CHANGE FROM SLURRY TO A SOLID MANURE HANDLING SYSTEM

2011 author: M.J. Taylor

Description
Change from a system where the manure from housed animals is collected as a liquid slurry to one where animals are kept on a bed of straw to produce a solid manure.

Rationale, mechanism of action
Solid manures are more easily stored than slurries and present less risk of pollutant loss when they are spread. In the UK during the period 2001-2004, there were 9.4 times more recorded water pollution incidents caused by slurry than by solid manure [1].

Sufficient bedding is provided in animal houses to soak up the liquid portion of the excreta to produce a solid manure that can be stacked and does not flow under gravity. As a result, there are fewer storage problems than with slurry. Manure in cattle houses is generally allowed to accumulate in the house throughout the winter. Therefore, there is not the same limit on storage capacity that may force farmers to spread slurry at unsuitable times during the winter. Because of their low moisture content, solid manures can be spread on fields with much less risk of N or P entering field drains or watercourses in surface run-off. Losses will only occur where there is heavy rain in the days following application. Compared with slurries, less of the N is present in a readily-available mineral form. Typically, 50-60% of the N in slurries may be present as ammonium-N, compared with about 25% in fresh cattle FYM and 10% in stored FYM, which results in lower nitrate leaching losses following FYM applications to land [2].

Applicability
The method is applicable to those farms with housed stock that currently handle all or part of their manure as a liquid slurry. It is not applicable to sheep or poultry units as these do not produce slurries. It will be most effective on sloping and less permeable soils where the risk of surface run-off is greatest, on free draining sandy or shallow soils that are prone to nitrate leaching and on drained clay soils where rapid losses can occur in drainflow from wet soils.

Effectiveness, including certainty
For nitrate: Cuttle et al. [1] estimated that in the dairy and beef systems studied, the option could result in a 40% reduction in the manure component of the baseline nitrate loss (a 10-20% reduction in the total baseline loss across the model farm area). In the pig system, it was estimated that the manure component of the nitrate loss could potentially be reduced by 80% (which represented a 30% reduction in total baseline losses across the farm area) [1].

For phosphorus: It was estimated that the manure component of the baseline P loss could potentially be reduced by 50% for sandy loam soils and 25% for clay loam soils [1].

Time frame
Effectiveness will be seen during the autumn (for P and FIOs) and winter (for nitrate) following implementation.

Environmental side-effects / pollution swapping
Ammonia emissions from solid cattle manure systems (i.e. from housing, storage and land spreading) are lower than from slurry systems but there are no clear differences between pig manure systems. Methane emissions are lower from solid manure systems. However, nitrous oxide emissions are higher from solid manure than from slurry systems.

Relevance, potential for targeting, administrative handling, control
Solid manure requires a source of suitable bedding material and is less-suited to regions where little straw is produced. There will be additional labour requirements associated with spreading straw in the animal house. Solid manure is less easily handled than liquid slurries. It cannot be pumped and cannot be used with umbilical spreading systems.

Costs: investment, labour
This is likely to be a capital intensive method, since it will require more space per animal and not all buildings lend themselves to being extended, nor farm steadings to allow additional buildings if that is the alternative.

For dairy cows, most are housed in cubicles, which will need to be removed and the building extended, to allow for the greater area required for loose housing. Assuming this is the case, a capital cost of £470/cow or £70,500/farm was estimated in 2006 [1]. It was assumed that slurry handling will be by contractor and this operation will remain so when the farm transfers to a solid manure system. In addition to amortised capital costs, annual costs for straw were estimated at £30/tonne delivered [1].

For pigs, the whole of the indoor farrowing system is slurry based, which may comprise a large range of building types, some that might be altered, but most of which would not be amenable to alteration. The alternative choice for this farm type would be to de-stock, demolish and re-build, subject to any planning issues. This would involve selling all stock including breeding stock and buying in new stock on completion of the buildings, a loss of at least six months output and a loss on selling and repurchasing breeding stock and the purchase of a manure spreader.

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. 61-62 http://www.cost869.alterra.nl/UK_Manual.pdf
[2] Chambers, B.J.(2001) Implications of potential measures to control pathogens associated with livestock manure management. Final Report for Defra, Project WA0656.