product to be used may have on potential residues in the tank or spray system.

Even after a complete and thorough decontamination it is possible that some residues may still be bound to the walls of the tank, plumbing or fittings. If the next product is to be applied to a crop and the tank mix contains an EC formulation, or perhaps a foliar fertiliser, it is possible that the solvents in the EC or the low pH values associated with foliar fertilisers could strip residues of previous products out of the sprayer components.

In these situations it is useful to consider spraying product onto a headland or fallow paddock, provided the label permits you to do this, before you enter the crop and apply the new tank mix.

Other things to check before changing products can include:

- check filter and screen mesh requirements for new products;
- check PPE required is available and serviceable;
- check mixing order and calculations;
- check mixing equipment is serviceable and clean; and
- check spray plan for nozzle requirements and controller settings for the new product.

4.5.2 Checks to do before changing nozzle types for another job

After the decontamination has been completed:

- check the nozzle patterns and do a rapid wear test on some of the current nozzles on the boom before changing to the new nozzle type;
- check filter screen requirements for new products and nozzles;
- check controller settings for new nozzle type (particularly the minimum hold requirements); and
- make sure the diaphragms in the non-drip valves are clean and functioning correctly.

Using a tip tester to rapidly compare nozzle outputs



Tip testers can be used to rapidly compare nozzle outputs for uniformity. Wear and flowrates should check the output volume by weighing it. ►

Photo: Graham Betts

Also complete any checks included in this module, section 4.1 on page 16, 'Before you start any job'.

4.6 Before putting the sprayer away for a while

It is important that the sprayer is put away in a state where it is ready to start another job immediately: finish clean so you can start clean.

Some things to consider before parking the sprayer for a period of time include:

- has the sprayer been decontaminated and is clean;
- what are the manufacturer's maintenance requirements;
- check cab air filters for remaining life/replacement;
- check tyre wear and condition;
- drain the pump and add a protectant to prevent corrosion (such as machining toll oil or radiator coolant); and ensure all other manufacturer's service requirements are up to date and that parts are available for expected replacements.

5. Planning for the next series of spraying operations

The best time to consider what may be required for your spraying activities is when you don't need to be spraying. When you have some downtime, it may be useful to consider some of the following.

- Review previous product use – actual use against what you expected to use during the season for the area sprayed.
- Review the results of previous spray jobs over the past spraying season – if you have any concerns discuss with these with an adviser.
- Order common spare and replacement parts for the sprayer e.g. filters, nozzles, nozzle bodies, diaphragms, pumps, etc.
- Check your water quality (see the GRDC factsheet on water quality).
- Check or prepare spray plans for next season.
- Consider producing mixing plans.
- Develop a template or spreadsheet to do the mixing calculations for you.
- Check the labels and Safety Data Sheets (SDS) of products you plan to use.
- Make sure all required PPE is available and serviceable.
- Think about future decontamination requirements and cleaning locations and that decontamination agents are on hand. Always check the expiry dates for chlorine/bleach-based products, or plan to buy these just before they are needed; and set up to be able to do jar tests for mixing new products or tank mixes.



► GRDC factsheet
on water quality:
[Spray Water
Quality](#)

6. Annual check-ups

Set aside several days each year that fit in with your cropping program and other commitments to fully check over and maintain the sprayer.

Always conduct a thorough decontamination of the sprayer and mixing and transfer equipment at least once a year, even if you have decontaminated these throughout the year when changing products.

This is the opportunity to really give the equipment a good soak, leaving cleaning agents in the spray, mixing and transfer systems overnight, followed by a thorough cleaning and rinsing process. Give everything a complete wash down, inside and out, to remove potentially built-up residues.

Always complete a full calibration of the sprayer and other metering devices at least once per year.

Making sure you check the accuracy of all equipment, including:

- **the flow meter and calibration factors;**
- **the speed sensors and speed calibration factors;**
- **infill meters and chemical transfer meters;**
- **tank volume, (if the tank has changed shape or been damaged);**
- **pressure at the nozzle and accuracy of pressure gauges;**
- **controller settings against spray plans; and**
- **nozzle outputs for all sets of nozzles.**

Always check all devices that provide inputs to the controller (speed, flow, pressure) and the serviceability of measurement devices used for mixing and transfer operations.

Checking pressure at the nozzle to compare against other gauges and the controller



Check pressure at the nozzle to check the accuracy of the output and gauges on the sprayer. ►

Photo: Bill Gordon

Run through many of the checks that were done when the machine was first delivered, including checking:

- filters, o-rings, nozzle bodies, diaphragms and seals are in good condition;
- pump capacity and for signs of wear or fatigue;
- plumbing – condition of hoses and fittings, clamps etc;
- electrical connections for corrosion, etc.;
- fatigue and wear points;
- boom stability and height control; and
- tyre wear and condition.



► For more information on decontamination or calibration go to Module 7: Mixing and decontamination and Module 8: Calibration of the spray system

Also make sure you check the following during the annual check:

- mixing and transfer equipment is in good condition and appropriate for future jobs;
- PPE requirements (including cab filters) and their serviceability for jobs that are likely to be done next season; and
- decontamination agents and procedures that might be needed for future jobs.

7. Summary

The initial check of the sprayer is the most important one the operator is likely to do, as it will underpin the success and safety of all future spraying operations.

Never assume that the sprayer is clean or calibrated when it arrives, always complete a thorough decontamination and calibration.

Try to incorporate making regular checks into how you operate the sprayer, this will help to minimise problems and downtime in the future.

[NEXT MODULE](#)

SPRAY APPLICATION MANUAL FOR GRAIN GROWERS

Module 7 Mixing and decontamination Avoiding potential problems
