

Using and storing pesticides safely

Application equipment – calibration

Before calibration or application, check equipment and nozzles

- Pressure hoses, joints and unions must be checked and tightened to prevent leaks.
- Nozzles and filters must be free from blockages and produce the correct spray pattern. NEVER blow through blocked nozzles with your mouth; using an old toothbrush, wash out the obstruction with clean water. Remember to wear gloves and eye protection while cleaning.
- Nozzles must be of the type and size to match the equipment being used and to produce the spray quality specified by the chemical manufacturer on the product label.
- Low pressure nozzles (anvil or fan) are best for herbicides where there is a risk of drift and for turf fungicide/insecticide applications.
- Hollow cone tips, which produce a fine spray, may be best for other uses eg. fungicide and insecticide application to give full cover on shrubs and trees. Take care to avoid drift.
- Flood jets are best for total residual weedkillers where good ground cover is needed.
- On booms ensure identical nozzles are fitted and ensure that they are all properly aligned.
- Regularly check uniformity of nozzle output and spray pattern along boom equipment. The best way to do this is to fill a stationary sprayer with water and then hold a calibrated beaker under each nozzle for the same length of time. Reject nozzles whose output varies from the average by plus or minus 5% or those whose pattern is distorted.
- Carry spare nozzles to replace when a blockage occurs while spraying.
- Further useful information is contained in the BCPC Spraying Handbooks available from BCPC Publications, Bear Farm, Binfield, Bracknell, Berkshire RG12 5QE. Tel 0118 934 2727.

Calibration

The principles of calibration are the same for all types of hydraulic sprayer; carried, pushed or power-operated. Always check that the spray nozzles are undamaged, are giving a good spray pattern and that all the nozzles on a boom are identical. For calibration purposes, only use clean water in a clean sprayer and wear appropriate clothing.

To calculate the volume of spray applied per hectare, three pieces of information are needed:

- a. Speed of travel in kph
- b. Swath width in metres
- c. Rate of flow of the spray through the sprayer nozzles, in litres per minute

All of these are simple to measure.

The following equipment will be needed:

- 1 Tape measure to measure up to 100 metres
- 2 Measuring jug, calibrated in millilitres, holding two litres
- 3 Stop watch
- 4 Pocket calculator and notebook
- 5 Markers eg. sticks or canes.

a. Speed of travel

- 1 Mark out a 100 metre stretch of ground typical of the type on which

work will be done. Sprayers tend to move faster on smooth surfaces and slower on rough ones. (A 50-metre length can be used if space is restricted, but it is less accurate).

- 2 Measure the time in seconds it takes to travel the 100-metre stretch twice using the spray equipment. If the time taken is very different the second time, repeat again. Calculate the average time to travel 100m.

- 3 To calculate the speed use the formula:

$$\frac{360}{\text{Time (in seconds) taken to travel 100 metres}} = \text{Speed in kph}$$

- 4 Record this figure in the notebook.

(For knapsack operators, speeds will differ between individuals but are usually around 5kph).

b. Swath width

- 1 Select an area of dry concrete, or similar, at least as wide as the swath width to be used.

2a For power equipment, spray out whilst standing still until the spray pattern is clearly visible. Measure the width in metres.

2b For hand-held equipment, hold the nozzle(s) at normal working height and spray out standing still until the spray pattern is clearly visible. Measure the width in metres. (To discover an operator's normal height, it may be necessary for them to walk up and down for a few minutes spraying out water).

- 3 Record the width, the number of nozzles and their size/type/classification in the notebook.

c. Flow rate

1a Power sprayers – set the pressure to the standard for the nozzles being used.

1b Knapsacks – ensure that any pressure regulator is set correctly and use a normal working pumping motion.

2 Spraying normally, but standing still, collect the spray from each nozzle over one minute into the calibrated jug. (For wide booms, one nozzle from each boom section is usually adequate). There are devices for measuring the flow rate from nozzles on a boom sprayer which are more convenient and quicker, but these should always be checked against the jug method).

