



Created by the industry, for the industry

Think manures

A guide to manure management



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Manures (slurry, farmyard manure or poultry manure) are an important resource. They provide **nutrients** that could reduce your bagged fertiliser costs, and **organic matter** that will improve the condition of your soil and help crop growth and performance.

Giving more thought to how you store and apply your manures will help you to:

- get the most out of your manures – increasing efficiency and yields;
- reduce nutrient losses which affect your profits as well as the environment;
- save on the cost of fertiliser use;
- improve soil quality, drainage and workability;
- comply with rules and regulations.

However, poor manure management can cause pollutants (including nutrients) to get into watercourses, lakes and groundwater, through run-off or drainage (for example, land drains).

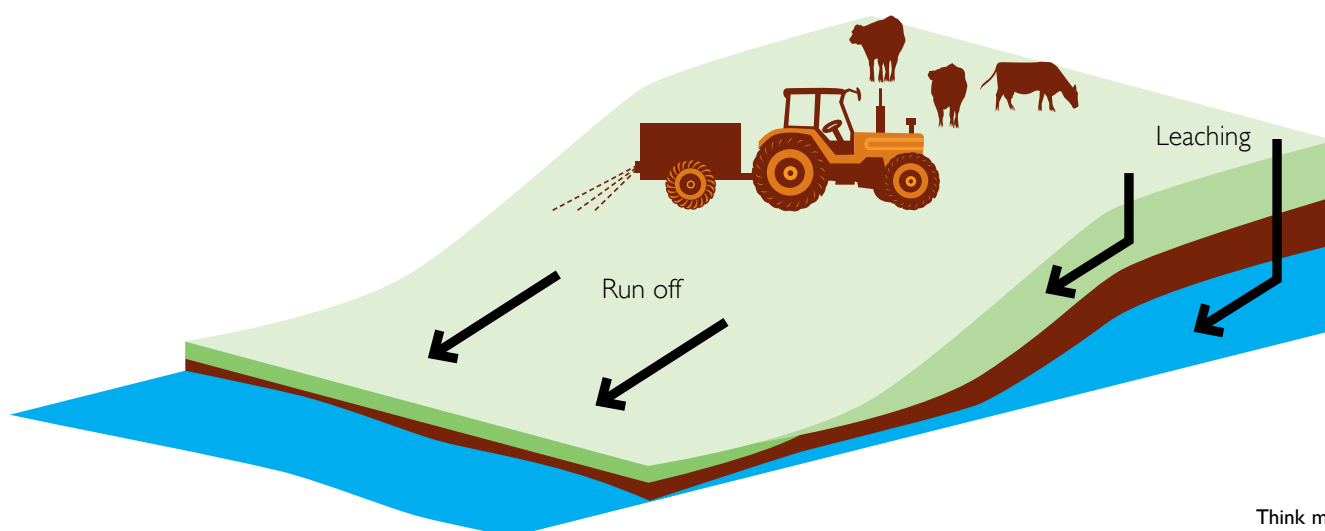
A 2200 gallon tanker of typical (6% dry matter) cattle slurry provides the 'bagged' equivalent of: 12kg of Nitrogen, 6kg of Phosphate and 29kg of Potash. Each hectare (2.5 acres) would get 60kg N, 30kg P and 145kg K from a 50 m³ (11,000 gallon - or 5 tanker) application. See page 12 for more about this type of calculation.

You can make a big difference to your business and the environment by taking simple measures, such as:

- having sufficient storage;
- spreading at optimum rates;
- spreading at more appropriate times;
- not spreading within 10 metres of a watercourse or on waterlogged, frozen or snow-covered land; and
- choosing more suitable land, if available.

This is a practical guide to help you get started. It should be used alongside a more complete guide to nutrient management such as *Tried & Tested* and *The Fertiliser Manual (RB209)*, soil management advice such as *Think Soils*, and more detailed guidance on regulations such as Nitrate Vulnerable Zones (NVZs) and Silage, Slurry and Agricultural Fuel Oil regulations (SSAFO) (relating to standards for manure storage). Details of where to find further information are provided at the end of this booklet.

Diffuse water pollution can be caused by the loss of valuable nutrients





Scraping collecting and dispersal yards, rather than volume washing, reduces slurry

How to make best use of your stores

- **Aim for enough slurry storage to allow for at least four months without spreading, or more if in an NVZ.**
- **Keep excess water away from your manures.**

A store big enough for four months of slurry production, or more if in an NVZ

This is perhaps the most important step in slurry management. Having enough storage will give you control over when and where to spread to maximise the fertiliser value of your slurry and to avoid water pollution.



Storage capacity of six months for pig slurry and poultry manure or five months for other livestock slurry is required if in an NVZ. For more information on NVZs see page 40.



Sufficient slurry storage will give greater flexibility of slurry applications without having to apply when field conditions are unfavourable e.g. frozen or snow covered

Example calculation: 4 months of slurry storage on Oakfield Farm

NVZ and SSAFO regulations have slightly different methods for calculating slurry storage. Using calculations under SSAFO (regulations that apply to slurry stores, particularly those constructed or altered since 1991):

Volume of slurry produced:

150 dairy cattle on a slurry based system producing, say, 1.59 m³ per dairy cow per month

$150 \times 1.59 = 238.5 \text{ m}^3$ each month or **954 m³** over 4 months

Volume of rainfall that enters the slurry store:

Area of slurry store (325 m²) plus 'dirty' concrete surface area (200 m²) is 525 m²

Winter rainfall (this is the maximum rainfall measured over a four month period between October and March in the past five years) is 549 mm (information available from Met Office).

$525 \times 0.549 = \mathbf{288 \text{ m}^3}$

Volume of wash water that enters the slurry store:

Farm uses a low volume hose at 0.6 m³ per cow per month

$150 \times 0.6 = 90 \text{ m}^3$ each month or **360 m³** over 4 months

Total storage capacity required for 4 months slurry production

$954 + 288 + 360 = \mathbf{1602 \text{ m}^3}$

Less slurry storage would be required if the parlour (prior to wash down) and yards used for livestock traffic were regularly scraped/brushed and the liquid produced was stored separately as dirty water. However, it is good practice to have at least 4-6 weeks storage capacity for the dirty water produced so it can be spread in safe conditions.

To make sure you make the most of your stores, aim to empty them by August and keep out excess water.

Note that silage effluent should be collected and dealt with separately. Do not put it in slurry stores because this can result in release of toxic gas.

In wet areas with annual rainfall of 1000mm (about 40") every 10 square metres of roof or clean yard collects the equivalent of a 10m³ (2200 gallon) tanker.

Keeping excess water away from your manures

Dung and urine scraped from the floor with some bedding material produces a very thick slurry. Some water is usually needed to make it easier to handle, mix and pump. A 60:40 mix of dung/urine to water gives a slurry of about the right 'soup-like' consistency for easy mixing, pumping and spreading and provides a significant fertiliser value.

However, if you add too much water:

- it is more likely to run off the field;
- it will dilute the fertiliser value of each load spread;
- it creates a greater volume of slurry, which will be more costly to store and spread.

Avoid these problems by:

- Diverting **clean water** away from the slurry store;
- Reducing **dirty water** production.



Leaking drinking troughs can greatly increase volumes of slurry or dirty water

Clean water

Rainfall run-off from roofs and *clean* yards not soiled by dung or urine. Also rainfall from covered silage clamps if it is not contaminated with effluent.

Dirty water

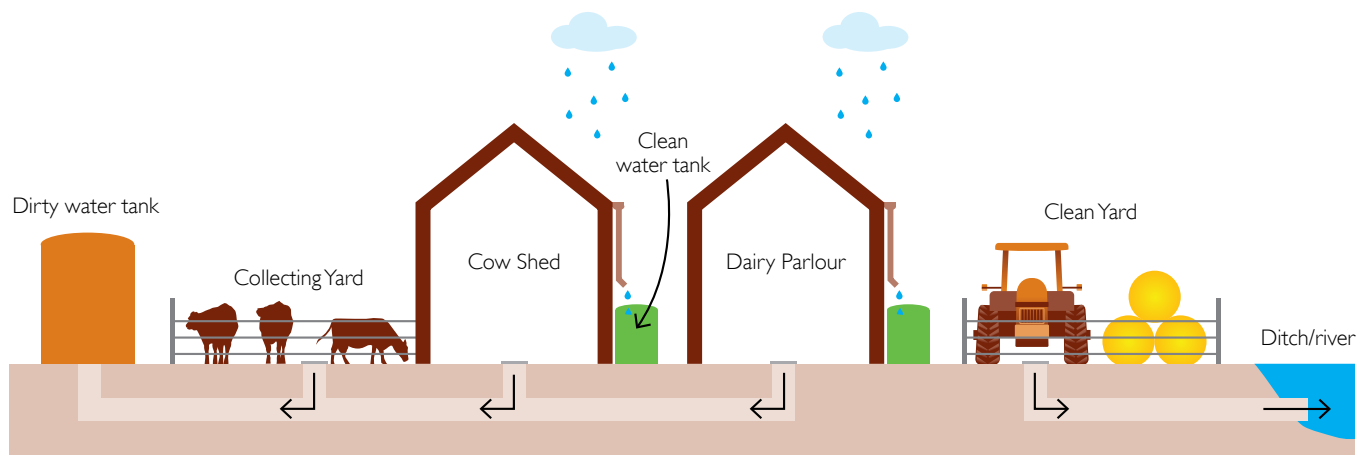
Run-off/wash water from yards or buildings, lightly soiled with dung and urine (for example rainfall run-off from regularly scraped/brushed yards and wash water from a parlour where excess dung has been removed before hosing down) which is collected separately from other slurry.

