Accurate manual spraying

Accuracy and efficiency are important topics in modern spraying. With tougher regulations and increasing costs there has never been more pressure to ensure that every drop of fertiliser, herbicide or insecticide is delivered precisely.

This has spawned many innovations on large scale spraying with GPS spraying, electrostatic spraying and other technological wizardry ensuring modern farmers are spraying less and getting better result. But what about the smaller scale spraying? The use of manual backpack sprayers is still common in many agricultural, horticultural and forestry settings. This article explores some ways in which these devices can be used more efficiently.

The problems with continual spraying

Manual sprayers rely on a pressure being pumped up in the backpack. This is then released as the trigger valve is pressed. When spraying continually the trigger is always pressed and so pressure gradually lessens over time. More pressure can be added with further pumps of the handle. It should be obvious that the pressure seen by the nozzle will vary considerably as the supply tank depressurises and is topped up with pressure over time. This will result in a variable flow rate and a droplet size (as droplet size is dependent on pressure).

This has two effects.

1- A potentially uneven distribution of fluid meaning areas of under or over dosing.

2- Variable absorption or drift rates due to different drop sizes. Smaller droplets (high pressure) present a bigger surface area by volume and so are absorbed more easily but they also can drift in wind.

So, in order to deliver a consistent spray, pressure needs to be kept as steady as possible.

Accuracy in continual spraying

Method 1 – Skill
It may be possible to maintain fairly regular pressures if the operator is skilled. Best practice is to initially charge the sprayer to a desired pressure level and then give a pressure maintenance pump with every few steps. The frequency of the maintenance pumps will depend very much on which nozzles or spray booms are used and it will take a lot of experience to get consistent results.

Method 2 – Regulator valves
A simple regulator valve fitted between the nozzle and discharge valve will allow spraying only at a certain pressure. So, regardless of the pressure in the tank, the nozzle will only see the pressure the regulator is rated for (normally 1, 1.5, 2 or 3 bar). If the available pressure is below the regulator's setting then spraying will stop completely. Best practice is to charge the backpack spray fully until the pressure release valve pops, normally around 3-4 bar. And then, whilst walking, give maintenance pumps of the handle regularly. As pressure is now regulated it does not matter if the pressure in the tank is over what is required and you will soon know if it is under. In this way a regular flow and droplet size can be achieved which results in a far more even spray less prone to human error. The only human factor is then the speed at which the operator walks the sprayer along. This will ultimately control the dose per m2 delivered but with a bit of experience and some simple calibration test runs good results can be achieved.

Problems with non-continuous spraying

The above discussion only considers spraying an area in a constant way via a boom but many spray applications require individual plants to be treated. For example, in a nursery polytunnel many thousands of small plants may need to be treated with a dose of liquid fertiliser or pesticide. Running a spray boom over the whole array would be wasteful so "on/off" cyclical spraying is required. This clearly means that standard methods of boom spray calibration are not going to work.

Achieving accuracy in spot spraying

Method 1 - good timing (the hard way)
Charge the sprayer with many pumps and then ensure one sprays each plant for the same duration. After each spray a couple of top up pumps will, hopefully, return the available pressure to the starting level and so the next timed spray cycle will deliver the same amount of fluid. The amount of fluid delivered with each spray cycle can be calibrated easily enough with a stop watch and a measuring cup.

Method 2 - pressure regulation (the easier way)
A pressure regulator will solve the problem of having to accurately recharge the pressure in the tank. As the pressure and flow rate will now be constant, calibration is easier. This still relies on the user only pressing the trigger for the same amount of time each and every time and so, whilst a vast improvement, is still not ideal.

Method 3 - dosing valves (the very easy way!)
Dosing valves work differently to pressure regulators. Rather than keeping pressure constant they have a fill chamber that will stop spraying after a set amount of fluid is delivered. Spraying will cease automatically when the fluid is delivered and, when the trigger is released, the valve will reset allowing for the next dose to be sprayed.

Dosing valves can be calibrated to deliver between 2 and 25 ml with each spray by simply changing the size of the dosing chamber via a simple screw.

Other tips

Nozzle selection and maintenance
There are a wide variety of spray nozzles available for the humble backpack sprayer. They come with a variety of different spray angles and patterns. Make sure you select the one which will deliver the fluid in the most accurate way for your application. Simply using the standard one that comes with the sprayer may not be the best choice. Nozzles cost very little and when compared to the cost of agrichemicals that may be wasted due to poor nozzle selection it's simply a no-brainer to spend a few minutes thinking about which pattern and flow rate will get the fluid where it needs to go.

Also ensure the nozzles are in good condition. A worn or clogged nozzle will simply be wasting chemicals. A backpack with good multi-stage filtration will help prevent nozzle clogging but every nozzle will wear over time so they are worth replacing regularly. Always have some spare nozzles in case you happen to spot a clogged or broken one mid job.

Use the correct lances and booms
There are a huge variety of booms and lances available for backpack sprayers and they are not particularly expensive. Ideally one wants to position the nozzle just close enough to the target to cover the required area; anything further away will be a waste and anything closer will result in missed spots. A lance or boom should be selected so that this optimum distance is achieved with maximum operator comfort. If the operator needs to bend down to achieve the correct nozzle position then either they will harm themselves or, as is more likely, will naturally revert to a more comfortable but less than optimal position resulting in substandard spraying.

Choose a quality sprayer
Backpack sprayers vary in cost from as little as £20 to well over £100 and the variation in quality is just as great. For simple gardening jobs cheap and cheerful sprayers are fine but if you are using the sprayer regularly or in a professional capacity then

money spent on a quality sprayer will be money well spent. Firstly, the more expensive sprayer will almost certainly last longer as they are better built but also, just as importantly, they will give a better and more accurate sprayer performance.

Little details like good filtration, in-tank agitation to prevent sedimentation, quality seals and a good quality pump will all help ensure a more accurate and consistent spray. When used in a professional setting any imprecision in spraying will result in a cost whether it be wasted chemicals or lost productivity due to under spraying. Either way these costs will almost certainly be greater over the course of a growing season than any extra cost on buying a good sprayer.