The Presence of *Brucella abortus* in Cattle Slurry: Measures to Minimise the Risk of Transmitting Brucellosis when Land-spreading Slurry

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Introduction

This paper is a follow up to a review of the possible role of animal effluents in the transmission of brucellosis in cattle, by Hahesy (1998). Brucellosis continues to be a problem in parts of Ireland, particularly in the south and south west. In 1999, the normal investigation which is conducted by the Department of Agriculture and Food in herds where brucellosis is confirmed, was broadened in a number of cases to include the culturing of slurry samples and the isolation of *Brucella abortus*. This paper reviews the possible role of cattle slurry in the spread of brucellosis and reports on the current investigation of the risks presented by slurry on farms where brucellosis occurs.

*Brucella* organisms present in fluids which are excreted by aborting cows can contaminate slurry tanks and bedding in cattle sheds and survive there for some time. The land-application of slurry which is contaminated with *Brucella* organisms can present a risk to cows through inhalation of aerosols or the contamination of grass or water supplies. Plommet (1974) reported the isolation of *Brucella abortus* in cattle slurry. The reported survival of *Brucella abortus* in slurry ranges from 77 days (Rankin and Taylor, 1969) to 240 days (Verger, 1981). Cameron (1932) reported that *B. abortus* survived for 100 days in faeces and for 4.5 hours in a suspension (not manure) when exposed to direct sunlight. The recorded distances for the dispersal of bacteria in slurry include 274 metres (Evenden, 1972), 400 metres (Tamasi, 1983), 350 metres (Boutin et al., 1988) and 800 metres (Hahesy et al., 1996). Evidence that contaminated manure is implicated in the transmission of brucellosis is limited. However, Hoflund (1961) reported that cattle became infected with *Brucella abortus* after the water supply was contaminated by other infected cattle. Transmission via stream water was proposed as a likely explanation for some brucellosis outbreaks in France by Plommet (1977).

Field Investigation

Samples of liquid cattle slurry were collected during May and June 1999 from a total of twelve brucellosis affected herds and two clear herds in four District Veterinary Office areas viz. Limerick, Cork SW, Tipperary North and Tipperary South. On eight of the brucellosis affected farms the slurry was taken from covered tanks, while in the case of the other four, the storage tanks were outside in the open. The slurry samples were taken at a range of levels in each tank down to the floor surface. In the case of the two clear herds, one had a covered slurry tank, while the second one was outdoors and open. Solid manures

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were not examined in this study. The slurry samples were cultured and examined for the presence of Brucella spp. at the The Brucellosis Laboratory, Department of Agriculture and Food, Cork.

The isolation of Brucella abortus from slurry samples was conducted as follows:

Samples of slurry were initially diluted using sterile PBS to 1/10, 1/100 and 1/1,000. Four culture plates were used for each sample dilution. Slurry samples were cultured on Brucella medium base supplemented with Farrells’ antibiotic combination in an atmosphere of 8% CO₂ at 37°C for up to 12 days. Suspect colonies were confirmed as Brucella by means of monospecific anti-Brucella antiserum.

Results

Brucella abortus was isolated from seven of the twelve slurry samples taken from herds where brucellosis was confirmed; the samples from the two clear herds were negative. In addition to the positive findings in seven samples, the number of Brucella organisms was very high in a number of the samples. In three cases, Brucella organisms were recovered at a dilution of 1/1000. It is likely that high numbers of Brucella in slurry occur where fluids and other materials excreted by cows at calving enter the slurry storage tank.

The isolation of Brucella abortus from slurry samples demonstrated that slurry could be a factor in the transmission of brucellosis, and indicated the need to adopt measures to minimise such a risk.

The management of Brucella contaminated manure in order to minimise the risk of spreading brucellosis

The principal measures which can be applied at farm level in order to minimise the risk of spreading infectious animal diseases through land-spreading of animal effluents are outlined below:

- Storage for a period to allow pathogens to die off before land application.

A storage period of at least nine months and preferably longer after cattle leave the shed is advisable where brucellosis occurs in a herd. Slurry tank capacity is not adequate on some farms to permit prolonged storage. In the case of slurry stores which are located in the open, a large proportion of the tank contents may be rainwater. The storage capacity in outdoor slurry tanks can be increased by the provision of a cover to divert rainwater. Long term storage is not normally a problem in the case of solid manure, providing it is fenced off to prevent access to livestock and is situated so as to avoid water pollution.

- Treatment with chemicals prior to land-spreading.

Published reports refer to the treatment of slurry with xylene (Plommet and Plommet, 1974). However, it is not clear if slurry treated with xylene has an adverse effect on grass yield or quality following land application. Strauch (1981) listed four chemicals which were suitable for treating slurry and which were tolerated by crops. These are (a) calcium hydroxide, (b) “thick lime milk”, (c) calcium cyanide and (d) formalin. In Germany, when brucellosis occurs in cattle, the veterinary regulations stipulate that
slurry must be treated with either formalin at a rate of 10 kg/m³, or with “thick lime milk”, i.e. a mixture of calcium hydroxide powder and water, at a rate equivalent to 20.2 kg hydrated lime/m³ (91.8 kg hydrated lime per 4,500 litres slurry). These calcium preparations raise the pH of the slurry to levels of 10-12 or higher.

- In addition, the risk of disease transmission associated with land spreading slurry can be minimised by observing the following guidelines:

  Spreading slurry on arable land or on grassland which is being closed for a crop of silage.

  Spreading in calm weather conditions, preferably when cattle are not present in adjoining fields. The use of shallow injection and band spread slurry applicators reduces aerosol drift compared with the commonly used splash plate method.

Based on experience of treating slurry with chemicals at farm level and concerns regarding possible risks to human health when working with formalin, a lime product may be the best option when considering chemical treatment. At present, “thick lime milk” is not commercially available in Ireland, while its preparation at farm level is not normally feasible, due to the large volumes involved. The use of calcium hydroxide powder (also referred to as “hydrated lime”, “slaked lime” and “builders lime”) may be the most practical approach. The main costs involved are those for the hydrated lime powder and the extra mechanical agitation of the slurry which is required after the addition of lime. The cost of hydrated lime required to treat 454 litres (100 gallons) of slurry is approximately £1.20. Assuming that a cow produces 6,800 litres of slurry (1,500 gals.) over the winter period, it is possible to estimate the cost of treatment for any herd.

**Conclusion**

The storage of slurry for at least nine months before land application can be the least expensive method to deal with slurry on farms when brucellosis occurs in a herd. Where long term storage capacity is not possible, treatment with calcium hydroxide, in order to attain a pH of 12 in slurry for at least four days, will inactivate any *Brucella* organisms present. Following treatment, the use of low drift spreaders and the application of slurry to arable land or grassland closed for a crop of silage can also minimise the risk of transmitting *Brucella abortus* to the home herd and contiguous herds.

**References**


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