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Farm biobed systems -
U K practical experience

UK background

- < 10 commercial biobeds in UK
- Some enthusiastic farmers
- Farm scale 3 year ‘commercial use’ project
- Other UK biobeds
- Water management authorities have ‘regulatory concerns’

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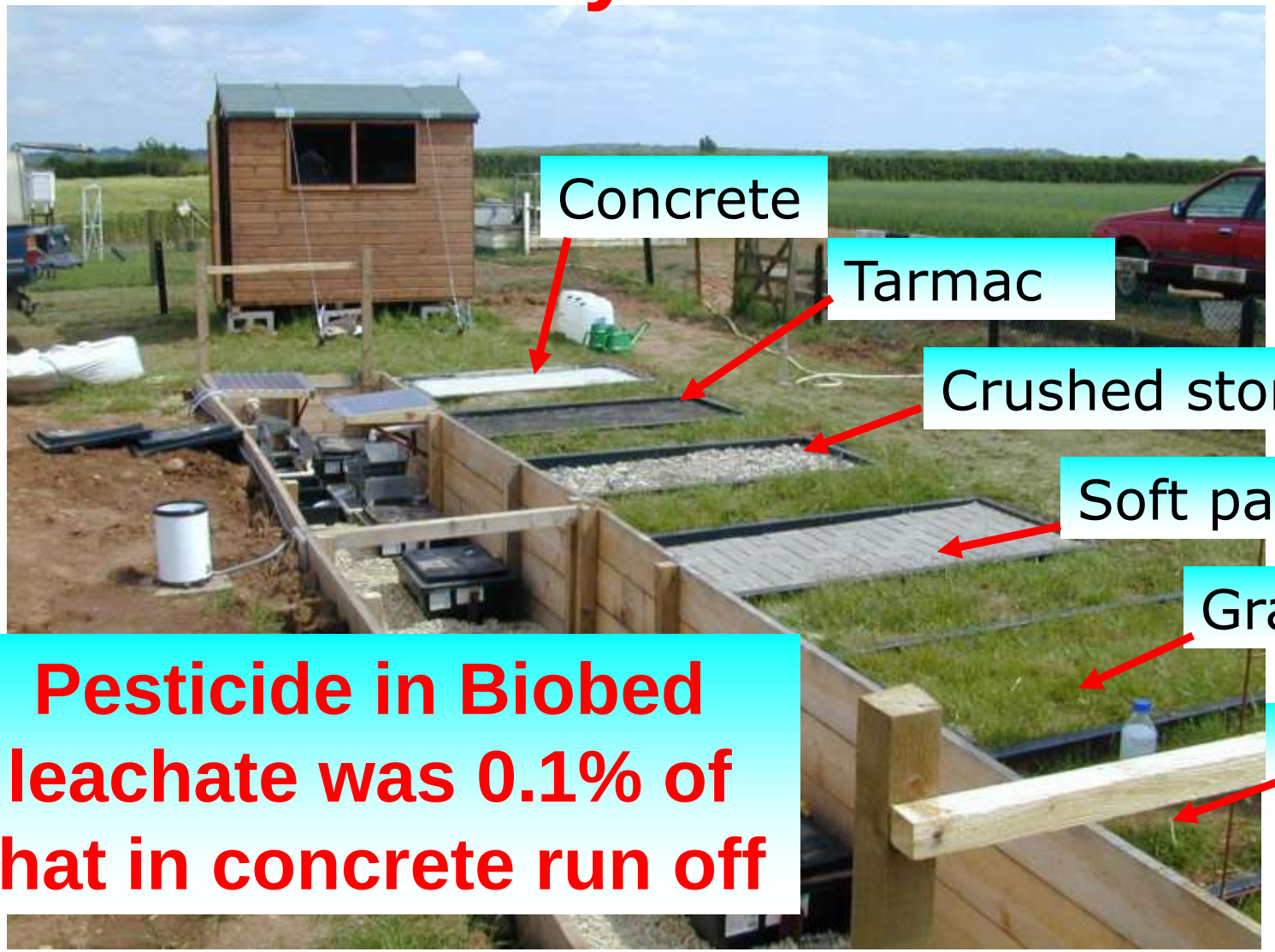
Which mixing / loading surface? - early assessment



Pesticide in Biobed leachate was 0.1% of that in concrete run off

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What is a biobed in this study?

- A hole in the ground with an impermeable liner and coupled drain
- 2 systems filled with composted mix 50% by volume straw, 25 % soil, 25% peat free compost (Biomix) and grass turfed over
- 1 system filled with friable sandy loam soil, not compacted with grass turf over

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Increase scale and monitor as a commercial operation

- 3 systems on one large farm - 1620 ha

  Each site serving 240 ha

- 2 offset -
  - A Concrete to lined biobed
  - B Concrete to lined ‘active’ soil biobed
- 1 direct
- Steel grid over lined biobed
- used by 2 x 24 m Self propelled sprayers

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Sprayer loading areas linked to Biobeds

- What do the systems look like?
  - **Offset** - A separate area, bunded concrete, where the sprayer stands and any liquids drain to a biobed

  - **Direct** - A drive over grid all liquids drain directly to the biobed below the grid.

- **For research both systems had lined biobeds**

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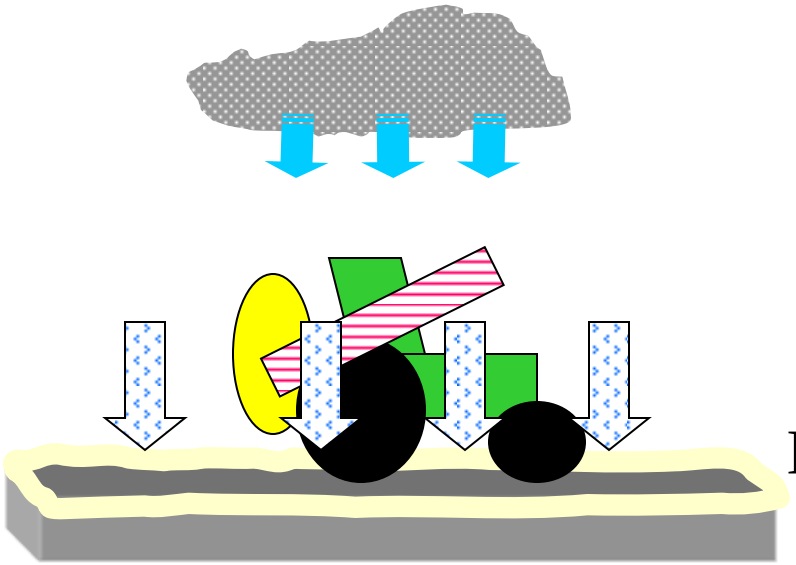
OFFSET LINED with disposal area



