11/00443/FUL.
DCADDINF - SJ

Manor Farm

Main Road, Ratcliffe Culey,
Atherstone, Warwickshire CV9 3NY

Telephone 01827 712269 or 07791 527688

Planning application:

Dear sir,

I have supplied some more information for my proposed slurry store. You asked for more details for the enzyme additive which will help reduce the release of ammonia and smell into the atmosphere.

Two companies have so far replied to my request for more information. Epizym have supplied some research data which you can access on the internet which i have also printed out at, www.epizym.com using the username WTrivett
Password WT1330

Also some information from Britmilk is also supplied. I hope this is of some useful assistance.

Yours faithfully

W.H. Trivett

Mr William Trivett



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ADAS REPORT, MAY 1994 - Executive Summary

EPIZYM-PIGS is a concentrated broad spectrum biological/biochemical complex in combination with selected ancillary organic chemicals which is designed to deodourize and liquefy animal wastes.

An experiment to evaluate the efficacy of addition of EPIZYM-PIGS to the slurry produced by groups of finishing pigs was conducted within hermetically isolated rooms with a high level of environmental control.

EPIZYM-PIGS significantly reduced the depth of sludge left after removal of slurry at the end of the experiment, which shows an increase in liquefaction of the sedimented solids. An increase in liquefaction of sedimented solids, which results in an increase in flow and potential to pump more sludge out of below-slat stores, will be of considerable benefit to the producer. Increased capability to empty stores will increase the effective storage capacity under slats for successive groups of finishing pigs and, potentially, reduce the frequency of emptying required. In addition, an increase in liquefaction and ease of emptying stores will be likely to reduce the need to agitate slurry to promote emptying. Mixing or re-circulating slurry, for example to remove sediments, can give off dangerous gases that can be lethal to both humans and stock.

An increase in liquefaction of the sludge would also benefit the producer to maximise storage capacity in above ground store slurry tanks where there is a need to comply with the requirement for four months' storage as specified in the Control of Pollution (Silage, Slurry, Agricultural, Fuel, Oil) Regulations 1991.

Measurements of ammonia concentrations in the exhaust ventilation air, taken at weekly intervals from the rooms, showed a significant reduction in ammonia concentration in the third week of the experiment and cumulative ammonia emission up to the end of the third week was also significantly reduced.

The reduction of ammonia concentration in week 3, following high levels of ammonia in the second week of experiment, showed the addition of EPIZYM-PIGS promoted a more rapid response in reducing ammonia than could be achieved by naturally occurring bacterial in slurry.

Subjective assessments of ammonia concentrations within rooms, by ADAS and Epizym Limited staff and others, more positively identified a benefit of reduction in ammonia concentration in EPIZYM-PIGS treated rooms.

Introduction

Complaints from the public about odours caused by agriculture are recorded and reported every year by the Institute of Environment Health Officers. In the years 1987/88 to 1989/90, there were on average 1,382 justified complaints annually of which pigs were the cause of 650 complaints (47%). In the same years the spreading of slurry or manure was the major source of justifiable complaint (44%) followed by farm buildings (25%) and slurry manure stores (21%).

Ammonia emission to the atmosphere has been implicated with both malodours and acid rain. In The Netherlands it has been estimated that ammonia emission contributed approximately 40% to the acidifying deposition in rainfall and that 85% of the emitted ammonia originates from volatilisation from animal manure. For these reasons, the Dutch Government aims at a reduction in ammonia emission of 50% by 1995 and 70% before the year 2000.

Sedimentation of slurry in stores reduces the effectiveness of emptying and thereby reduces the storage capacity for subsequent refilling with slurry.

An effective slurry additive for odour control and reduction of ammonia emission would be of considerable public and environmental good. Increased liquefaction of slurry would increase the efficiency of slurry removal from buildings and reduce slurry sedimentation and could be of considerable financial benefit to the pig farmer.

EPIZYM-PIGS is a highly concentrated, broad-spectrum, biological/biochemical complex, in combination with selected ancillary organic chemicals for the positive deodourisation and

liquefaction of all types of animal wastes.

This experiment protocol was designed to test the efficacy of the slurry additive EPIZYM-PIGS on a commercial scale in pig finishing pens with independent slurry stores and a high degree of environmental control.

Materials and Methods

Four fully-slatted, hermetically isolated rooms in a controlled environment building, were thoroughly cleaned to remove all sediment from the below-slat store. The outlet from each store was then sealed to prevent loss of any liquid. Each room contained two pens capable of housing fourteen pigs per pen. Rooms were paired, and the water delivery rate of pig drinkers within rooms pairs was adjusted to be balanced between room pairs.

One hundred and twelve pigs of approximately 50 kg live weight were weighed and allocated to pens within rooms. Total pig live weight was also balanced between room pairs at the start of the experiment.

Each pair of rooms represented one replicate within a randomised block experiment design with room as a blocking factor. The experiment used four replicates in total, with the first two replicates run concurrently with pigs from 50 to approximately 85 kg live weight.