- 3 Record in the notebook the amount collected from each nozzle over one minute, in litres.

For boom sprayers, discard and replace any nozzle that varies more than +/- 5% from the average.

Using the above data, there is a simple formula to enable the output in litres per hectare to be calculated:

$$\frac{600 \times \text{nozzle output in litres per minute}}{\text{Speed in kph} \div \text{Width in metres}} = \text{litres per hectare}$$

With a boom sprayer, the nozzle output can be either:

- a. The average from all the nozzles across the boom, or
- b. The total from all the nozzles across the boom

In case of a., the swath width will be the spacing between the nozzles. In case of b., it will be the measured swath width across the boom.

To calculate the number of tankfuls per hectare and the amount of pesticide to be added per tankful, the following procedures must be carried out.

Taking the volume per hectare as calculated above in litres and dividing it by the number of litres which the tank holds will give the number of fills required per hectare. To calculate the quantity of pesticide per tankful, divide the rate per hectare by the number of fills per hectare as above. (The rate per hectare is usually obtained from the product label or it may be in the written instructions for carrying out the particular job).

In all the calculations above, it is perfectly legitimate to correct figures to the nearest whole number and ignore decimal points. When measuring out product, it is unlikely that field measuring equipment will be more accurate than +/- 25mls.

Controlled droplet applicators

Carry out pre-work checks and calibration according to the chemical manufacturer's handbook. Check:

- 1 The product has been approved for CDA.
- 2 Flow rates of products through the equipment.
- 3 Walking speed is correct.
- 4 Height of sprayer above the target is correct.
- 5 Before spraying check that the swath width and spray pattern are correct. CDA equipment needs to be very carefully set up. Some CDA manufacturers will supply 'blank' CDA product to aid calibration.

Granule application equipment

The basic principles of calibration for liquids can be used for granules although this equipment usually has a range of settings. The aim of calibration is to find the setting that gives the recommended application rate rather than to find the volume rate at a fixed output setting.

Calibration can be done easily for barrow or other linear-type distributors which rely on free-fall across an easily-measured width. But for spinner-type distributors, which deliver less at the extremes of throw than at the centre, it may be better to mark out the appropriate area to calibrate by applying a measured amount through a given setting until the correct setting is achieved. Remember to use an application pace suitable to the site – the pace in a shrub border is much slower than on open ground. For gravity fed applicators, follow the manufacturer's instructions for recommended products or calibrate as above by adjusting speed.

Make notes

Memory can be very unreliable. It is therefore sensible to write down the settings, nozzle selections and rates during calibration. It could well save valuable time in the future and will certainly reduce mistakes.

Application and cleaning

Operation

For spray booms, nozzles need to be set at the manufacturer's specified working height. Hollow cone nozzles are generally set so that the cones, when they spray from each nozzle, just begin to overlap when they meet the target. Flat fan nozzles are generally set to overlap 50% when they meet the target. Ensure flat fan nozzles are slightly off-set to avoid interface with the spray pattern of individual tips. The height of the nozzle above the target area is determined by the spray angle of the nozzles. To maintain constant height for:

- Three or four wheel sprayers - keep the boom level and securely fixed at the right height;
- Two wheel sprayers - hang from the boom a chain which is just the right height from the ground;
- Hand-held sprayers - select a comfortable working height and swath width.

Pattern of work

Accurate marking of strips is essential to minimise misses or overlaps.

Where a dye marker is not used and sprayer wheelings cannot be followed, lines and/or marker pegs should be used particularly on important areas such as golf or bowling greens. On such areas, it is also advisable to spray or spread over the area twice with a half-rate mix, the second application at right angles to the first. This is especially important with controlled droplet applicators because it is not easily apparent where chemicals have been applied.