Bunded area

Disposal by drip or sprinkler

Turf over

BIOBED

LINER

Pump

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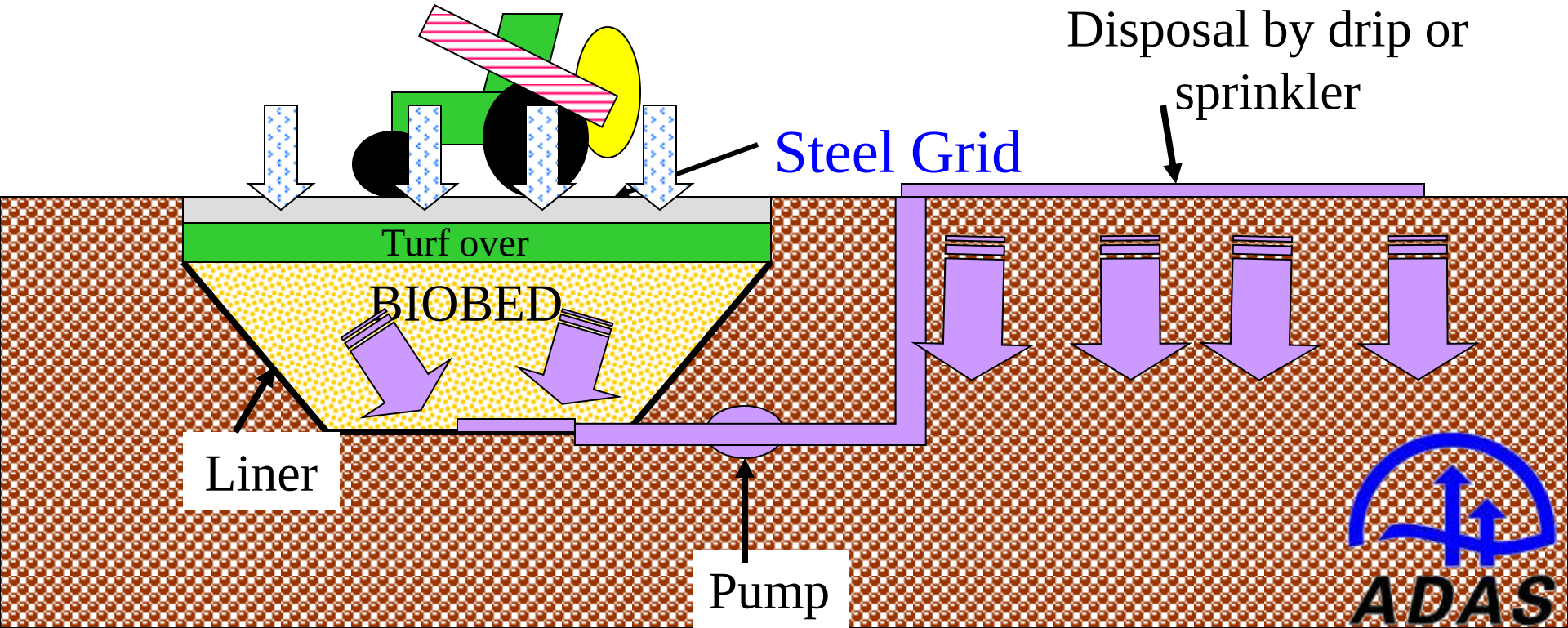
DIRECT
LINED-DRIVE OVER



