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Calf Note #147 – Controlling bedding pH and fly populations

Introduction

Calf facilities have been shown to harbor many flies and contribute significantly to the overall fly population on dairy farms and calf ranches. Flies can transmit disease, harm the calf, reduce growth and pose a welfare concern for both animals and workers.

Previous research showed that the choice of bedding had a significant effect on the numbers of flies in calf housing; using straw promoted growth of more flies than did non-organic materials such as sand (Schmidtmann et al., 1991). However, recent research suggests that the acidity of the bedding may also affect development of flies in bedding.

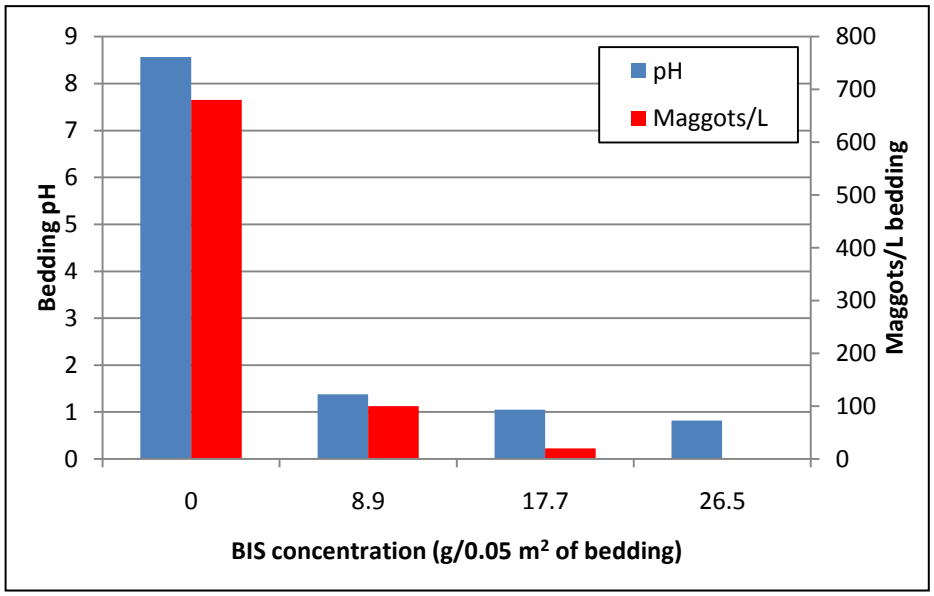
Summary of Research

Castro and workers (2010) published a paper in the Journal of Dairy Science that evaluated the use of sodium bisulfate as a means to control fly populations. Sodium bisulfate (**BIS**) is an acid that controls the growth of bacteria by reducing pH. It's widely used in many different applications, including food production and industrial applications. For more information on uses of BIS, see the following websites: http://www.ehow.com/about_5471540_sodium-bisulfate.html, and http://en.wikipedia.org/wiki/Sodium_bisulfate. Some have used BIS to control growth of bacteria and flies in poultry litter (Terzich et al., 1998a, b). Iowa State researchers (Johnson and Murphy, 2008) reported that BIS also reduced the liberation of ammonia from poultry litter by 60-90%. Improved bird performance more than paid for the cost of BIS treatment. Sun et al. (2008) also reported significant reduction in ammonia release from dairy slurry treated with 0, 0.125, 0.250, and 0.375 kg per m^2.

In the study by Castro et al., (2010), researchers evaluated BIS as a way to control growth of house flies in the laboratory. The researchers used house fly larva and bedding obtained from the calf housing at the University of California Davis dairy farm. The bedding consisted of 400 grams of rice hulls plus 600 grams of manure/urine slurry. These were mixed together to form the "bedding" used in each experiment. The bedding was added to plastic or glass pans and 3,000 house fly eggs were added to each pan to serve as the experimental "housing".

Study 1. Pan were prepared to contain 1 liter of bedding to which 3,000 house fly eggs were added. The BIS was added at a rate of 0, 8.9, 17.7 and 26.5 g of BIS per 0.05 square meters of bedding. These amounts were equivalent to 0, 1, 2 or 3 lbs of BIS per 5.4 m^2 of surface area, respectively. The BIS was added three times per week, and the trial lasted 23 days. Throughout the study, survival of larva were monitored.

The results (Figure 1) showed that adding BIS had significantly reduced pH as well as survival of fly larva.



Study 2. Pans were also prepared to contain 1 liter of bedding and 3,000 fly eggs as in the previous study. To pans, BIS was added at 0 or 8.9 g of BIS/0.05 m^2 of bedding three times per week, or the same amount of BIS (8.9 g/0.05 m^2 of bedding) applied one time at 48 hours before the end of the trial, which lasted 8 days.

