Modernizing sprayers for optimal control of Spotted Wing Drosophila

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The application of pesticides to all crops often leaves much to be desired, some growers have maintained their levels of investment in spraying by purchasing modern sprayers, others have chosen to "get by" with using old sprayers inherited from their parents or found behind the barn of some old neighbouring farm. There are many good reasons to either purchase a new machine or at least to improve an existing machine.

Old galvanised tanks for example, begin to rust away after many years of sitting out in the sun or being covered in 1-2 feet of snow. Rust flakes block filters or strainers, if fitted, and/or block nozzle tips. Modern tanks are made from poly materials which won't rust (but will break down if left outside in the sun for too long).

Old sprayers have centrifugal pumps – these are fantastic for high volume but useless for fine pressure adjustment and versatility. Some really old sprayers have piston pumps, these require expensive maintenance and produce incredible pressures using plenty of power – why use them when the modern sprayer can work perfectly well with a diaphragm pump and create droplets at sensible pressures?

Filtration is so important if nozzles are to remain open and to maintain sprayer output and the resultant timeliness. Clearing blocked nozzles is a nuisance to say the least, exposes the operator to potential danger and is totally unnecessary if correct filtration and good agitation is in place. Extra filters can be installed in-line and self-flushing filters are a boon to those who still insist on using murky pond water.

When farmers are using air-blast sprayers or cannon sprayers to send the insecticide into the crop, they need to ensure that the spray plume is well-targeted to the crop and that deposition is improved whilst reducing drift. Matching airflow to the canopy volume and distance is very important –it is part of the unique combination of target, forward speed and air volume. Growers should try shutting down tractor PTO speed as the first no-cost method of matching spray to the target.

One of the most appalling features of old boom sprayers is boom stability, usually an old piece of bent, galvanised water pipe, attached to the sprayer with chains of variable length and drooping like the wings of a tired seagull! Driving such a sprayer over typical undulating ground, over woodchuck holes and rocks results in impressive boom bounce – spray pattern and distribution pattern being totally disrupted. The sight must be reminiscent of the Dodo, an extremely ungainly bird, now extinct and I would suggest the same fate should happen to the old sprayer.

Modern nozzle technology has dramatically improved nozzle quality, ceramic nozzle tips last so much longer than the inherited brass nozzles once favoured by our grandfathers and passed from generation to generation. Nozzle spray quality classification allows the operator to select the

correct spray quality for the right target, ensuring that drift is minimised and deposition improved. Fine spray quality for contact insecticides is a must.

Old sprayers frequently dribble spray from the nozzles when they are switched off resulting in environmental pollution, potential scorching of plants and is, of course, crass stupidity – it is such a waste of product therefore a waste of money. Modern diaphragm check valves prevent drips, switch off rapidly and are so superior to the old ball and spring anti-drip or check valve.

Air assistance sprayers such as the Gregson air-assist and Hardi Twin sprayers uses flat fan nozzles to form droplets and a hydraulically-driven fan is used to create an air blast along the boom to assist in improving penetration of the spray liquid into canopy, making the distribution of pesticide more even and diminish the risk of drift. Air assisted sprayers undoubtedly help droplet penetration and can reduce drift, particularly when the leaf canopy is developed. It is crucial to be able to adjust air volume to reduce drift. The advantages of air assistance have to be weighed against the increased capital cost and higher tractor power requirement necessary to drive the fan.

Calibration is so important and should be conducted at regular intervals before and during the spraying season, but unfortunately many growers fail to do it because it takes too long. Electronic calibration devices such as the Innoquest Spot-on and Wilger calibrator speed up the process and allow rapid calibration – a simple measuring device, a vessel with a digital display, is placed under the nozzle and, within a few seconds, it displays the flow rate.

Much can be done to improve the existing sprayer but, of course, the excitement for the young technologist of tomorrow must be with modernising our sprayers with modern technology that helps the operator and the management of the system.

Automatic flow rate adjustment can also be carried out in the cab by using simple electronic controller. The desired application rate can be selected for the target on a crop and an adjustable controller, usually a butterfly valve in the line adjusts the flow accordingly.

Most tractor manufacturers and components manufacturers offer some form of guidance system. Using GPS and or GIS, the basic designs provide a light bar to guide the operator in a straight line. The operator watches a line of flashing lights, and, when in the correct driving position, the lights, for example, are green, go off course slightly and the lights change to orange. A field map, using GIS is the next stage, showing the driver the location of the sprayer. Boom sections can be switched on/off depending upon the shape of the field and location of the sprayer, avoiding costly overlaps.

Fully automatic steering systems are available from a number of manufacturers, ranging from simple adaptations to fit against the steering wheel to fully plumbed-in hydraulic systems. They are the most rapidly adopted piece of technology seen in many years, and, besides reducing overlaps it also reduces operator fatigue allowing longer working days. A major plus is the ability to text a message, drink a cup of coffee, change satellite radio stations and watch the implement on the back all whilst operating the tractor in a straight line!

Recording spray use is important for both record-keeping and traceability issues. A number of companies are offering systems based upon GPS/GIS which use a flow meter and datalogger to record how much spray is applied and where. The ultimate solution is to be able to place this information directly into a record-keeping system, thus avoiding the chore of manual data entry.

Engineering controls have been developed to reduce operator contamination and environmental pollution. Closed transfer systems allow concentrated pesticide to be moved from the original shipping container to the sprayer mix tank with minimal or no applicator contact. Many systems exist which provide a method to measure the concentrated pesticide. Some systems also include a container rinsing system. Currently available closed transfer systems use a probe inserted into the pesticide container, a connector on the container that mates to a similar connector on the application equipment, or a vacuum-type (venturi) system that uses flowing water to transfer the chemical from the container.

Induction bowls are metal, plastic or fiberglass hoppers attached to the side of the sprayer or the nurse tank that allow pesticides to be added to the mix tank without the applicator climbing onto the spray rig. Pesticides are poured into the bowl and water is added to flush out the bowl and carry the pesticide to the spray tank. Often a rinse nozzle is mounted inside the bowl for rinsing out empty pesticide containers. Typically induction bowls are raised out of the way during spraying and lowered to about 3 feet above ground when loading the sprayer.

Container rinse systems consist of a rinse nozzle and a catch bowl that traps the container washings (rinsate). The empty container is placed over the rinse nozzle and a jet of water cleans the inside of the container. The rinsate caught in the bowl is pumped into the spray tank to be used along with the spray mixture. Often rinse nozzles are installed in chemical induction bowls. Most closed transfer systems also provide a way of rinsing containers and piping the rinse water into the spray tank.

Sprayer tank washing has always taken a long time if the operator is careful about tank hygiene and is meticulous about cleaning out the pipeline, filters and nozzles. The operator is at great risk during tank washing from splashes of pesticide residue. Commonly, washing out may be carried out during overtime periods at the end of the working day, resulting in extra labour costs and employee concern regarding leaving the work place as soon as possible. The use of built-in tank washers reduces the amount of water required resulting in less rinsate to dispose of. The other major advantage, particularly when used in conjunction with a second tank of clean water is that rinsing out can be done in the field without the need to return to the filling area. Operator contamination is minimised.

There are a number of proven methods to improve deposition and reduce drift whilst spraying insecticides onto small fruit crops. Some solutions are relatively inexpensive such as correct nozzle selection, changing tractor PTO speed etc., others require an injection of capital. As increasing legislation continues to provide challenges for farmers and growers we are also faced with accountability to the supermarkets who buy our produce. Engineering solutions exist to help the grower meet future production requirements.