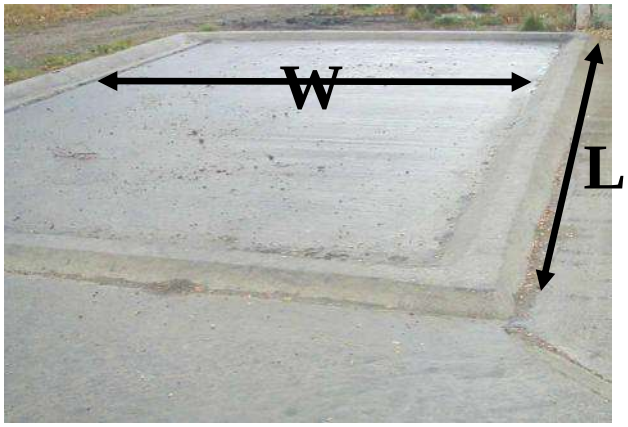
Under construction - Feb 2002

Concrete pad

Steel grid

Sprayer loading area
Offset

Concrete pad



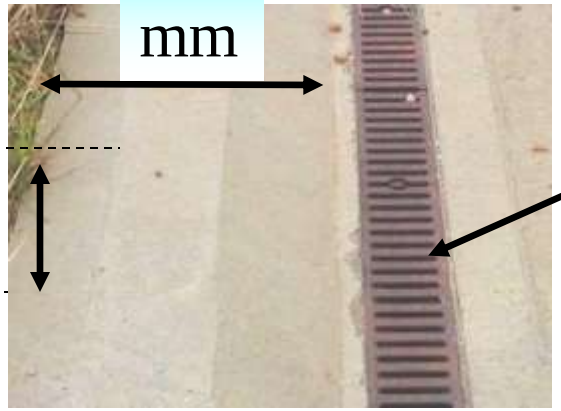
W = Sprayer transport width + 2 m

L = Sprayer length + 1.5 m

Bund

300 mm

100 mm



Drain via silt trap to pump chamber

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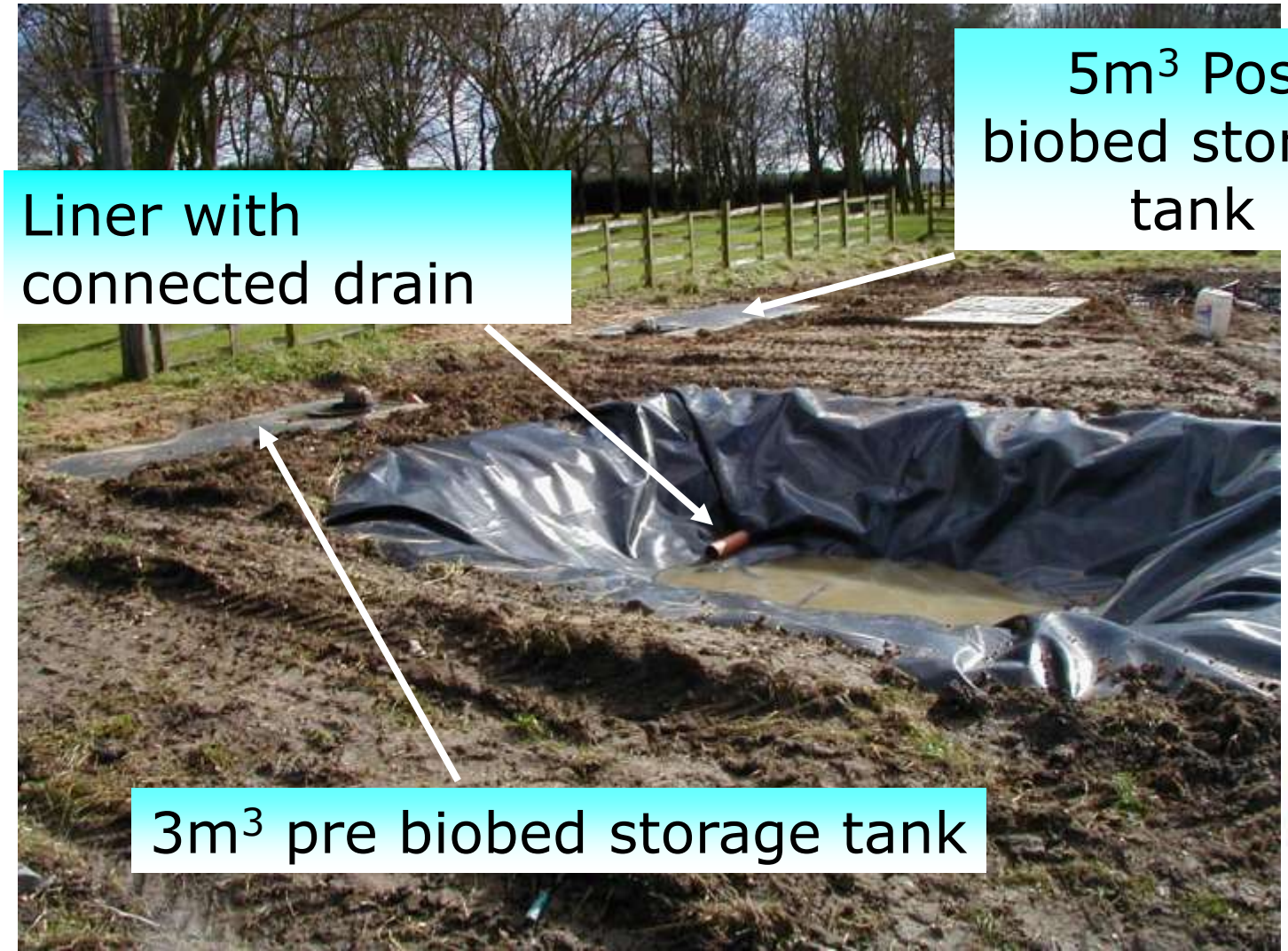
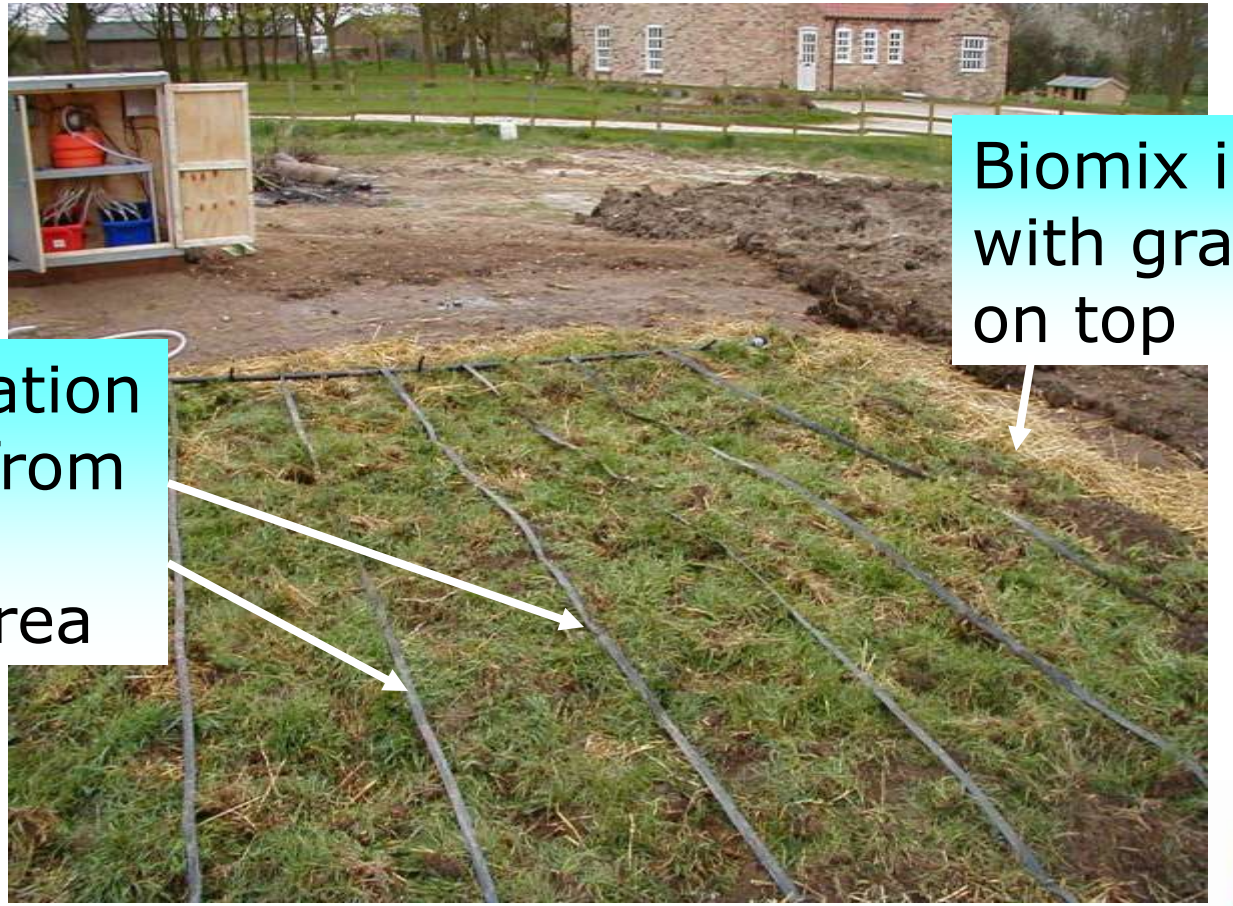
Under construction - Feb 2002