Contamination of clean water may also arise from yards soiled with waste feedstuffs, spilt fertiliser, and so on.

Slurry

A mixture consisting of dung and urine, livestock bedding, rainwater and washings from a building or yard used by livestock that can be pumped or discharged by gravity. Liquid from weeping wall stores and strainer boxes are slurry. Drainage from solid manure (for example farmyard manure) stores is sometimes classed as dirty water under NVZ rules.

Separating clean and dirty water



Note: if not brushed/scraped regularly, collecting yard and cow shed may produce slurry rather than dirty water.

CLEAN WATER from roofs or clean yards can collect in large volumes. This should not be mixed in with dirty water or slurry but diverted directly to a drain or ditch or, better still, stored for use on the farm.

DIRTY WATER can cause pollution and so you should have enough storage to be able to spread it in the right soil and weather conditions.

To avoid water pollution when spreading dirty water:

- avoid using static irrigators;
- spread it widely, evenly and thinly. This is particularly important where there is risk of loss by drainage to land drains or to groundwater;
- spread at least 10 metres away from any watercourse.

It makes sense to reduce the amount of dirty water produced on your farm:

- Make sure that roof gutters and down pipes are in good order so that clean rainfall does not end up on a dirty yard.
- Reduce the dirty yard area where possible, as clean areas can drain to your clean water system.
- Try to divert rainfall on silage clamps covered with plastic sheets before it hits the ground and mixes with effluent.
- Remove as much dung as possible before washing down and choose a wash-down method that is economical with water.

Brushing out a broiler shed before power washing will reduce the volume of effluent for disposal to land or off site



Damaged gutters or downpipes greatly increase the volumes of water to be stored and dealt with



Solid manures

Solid manure that is not seeping can be stored safely in field heaps. Alternatively keep it on a concrete pad for a few weeks where you can collect and store the liquid seepage until it stops. It is good practice to change the location of field heaps each year and keep them a safe distance from wells and boreholes (at least 50 metres), and from watercourses and land drains (at least 10 metres).

Try to make A-shaped heaps to stop rain getting in and washing out your nutrients, or consider covering your heaps.



There are restrictions concerning field heaps within NVZs.

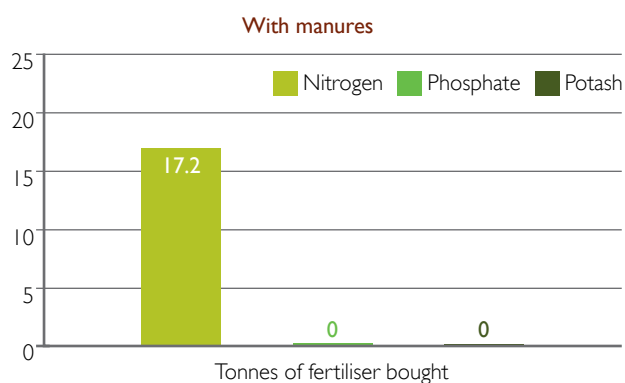
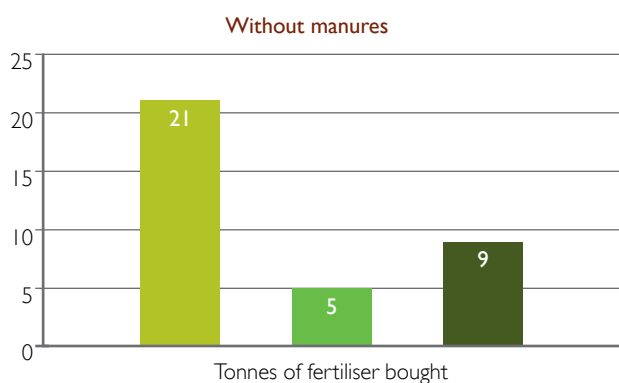




No purchased P & K

“At eight per cent dry matter, the slurry from my dairy herd is dryer than average because I make sure that very little excess water gets into the store. Spreading this at 75m³/ha (6750 gallons/acre) in two separate applications before establishing my maize has enabled me not to buy any bagged phosphate or potash for several years.”

Dairy cow slurry use on 20 hectares (50 acres) of maize/wheat - Purchased fertiliser requirements



An A shaped heap reduces the volume of slurry produced as less rainwater washes through

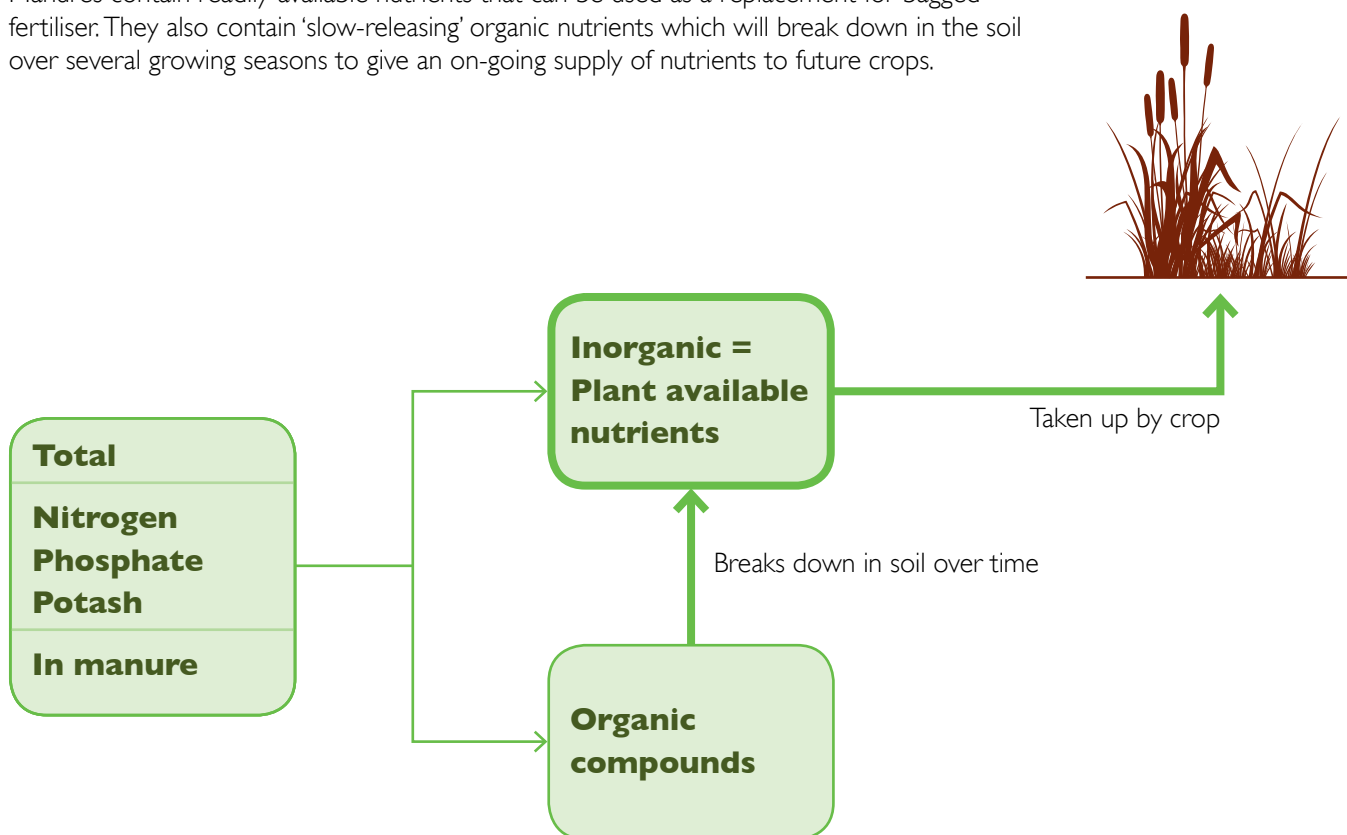


How much to spread?