All spray-work using a boom should be done in parallel lines, not curves. This avoids different speeds at either boom tip as the boom sweeps round a corner. Even with single-nozzle equipment parallel working is essential for accurate and even application. Lateral movement of the nozzle while walking forward on turf will almost certainly cause scorch.

Application to hard surfaces

Any activity involving pesticides can result in surface-water contamination, particularly where spillages occur on hard surfaces. To minimise this risk, spray operators are advised to examine their current practices and adopt the following procedures:

- Choose the filling area carefully to avoid direct run-off into water.
- Carry out the preparation operations on either an area of suitable waste land or on a hard surface with a dedicated drainage sump;
- If a hard surface is used, do not wash spills into drains or streams;
- Prevent glugging; even small splashes can contaminate water;
- Clean empty containers well by triple-rinsing and dispose of the washings correctly;
- Do not invert empty containers. Reseal and replace in boxes in an upright position and await disposal;
- Put seal and lids in cardboard packaging, not on the ground;
- Provide spill kits for leaks, drips and spillages, then dispose of safely.
- Please read product labels carefully.

Spot treatment is not recommended because of too great a variation in application rates. But patch spraying and treating cracks only is a sensible way of targeting the treatment. The exceptions are where total weed control is wanted in patchy vegetation or where a 'spot-gun' applicator is used.

Cleaning

Where one machine is used to apply many different products, cleanliness is of paramount importance to avoid contamination etc. When using a borrowed sprayer, always wash it thoroughly before use. Ideally a special sprayer should be kept for total weedkillers.

- 1 Wear gloves and a face shield if required on the product label, remove nozzles and filters and wash them separately.
- 2 Empty out surplus spray solution into a bucket and dispose of it safely; Do not contaminate waterways, ponds or drains. (Note: Calculate the correct amount of product to avoid creating a disposal problem).
- 3 Rinse out everything with plenty of clean water so that all traces of chemical are removed. Pump clean water through the system.
- 4 For stubborn residues, scrub off oil-based sprays with liquid detergent and other types with washing soda.

Pesticide storage

The Health and Safety Executive, in whose remit the storage of pesticides falls, has issued guidelines on the storage of pesticides and in particular the construction of stores. These are contained in Guidance Note AIS16 "Guidance on storing pesticides for farmers and other professional users". There are 10 basic points which the HSE expects to see in every permanent store small or large, brand-new or converted.

All stores must:

- 1 Be suitably sited;
- 2 Have adequate capacity;

- 3 Be soundly constructed of fire-resistant materials;
- 4 Have suitable entries and exits;
- 5 Be capable of containing 110% of the contents of the store in the event of spillage;
- 6 Be dry and frost-free;
- 7 Be well-lit;
- 8 Be well-ventilated;
- 9 Be marked with the appropriate warning sign and secure against theft and vandalism;
- 10 Be equipped and organised to contain the intended contents.

To meet these criteria, users are likely to need to consider the following:

Construction and other criteria

Small quantities of pesticides:

- May be stored in a leakproof container in a locked room or building, with the approved warning sign displayed clearly;
- Wherever possible, should be stored separate from other products;
- Should be stored in a lockable metal locker or bin with a leakproof base;
- Should have enough capacity within the leakproof base to hold 110% of the contents of the store;
- Should be marked with the approved warning notice which should also be displayed on the outside of the building;
- Should not be sited within a staff room, office, human or animal feed store, food processing area or dwelling house;
- Should be stored in a facility where the side, top, floor, door or lid will not collapse and will resist flame for up to 30 minutes.