ADAS

Under construction - March 2002



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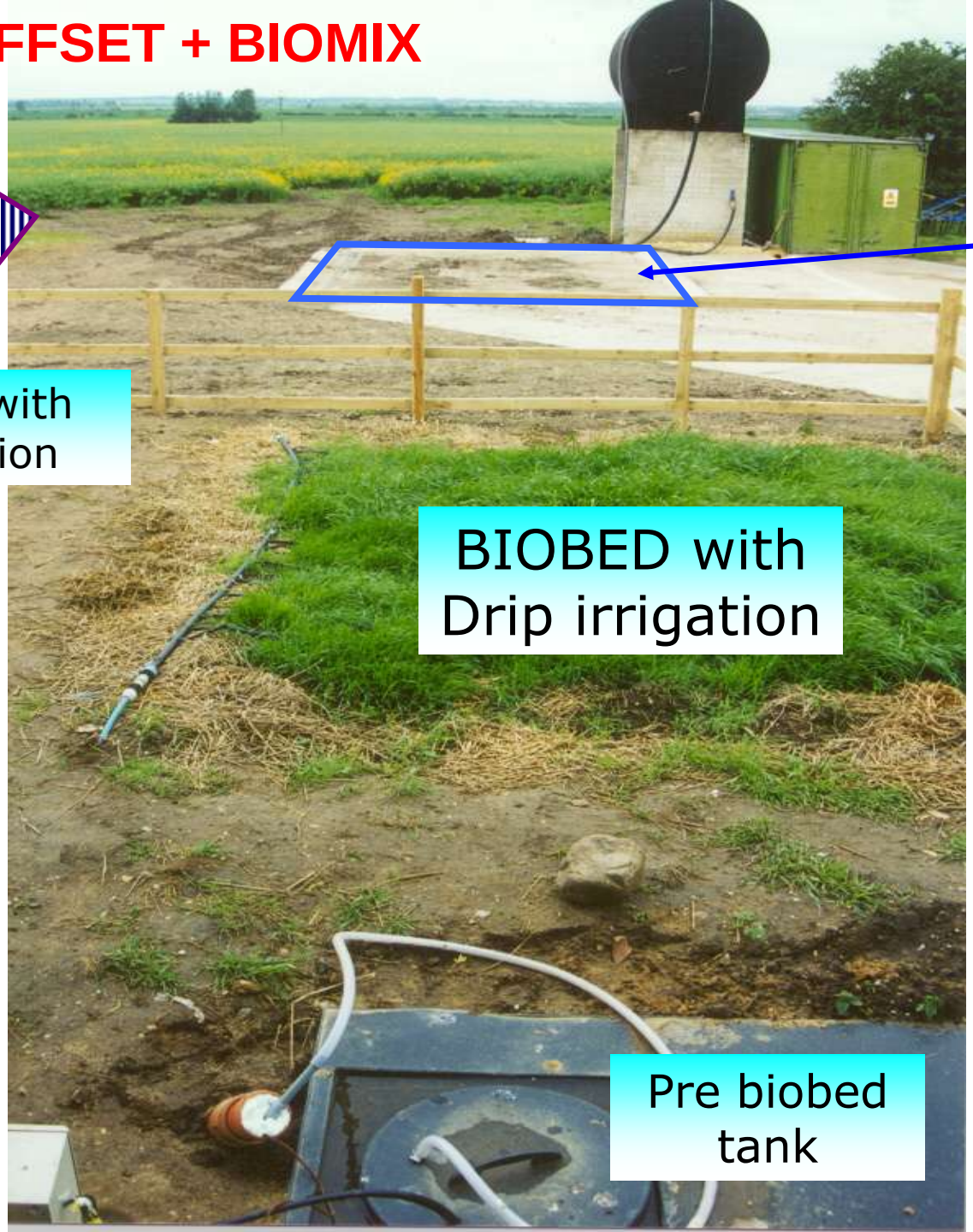
OFFSET + BIOMIX



GWA Area with drip irrigation

Bunded concrete area

BIOBED with Drip irrigation

Pre biobed tank

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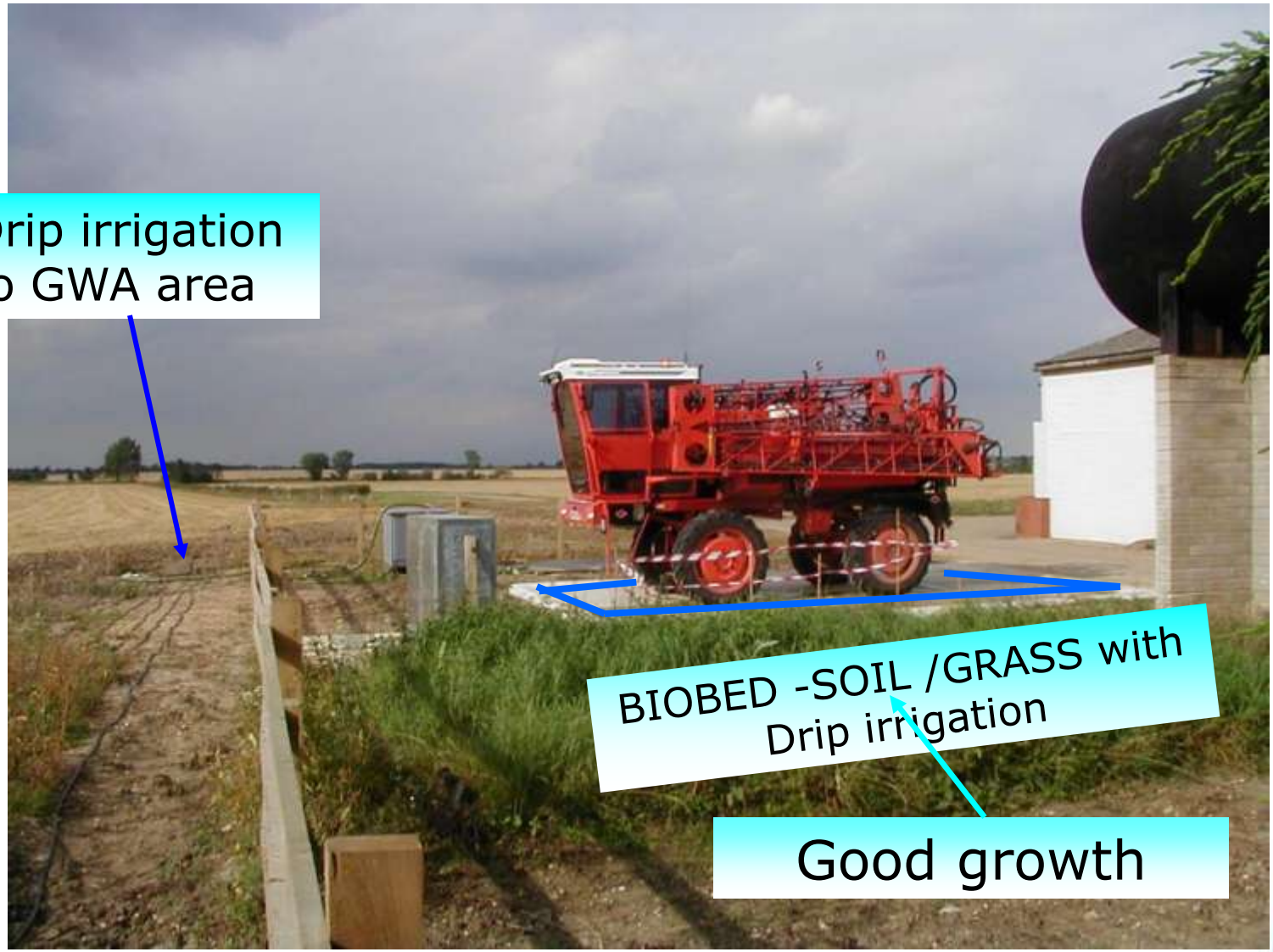
OFFSET + SOIL / GRASS