- **Don't waste money on bagged fertiliser that's not needed – only use it to 'top up' nutrients where required.**
- **Follow a recognised fertiliser recommendation system for each of your crops, such as *The Fertiliser Manual (RB209)*.**
- **Take full account of the nutrients available in your manures.**

Available and organic nutrients

Manures contain readily-available nutrients that can be used as a replacement for bagged fertiliser. They also contain 'slow-releasing' organic nutrients which will break down in the soil over several growing seasons to give an on-going supply of nutrients to future crops.



In general, 50 to 60 per cent of the total phosphate and 90 per cent of the total potash in manures is readily available. Phosphate and potash percentages do not vary by time of year or soil type. About 20 to 40 per cent of the total nitrogen is readily available, but this is more easily leached from the soil when manure is spread in the autumn/winter; and can be lost to the atmosphere as ammonia gas or nitrous oxide. Readily-available nitrogen is highest in slurries and poultry manure. The amount of nitrogen lost depends on when, where and how you spread (see following chapters).

Some typical values for different types of manure are given in the table below. Crop available nutrients values are based on spreading in late winter/spring (values for spreading at other times are available from Defra's *Fertiliser Manual* RB209 or NVZ guidance leaflets – which should be used if you are in an NVZ).

Type of manure and dry matter (DM) content (%)	Total nutrients			Crop available nutrients		
	Nitrogen (N)	Phosphate (P ₂ O ₅)	Potash (K ₂ O)	Nitrogen (N)	Phosphate (P ₂ O ₅)	Potash (K ₂ O)
kg/m³						
Cattle slurry (2%)	1.6	0.6	2.4	0.9	0.3	2.2
Cattle slurry (6%)	2.6	1.2	3.2	1.2	0.6	2.9
Cattle slurry (10%)	3.6	1.8	4.0	1.3	0.9	3.6
Pig slurry (2%)	3.0	1.0	2.0	2.2	0.5	1.8
Pig slurry (4%)	3.6	1.8	2.4	2.5	0.9	2.2
Pig slurry (6%)	4.4	2.6	2.8	2.8	1.3	2.5
Typical dirty water	0.5	0.1	1.0	0.3	0.05	1.0
kg/tonne						
Cattle FYM (25%)	6.0	3.2	8.0	0.6 (old) 1.2 (fresh)	1.9	7.2
Pig FYM (25%)	7.0	6.0	8.0	1.0 (old) 1.8 (fresh)	3.6	7.2
Layer manure (35%)	19	14	9.5	9.5	8.4	8.6
Broiler litter (60%)	30	25	18	10.5	15.0	16.2

To convert kg/m³ to units/1000gallons, multiply by nine. To convert kg/tonne to units/ton, multiply by two.

To work out how many nutrients will be provided by an application of manure if spread in late winter/spring, simply multiply the spreading rate (m³/ha or tonnes/ha if using solid manure) by the values in the table.

So for instance, a six per cent dry matter cattle slurry applied at 25 m³/ha will provide 65 kg/ha total nitrogen (2.6 × 25), and 30 kg/ha available nitrogen.

Estimating the dry matter content of your slurry



Cattle slurry 2% DM (thin soup)



Pig slurry 2% DM (thin soup)



Cattle slurry 6% DM (medium soup)



Pig slurry 4% DM (medium soup)



Cattle slurry 10% DM (porridge)



Pig slurry 6% DM (porridge)



In this field the rate of application is too high for the soil condition, which is at field capacity. Some slurry is also ponding, with run off towards a watercourse, from areas compacted by the spreading vehicle.

Meeting your crop requirements with manures

You can use a recognised nutrient management plan such as Tried & Tested (see 'The next steps' chapter) to work out how much nutrient to apply to a crop. All plans are based on a nutrient 'balance sheet' which takes into account:

- 1 Nutrient requirements for different crops. These can be found in guidance such as Defra's *Fertiliser Manual* (RB209) and will vary depending on cropping, yield and soil fertility.
- 2 Plant-available nutrients already in the soil for crop uptake during the growing season (for example, nitrogen slowly released from previous manure applications and crop debris). Nutrient management plans help you estimate this, or you can test your soils.
- 3 Nutrients available from your manures.

When working out how much manure to apply to a crop:

NITROGEN: Refer to the crop **available** amount in your manures. Aim for the manure application to supply no more than 50-60 per cent of the total nitrogen requirement of the crop, with manufactured fertilisers used to make up the difference if your farm is not organic. This approach will minimise the potential impact of variations in manure nitrogen supply on crop yields and quality.

PHOSPHATE AND POTASH: If the crop is likely to be responsive (for example, where there is low soil fertility or if growing certain crops such as potatoes) refer to **available** content of your manures. Otherwise, use **total** content. In most cases, typical manure application rates can meet, and even exceed, the crop's phosphate and potash needs. You should not greatly exceed the fertiliser recommendation for the crop, especially on fertile soils. If you do apply more than is needed, take this into account when working out applications for the next crop.

Example calculation: First cut grass silage

Based on the typical values given on page 12, cattle slurry with 6% dry matter is applied in late winter/spring to a field with low phosphate and potash soil levels, at a rate of 50m³/ha. This provides half the nitrogen, just under half the phosphate and much more potash than needed.

This would result in a significant saving on bagged fertiliser. With a 50m³/ha application rate you will make more savings by taking the surplus potash into account when working out the fertiliser requirement for the second cut.

	Nitrogen (N)		Phosphate (P ₂ O ₅)		Potash (K ₂ O)	
	kg/ha	Units/acre	kg/ha	Units/acre	kg/ha	Units/acre
Fertiliser recommendation:	120	96	70	52	80	64
(Available) Nutrients from slurry:	60	48	30	24	145	116
Bagged fertiliser 'top up' needed:	60	48	40	32	0	0
Surplus nutrients:	0	0	0	0	65	52

50m³/ha (4500gals/acre) cattle slurry at 6% DM spread in Feb/March for first cut grass silage. Less fertile soil (Soil P and K Index = 1).

You can now top up with bagged fertiliser. Reduce the amount of bagged nitrogen, phosphate and potash recommended for the crop by the amounts of these nutrients provided by the manure.

If using sewage sludge, digestate or composts, make sure these nutrient inputs are also taken into account within your nutrient management plan and regularly test your soils for nutrients and heavy metals.



Plan the application rate for each field ensuring that no more than 250 kg/ha total organic manure nitrogen is applied in any 12 month period – it is mandatory in NVZs not to exceed this amount.

Can you afford NOT to test your soils?

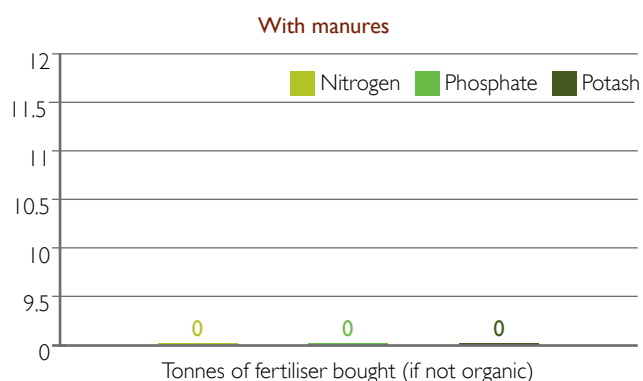
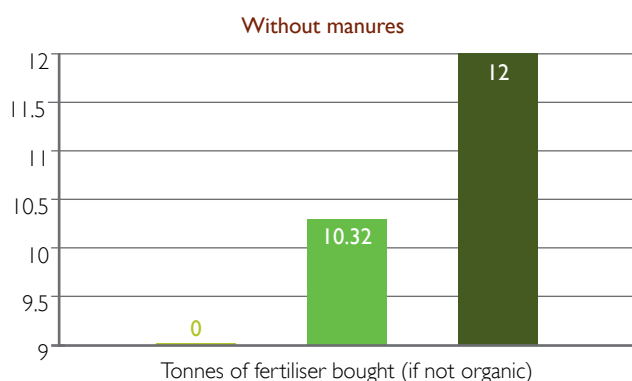
Based on data from routine soil tests, only 11 per cent of arable and 8 per cent of grassland samples were at the 'target' index for both phosphate and potash. Where indices are low, yields may suffer. Where nutrient levels are already high, applying more wastes time and potentially hundreds of pounds on fertiliser.



Nutrients in manure are very valuable!

"I use the composted litter from my broiler enterprise to fertilise organic grass silage fields. Since I farm organically, the nutrients supplied by the broiler litter and beef cattle farmyard manure are very valuable."

