Manure reuse for on-farm profitability

Farmer Case Studies

(August 2007)

Produced by FSA Consulting on behalf of the industries listed and the funding bodies. FSA Consulting has taken all reasonable steps to ensure that the information contained in this case study is accurate at the time of production. FSA Consulting and the funding bodies maintain no responsibility for the accuracy or reliability of information supplied in this case study and accept no responsibility due to the incorrect use of this information.

Table of Contents

Introduction

In conjunction with representatives from Queensland Chicken Growers Association, Meat and Livestock Australia, Australian Lot Feeders Association, Pork Queensland Incorporated and Dairy Australia, Queensland Dairyfarmers' Organisation (QDO) was successful in the development of a project to address the utilisation of animal waste products as fertiliser in the Wide Bay-Burnett and South East Queensland regions. Funding for this project was supplied by Landcare and Burnett Mary Regional Group. QDO contracted FSA Consulting to deliver this project.

Stage 2 of the project was the development of four case studies. This was to include aspects specifically relating to the use of dairy, feedlot, piggery and poultry by-products on-farm. Key issues to be covered in the case studies include:

- Insight into on-farm manure reuse for improved crop and pasture productivity.
- Economic benefits to business.
- Manure reuse management techniques.
- Advantages of soil testing and nutrient management.

The following material has been compiled by developing a series of four case studies on the reuse of dairy, piggery, feedlot and poultry manure and spent litter. The case studies provide examples of best practices for animal by-product reuse by providing an overview of operations on the four farms.

Manure reuse for on-farm profitability

Farmer Case Study 1 — Dairy

(August 2007)

Key points:

- ***Managed feeding operations has resulted in higher nutrient inputs to the system.***
- ***Manure has now become a valuable nutrient source for on-farm silage production.***
- ***Soil tests have shown large improvements in soil nutrient levels.***
- ***Manure applications have been reduced after initial high rates to match crop requirements.***

Introduction

Dairy production in Southern Queensland has seen a shift in management systems from grazing to partial or total mixed rations in response to drought conditions over the past 8-10 years.

Along with the managed feeding systems has come the need to manage manure in a way that avoids animal health and environmental problems.

While feeding is a large cost to the dairy industry, one benefit can come from the manure that is available to be harvested and reused. This may go someway in offset fertiliser costs on dairy farms.

Photograph 1 — Manure management is now a regular part of dairy management.

Property description

The case study dairy is a large dairy that feeds cows year round with a total mixed ration. With this system, several hundred tonnes of solid manure and more than 10 ML of effluent is currently produced annually.

Photograph 2 — The dairy cows are fed a total mixed ration.

Soils

Soils on the property comprise mainly of alluvial black earths in the cropping areas, which are ideal for a range of crops and pastures. These soils are brown to black medium clays with pH of around 7.

Soil analyses revealed that continuous cropping had lowered soil phosphorus levels below crop requirements and fertiliser additions were required for high yielding silage crops.

Australian Government
Department of Agriculture, Fisheries and Forestry
National Landcare Programme

Burnett Mary Regional Group
Queensland Dairyfarmers' Organisation
Queensland Chicken Growers Association
mla
DAIRYAUSTRALIA
FSA CONSULTING

Manure applications

Reuse of solid manure produced on-farm is a relatively new aspect of dairy farming. Manure applications were initially planned to address the historic run down of soil nutrients with two relatively large applications (10-15 t/acre or 25-37 t/ha) of dairy manure in 2006.

Following each of these applications, a moderate crop of silage was grown, limited by the low rainfall drought conditions. Applications for this growing season will be aimed at meeting crop demand for phosphorus, which is about 10 t/ha of dairy manure for an irrigated corn silage crop.

Photograph 3 — Using a manure spreader ensures a more even manure application rate.

Soil and crop results

Following manure applications, phosphorus levels in the surface soil increased significantly, indicating that two large applications of manure may supply adequate nutrients for multiple crops. Along with phosphorus, increases in nitrate nitrogen, potassium and sulphur were observed, together with increases in most trace elements.

These high levels are likely to be in response to low crop yields (due to drought conditions) in the seasons following manure application.

There are plans to reduce application rates to meet crop demand in following seasons, now that the soil nutrient status has improved to good agronomic levels.

Photograph 4 — This 15 ha paddock has been spread with manure at 25 tonne/ha and cultivated ready for a silage crop.