After slaughter of pigs and removal of slurry from the first two replicates, the rooms and slurry stores were thoroughly cleaned and resealed. For the third and fourth replicates, a further 112 pigs of approximately 50 kg live weight were weighed and allocated to rooms within room pairs, again so that total pig live weight within rooms was balanced between room pairs.

For each of the first two replicates, rooms within pairs were allocated at random to one of two treatments:

1. Control, no additive
2. EPIZYM-PIGS applied to pen floor and slurry store after one week and weekly thereafter until pigs were selected for slaughter.

For each of the last two replicates, rooms within pairs were allocated to the alternative treatment from that allocated in replicates 1 and 2, to account for any possible room effects in the experimental design.

EPIZYM-PIGS was reconstituted in lukewarm water and applied at the concentration and rate specified by Epizym Biosystems Limited (455g/4.551 water/pen (week 1; pure dose) and 60g/4.551 water/pen (subsequent weeks; preventative maintenance treatment), based on the slurry store capacity of approximately 18,200 litres).

From the starting live weight of approximately 50kg to the slaughter live weight of approximately 85 kg, pigs were offered *ad libitum* a pelleted compound diet containing approximately 13.6 MJ/kg digestible energy and 20% crude protein (Appendix I). Final live weight of pigs at slaughter and food offered and refused between start and slaughter were recorded. Water consumption by pigs was recorded each week for all rooms.

The ventilation rate of each room was set at 0.1m3 / s / room (10% of typical maximum ventilation rate for a commercial building housing pigs of 50 to 85 kg live weight) throughout the experimental period. For replicates 3 and 4, ventilation rate of each room was set at 0.1m3 / s / room from the start until the end of the third week and 0.3m3 / s / room (30% maximum ventilation rate) from week 4 until the end of the experiment. Room temperature was maintained at 180 throughout the whole of the experiment.

Ammonia concentration of inlet air (one sample point) and exhaust air (three sample points) was determined by micro meteorological mass balance techniques using acid flasks over the 24 hours preceding stocking of the rooms with pigs and at weekly intervals until slaughter thereafter. Ammonia was absorbed into 0.1 molar orthophosporic acid through which a recorded volume of either inlet or exhaust air was drawn. Ammonia absorbed in the orthophosphoric acid was determined by flow injection analysis by the salicylate method. Samples were heated with salicylate and hypochlorite in an alkaline phosphate buffer to prevent precipitation of calcium and magnesium salts. The density of the colour produced, which is proportional to the ammonia concentration, was measured absorptiometrically at 660 nm. The total ventilation for each room over the 24 hour sampling period was recorded, and ammonia emissions over each 24 hour period were calculated.

After removal of pigs from pens for slaughter, both pens within each room were cleaned by pressure washing, and the volume of water used recorded. After cleaning, the depth of slurry in each room was measured using 35 grid reference points (Appendix II). For each room in turn, slurry was removed using a submersible pump at the outlet from the store which transferred slurry to a reception tank. A 5 litre sample of slurry was taken before the slurry in the reception tank was drawn into a vacuum slurry tanker. The depth of settled sludge remaining in the slurry store after the initial slurry emptying was measured at the same 35 grid reference points used for initial slurry depth. After measurement of settled sludge depth, the seal between the slurry store and an external channel was broken, and the settled sludge was manually removed to the external channel. The sludge was then pumped, from the external channel into the reception tank and a 5 litre sample was taken before the sludge was drawn into the vacuum tanker. The contents

of the vacuum slurry tanker were discharged back to the reception tank, re-drawn into the vacuum slurry tanker and then discharged once again into the reception tank to ensure thorough slurry handling facilities at ADAS Terrington. The reception tank was thoroughly cleaned by pressure washing and the vacuum slurry tanker was charged with clean water and emptied. (to clean the tanker interior) before the whole precedure for slurry removal was repeated on the next room. For replicates 1 and 2 and replicates 3 and 4, both control treatment slurry stores were emptied before the EPIZYM-PIGS treatment slurry stores, to ensure no cross contamination of micro-organisms occurred between control and EPIZYM-PIGS treated slurry.

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The viscosities of the 5 litre samples of slurry, sludge and mixed slurry and sludge were measured in centipoises units and the mixed sample was also analysed for total solids. PH, Biochemical Oxygen Demand (BOD_5), Chemical Oxygen Demand (COD), total nitrogen and ammonium nitrogen. The 200 litre samples of mixed slurry and sludge from replicates 1 and 2 were stored under aerobic conditions for four months. The 200 litre samples from replicates 3 and 4 were stored under aerobic conditions for two months and ammonia emissions after spreading on grassland were measured using small wind tunnels through which known volumes of air drawn. Loss of ammonia to the atmosphere, from small plots (2m x 0.5m) spread with 5 kg slurry, was calculated from the product of the volume of air (drawn at 1./sec-1) which flowed through the wind tunnel and the difference between the concentration of ammonia in air entering and leaving the tunnel (Lockyer et al., 1989). Ammonia concentrations were measured by micro meteorological mass balance technique using acid flasks, containing 0.01 molar orthophosporic acid, through which air was drawn at 5 1 /minute -1. Flasks were changed eight times, over approximately four days to give cumulative loss of ammonia over 24, 48, 72 and 102 h.