Broiler manure use on 12 hectares (30 acres) of grass clover silage - Purchased fertiliser requirements



Using a slurry injector or trailing shoe prevents contamination of grass for silage or grazing and stock can be returned sooner



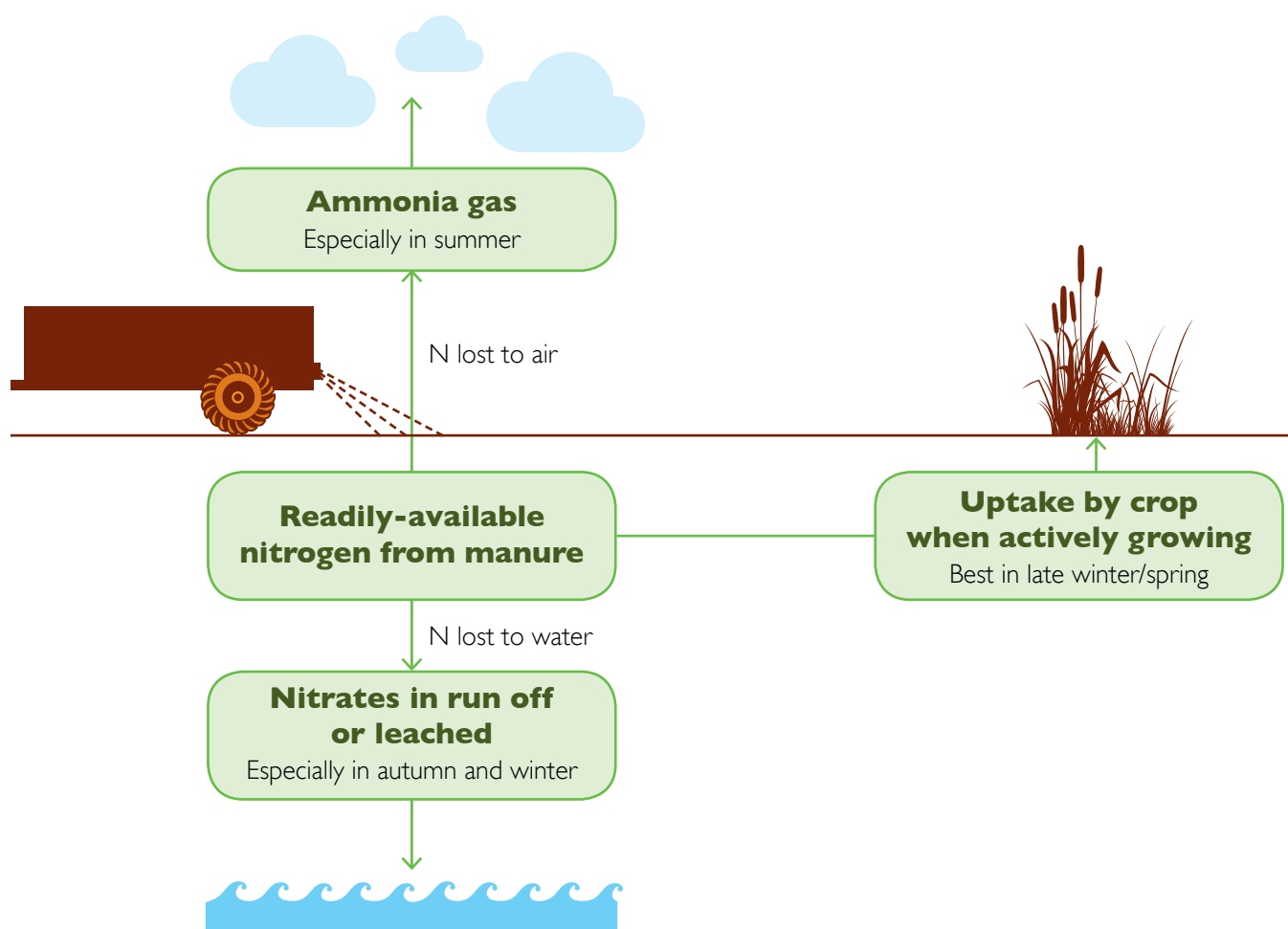
Deciding when to spread

- **Spread when your crops need nutrients to grow - usually late winter/spring and summer.**
- **Take weather and soil conditions into account to minimise the risk of water pollution and soil compaction.**
- **Beware of causing contamination of grass for grazing or silage.**

Late winter/spring is the best time of year to spread as this is when crops are most likely to be able to take up nutrients, so you can maximise yields, reduce fertiliser costs and minimise nutrient losses to the environment.

If you supply nutrients during the autumn or early winter which are not needed at that time, in particular nitrogen, they will be lost through run-off and leaching (especially on shallow/sandy soils). In the summer there is less risk of leaching, but extra nitrogen is lost from manure applications as ammonia gas.

Nitrogen cycle on farm

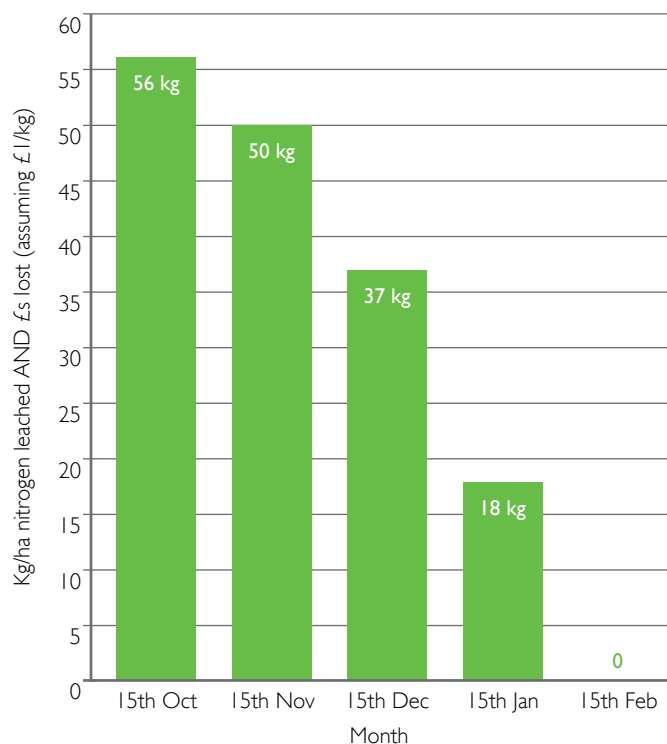


Leached nitrogen from slurry applications in winter

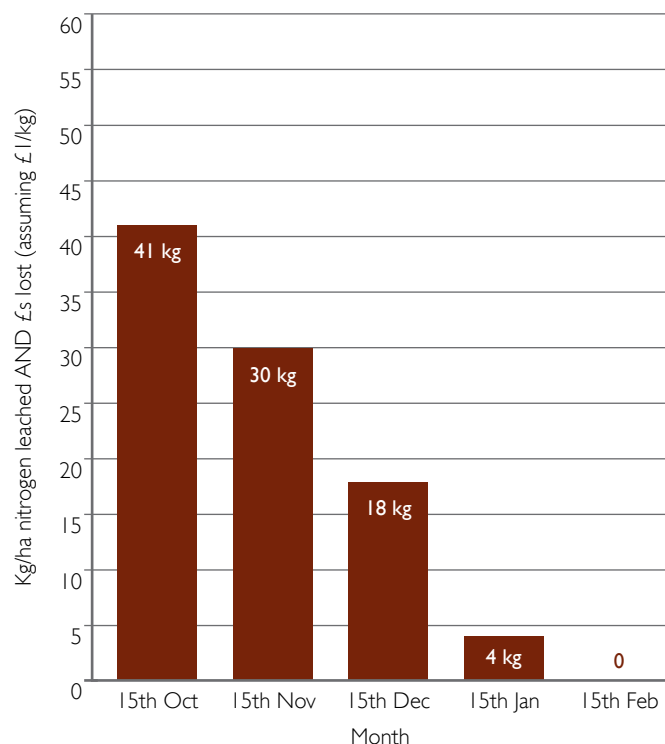
This example in the bar charts uses results from MANNER software (see 'The next steps' chapter). It shows estimated nitrogen losses when a dairy slurry with 6 per cent dry matter (2.6 kg/m^3 total nitrogen) is spread on land at a rate of $50 \text{ m}^3/\text{ha}$ during the autumn and winter months (incorporated within less than two hours to minimise ammonia loss). At the time of spreading, the slurry supplies 130 kg/ha total nitrogen, of which 64 kg/ha is in a plant available form. The amount of plant-available nitrogen increases and the nitrogen leached decreases when the manure is applied in late winter/spring.

Nitrogen leaching varies by soil type. The maximum saving from getting the application time right on a 10 ha field was £563 on sandy loam, and £406 on clay loam over clay, assuming nitrogen costs of £1/kg.