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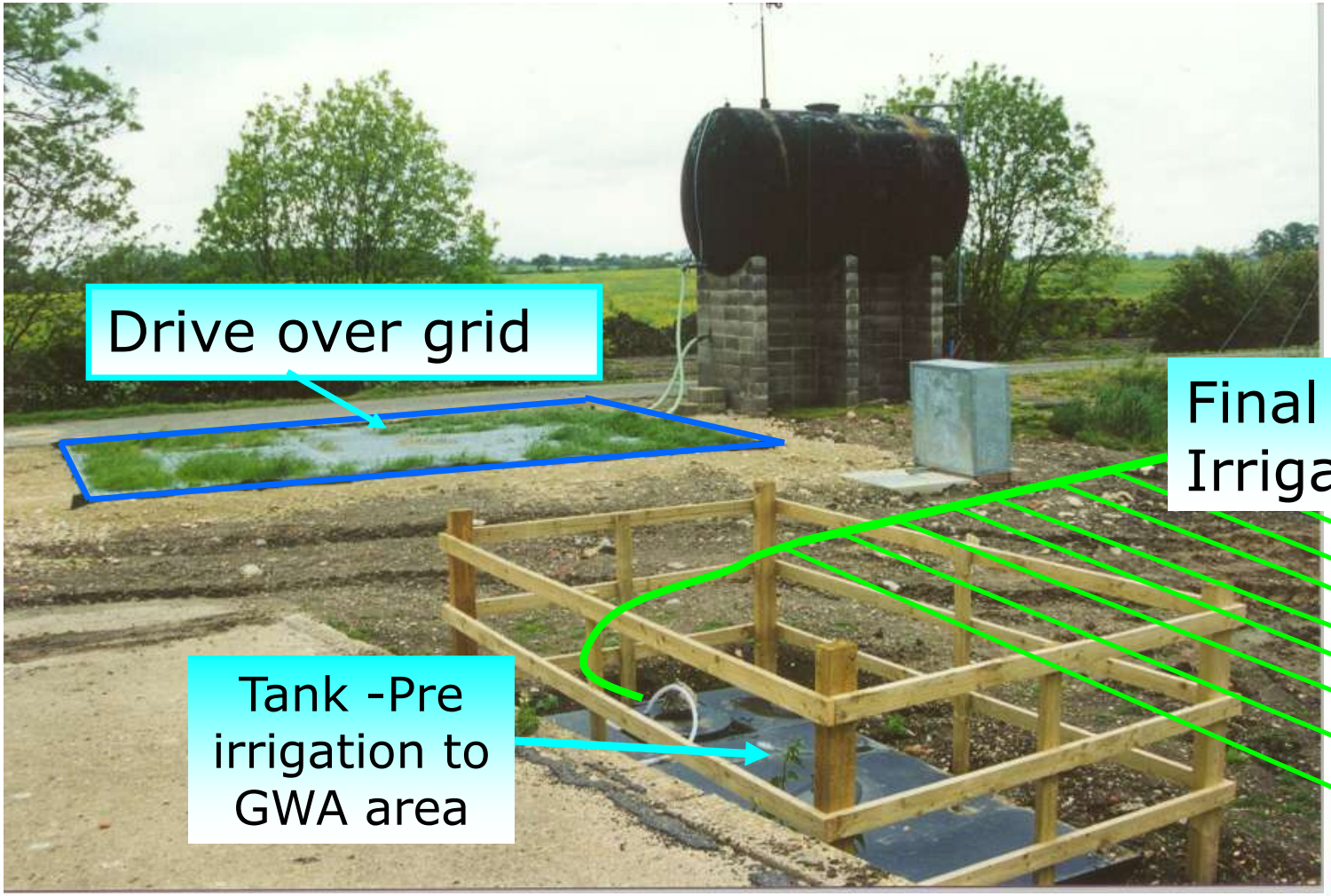
DIRECT - BIOMIX