Larger quantities of pesticides should be stored in a purpose-built or adapted store which should:

- Be secure against thieves and vandals;
- Be dry and well ventilated, particularly at low level;
- Be sited to prevent any hazard to:
 - Public roads or any roads or footpaths to which the public have access;
 - Houses, buildings used for livestock and buildings used for storing fertilizers, fuel or combustible materials;
 - Watercourses, ponds, ditches, surface catchment areas or boreholes which might be contaminated by spilt pesticides;
- Have floors and walls which contain spillage or leakage at a level below that of the stored containers and which prevent spilt liquids seeping into the ground;
- Have high-level, internally barred windows, which are shaded unless north-facing;
- Be fitted with an outward-opening door, capable of resisting fire for at least 30 minutes;
- Be provided, if the travel distance within the store is greater than 6m, with an alternative outward-opening emergency exit which can be opened without a key. This exit should be marked 'Fire Exit' in 125mm white block letters on a green background;
- Have a lightweight roof which can be broken in an emergency;
- Have high-level and low-level cross-flow ventilation;
- Have secure, adequately supported non-absorbent shelving;
- Have a 'No Smoking' notice;
- Have an emergency action notice;
- Have a fire procedure notice, displayed internally by the door;
- Be provided with a 9-litre water fire-extinguisher, wall-mounted by the door;

- Be provided with a bucket of sand by the door.

In addition, the store should:

- Have separate washing facilities with hot and cold water available either adjacent to the store or in the near vicinity;
- Have near to the store but not in it, separate ventilated cupboards in which protective clothing and personal clothing can be stored;
- Have adequate first-aid facilities to hand;
- Have easy access for Fire Service and other emergency services;
- Display a black-edged yellow triangle with a black exclamation mark
 - In a prominent position outside a store or building, at about 2m above ground level;
 - Clearly visible on any approved cabinets or cupboards housed within another building.

Newly purpose-built or converted stores

Where a new purpose-built store is not practicable, pesticides may be stored in a separate storeroom which is part of a larger building provided that it does not contain a staff room, workshop, office or area used to process or store feeding stuffs and it is not attached to a dwelling house or retail premises.

Building materials should:

- Be resistant to fire, liquids and chemical attack;
- Insulate the store adequately because pesticides and their containers will deteriorate if stored in freezing temperatures;

Walls should:

- Where they are external ones, provide at least 30 minutes fire resistance;
- Where they are internal ones, extend through the roof space to the roof;
- Have interior surfaces which are smooth, clean, easily washable and free from dust-traps.

Floors should:

- Be below ground level where possible and impervious to liquids;
- Be provided with an anti-slip surface, easily washable and resistant to leakage. In existing stores where this is not practicable, an impervious bund may be a suitable alternative. It should have a double-sided access ramp with a slope no greater than 1:10.

Doors should:

- Where they provide access, open outwards, be of 30 minute fire-resisting construction, and of adequate width and height to allow the safe movement and handling of pesticides;
- Be self-closing where they are internal doors;
- Be faced externally with galvanised steel sheeting if they are timber doors;
- Be provided with a padlock bar with concealed fittings and a close-shackled padlock;
- Have hinges fixed with coach bolts.

Emergency exits

In larger stores, emergency doors may be necessary, a need determined by the number of people at work, the size of store, quantity and types of pesticides stored, the number of internal dividing walls and the location of main doors.

The means of escape should be properly maintained and kept free from obstruction at all times. Exits should be clearly marked with a notice such as 'Fire Exit' and be capable of being opened from the inside with a securing mechanism that does not include a lock.

Roofs and ceilings

In single-storey buildings, the roof should be of a material which can quickly fail in a fire, acting as a vent. Appropriate notices should warn that it is fragile.

Windows

Where fitted, should:

- Open inwards;
- Be barred against intruders or fitted with vandal-proof glass;
- Be positioned high enough to deter unauthorised entry;
- Be shaded or built into a north wall to prevent sunlight causing plastic containers to deteriorate. Roof-lights, where fitted, should be translucent and protected against forced entry.

Natural or artificial light should reach at least 100 lux. Containers should not be stacked to obscure natural light. Switches should be placed where they will not be damaged.

Drainage should be directed to a below-floor sump or tank. Larger stores should discharge into an external liquid-tight tank. Waste should be removed by a specialist waste contractor. Keep rain, surface water or other drainage from entering sumps and tanks designed to hold such polluted liquids.