Sandy loam



Clay loam over clay



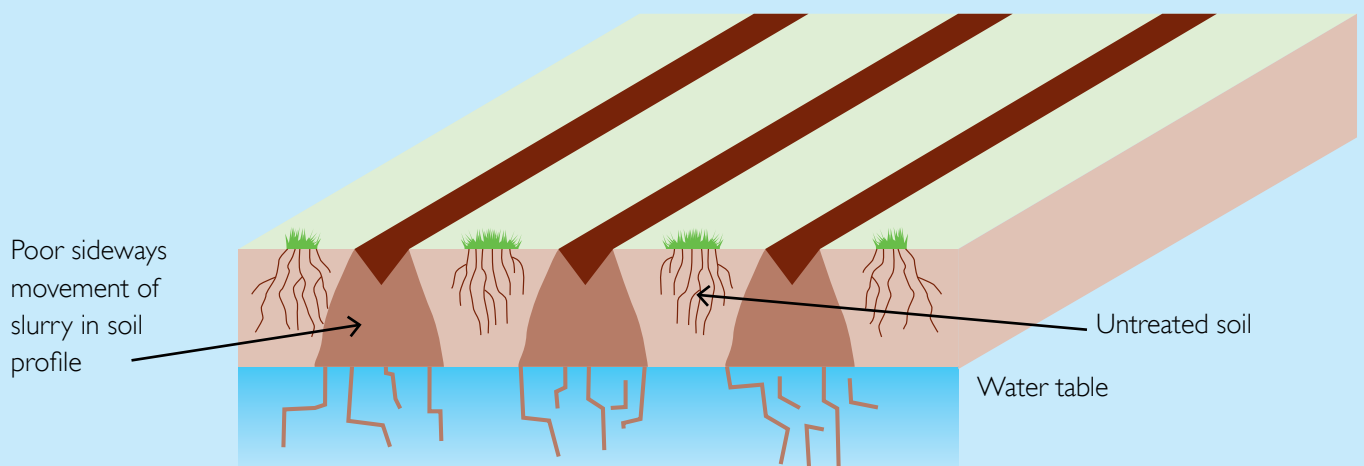


FYM spread prior to reseeding provides all the phosphate and potash needed for the new ley

Shallow injection problems in wet clay soil

Even when overall application rates are correct and evenly applied, in the wrong conditions you can still end up with areas with too much or too little slurry. This illustration shows how applying slurry by open slot shallow injection to clay loam soil that is close to field capacity can cause stripes of slurry at a much greater concentration, inbetween untreated soil. The slurry is then lost by drainage into the groundwater below.

Open Slot Shallow Injection



Timing opportunities for spreading manures

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Grass: silage 1st cut	SL, FYM, PM	SL, PM										
Grass: silage 2nd cut						SL, PM						
Grass reseed	SL, FYM, PM							SL, FYM, PM				
Grass grazing	SL											
Forage maize	SL, FYM									FYM		
Winter cereal	SL, PM	SL, PM					SL, FYM, PM					
Spring cereal	SL, FYM, PM	SL, PM										
Winter oilseed rape	SL	SL					SL, FYM, PM					
Potatoes	SL, FYM, PM											
Root crops				SL, FYM, PM								

Aim to get manure store empty by end of August

Key

-  Optimum opportunity for top dressing
-  Opportunity for top dressing subject to soil and weather conditions
-  Opportunity for ploughing in after spreading subject to soil and weather conditions.
- SL** Slurry
- FYM** Farm yard manure
- PM** Poultry manure

This table shows likely best times for spreading. However, to avoid the risk of pollution, take soil and weather conditions into account. Make sure you have enough storage so that you can avoid spreading when:

- soil is waterlogged;
- soil is frozen or there is snow or ice;
- there is flooding;
- heavy rain is forecast.

Do not spread slurry when the soil is saturated at field capacity (for example, during the winter months). On wet soils spread slurry thinly to prevent it leaching through the soil beyond crop use and causing water pollution. This is particularly important where land drains are present, and also on shallow sandy soils over groundwater.

There may also be other restrictions on when to spread, such as during outbreaks of animal disease.



In NVZs there are closed periods in autumn and winter when spreading of slurries and poultry manure, as well as manufactured fertiliser, is prohibited.



Timely application of manufactured fertilisers may also be necessary to meet total nutrient requirements for crop growth and optimum yield

Silage and grazing

For silage fields, make sure you leave enough time between spreading and cutting for rainfall to wash slurry off the herbage. Contaminated herbage will yield poor quality silage that may be rejected by livestock. You can use a trailing shoe spreader or injection techniques to avoid contamination.

For grazing fields, you should be aware of the risk of causing health problems in otherwise healthy stock. These include:

- botulism from carcasses in poultry manure
- grass staggers in stock, from high crop uptake of potash supplied by cattle slurry and problems of herbage rejection.

If spreading on these fields is unavoidable, leave plenty of time (at least four weeks, or until all visible signs of slurry solids have disappeared) before grazing to avoid the risk of transferring diseases. A minimum of six to seven weeks is essential if grazing young stock. You can use a trailing shoe spreader or injection techniques to reduce the time between spreading and grazing.

Spreading on grassland for silage in the spring makes good use of the nitrogen, phosphate and potash



Deciding where to spread

- **Know which crops are best at using the nutrients in your manures.**
- **Use your manure management plan to identify where not to spread and where spreading restrictions apply to avoid causing water pollution.**

Target crops

Target crops are those best at taking up nutrients and which are then taken away at harvest. Applying manures to these crops will help you to avoid the build-up of nutrients, especially phosphate, in the soil to levels that could eventually result in water pollution.

Good target crops include:

- grass silage
- maize
- cereals
- oilseed rape
- root crops

Grass for grazing is a poor target crop because many nutrients are not taken away for harvest (in the form of beef or milk) but returned back to the soil in dung and urine. Therefore demand for added nutrients for grazing grass is much lower than for cut grass.

Legumes need very little or no nitrogen because they take what they need from the atmosphere, and so are also poor target crops. These include peas, beans and clover.

Manure management plan

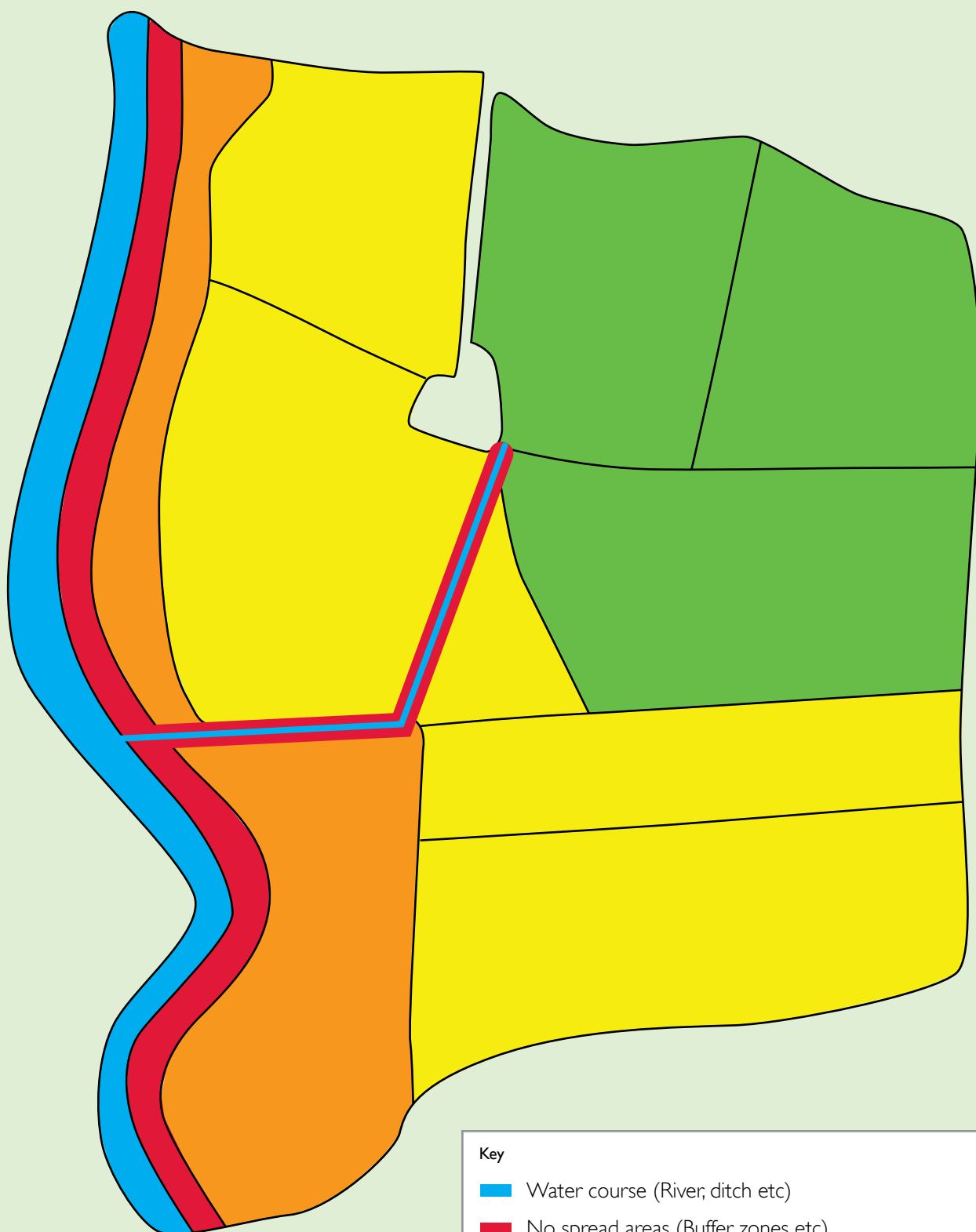
Identify fields, or parts of fields, where spreading restrictions apply by drawing up a simple manure management plan.