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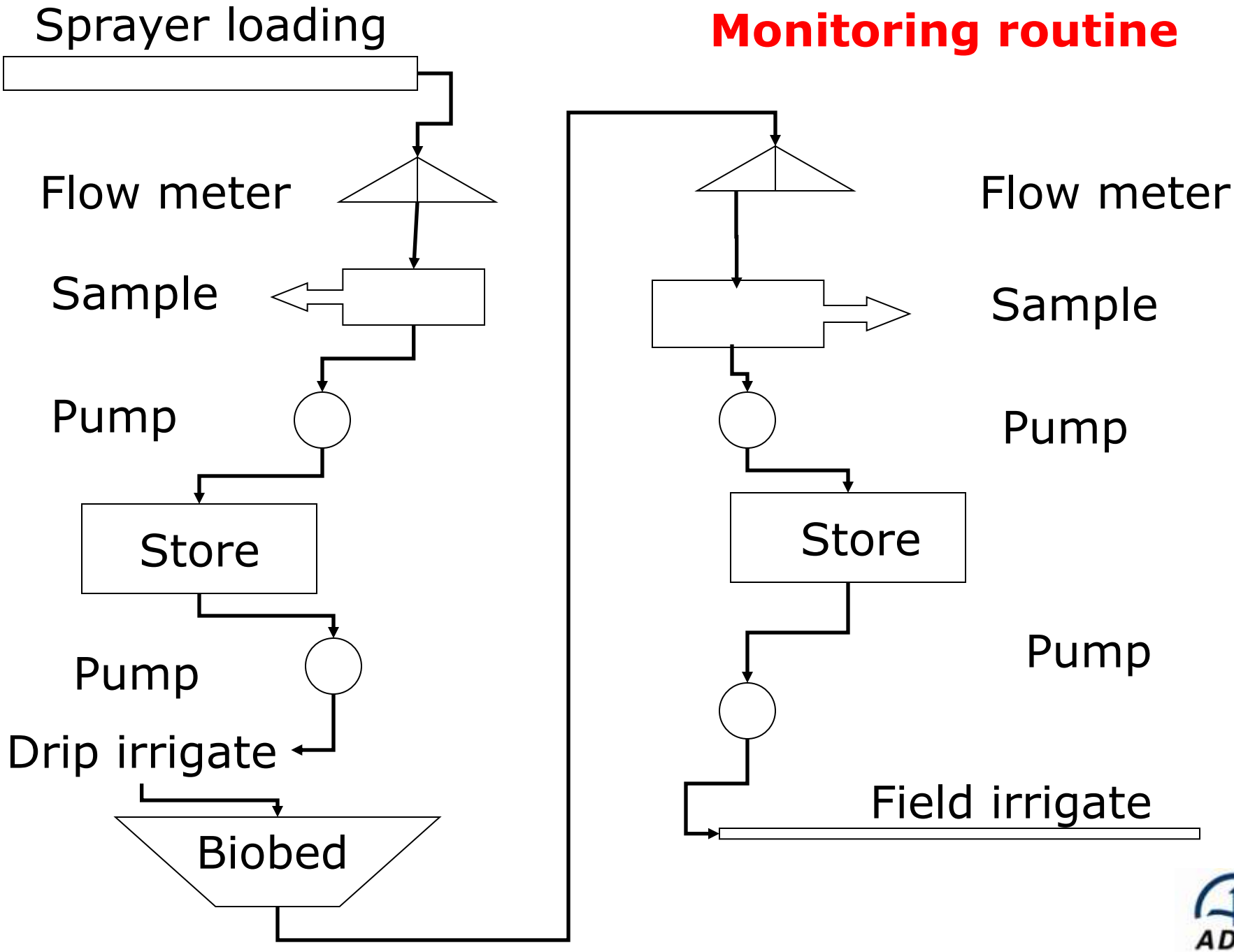
Monitoring routine



Commercial use plus artificial pesticide contamination TWICE

6 pesticides as used in previous experimental surface studies

Same contamination sources - concentrate, rinsings, suspension, washings

Simulated max. contamination losses from 16 tank mixes on one day

2 applications - June and September 2002, 55 days monitoring afterwards

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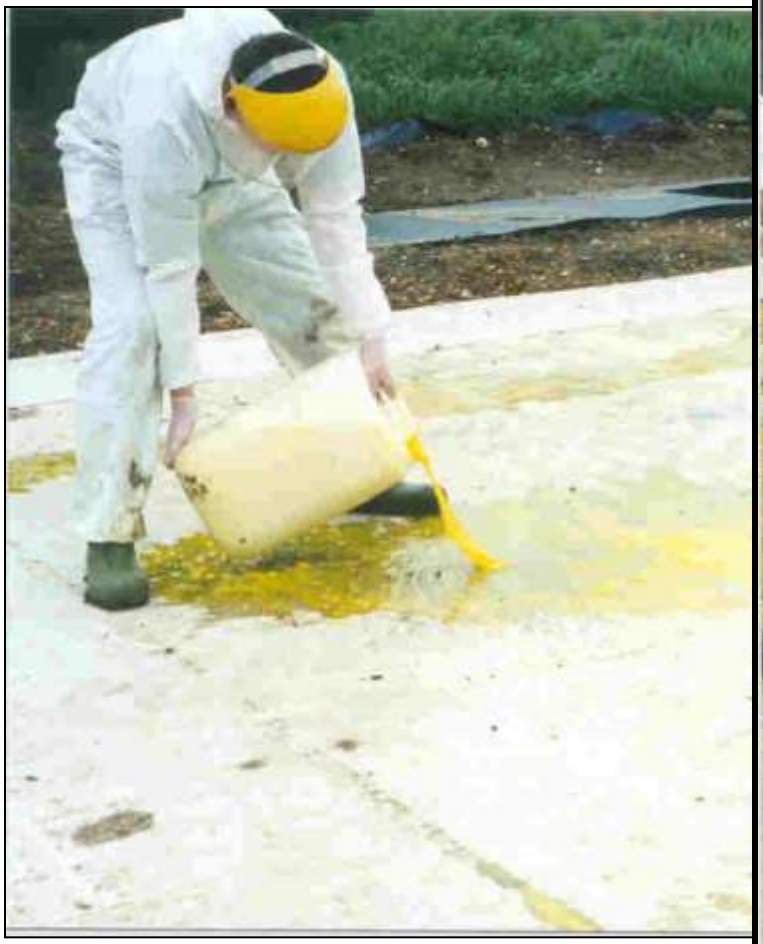
Artificial applications



Sump rinsings

Sprayer washings

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Pesticides artificially applied (range of physico-chemical properties)

Herbicides

Isoproturon (v.soluble)

Pendimethalin (v.adsorptive)

Fungicides

Epoxiconazole

Chlorothalonil

Insecticides

Dimethoate (v.soluble)

Chlorpyrifos (v.adsorptive)

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Typical concs. (μg/L) after application
Concrete pad to biobed

PESTICIDE		Days elapsed		
		0	11	55
Isoproturon	Concrete	140850	5370	15.8
	Biobed leachate	<0.5	<0.5	<0.1
Chlorothalonil	Concrete	96807	<2	8
	Biobed leachate	0.3	<0.1	<0.1

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Typical concs. (μg/L) after application
Drive over biobed leachate

PESTICIDE		Days elapsed		
		0	11	55
Isoproturon	Biobed leachate	<0.5	<0.5	<0.1
Chlorothalonil	Biobed leachate	<0.1	<0.1	<0.1

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Max. concentrations measured (μg/L)

