

Biobeds for treatment of pesticide waste and washings

Paul Fogg and Lindsay Fogg, ADAS UK Ltd

To comply with the code of good agricultural practice for the protection of water, growers must dispose of pesticide wastes and washings safely to avoid the contamination of surface and ground water. Biobeds offer an extremely safe and efficient method of disposal. This factsheet outlines how biobeds work, how to construct them and how they can be used.

Introduction

Growers tend to operate all pesticide handling activities on the same site due to the location of pesticide stores and their proximity to a clean water supply. Studies have shown that 20–70% of the pesticide contamination measured in raw (surface) water is attributed to spray fill sites.

Whilst the characteristics of the filling area, operating practices and local conditions may vary, the origins of water contamination are generally similar, and result from sprayer filling, poor container disposal and machinery maintenance.

Such ‘point source’ releases can be minimised by modifying handling practices. However, it is inevitable

that accidents will still occur, and additional methods are required by the industry to further reduce water contamination. Biobed technology is one such method which is inexpensive to use and requires low labour and time inputs (Figure 1).

Biobeds intercept and treat contaminated runoff from the filling area and/or drips and spillages arising



1 Biobed technology is one method available for reducing water contamination

during the filling process. In its simplest form, a biobed is a lined structure filled with an organic filter (biomix). The biomix removes the pesticides from the contaminated water passing through it. The retained pesticides are subsequently degraded, with the treated water available for safe disposal or re-use.

Standard biobeds used in agriculture, consisting of a 1 m deep hole in the ground and a surface area of 40–60 m², are suitable for field produced horticultural crops including field vegetables, soft fruit and tree fruit. However, they are not always appropriate for all horticultural businesses owing to the area

required. A novel biofilter system has been developed in HDC projects PC/HNS 255 and 255a but as this system is not currently covered by the existing biobed Agricultural Waste exemption, approval for use is being sought. Further information on biofilters will be delivered once such an approval has been granted.

Pesticide point source issues

Some of the most serious cases of water contamination from pesticides originate from what is often termed a point source. In other words, it is derived from a localised situation and enters the water body at a specific

or restricted number of locations. Both approved and non-approved forms of point source contamination can occur. Approved point source contamination occurs in the form of consented discharges (eg from vegetable washing plants). Non-approved contamination occurs through spillages or discharges of product, tank mix, waste or washings

to surfaces or drainage systems, which can enter surface water or groundwater (via soakaways). Methods have been developed to reduce point source losses to water. These are summarised in Table 1.

Table 1 Point source losses and potential methods to reduce losses to water

Entry Route	Method to reduce losses to water	Entry Route	Method to reduce losses to water
Tank Filling	Container modification, eg anti-glug necks, pack size, returnable packs	Spillages continued...	Immediate incineration of empty containers (if permitted) or storage under cover before return or disposal
	Add container rinsate to the tank mix		Education of operator
	Engineering solutions, eg tank full alarm, direct injection	Faulty equipment	Regular maintenance and servicing of sprayer
	Remove operations from drained permeable areas		Sprayer testing
	Biobeds	Washings and waste disposal	Biobeds
	Interception areas drained to waste collection site		Other on farm treatment systems, eg Sentinel
	Operator training		Authorised waste disposal
Spillages	Remove operations from drained permeable areas		Dispose of tank sump contents appropriately
	Biobeds	Sumps, soakaways and drainage	Requirement for licensing
	Interception areas drained to waste collection site		Diversion from direct discharge to water
	Use of sorbant pads/material and materials to intercept spills or clean up	Direct entry including overspray	Avoidance
			Operator training
Use of licensed hazardous waste contractor	Consented discharges	Requirement for licensing and compliance with Environmental Quality Standards	

Regulations appertaining to biobeds

Under the Agricultural Waste Regulations (May 2006), it became illegal to wash down sprayers or dispose of waste pesticide solution to soil, grass or on hard surfaces that drain to soil or grass, more than once a year. These processes can continue once per year or less, but are subject to a Groundwater Authorisation.