The plan should identify areas where:

- manures should never be spread, that is within 10 metres of a watercourse (including ditches) and within 50 metres of a spring, well or borehole;
- spreading restrictions apply because there is a risk of water pollution, for example sloping land falling to a watercourse or ditch, or where there is shallow sandy soil or soil compaction;
- there is an opportunity to spread some manure with care during the winter, with the least risk of run-off/ drainage and pollution, until you have storage to avoid winter spreading;
- land slopes steeply or drains towards channels (such as tracks or highways) leading to land drains or watercourses;
- there are particular environmental sensitivities, for example Sites of Special Scientific Interest (SSSIs).

Most farm assurance schemes require you to make a manure management plan. It should also be passed on to your contractor or a worker who is less familiar with the farm.

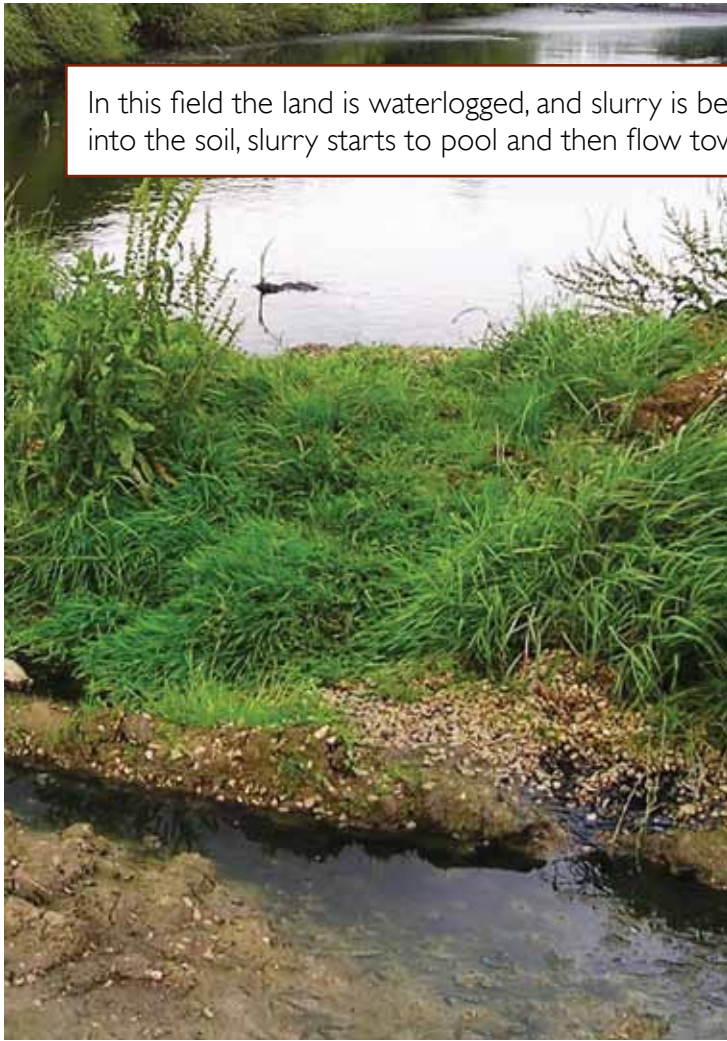
Example of a simple manure spreading risk map



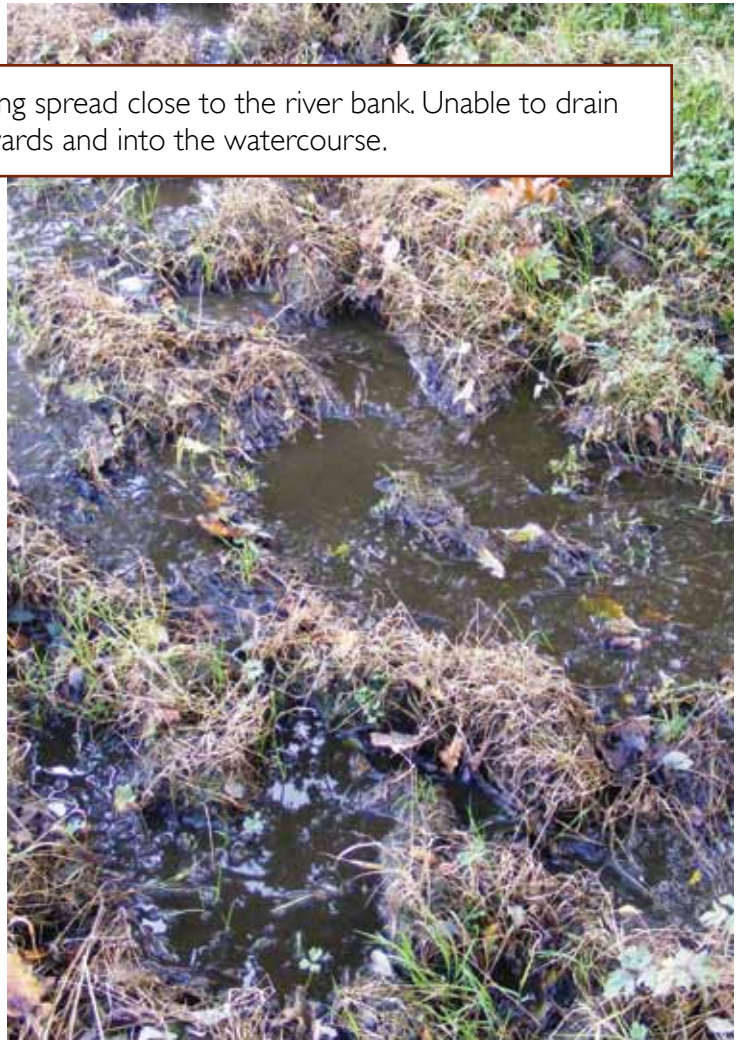
Key

- Water course (River; ditch etc)
- No spread areas (Buffer zones etc)
- Very high risk land - Avoid winter spreading and summer spreading when ground is compacted or cracked to drains
- High risk land - Restrict application rates during winter
- Lower risk land - May be possible to spread throughout the year

Defra provides guidance on how to create a more detailed spreading risk map. See p.40 for more details.



In this field the land is waterlogged, and slurry is being spread close to the river bank. Unable to drain into the soil, slurry starts to pool and then flow towards and into the watercourse.



Before spreading it is good practice to inspect your fields to consider the risks of manure getting into watercourses and groundwater or causing soil damage. Take particular account of:

- ground cover;
- weather conditions;
- soil conditions (for example, if it is waterlogged);
- presence of land drains and watercourses.

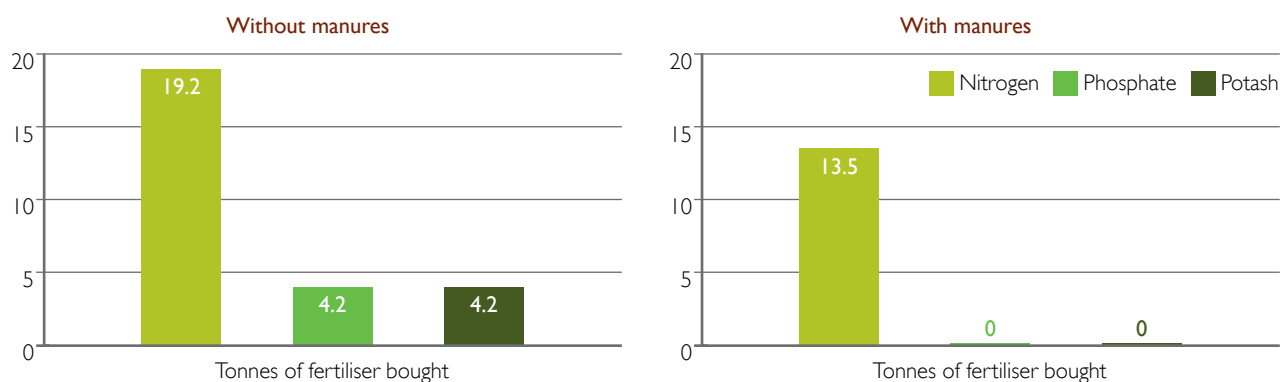


A risk map, one element of a Manure Management Plan, must be drawn up for your farm if you are in an NVZ.