Ventilation should be permanent. This can be achieved by four air-bricks at a high level and four at low level for every 20 cubic metres of storage space, set above the height of any bund. Extractor fans should be installed where adequate natural ventilation cannot be provided.

Shelving should be non-absorbent. It should be of sufficient strength and adequately supported. It should not be too deep so that it is difficult to reach or stack containers and it should have a lip where glass containers are stored.

Water supply – a tap with a hose union and non-return valve should be fixed nearby.

Any internal fittings should be protected against freezing.

Heating should be of the non-radiant 'black heat' type with thermostatic controls. Heaters should be fitted just below the level of the lowest storage shelf.

Safety signs should be fitted in a prominent position outside and on the store at about 2 metres above ground level.

Washing facilities should be provided separately from the pesticide store. A washroom for personnel should be equipped with a wash-basin with clean hot and cold water, soap and drying facilities. An area should also be provided, convenient to the store, where protective clothing and other equipment can be washed and the contaminated water drained away without causing pollution.

Clothing accommodation must be provided outside the pesticide store. It must be ventilated and allow separate areas for clean, soiled and personal clothing.

Store management

Pesticides should be stacked so that there is no danger of them falling and to a height that can be easily reached. They must not block internal drain covers, cover windows or impede entries and exits.

Stock should be rotated and inspection should be regular in case plastic containers have become brittle with age and exposure to ultra-violet light. Impervious containers are needed to hold spilt material until safe disposal can be arranged.

Sodium chlorate and fumigants should be stored in a separate section.

Empty containers should be washed out and stored in a separate rain-proof compound to await disposal.

Only authorised personnel should have access to keys and be allowed in the store.

For stores over 200 litres/kg capacity, a current stock list of all stored

pesticides should be retained in the office and a list of pesticides used annually at that location should be on display in the washroom.

In addition, for stores with a capacity over 200 litres/kg, the local fire service should be provided with:

- A list and location of all pesticide storage facilities;
- A list of chemicals used annually;
- A named person for reference in an emergency.

If pesticides and fertilizers are kept in the same building, they should be held in separate sections and cross-contamination should be avoided.

Whatever the amount or type of pesticide stored, guidance on the various aspects of safety may be obtained from the Health and Safety Executive, Crime and Fire Prevention Officers from your local police and fire services or the Environment Agency. When planning a new store, all of the above, and the local Planning Officer should be consulted.

Record-keeping

Good records must be kept of all operations involving the storage, application and disposal of pesticides. This is not only good management practice but is also essential as a reference in event of accidental contamination of people, honey bees, other creatures, land, water or non-target areas.

Good records safeguard against possible overuse of chemicals. Insufficient records can lead to poor stock control and make it difficult to observe any time constraints on access to treated areas by people and animals. Records can be kept in any convenient way but make sure they can be completed easily and without error. People should also be able to quickly consult and understand records with ease; this also applies to COSHH Risk assessments.

Employers and the self-employed should use a bound book rather than a loose-leaf one to record stock control, disposal, maintenance and health monitoring. They should also keep a log of applications. An adequate spray record sheet should allow for entries on:

- 1 Date of operation;
- 2 Name of operator;
- 3 Site of operation and beneficial occupier;
- 4 Type and use of area, structure or crop;
- 5 Reason for treatment;
- 6 Product used;
- 7 Dilution and application rate and total volume of spray used;
- 8 Work start and stop times;
- 9 Weather conditions including wind-speed and direction;
- 10 Other relevant details.

Records should also be kept when calibrating equipment.

Enforcement officers should be able to consult records for at least the past three years without delay. Some records for COSHH need to be kept longer as do health monitoring records.

If people suggest that they might have been affected by pesticide, it is most important to give them or their advisers full and accurate information without delay.

They will need the full name of the product, MAFF/MAPP or HSE number and any other information which can help in the treatment of people or animals.

It is not enough for suppliers of products, contractors or advisers to hold records on behalf of their clients.