To overcome this restriction, growers can mix and wash down directly or indirectly to a lined biobed system. Under the Agricultural Waste Regulations, biobeds are regarded as waste recovery systems and as

such require a waste management licence. However, a new waste management licensing exemption for the disposal of dilute pesticide washings into a lined biobed was granted in May 2007. This exemption introduces a number of key provisions designed to ensure that any lined biobed is constructed, maintained and operated in a manner that will ensure that the pesticide washings are treated appropriately and that the activity does not cause pollution or harm to groundwater and/or surface waters.

By registering an exemption you are making a statement that your biobed will not pose any significant risk to the environment. Exemption packs can be obtained by contacting the Environment Agency's Agricultural Waste Line

Tel. (0845) 603 3113 and detailed advice on how to comply with the exemption can be found at <http://publications.environment-agency.gov.uk/epages/eapublications.storefront> (See Further information section.)

Currently you only have to register a biobed exemption once prior to installation. However, all Agricultural Waste exemptions are currently being reviewed, with any new requirements expected to be released in 2009. It is anticipated that new requirements will include the need to re-register exemptions every 3 years. All existing agricultural exemptions will benefit from a transition period and will not have to re-register until 2012. Growers should check on the current regulations before installing a new biobed.

Understanding biobeds and their composition

The overarching principle of the biobed system is one of containment/treatment/re-use. Before constructing a biobed the EA biobed guidance document must be consulted

(see Further information section) in order to ensure compliance with the Agricultural Waste Regulations exemption.

The biobed is an organic filter system. Most pesticides have a strong affinity to organic matter, so when runoff water contaminated with pesticides is directed through the biobed, the pesticides stick to the organic material and 'clean'

water is delivered for re-use. The pesticides held in the biobed are then broken down by micro-organisms. The organic filter or 'biomix' (Figure 2) consists of a mixture of:

- 2 parts straw (wheat or barley)
- 1 part compost (preferably peat free)
- 1 part topsoil



2 The three constituents of a biomix include straw, compost and topsoil

Ideally the mix (Figure 3) should be allowed to stand outside in a windrow (Figure 4) for between 30 and 90 days before being added to the biobed. This allows the composting process

to start to break down the straw, which makes it easier to create a homogenous mix. The duration of the pre-composting is not critical to the performance of the biobed.

As a rough guide, it is generally ready to use when the top soil and straw don't separate out when the mix is turned.



3 Prepared, pre-composted biomix



4 The biomix should be composted in a windrow for between 30 and 90 days. This image illustrates a typical compost windrow

Siting and design of the biobed

Biobeds must be located in a secure place, at least 10 metres away from any surface water and 50 metres from any spring, well or borehole.

The exact design of the biobed can be adapted to meet specific local requirements. However, the size of the biobed is dependent on both natural rainfall and the annual volume of pesticide waste and washings requiring treatment (maximum 15,000 litres per biobed per year). Rainfall can represent a significant contribution to the total volume of liquid passing through the biobed, particularly if using an in-direct design in a high rainfall area, where the surface catchment is doubled (1 mm on 1 m² = 1 litre). Crucially, the biobed must be sealed, be at least 1.0 m deep and have a minimum surface area of 1 m² for every 1000 litres of liquid requiring treatment.

In a typical system, a pit should

be excavated to contain the biomix. This can be a shape to accommodate any impermeable tank or lining system. Successful biobed operation has been found with soil side slopes of 30–35°. These should be blinded with 25 mm sand, over which a geotextile membrane of 190 g/m² should be laid. The hole should then be lined with a material suitable for a small reservoir. This liner should be at least 1 mm thick and be constructed from a synthetic impermeable material, for example butyl rubber. The liner will require a bonded outlet point, able to accommodate a 100 mm outlet (Figure 5). The outlet should be installed at the lowest point of the excavation. It should be compatible with the site layout and provide rapid removal of the treated water for final distribution. The water can be collected in a variety of ways, but is generally drained by gravity into a holding tank, where it can be collected and pumped into other suitable containers. The water can be irrigated onto an area of sacrificial land adjacent to the biobed.