Pig slurry saves nitrogen and P & K on winter cereals

“By spreading pig slurry to growing cereal crops during the spring, I have been able to save large amounts of purchased fertiliser on winter cereals.”

Pig slurry use on 30 hectares (75 acres) of winter cereals - Purchased fertiliser requirements







Cattle slurry 25 m³/ha
(2250 gallons per acre)



Cattle slurry 50 m³/ha
(4500 gallons per acre)



Cattle slurry 100 m³/ha
(9000 gallons per acre)



Pig slurry 25 m³/ha
(2250 gallons per acre)



Pig slurry 50 m³/ha
(4500 gallons per acre)



Poultry litter 5 tonnes per ha
(2 tonnes per acre)



Poultry litter 10 tonnes per ha
(4 tonnes per acre)



You are required to plough in after spreading slurry or solid manures on bare soil or stubbles in NVZs.

How to spread accurately and evenly

- **Keep manure spreading rates low – as a general rule spread less over more fields.**
- **Calibrate your spreader to ensure even, accurate spreading.**
- **Consider the most suitable type of spreading machinery.**

Spreading rates

It is good practice not to spread more than 50m³/ha (4500 gallons/acre) of slurry in one dose because of the risk of run-off to a watercourse, or losses into groundwater. When the soil is saturated at field capacity you should avoid spreading. Excessively high spreading rates can also lead to management problems including poor grass silage quality, lodging in cereals and health problems in grazed stock.

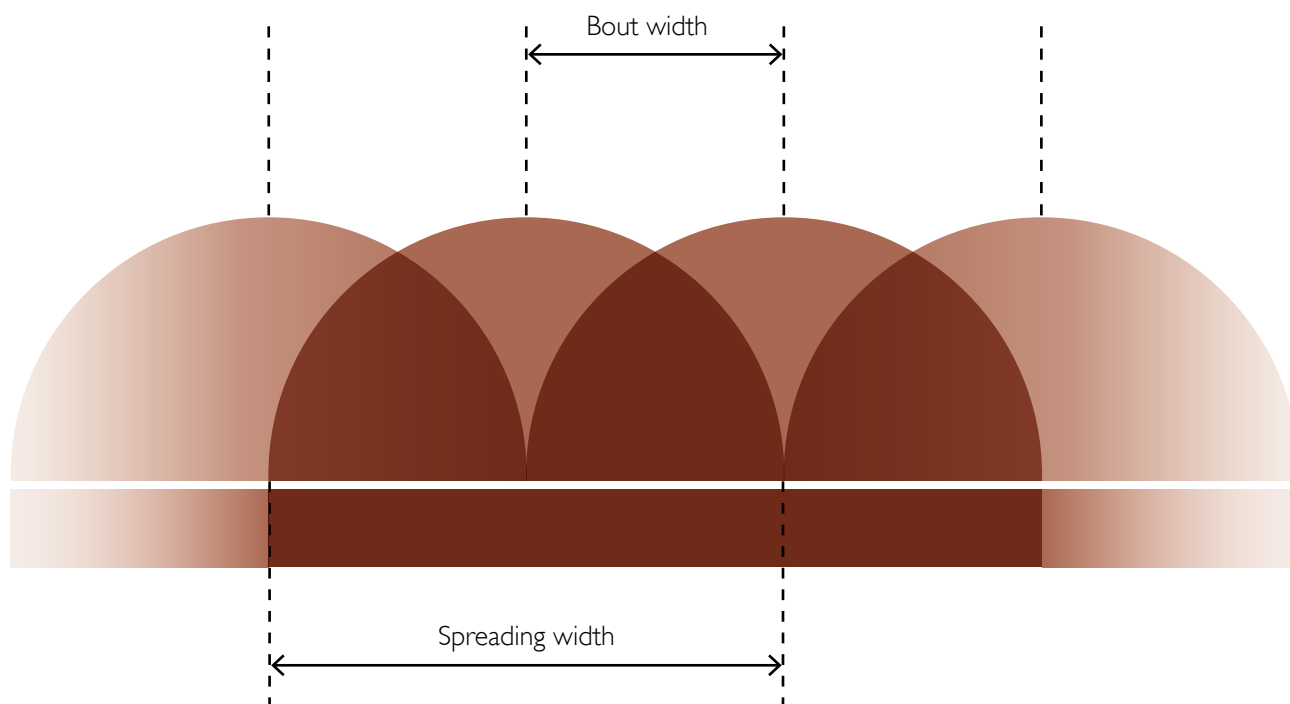
Leave at least three weeks between each application to prevent surface sealing and to let the soil recover.

Where possible, plough in slurry as soon as you can after spreading to stop nitrogen being lost to the air as ammonia gas. Ploughing in within six hours of spreading slurry, and 24 hours for solid manures, will increase the amount of nitrogen available to your crops by 10 to 25 per cent.



Mixing contents of a slurry store makes it easier to spread evenly and accurately

For most spreaders, the amount spread across the bout is uneven, with less applied towards the edges. Overlap the bouts to get an even application across the field. Generally, overlap the bouts by about half (this means the bout width is about half the spreading width).



Calibrate your spreader

The simplest way to check the calibration of your spreader is to:

- weigh it empty and then full to determine its capacity;
- spread a full load over a known area;
- adjust forward speed to give required spreading rate;
- refer to the manufacturer's operating guide for further information.

This is especially important for farmyard manure because its density, and hence the weight of a load, can vary considerably with straw content, age and packing density. An accurate flow meter should be used to measure the slurry application rate of umbilical systems.

Adjust the discharge from the spreader so that the spreading trajectory is low and manure is not being thrown high into the air.

Stirring slurry stores just before spreading will help ensure a more even application of nutrients.



A trailing shoe spreader which has similar advantages to injection but has a lower tractor power requirement and can be used on taller grass and a wider range of soil types

Choice of spreading machinery

The main types of spreaders are:

- broadcast
- band
- trailing hose/shoe
- shallow slot injection
- deep injection.

All these can be attached to a vacuum or pump tanker or to an umbilical hose, and travelling/pulse jet irrigators.

Deep injection should be avoided during the winter months and not used until the soil has sufficiently dried in the spring. Slurry distribution in the soil is likely to be poor and the risk of drainage beyond crop use high – wasting nutrients and increasing the risk of water pollution.

Broadcast spreaders (splash plate or nozzles) will waste nutrients too through ammonia loss and are more likely to cause an odour nuisance.

When using trailed spreading machinery, use low pressure tyres to minimise soil compaction.

Irrigators should only be turned on when conditions are suitable, and aim to spread widely, evenly and thinly to avoid water pollution.

If upgrading or contracting out, consider more efficient spreading techniques, such as advanced band, trailing shoe and shallow slot injectors, matching application rates to the site, soil and weather conditions.



In NVZs, high trajectory spreaders should not be used for slurry spreading in most circumstances.



Band spreaders are very flexible being suitable for both grassland and top dressing growing crops



Injecting slurry reduces nitrogen loss, improves accuracy and minimises odour and contamination



Rear discharge spreader spreads solid manures very evenly and accurately even at low rates



Umbilical low trajectory slurry spreading minimises soil compaction



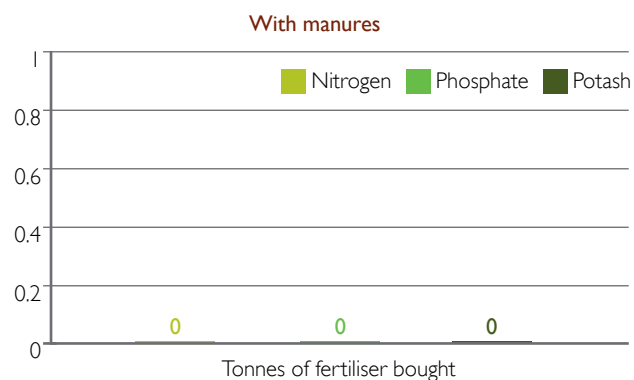
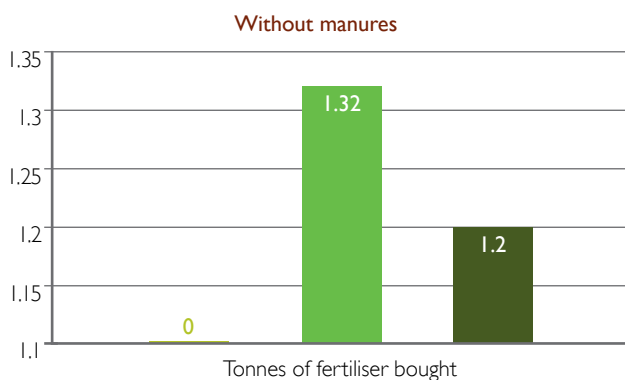
Dual purpose spreader (side discharge) being used to spread FYM



Farm Yard Manure for grass reseeding

“Spreading solid manure before a reseed means we do not need to use compound fertiliser to supply early crop development requirements. We spread approx 20 tonnes/ha (eight tonnes/acre) of farmyard manure before ploughing.”