	Concrete intercept to biobed	
	Runoff	Leachate
Dimethoate	44,277	0.9
Chlorothalonil	96,807	0.3
Isoproturon	140,850	<0.5
Chlorpyrifos	77,646	0.7
Pendimethalin	205,550	2.3
Epoxiconazole	9,108	0.8

ADAS

Max. concentrations measured (μg/L)

	Concrete intercept to biobed		Drive-over biobed
	Runoff	Leachate	Leachate
Dimethoate	44,277	0.9	15.5
Chlorothalonil	96,807	0.3	<0.1
Isoproturon	140,850	<0.5	1.2
Chlorpyrifos	77,646	0.7	0.4
Pendimethalin	205,550	2.3	0.5
Epoxiconazole	9,108	0.8	0.7

ADAS

Max. concentrations measured (μg/L)

	Concrete intercept to biobed		Drive-over biobed	Concrete intercept to soil/grass	
	Runoff	Leachate	Leachate	Runoff	Leachate
Dimethoate	44,277	0.9	15.5	24,800	<0.5
Chlorothalonil	96,807	0.3	<0.1	94,600	<0.1
Isoproturon	140,850	<0.5	1.2	55,900	<0.5
Chlorpyrifos	77,646	0.7	0.4	56,300	0.8
Pendimethalin	205,550	2.3	0.5	107,900	0.8
Epoxiconazole	9,108	0.8	0.7	9,450	0.8

Over the two 3-month monitoring periods:

Input concentrations typically reduced by 10,000-100,000 fold

>1100 individual pesticide determinations from leachate samples

87% of leachate determinations had concentration <0.5μg/L

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Could the leachate water be used again?

Ex biomix biobed

Ex soil/grass biobed

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Operational Aspects

- Water storage - dilution, flow management & biobed moisture
- Controls - simple pumps with float and time switches
- Drip irrigation to biobed and to disposal Area
- Annual Biomix Top-up
- Winterisation - frost protection
- Long Term Biomix Disposal - Residues?
- 9 bulked samples from top 30 cm -**ND**

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Horticultural glasshouse business

- Insectides and fungicides only, total recirculation

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Biobed in Scotland - 50% soil:50% horse manure

Year 1

Year 2 -under cover

Biobed with drip irrigation

Tensiometer use

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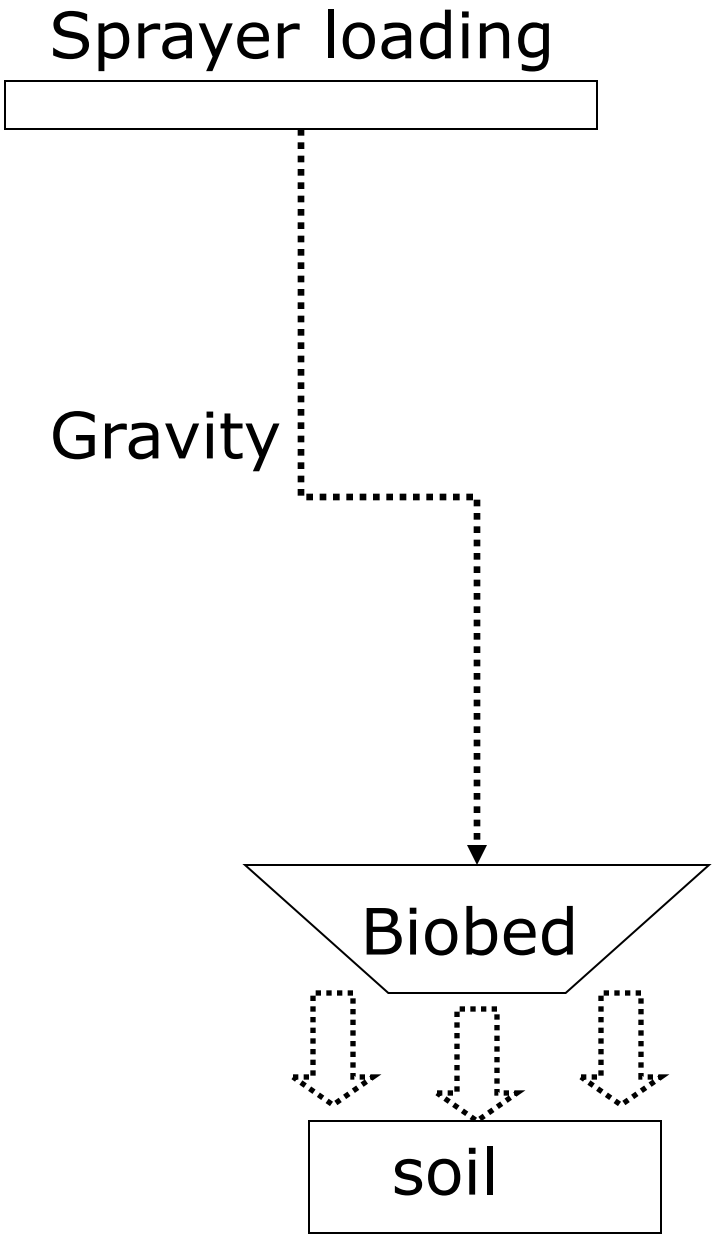
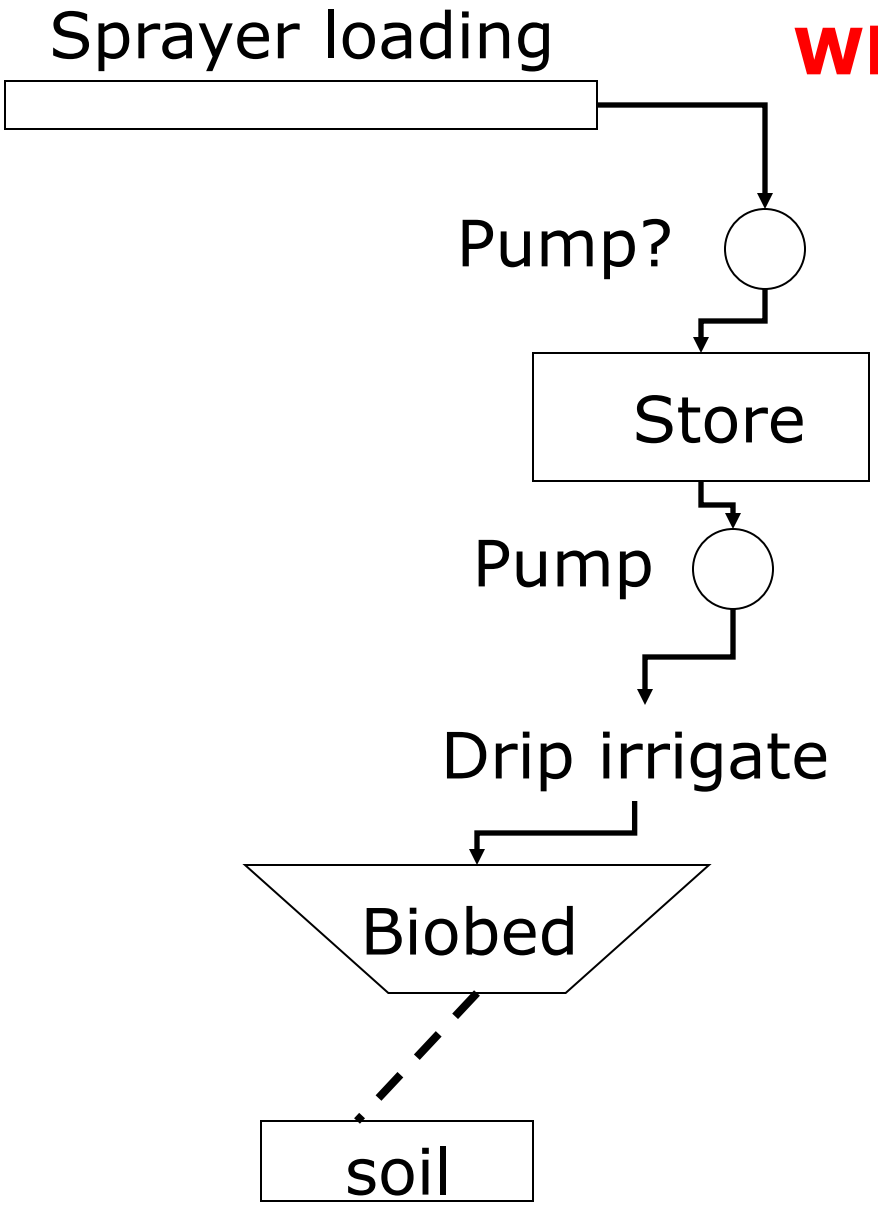
Benefits from a site review