Such land should be of low value to

wildlife and have a minimal risk of run-off.

After lining, the pit should be filled with biomix and covered with turf. If the biobed is not to be used immediately, turf laying should be delayed to allow for the addition of fresh biomix following an initial settlement period. However, the turf layer must be in place before pesticides are added to the biobed.

Maintenance tasks

- Biobeds are intended to have low operation costs and require only minimal technical and management inputs. However, certain maintenance is required for the system to perform as designed.
- Periodically the handling area of in-direct systems should be cleaned with any loose soil placed directly onto the surface of the biobed.
- Over time, the biomix will decompose and compact. For the biobed to achieve the required level of

performance, an average minimum depth of 1.0 m should be maintained.

- To achieve this the biobed will need to have fresh biomix added every year.
- The total volume of biomix must be replaced completely after 5 years.
- The exhausted biomix must be stored securely for a minimum of 12 months, but not more than 36 months, prior to land spreading (see EA Guidance).
- The biomix must not be stored within 10 m of a surface water-course or 50 m of any spring, well or borehole.



5 Lined pit accommodating 100 mm outlet

Main biobed systems

The two types of biobeds that can be employed are Direct and In-direct systems.

Direct system

With a direct biobed system, the sprayer is parked over the top of the biobed, which directly intercepts any spills, drips and washings (Figure 6). The biobed is constructed as described earlier. However, a grid over the surface is required to provide access to vehicles. This needs to comply with Health and Safety requirements both for operators handling concentrated pesticides and the support of a fully loaded sprayer.

Both liquids and soil/mud from tyres should be free to pass vertically down through the grid and onto the biobed. The grid



6 Direct biobed system. The sprayer is parked on top of the metal grid such that all spills, drips and washings are intercepted directly by the biobed

needs to be supported with end and side foundations and also requires removable sections, to allow for maintenance of the biobed.

The direct biobed system should not accept liquids, other than those passing directly from vertically above.

In-direct system

With an in-direct biobed system, all pesticide mixing and handling takes place on an impermeable surface with a sealed drainage system. The runoff is directed to an adjacent biobed (Figure 7).

The handling area should be constructed from an impermeable material, eg concrete, and fitted with a bund and drain and also a silt trap. The area should be at least 2 m wider than the sprayer transport width and 1.5 m longer (Figure 8). All runoff from the pesticide handling/washdown area must drain, via the silt trap, to a secure temporary store of not more than 1500 litres capacity, constructed from seamless polyethylene or similar.

The stored liquid should be distributed evenly over the biobed so as to utilise the full surface area. This can be achieved using low cost drip irrigation (Figure 9). Such systems have a low pressure demand (nominally 7 m head) and can be driven by a submersible pump, fitted with a float switch and installed into the base of the temporary storage tank. Pumps with a nominal capacity of 50 litres per minute @ 6.5 m head (approx. 200 watt motor) would be suitable. Flow rates from the emitters on this type of irrigation are typically 1–2 litres per hour. Emitters should be spaced at 0.25–0.4 m, with the main lines spaced at a similar distance. The system should be inspected regularly for signs of damage and loose joints.

Typical costs and suppliers of components of direct and in-direct biobed systems

Table 2 lists typical costs of component materials required to construct direct and in-direct biobeds. The costs are estimates and labour costs for construction are not included. Direct systems are likely to be significantly more expensive given the



7 In-direct biobed. Sprayer is parked on impermeable handling area with runoff diverted onto an adjacent biobed



8 Concrete pesticide handling area with bund and ARCO type drainage system



9 Distribution of pesticide waste and washings to surface of in-direct biobed system using low cost drip irrigation

need for extensive ground workings and steelwork. The intention is that the biobed will be built by the grower and adapted to meet the specific requirements of the business

(subject to compliance with the exemption) using locally available materials. Under the England Catchment Sensitive Farming capital grants scheme, biobeds are eligible

for up to £2,850, subject to the business being located within one of the priority catchments.