Cattle farm yard manure (FYM) use on 12 hectares (30 acres) of grassland reseed - Purchased fertiliser requirements



Soil sampling grassland with a spade



The next steps

- **Work to a nutrient management plan to improve your business efficiency.**
- **Work out where and when to spread manures on your farm to avoid water pollution and prevent nutrient losses.**
- **Consider the likely return on investment for soil and manure testing on your farm.**
- **Get to know the regulations and codes that set minimum standards for manure management.**

This booklet covers the basics of manure management. You should use it as a companion to a nutrient management plan and in accordance with environmental regulations. We have therefore given details below of where to find more detailed information on topics we have covered to allow you to go further:

Finding out more about nutrient management planning

Nutrient management plans are a good next step as they help you to use your nutrient inputs as efficiently as possible – maximising plant uptake and minimising losses to the environment. They also help you to comply with regulations and schemes.

Tried & Tested Nutrient Management Plan. This paper plan comprises farm record sheets (for the whole farm) and field record sheets (for each field). Completing these gives a record of nutrient use, both from bagged fertiliser and manures, throughout the season. The plan also gives guidance on nutrient spreading, soil analyses, nutrient storage and fertiliser security. Available free at www.nutrientmanagement.org 02476 858896 or nutrient.management@nfu.org.uk.

Crop fertiliser recommendations. Accurate recommendations for each crop grown on your farm can be obtained from a FACTS Qualified Adviser or by referring to Defra's *Fertiliser Manual (RB209)*. This will give the optimum amount of nitrogen, phosphate and potash

(and other nutrients) required by crops at different times of the year. It takes into account nutrients supplied by the soil, rainfall, soil type and previous cropping. Download for free from www.defra.gov.uk/food-farm/land-manage/nutrients or order (payment required) from The Stationery Office 0870 600 5522. You can also use the PLANET computer software which mimics calculations in the Fertiliser Manual to generate nutrient management recommendations and help farmers comply with NVZ rules. Available free at www.planet4farmers.co.uk.

Soil testing and analysis. Specialist laboratories offer relatively inexpensive tests (typically less than 20p/ha/year) to analyse the nutrient and pH levels of your soils and provide accurate fertiliser recommendations. You should aim to do this every three to five years to find out the level of phosphate and potash in your soils. If it is higher or lower than the 'target index', you can adjust the amount of nutrients you apply to your crops to maximise yields for minimum costs. For a list of soil testing laboratories see www.nutrientmanagement.org/Support-and-advice/Soils/Soil-testing---find-a-laboratory.

Nitrogen levels in soil tend to be more expensive to test for and so a soil nitrogen supply (SNS) estimate can be made based on knowledge of previous cropping or grassland management, previous fertiliser or manure use, soil type and winter rainfall. Tried & Tested has a calculator for this which can be downloaded at www.nutrientmanagement.org/Library-publications/SNS-Calculator or you can use the tables in the Fertiliser Manual (RB209).

Regulations and codes of practice relating to manure management

In previous chapters, this booklet has highlighted a few of the key requirements set by regulations in England. However you will need to refer to separate advice and guidance to be sure you are meeting all the minimum standards.

Nitrate Pollution Prevention Regulations 2008. Nitrate Vulnerable Zones (NVZs) are designated under these regulations. If you farm within a designated area, these regulations will impact on how, when and where you store and spread manures. *Guidance for Farmers in Nitrate Vulnerable Zones* is a series of leaflets, and further Q&A and Factsheets have been produced to support this. At the time of publication these can be accessed from the businesslink website, <http://www.businesslink.gov.uk> or hard copies of the leaflets ordered from the Defra Library on **020 7238 6575**. New Regulations will be made during 2012, and this will lead to revised guidance.

The Water Resources (Control of Pollution) (Silage, Slurry and Agricultural Fuel Oil) (England) Regulations 2010(SSAFO). These regulations, which were reintroduced in 2010, impact on the construction of new or substantially altered slurry stores since 1991. Guidance notes for farmers is currently available from the Defra website, <http://www.defra.gov.uk>. Factsheets are currently available at www.environment-agency.gov.uk/business/sectors/118798.aspx

Sludge (Use in Agriculture) Regulations 1989, and Code of Practice. These apply to farmers who use sewage sludge (biosolids) on agricultural land. For more information visit <http://www.businesslink.gov.uk>

Environmental Permitting Regulations 2010 (EPR). These apply to large pig and poultry farms which need a permit to operate. They may have to take steps to reduce ammonia, odour and excess nutrients from manures and reduce risks of surface and groundwater pollution. The regulations also apply to spreading industrial wastes on land for agricultural benefit. The *Animal By-products Regulations* may also apply where animal by-products (for example treated blood) are spread on farm land.

Cross Compliance. These standards must be followed to qualify for the full single farm payment. The main areas relevant to manure management are NVZs (see above), sewage sludge, groundwater protection and soil protection. For more information visit <http://www.defra.gov.uk/crosscompliance/guidance/> or call the Cross Compliance helpline **0845 3451302**.

Protecting our Water, Soil and Air: A Code of Good Agricultural Practice for Farmers, Growers and Land Managers (CoGAP). This contains detailed advice and guidance on avoiding pollution and the risk of prosecution by the Environment Agency under the Water Resources Act. Available from The Stationery Office order line: **0870 600 5522**, or visit <http://www.businesslink.gov.uk>



Agros on farm nitrogen meter

Further help and advice

Manure Management Plan. A step by step guide for farmers. This guide from Defra provides further information on how to develop a manure management guide including template forms to help you identify your own farm requirements. Free to download at <http://adlib.eversite.co.uk/resources/000/015/584/manureplan.pdf>

Managing Livestock Manures 2007. A series of four booklets with more detailed information on using manures as fertilisers, produced by ADAS.

Booklet 1.

Making better use of livestock manures on arable land.

Booklet 2.

Making better use of livestock manures on grassland.

Booklet 3.

Spreading systems for slurries and solid manures.

Booklet 4.

Managing manures on organic farms.

These are currently out of print. Any copies will not be consistent with the latest nutrient advice in Defra's *Fertiliser Manual* (RB209), but the general advice on manure management is still valid. Call ADAS on **01623 844331** to receive email copies.

Manure Testing and Analysis. The average values used in the booklet for nutrients in manures provide an easy,

practical means of estimating nitrogen, phosphate and potash content. However, computer software such as MANNER can help you do this more accurately for your farm. It calculates crop available nitrogen provided by manures spread on land, taking into account manure type and analysis, spreading rate and method, nitrogen losses and changes in the soil. Available free at www.adas.co.uk/manner or telephone **01623 848333**. You can also take a sample of the manure and have it analysed by a reputable laboratory. There are also on-farm test kits available. Both the Agros and Quantofix meters measure the amount of readily available nitrogen in a slurry sample. A hydrometer can measure the phosphate and potash content based on the degree of dilution of the sample.

Catchment Sensitive Farming (CSF) provides support to farmers in priority catchments, to enable them to take voluntary action to reduce diffuse water pollution. CSF officers can provide tailored advice on manure management, and CSF grants can be awarded for installing facilities such as roofing for manure stores. For more information go to www.naturalengland.org.uk/csf

ThinkSoils and **Best Farming Practices** are two Environment Agency publications which can help you to look after your most precious farming resources: soil, nutrients and water. These are free to download at <http://publications.environment-agency.gov.uk> or call **03708 506 506**.



Quantofix on farm nitrogen meter



Slurry hydrometer used to estimate nutrient content of slurry



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For free copies of this booklet please email nutrient.management@nfu.org.uk
or call 02476 858 896

This guidance is an aid to nutrient management planning and can help users meet the requirements of the NVZ regulations, where these apply. Whilst the Professional Nutrient Management Group has used its best endeavours to ensure the accuracy of the guidance, we cannot accept any responsibility or any liability from its use.

Whilst the production of this publication was part-funded by Catchment Sensitive Farming Delivery (CSF), the content does not necessarily reflect the agreed policy of Natural England, Environment Agency or Defra.

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