A clear solution for farmers

CATCHMENT SENSITIVE FARMING

Best Practice in Slurry and Manure Application

Organic manures are a valuable source of plant nutrients, including Nitrogen (N), Phosphorus (P), Potassium (K), Sulphur (S) and Magnesium (Mg). Manure and slurry nutrients can contribute directly to crop requirements, as well as building up soil N, P and K reserves. These are also beneficial in building up organic matter in soils, particularly in arable soils.

However, if organic manures are applied inappropriately, this can result in water pollution, as well as financial loss which may arise from the impact of excess rates of manure on crop yield and quality and from the loss of nutrients.

What is the issue?

Water pollution from organic manures can be point-source or diffuse. Potential pollution issues are:

- N and P enrichment resulting in high levels of weed/algal growth and eventually eutrophication (killing streams);
- Elevated BOD (biological oxygen demand) resulting in the death of fish and other aquatic organisms;
- Bacterial contamination of streams and potential impact on the quality of downstream bathing beaches and shell fisheries;
- Visual impact, odour and loss of amenity value.

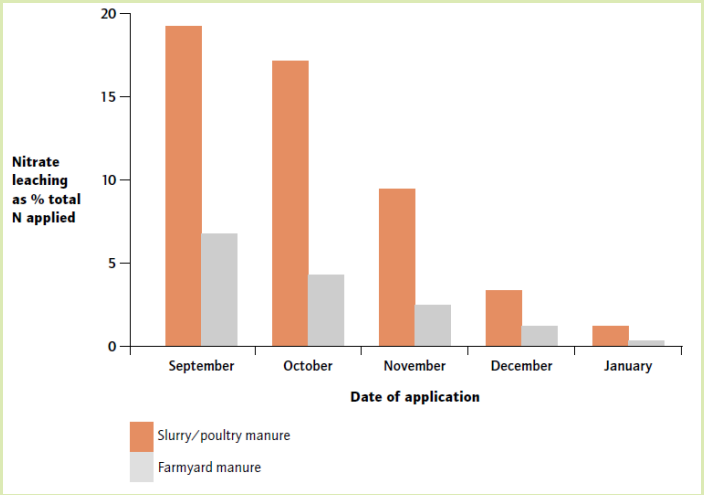
How manures contribute to Water Pollution

There are several pathways for manure and slurry nutrients to enter water bodies. The main pathways are:

1. Leaching to ground water

Pollution leaching can occur following spreading at inappropriate timings or rates and is of particular risk where there are light soils, chalk or underlying chalk, and sand or limestone geology. This risk is demonstrated in figure 1 – where slurry/poultry manure is applied over the autumn/early winter period, up to 20% of the total N may be lost via leaching. The risk of losses from FYM is much less.

Figure 1: Nitrate leaching losses following manure applications to free-draining arable soils



2. Surface run off

The main problems arise due to poor slurry spreading practices, in particular excessive application rates and poor timing made worse if undertaken on heavy and or compacted soils. Research has shown that slurry application rates should not exceed **50m³/ha** (4500 gallons/ac).

Picture 1: surface run off

3. Via drainage in structured soils

Rapid losses of slurry nutrients can occur via field drainage systems. This is especially a risk soon after, or just before a heavy rainfall event and can cause particular problems because drain outfalls are so directly linked to watercourses

How manures contribute to Air Pollution (ammonia)

Spreading slurry or high N content manures via broadcast spreaders can promote N loss to the air as ammonia. The ammonia-N is a significant loss and may cause pollution of sensitive ecosystems.

How water pollution can be prevented?

There a number of industry measures designed to manage risk of pollution. The two main categories are best practices and regulation.

Strategies to reduce risk of pollution from manures include:

- Spreading conditions & timings

Spreading at the correct times not only reduces the risk of water pollution, but also maximises nutrient availability, especially N. **The recommended period for spreading slurry is the spring.** This is the season where the crops can make most efficient use of the N.

Best practice includes:

- not applying to steeply sloping land, waterlogged, frozen, or snow-covered soils;
- not applying to structured clay soils which have been drained in the past 12 months and where heavy rain forecast;
- not applying immediately prior to forecasted heavy rainfall;
- Observing closed periods for high available N manures (e.g. slurry, poultry manure) in NVZs, see Table 1:

Table 1: Closed periods for NVZs

	Grassland	Tillage
Sandy & shallow soils	1 Sept – 31 Dec	1 Aug – 31 Dec
All other soils	15 Oct – 31 Jan	1 Oct – 31 Jan

- Manure analysis

The nutrient content of manures can be highly variable, particularly if rainwater and yard run off is collected in the same store. Analysis of representative samples provides better understanding of nutrient content and availability. This allows

greater precision when applying manures and ensures that applications do not exceed crop requirements or regulatory limits. Alternatively, "standard" RB209 values should be used as a minimum guide to target applications and may be more reliable with dairy slurries.