Addition of BIS three times per week reduced pH as well as fly survival by 90% and bacteria by 68% during the trial. Adding BIS only on day 6 was not effective in reducing number of fly larvae or bedding pH, except on the day that the BIS was applied.

Economics

What is the cost of application? In this study, the application of 1, 2, or 3 lbs (0, 0.45, 0.91, and 1.36 kg) of BIS per 5.4 m^2 surface area of calf hutch would cost approximately $12, assuming that BIS costs $25 per 50 lb and the product is applied at the rate of 1 lb for 60 days.

Other work

Others (Johnson and Murphy, 2008) have recommended application rates are of 0.32-1.95 kg/m^2 (50-300 lb/1000 ft^2) of animal housing space for poultry and livestock housing, dependent on age of bedding and animal density.

Sodium bisulfate has been evaluated in horse farms, also. Sweeney et al. (2000a) applied BIS to horse stalls that ranged in size from 9.3 to 13.8 m^2. They added 0.5, 1.1 and 2.3 kg of BIS per stall every day for seven days. Then, numbers of flies collected on fly tapes were evaluated, as well as the condition of horses hide as an indication of the acidity of BIS. Adding BIS significantly reduced fly populations at all rates of addition, though there was no further reduction in fly numbers above 1.1 kg of BIS/day added to each stall. Also, there was no evidence of skin lesions or abrasions on the horses' hides caused by BIS. In another study by

Sweeney et al. (2000b), BIS and water were placed on a piece of gauze and applied to skin of six ponies to evaluate its irritant effect. The BIS was added once for 48 hours or for 6 hours per day for 10 days. There was no irritation on the skin caused by BIS applied once or repeatedly.

Finally, BIS was applied to the sole of front hooves of each pony and covered with wet gauze, and the hoof was covered with tape for 48 hours. Again, there were no measurable effects of BIS on any parameter measured by the researchers. These data suggest that BIS is relatively safe, if precautions are taken to minimize exposure to the pure acid.

Precautions

Examples of the MSDS sheet for BIS are available on the web. Some examples include http://www.sciencelab.com/msds.php?msdsId=9927267 and http://www.sciencestuff.com/msds/C2540.html. These forms indicate that the chemical BIS can cause skin irritation and burns when animals or humans come in contact with the pure form of the acid. Care should be taken to handle and apply BIS according to all safety regulations.

Summary

Using BIS to reduce pH of animal bedding has been evaluated in poultry housing and can reduce growth of bacteria, proliferation of house flies and release of ammonia and other volatile organic compounds. Keeping pH of bedding less than 5 can reduce the release of ammonia and help promote a more healthy environment for animals and workers.

References

Calvo , M. S., A. C. Gerry , J. A. McGarvey, T. L. Armitage , and F. M. Mitloehner . 2010. Acidification of calf bedding reduces fly development and bacterial abundance. J. Dairy Sci. 93:1059–1064.

Johnson, T. M. and B. Murphy. 2008. Use of sodium bisulfate to reduce ammonia emissions from poultry and livestock housing. Proceedings of: Mitigating air emissions from animal feeding operations conference. Web address: http://www.ag.iastate.edu/wastemgmt/Mitigation_Conference_proceedings/CD_proceedings/Animal_Housing_Amendments/Marsh-Johnson-Sodium_Bisulfate.pdf. Accessed 12 April, 2010.

Schmidtmann, E. T. 1991. Suppressing immature house and stable flies in outdoor calf hutches with sand, gravel, and sawdust bedding. J. Dairy Sci. 74:3956–3960.

Sun, H., Y. Pan, Y. Zhao, W. A. Jackson, L. M. Nuckles, I. L. Malkina, V. E. Arteaga and F. M. Mitloehner. 2008. Effects of sodium bisulfate on alcohol, amine, and ammonia emissions from dairy slurry. J. Environmental Quality 37:608-614.

Sweeney, C. R., T. Scanlon, G. E. Russell, G. Smith, and R. C. Boston, PhD. 2000a. Effect of daily floor treatment with sodium bisulfate on the fly population of horse stalls. Amer. J. Veterinary Research. 61:910–913.

Sweeney, C. R., P. L. Habecker, and G. Russell. 2000b. Effect of sodium bisulfate on skin and hooves of horses. Amer. J. Veterinary Research. 61::1418–1421.

Terzich, M., C. Quarles, M. A. Goodwin, and J. Brown. 1998a. Effect of poultry litter treatment (PLT) on the development of respiratory tract lesions in broilers. Avian Pathol. 27:566–569.

Terzich, M., C. Quarles, M. A. Goodwin, and J. Brown. 1998b. Effect of poultry litter treatment (PLT) on death due to ascites in broilers. Avian Dis. 42:385–387.

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