Table 2 Typical costs and suppliers* of direct and in-direct biobed systems

These costs are only estimates and are based on the costs incurred from biobed construction at a scientific research site in 2008.

Component	Possible Supplier	Typical cost
33 ton of Type 1 ballast	Local supplier	£330.00
12 m ³ ready mix concrete	Local supplier	£600.00
Pipes work, drain, sump and fittings	Local supplier	£300.00
Geotextile protective under cushion, estimate 100 m ²	Midland Butyl Limited Windmill Farm, Biggin Lane Nr. Hulland Ward, Ashbourne Derbyshire DE6 3FN Tel. (01335) 372133 Fax. (01335) 372199 web@midland-butyl.co.uk www.ukwaterproofingsolutions.co.uk	£130.00
1 mm thick butyl liner, estimate 100 m ²	Midland Butyl Limited Windmill Farm, Biggin Lane Nr. Hulland Ward, Ashbourne Derbyshire DE6 3FN Tel. (01335) 372133 Fax. (01335) 372199 web@midland-butyl.co.uk www.ukwaterproofingsolutions.co.uk	£500.00
Boot to fit 100 mm (4") soil pipe + adhesive tape. NB need to specify angle of side slope	Midland Butyl Limited Windmill Farm, Biggin Lane Nr. Hulland Ward, Ashbourne Derbyshire DE6 3FN Tel. (01335) 372133 Fax. (01335) 372199 web@midland-butyl.co.uk www.ukwaterproofingsolutions.co.uk	£40.00
X 2 BWST-UG1370-B1, underground water storage tank including delivery	Balmoral Tanks Balmoral Park, Loirston Aberdeen AB12 3GY Tel. (01224) 859100 Fax. (01224) 859123 tanks@balmoral.co.uk www.balmoraltanks.com	£1500.00
X 2 4" entry connectors	Local supplier	£100.00
X 2 submersible pumps	Local supplier	£200.00
Electrical work	Local supplier	£400.00

*This list of suppliers is not exhaustive and no criticism is implied of suppliers not included

Action Points for growers

- Ensure that all pesticide mixing, handling and cleaning activities take place on a bunded impermeable surface, fitted with a sealed drainage system. This will prevent waste, washings and contaminated runoff from potentially contaminating surface or groundwater.
- Review your pesticide management practices and try and keep the volumes of waste being generated to an absolute minimum.
- Wherever possible spray washings out onto the intended target, provided label restrictions are followed.
- Consider installing a biobed as an integral part of your pesticide management facility.
- The use of a biobed does require you to register an exemption from the Agricultural Waste Regulations with the Environment Agency Tel. (0845) 603 3113.

Further information

Useful publications

Guidance on using a lined Biobed to dispose of agricultural waste consisting of non-hazardous pesticide solutions or washings (Exemption 52) Environment Agency ref: 30139296
<http://publications.environment-agency.gov.uk/epages/eapublications.storefront>

Defra Code of Practice for using Plant Protection Products, ISBN 0-85521-170-9. You can download the code of practice www.pesticides.gov.uk/safe_use.asp?id=64 or alternatively you can get a free copy on compact disc, or a printed copy for a charge of £15, from Defra Publications at;

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Scottish Natural Heritage

www.snh.org.uk/publications/on-line/heritagemanagement/tibre/section2_4_26.htm

Guidance on regulations appertaining to biobeds

Environment Agency National Agriculture Customer Help Line
(0845) 603 3113

Additional information on the approved used of biobeds is available at www.biobeds.info

Consultancy services on the design and construction of biobeds

ADAS
enquiries@adas.co.uk

Bill Basford (Independent)
mecbasford@aol.com

Steve Higginbotham (Independent)
steve@stewardship-ltd.co.uk

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