- Machinery calibration

In order to make best use of manure nutrients, it is essential that application rates are known and recorded. There are simple approaches, including the use of electronic weigh pads, or assessment of spreader volume, to estimate spreader load. For spring application of slurry or poultry manure, the lateral spread pattern CV should also be assessed periodically.

- Application rates & techniques

The risk of surface runoff can be greatly reduced if slurry application rates do not exceed **50m³/ha (4500 galls/ac)**. Manure applications should be limited to supplying <250kg N/ha in any 12 month period.

Water and Air pollution can also be reduced where band spreader or injector technology is used, or manure is quickly incorporated. The advantages and disadvantages of different application techniques and systems are summarised in Table 2.

Manure and fertiliser management plans are the most effective way of combing these best practice principles. Planning the manure and fertiliser applications ensure that excess nutrients are not applied that the crop cannot use. For N the supply should not be more than 50% of crop N requirement. Soil analysis allows for the targeted application of P and K.

Picture 2: band spreading on winter wheat

Picture 3: rear discharge spreader on grassland

Table 2: pros and cons of different application systems and techniques

Application technique	Pros	Cons
Band spreaders & injectors	Reduced odour and ammonia emissions and risk of surface runoff. Reduced herbage contamination increases the time window for grassland application. Allows a reduction in the non-spread zones around water courses (6m instead of 10m).	Scope for slurry injection limited by soil type and cropping. Technology for even slurry distribution across spreading width increases cost compared to surface broadcast spreading.
Umbilical systems	Increased work rate; reduced risk of soil compaction compared to tanker operations.	Care needed to ensure matching of pumping with field application rate; also to avoid over-application on headlands. Potential risk of burst pipes through pressure build up in the system.
Broadcast spreaders	Equipment simple, low maintenance, low cost.	Reduced time available between spreading and cutting/grazing due to sward contamination. May not be suitable for spring top dressing of arable crops; application rate variable with slurry consistency.
Solid spreaders – rear discharge	Capable of spreading a wide range of manure types. Symmetrical spread pattern allows easy matching of bout widths; may be suitable for spring top dressing of growing crops.	Limited range of application rates achievable with some machines; may not be capable of low rates required for high N poultry litter.
Dual spreaders	Capable of spreading slurry and wide range of solid manures; can achieve low application rates.	Side-discharge, asymmetrical spread pattern, causes difficulty with matching bout widths.

Latest Research

Recent research has improved information on manure S content, availability and impact of application timing. Like manure N content, S is subject to significant leaching loss and benefits from spring application, particularly for responsive crops like high yielding grass for silage, or oilseed rape. This research (HGCA PR522) underlines the importance of manure analysis and well managed field application, for best utilisation.

Best practice: Dos and Don'ts

Do:

- Regularly analyse soil and manure samples;
- Use manure and fertiliser management plans to target applications;
- Prepare a risk map to identify no-spread zones and low, medium and high risk spreading areas;
- Ensure spreading at an appropriate time of year;
- Assess crop growth and field conditions prior to spreading;
    - Check the weather
    - Assess ground conditions
- Select appropriate application techniques and calibrate spreaders;
- Incorporate manures asap after spreading onto bare soil/stubble;
- Choose a suitable application rate;
- Keep records of manure application dates and rates;
- Follow NVZ and SSAFO regulations as well as Codes of Good Agricultural Practice (CoGAP) and Cross Compliance;
- Provide relevant training for farm and business staff to ensure spreading competence;
- Exchange information between the land owner and spreader (formalise contactor and farmer relationships);
- Develop a contingency plan for any pollution incidents.

Do not:

- Spread in no-spread zones (10m from a watercourse and 50m from a borehole);
- Apply more than 50m³/ha of slurry in one application;
- Apply more than 250kg N/ha in a 12 month period (equivalent to *ca.* 42t/ha cattle FYM, 63 – 125m³/ha of slurry).
- Apply when spreading conditions are unfit (*see: how DWPA can be prevented?)*
- Apply slurry in the closed periods.

Further information available:

- Spreading systems for slurries and solid manures. Booklet 3. Making the most of manures. Revised 2007.
- Defra (2010) The Fertiliser Manual (RB209), section 2, 8th Edition.
- The Catchment Sensitive Farming Website: www.naturalengland.org.uk/csf

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