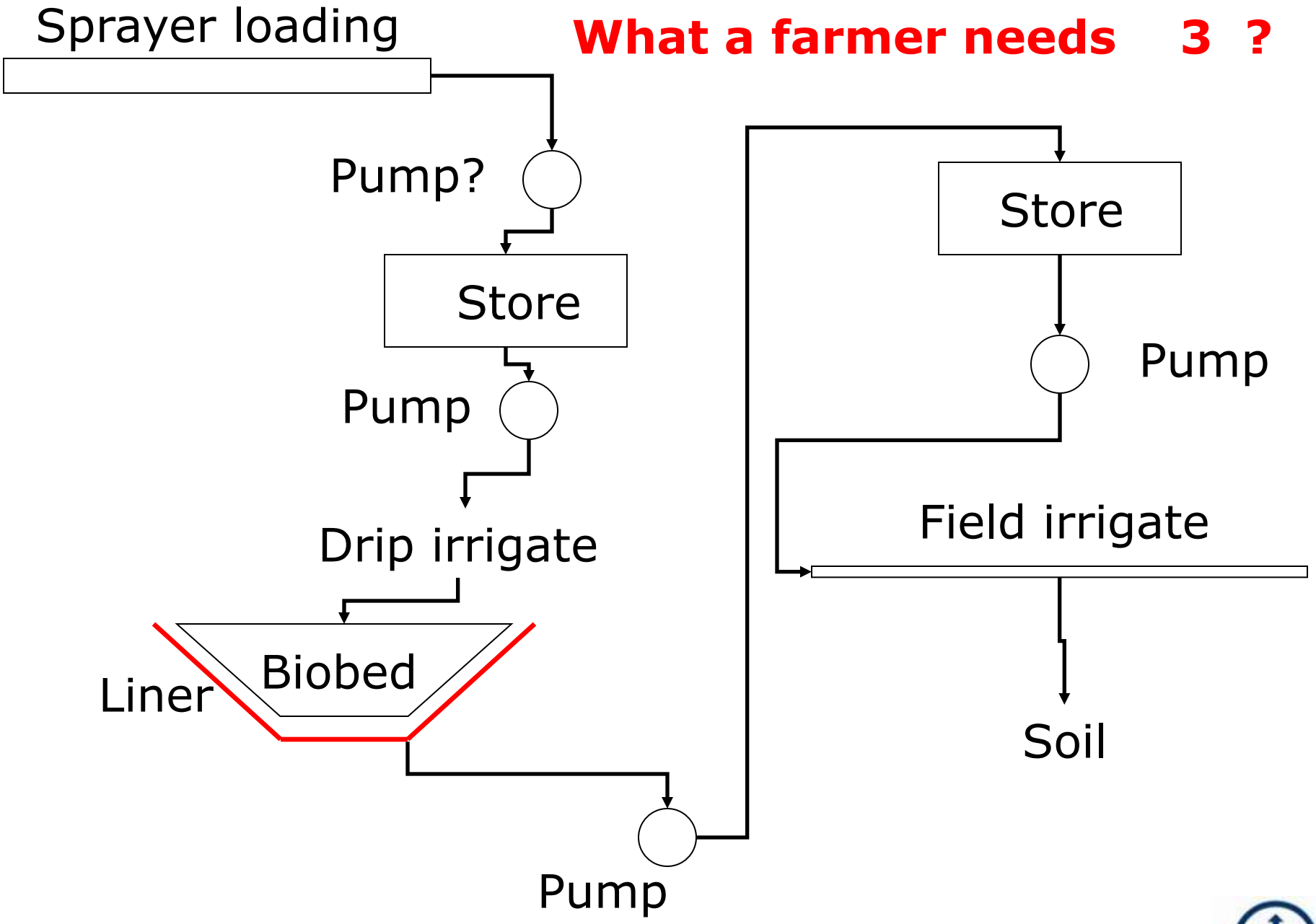
What a farmer needs 1 ?



What a farmer needs 2 ?



What a farmer needs 3 ?



Further questions

- Regulations- EU Waste Directive?
- Liners needed or not ?
- Higher rainfall areas ?
- Soil types for effective use - drains ?
- Soil / grass performance v biomix ?
- Biomix - ingedients - life - disposal ?
- Costs ?
- Future Funding for development work ?

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Reductions of 10,000 to 100,000 fold in pesticide concentration on discharge

Practical systems in advance of other solutions

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