MONASH University

MONASH INDUSTRY TEAM INITIATIVE (MITI)

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Novel manure management technologies for an intensifying dairy industry

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PROJECT BACKGROUND

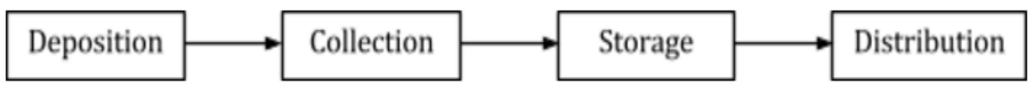
The Victorian dairy industry consists of approximately 4200 farms, which produce two thirds of Australia's milk supply annually. Due to economic pressures from fluctuating milk prices, farmers have increased farm and herd sizes to remain profitable. As a part of this intensification, dairy herds increasingly rely on purchased feed and spend an increased amount of time on feed pads or in open housing systems. This in turn increases the amount of manure requiring collection, storage, handling and land application. Improved manure management and associated infrastructure is thus of growing importance in a transitioning dairy industry.

TABLE 1. AN EXAMPLE OF COLLECTABLE MANURE FROM PASTURE AND HOUSED DAIRY SYSTEMS.

System	Collectable Excrement (t/day)
500 head traditional paddock	3.5
1000 head fully enclosed barn	56

Poorly managed manure can cause a range of environmental issues. Gaseous emissions such as ammonia and methane can be hazardous to the atmosphere, as well as eutrophication from excess nutrient levels entering local waterways. Furthermore, odour is increasingly becoming a concern as residential development is expanding in traditional dairy farming regions. If proper systems are in place, these risks can be mitigated and reduced, improving the sustainability of dairy farming in Victoria.

FIGURE 1. KEY COMPONENTS OF AN EFFECTIVE MANURE MANAGEMENT PLAN



An effective manure management plan should include considerations of all areas where manure is deposited, effective methods for collection, a secure and economical method of storage, and a long term means of distribution. It is important that each step along the way has adequate infrastructure in place to accommodate for the maximum reasonable intake, and to avoid accumulation.

CASE STUDIES

In this project, four case study farms were used to generate a report detailing key recommendations to the dairy industry regarding good manure management practices. Figure 1 describes the basis upon which farms were evaluated, with each step reviewed to ensure an extensive manure management system was in place. The four farms are at different periods of transition and face differing issues within their manure management systems.

ENABLING TECHNOLOGIES

In providing recommendations for the case study farms, a number of innovative technologies and management methods were explored and are detailed below. Some of these technologies will required additional research to investigate effectiveness and the likelihood of implementation.

Biofiltration - A floating plant bed that can reduce gaseous emissions and odour from effluent ponds by absorbing a significant portion of the nutrients that would otherwise volatilise. These are currently used in sewage waste treatment and their application in dairy effluent ponds looks promising.

Covered Pond - Ponds open to the environment emit carbon and nitrogen through the production of methane and ammonia. A pond that is fully covered can reduce emissions by up to 95%.

Biodigestion – Anaerobic fermentation of organic material such as manure produces methane gas, which can be used for used for heating and/or electricity generation. This technology is commonly used in Europe and North America to manage the solid fraction of collected manure.

TABLE 2. ESTIMATES OF POTENTIAL BIODIGESTER ELECTRICITY PRODUCTION FOR DIFFERENT MANURE SOURCES.

Effluent content	Potential KWh
Carbon content (28%)*	48 – 96
Excess solid	110 – 153
Excess liquid	5.5 - 7.6

Biochar and other absorbent additives - the application of organic materials can 'soak up' nutrients in manure, specifically nitrogen and phosphorus. This has a two-fold benefit in that it reduces nutrient and odour emissions while also providing greater nutrient value of manure when reapplied to land.

CONCLUSION

Our report highlights some real challenges the dairy industry faces with respect to manure management. Many of the emerging technologies mentioned above, have been proven internationally as effective emission mitigation measures. The responsibility for the dairy industry, in partnership with the research and policy community, is to determine the effectiveness of these and other technologies, quantify the benefits that can be extracted from reduced emissions from manure, and encourage greater adoption of successful manure management systems.

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