ADOPT BATCH STORAGE OF SOLID MANURE OR SLURRY

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Description

- Store batches of slurry or solid manure for at least 90 days before spreading on fields.
- No fresh slurry or manure should be added to the heap during this storage period.

Rationale, mechanism of action

The method is primarily directed at reducing loads of faecal pathogens and will have a limited effect on nitrate or P losses. Because Faecal Indicator Organisms (FIOs) die off during storage, there are fewer organisms in the material that is spread and therefore less risk of microorganisms from the manure or slurry entering water bodies *via* surface run-off or percolation through the soil to field drains. The readily available N and total N content of stored farmyard manure will also be lower than in the fresh manure, which will lessen the risk of nitrate leaching loss.

Die-off of FIOs during storage of manures and slurries can be an effective means of reducing bacterial numbers [1]. The rate of decline is accelerated for manures if composting occurs and high temperatures develop in the heap. This happens naturally in most farmyard manure (FYM) and poultry litter heaps [2]. There are thus fewer microorganisms in the manure or slurry that is spread onto land and therefore less risk of FIOs entering water bodies via run-off or percolation to underlying drains. Although storage is effective at reducing bacterial numbers, it is less effective in reducing populations of the protozoan parasite, *Cryptosporidium*. Because there will be gaseous losses of ammonia and nitrous oxide and immobilisation of N during storage, the quantity of mineral-N potentially available for loss by leaching or in surface run-off will also be reduced. Ammonium-N represents 25% of the Total N content of fresh cattle FYM [2], compared to 10% in FYM that has been stored for more than 3 months. There is also a reduction in the total N content: typically, 30-50% of the total N in FYM is lost during storage. For poultry manure, about 15% of the N is lost during storage but the proportion of readily-available N remains similar to that in the fresh material. The method will have no effect on P losses.

Applicability

The method is applicable to livestock farms that produce solid manure or slurry and have only a single store where fresh material is continuously added to that already present. Potential benefits will be greatest on:

- impermeable soils and/or sloping ground where the risk of surface run-off is greatest,
- drained clay soils with rapid by-pass flow routes to drains, and
- freely-drained soils that are susceptible to nitrate leaching.

The method requires that manure or slurry is stored for a 90-day period without any additions of fresh material. This will avoid contaminating the stored material with fresh, viable microorganisms. In most cases, this will require more than one store.

[1] Combined from two separate factsheets by R.M. Monaghan, New Zealand

Effectiveness, including certainty

Batch storage of manure: In their assessment of likely N reductions using this method, Cuttle et al. [1] based their estimates on a beef and sheep model farm system in which FYM is stored for three months. Assuming FYM is applied one year in three, the effect would be a reduction of 3 kg N/ha per year (when compared with a baseline loss of 10-20 kg N/ha) on the fields to which the FYM is applied. There will be no effect on P losses. The method was also assumed to have limited effectiveness for reducing losses of FIOs on the model farm, as it was assumed that most FYM was already stacked for more than 3 months before spreading.

Batch storage of slurry: FIO losses may be reduced by 40% on the dairy and indoor pig farms. Smaller reductions may occur on the latter because slurry is typically already stored for 3 months. Estimates of effectiveness at the farm-scale assume that the method affects 85% of the farmed area in the Dairy system, and 100% of land within the Indoor Pig system. The method is expected to have little effect on N or P losses.

Time frame

Once additional manure and slurry storage has been constructed, the method will be fully effective for reducing FIO losses after 90 days. The method will be fully effective for reducing nitrate-N leaching within a couple of winters following implementation of manure batch storage.

Environmental side-effects / pollution swapping

Storage gives rise to increased ammonia and nitrous oxide losses [1], whereas gaseous N losses during and after field application of manures and slurries can be reduced through good management. For example, incorporation of FYM into the soil within 24 hours can significantly reduce ammonia losses, and applying FYM in the spring can potentially reduce N_2O emissions. Through incorporation and better timing of fresh manure applications, the overall gaseous losses can be lower from the application of fresh manure than from the long-term storage and application of 'old' manure. However, precautions such as covering manure and slurry stores will reduce volatilization losses.

Relevance, potential for targeting, administrative handling, control

Storage facilities for solid manures can be constructed relatively simply and cheaply and there are therefore few limitations to adopting this method. There are however some logistical matters to consider. If manure from loose-housed cattle is only removed from the animal house at the end of the winter housing period, a 90-day storage period would restrict its use on some spring-sown crops, e.g. maize. This might have an adverse environmental effect, as farmers would then have to apply manure from loose-housed cattle in the autumn, ahead of cereals or oilseed rape. Despite the low mineral N content of stored manure, autumn manure applications can lead to higher nitrate leaching than spring applications due to the reduced opportunity for full plant uptake of applied N. Thomsen [3] reported that N leaching losses after autumn FYM applications were twice those following spring applications. Grall and Morvan [4] also showed that FYM application before maize provided a suitable compromise between environmental, economic and production criteria. Because of these considerations, the adoption of 90 days storage for solid manure should be limited to situations where there is a high risk of transfer (via surface run-off, by-pass flow or drains) to sensitive waters.

Assuming grassland is available, there are fewer logistical limitations for slurry spreading on land than noted above for manure application to crops.

Costs: investment, labour

Assuming no concrete pad is used at present, a hard-standing surface with a drain and trap will be required to store manure.

For additional slurry storage where no storage currently exists, the amortised cost is calculated per tonne slurry pa for 20 years, plus a reception pit at capital cost. The figure calculated for cows excludes young stock, since they will be on straw. The figure for sows will includes slurry from weaners. Capital costs will be amortised.

References

[1] Cuttle, S., Macleod, C., Chadwick, D., Scholefield, D., Haygarth, P., Newell-Price, P., Harris, D., Shepherd, M., Chambers, B. & Humphrey, R. (2006). An Inventory of Methods to Control Diffuse Water Pollution from Agriculture (DWPA) USER MANUAL. Defra report, project ES0203, 115 pp. p. 56-58 http://www.cost869.alterra.nl/UK_Manual.pdf

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[3] Thomsen, I.K. (2005). Crop N utilization and leaching losses as affected by time and method of application of farmyard manure. Eur. J. Agron. 22, 1-9

[4] Grall, J. & Morvan, T. (2007). Fertilization of fodder maize with cattle manure in Brittany. Poster. 16th International Symposium of the International Centre for Fertilizers, 16-19 Sept 2007, Genth