Table 1 . Performance of pigs finished in control and EPIZYM-PIGS treatment rooms and reasons for removal of pigs from experimant

	EPIZYM-PIGS		Control		*t*	*P*
No. of pigs at start	112		112			
No. of pigs at slaughter	108.0		105			
Average live weight at start (kg)	51.7	(1.95)	51.5	(1.77)	0.083	NS
Average live weight at slaughter (kg)	83.8	(1.53)	81.8	(1.82)	0.833	NS
Food conversation ratio (start-slaughter)	2.77	(0.071)	2.9	(0.094)	1.059	NS
Reason for removal:						
rectal prolapse	3		4			
pneumonia	1		1			
died	-		2			
( ) ± s.c.						

Table 7. Depth of slurry and settled in EPIZYM-PIGS and control treatment rooms

	EPIZYM-PIGS	Control	s.e.d	fpr.
All replicates:				
Slurry depth (mm)	226.8	197.8	3.122	<0.001
Sludge depth (mm)	84.3	89.3	2.59	0.056
Sludge as a proportion of slurry	0.37	0.46	0.011	<0.001
Replicates 1 and 2:				
Sludge depth (mm)	220.4	189.4	2.41	<0.001
Sludge depth (mm)	73.4	99.6	3.12	<0.001
Sludge as a proportion of slurry	0.34	0.53	0.017	<0.001
Replicates 3 and 4:				
Slurry depth (mm)	233.1	206.3	6.94	<0.001
Sludge depth (mm)	95.1	78.9	4.54	<0.001
Sludge as a proportion of slurry	0.4	0.39	0.016	0.219

SILSOE RESEARCH INSTITUTE				
Odour assessment by dynamic Olfactometer unit on Pig Slurry from Epizym trial at ADAS Climate House.				
Results.				
Room	**Mean Odour (OU/m3)**	**Pig Weight (Kg)**	**Odour Emission (OU's)**	**Odour (OU/Kg)**
3	5014	2249	538	0.239
5	6548	2130	702	0.330
	Mean Epizym Treated		620	0.284
4	16007	2202	1716	0.779
6	8779	1937	941	0.486
	Mean Controls		1328	0.632
Odour reduction:	Gross Emissions - 53.4%, Per Kg Pig live weight - 55.1%			

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Nutri-Sol

The increasing cost of bagged fertilizer is making slurry a much more valuable and cost effective way of providing nutrients for the growing plant.

Nutri-Sol is a combination of enzymes, anaerobic and aerobic bacteria, wetting agents, activators and nutrients.

Nutri-Sol's unique formulae works progressively breaking down organic matter and locking up nitrogen and sulphur compounds into a form that is available to the plant and soil bacteria, but also preventing losses during storage and spreading.

Calculating Tank Sizes

1 cubic metre = 1000 litres

Rectangular Tank

width (m) x length (m) x depth (m)
x 1000 = volume in litres

Circular Tank

Radius (½ diameter)

radius (m) x radius (m) x height (m)
x 3.14 x 1000
= volume in litres

Nutri-Sol

Benefits of Use

- Suppression of crusts in pits.
- Locking up ammonia and sulphur compounds to enhance the slurry's fertilizer value. The lock up of ammonia by **Nutri-Sol**, changes the nitrogen source from a quick release to slow release form of nitrogen. This is better suited for the plants needs with less leaching of nitrogen into the ground water. The **SAVINGS IN NITROGEN ALONE** represents a return of **over £3.00** for every £1.00 spent on **Nutri-Sol.**
- Improved air quality in houses with underground tanks leading to less respiratory problems.
- Liquefying of solids makes for easier spreading, particularly for umbilical pumping systems. This results in **BIG SAVINGS IN TIME AND FUEL** due to less mixing.
- Improved soil structure due to less harmful compounds damaging worms and bacterial activity.
- Improved uniformity of nutrients to be spread.
- Better run off from the plant leaf resulting in less damage.

Nutri-Sol

Dosage Rate

Longer Storage (3 months plus)
250g of **Nutri-Sol** treats 250m^3 (250,000 litres)

Medium Storage (2 months plus)
250g of **Nutri-Sol** treats 200m^3 (200,000 litres)

Short Storage (1 months plus)
250g of **Nutri-Sol** treats 100m^3 (100,000 litres)

Preparation

Dissolve the required quantity of **Nutri-Sol** in warm water (35°C approx) and leave for 20 minutes (250g sachet into 13 litres).

Further dilution of the concentrate is advisable particularly for underground tanks to aid distribution. Slurry pumped into lagoon's/tower's better to add **Nutri-Sol** into reception pit to ensure good mixing.

Also ensure there is a minimum height of slurry (0.5m) in tank/tower before adding **Nutri-Sol**. When emptying, always leave some slurry in tanks to innoculate fresh material, otherwise constant topping up with **Nutri-Sol** will be required.

Contact Britmilk representative or head office for more details.

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Nutri-Sol

MAKING BETTER USE OF SLURRY AND SAVING TIME + FUEL

from

BRITMILK