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Authors(s) | Hahesy, Tom; Sheahan, Michael
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The Treatment of Cattle Slurry at Farm Level to Inactivate *Brucella abortus*

T. Hahesy and M. Sheahan

Introduction

Brucellosis continues to be a problem in dairy and suckler cow herds in some parts of Ireland. The existing control measures applied to herds depopulated through brucellosis is to be supplemented by sterilising the on farm *Brucella* contaminated slurry before land application. This decision was made by the Department of Agriculture, Food and Rural Development (DAFRD) in 2001 as an additional measure to prevent a recurrence of brucellosis in affected herds and to avoid spread to neighbouring farms by preventing the contamination of grassland or the inhalation of contaminated aerosols during the land application of slurry. This paper outlines the role of slurry management in containing the spread of brucellosis and a review of the treatment of slurry carried out to date. This topic was addressed by Hahesy and Heneghan (1999; 2000).

The Presence, Survival and Inactivation of *Brucella abortus* in Manure

Plommet (1974) reported the presence of *Brucella abortus* in cattle slurry, while Hahesy and Heneghan (1999) recorded the isolation of *Brucella* organisms in slurry collected at seven of twelve brucellosis affected herds in Ireland. The recorded survival times of *Brucella abortus* in slurry ranges from 7 days (Rankin and Taylor, 1969) to 240 days (Verger, 1981). The recorded distances for the dispersal of bacteria when land-spreading slurry include 274 metres (Evenden, 1972), 400 metres (Tamasi, 1983), 350 metres (Boutin et al., 1988) and 800 metres (Hahesy et al., 1996).

The principal measures that are applied at farm level to minimise the risk of dispersing pathogens when land-spreading animal effluents are:

a) long term storage of slurry to allow pathogens to die off before land application and

b) treatment with chemicals.

A storage period of at least eight months and preferably longer after cattle leave a shed is advisable when brucellosis occurs in a herd. Long-term storage is not normally a problem in the case of solid manure. However, the storage capacity of slurry tanks on many farms is not adequate to permit prolonged storage of liquid slurry. Treatment with chemicals prior to land-spreading is an alternative. In Germany, when brucellosis occurs in cattle, slurry must be treated before land application with either a) formalin or b) “thick lime milk”, i.e. a mixture of calcium hydroxide powder and water. The inactivation of *B. abortus* in slurry by the addition of lime milk was demonstrated in a laboratory experiment by Heneghan in 2001 (pers. comm.).

Field Work

During 2000 fieldwork was carried out at a number of farms in Ireland to assess the effectiveness of the chemical treatment of slurry. During this development stage, hydrated lime powder was initially added to increase the pH in slurry. At a later stage liquid lime milk was used when it became available commercially. The procedure used was that stipulated in the veterinary regulations that apply in Germany.

1 M. Sheahan, Department of Agriculture, Food and Rural Development.
During this phase, a uniform increase in slurry pH to a level of 12.0 was used as an indication of effective treatment. In general, the pH in slurry before the addition of lime was approximately 7.0. Based on this fieldwork, a set of guidelines was developed to assist DAFRD staff who might be involved in the treatment of slurry.

**Progress to date**
In 2001 slurry was treated with lime milk on approximately 100 farms in Ireland where herds were depopulated due to brucellosis, while it is expected that this treatment will be carried out at a similar number of farms in 2002. Staff from the local Department of Agriculture offices arrange and supervise the treatment of slurry on affected farms. The approximate cost of the treatment is 3.5 Euro per 1,000 litres of slurry (25 Euro/cow). This cost is borne by the Department of Agriculture.

**Guidelines for the treatment of cattle slurry with liquid lime milk.**
- Treatment normally takes place a short time before the slurry is due to be spread on farmland. It is advisable to spread the slurry within three weeks after treatment to ensure that the lime does not separate from the slurry and lead to problems in its removal from the slurry tank.

- The dimensions of the slurry tank and the depth of slurry are measured in order to calculate the quantity of lime milk\(^2\) required. A quantity of 20.25 kg hydrated lime mixed in water is used per 1,000 litres of slurry. The volume of lime milk is approximately 35 litres per 1,000 litres of slurry (20.25 kg hydrated lime is mixed in water). The lime milk solution is supplied by Cloghrennane Lime Ltd., Carlow.

- The entrance to the farm must be examined in each case to establish if it is large enough to allow access for the articulated delivery tanker. When the farm entrance is not accessible, the lime milk can be transferred to a tractor drawn slurry tanker near the farm and transported to the slurry tank in this way.

- The agitation of the slurry before the lime milk is added is a crucial part of the treatment. When this operation is carried out effectively and the slurry is fluid and free from solid lumps, the lime milk mixes quickly with the slurry. However, when lime milk is added to slurry that is not adequately agitated, it is difficult to obtain a uniform increase in pH throughout the tank. On some farms slurry may have a relatively high dry matter e.g. when baled silage is fed to cattle. Water is frequently added to the slurry in such cases to facilitate agitation. In some situations, it may be necessary to remove a quantity of slurry to another tank in order to create space for the addition of water. In the case of outdoor tanks, agitation is usually facilitated by the presence of rainwater in the slurry. It was observed that the pH increases in slurry in outdoor tanks relatively quickly after the addition of lime.

- The lime milk is added to the slurry at the agitation point(s). When slurry is adequately prepared, the lime milk mixes quickly through the slurry with the aid of agitation and a uniform increase in pH is achieved within one to two hours. A portable pH meter is used to measure the pH level in samples of slurry taken at a number of representative points in the tank. A reading of 12.0 or over is considered to be effective.

\(^2\) The lime milk solution is supplied by Cloghrennane Lime Ltd., Carlow.
• Herdowners are advised to limit the application rate of treated slurry to 20,000 litres/hectare in order to avoid any adverse effect on grass growth. This guideline is contained in the German regulations for the treatment of slurry.

• It is necessary to take precautions to avoid harm to health when work is carried out with slurry, particularly in covered cattle sheds. At the early stage of agitation, hydrogen sulphide gas may be released and can be fatal. Ammonia release can also create unpleasant working conditions. The slurry agitation points in most modern cattle sheds are located outside the buildings and this assists safety precautions.

Conclusion
The addition of lime milk to slurry is a practical way to treat cattle slurry at farm level in order to inactivate B. abortus. The programme to treat slurry has proceeded satisfactorily in Ireland over the past two years. In some cases difficulties arose due to:

a) inadequate agitation of slurry before the addition of lime milk and
b) difficulty for the delivery tanker to get access to the farmyard.

This additional procedure is dependent on financial support from the DAFRD, as the costs involved would otherwise deter herdowners from following this practice. Notwithstanding this, it is expected that the treatment of cattle slurry, in addition to the other measures employed, can assist in controlling the spread of brucellosis.

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