Manure reuse for on-farm profitability

Farmer Case Study 2 – Piggery

(August 2007)

Key points:

- ***South Burnett piggery produces both effluent and solid by-products from conventional and deep bedding sheds.***
- ***All spent bedding is partially composted by turning 3-4 times before reuse or sale.***
- ***Good results have been observed from spent bedding use on pasture country.***
- ***The preference is to apply effluent on fertile alluvial country for crop production.***

Introduction

Piggery enterprises in Southern Queensland require effective effluent and solid manure management.

Piggery effluent and spent bedding are rich sources of nutrients, in particular nitrogen and potassium.

Property description

The grow-out piggery is on a 103 hectare property near Nanango in the South Burnett region in SE Qld. The piggery comprises both deep litter and conventional sheds, producing effluent and spent bedding as by-products.

Deep litter housing requires that a substantial amount of straw or sawdust be used in the sheds to absorb the manure produced by the growing pigs. This bedding is a valuable fertiliser and soil amendment source for crop and pasture land. About 500 tonnes of spent bedding (a mixture of sawdust and manure) is produced each year from their piggery. This material is partially composted by turning the bedding 3-4 times prior to reuse or sale.

When the spent bedding is removed from the shed it can be pretty variable, with some parts quite wet [with manure] while other material is reasonably dry. The operators then turn the bedding to mix it through and make a homogenous product.

Photograph 1 — Spent bedding is turned on site to produce a more uniform, consistent product.

The composting process, which is carried out on a controlled drainage pad, is done by piling the spent bedding in windrows about 2 m high and turning these on a 3 weekly basis initially, then as labour and time permit. Overall, the spent bedding is turned 3-4 times. This produces a more consistent and valuable fertiliser product.

Soil description

There are two distinct soil types on the piggery property. These soils range from deep alluvial black earths used for irrigated cropping to sandy loam grazing country.

The lighter soils in this region are typically low in fertility and require significant fertiliser inputs to improve productivity, while the alluvial black earths are highly fertile and productive.

When the piggery was established, it was decided that spent bedding would be applied to the lighter grazing country to improve fertility and organic matter levels,

Australian Government Department of Agriculture, Fisheries and Forestry National Landcare Programme

Produced by FSA Consulting on behalf of the industries listed and the funding bodies. FSA Consulting has taken all reasonable steps to ensure that the information contained in this case study is accurate at the time of production. FSA Consulting and the funding bodies maintain no responsibility for the accuracy or reliability of information supplied in this case study and accept no responsibility due to the incorrect use of this information.

Burnett Mary Regional Group · Queensland Dairyfarmers Organisation · mla · DAIRYAUSTRALIA · FSA CONSULTING

Photograph 2 — This grazing paddock has received 12t/ha of spent bedding over the past 3 years with good results in pasture growth.

while effluent would be irrigated with clean water onto the alluvial black earths where high production crops are grown to effectively use the added nutrients. By managing by-products in this way, the operators have maintained high levels of crop production.

Bedding reuse

Since beginning operation of the piggery, up to 12t/ha of spent bedding has been applied to grazing country, with good responses in pasture growth being observed.

The operators have been very happy with the response when bedding was applied to one half of a pasture paddock to compare the pasture growth.

However, the recent dry seasons have limited pasture growth, and the operators believe the full benefit of applying the bedding compost hasn't been fully seen on their own country.

The only reason more hasn't been applied on the irrigated country is because they aim to apply effluent to this area.

Recent analysis of the composted bedding material is shown in Table 1 below.

Component	Amount (%)
Moisture	32.7
Nitrogen	2.0
Phosphorus	1.2
Potassium	2.1

Table 1. Spent bedding analysis for the piggery

Effluent reuse

Effluent production from the conventional sheds at the piggery produce around 3-4 ML of effluent per year for irrigation, depending on the season. The operators aim to put this to good use on their irrigated cropping country.

The operators have been able to grow good crops on the creek flats provided there is enough water for irrigation, however in the last couple of years water has been a bit scarce and they haven't started irrigating effluent as yet.

With grain sorghum yields ranging from 5-8 t/ha, effluent will be a useful source of nutrients for maintaining the cropping system when normal seasons return.

Off farm reuse of spent bedding

Because of the limited amount of land at the piggery, around 75% of the spent bedding will be sold off farm each year. This material is currently being purchased for application on pasture, grain and horticultural crops with good results.

"One customer has applied spent bedding to passionfruit vines with great success, seeing improvements in the yield and quality of fruit produced with composted bedding application" said the operators.

One benefit from using a sawdust based bedding compared to some other manures is that it spreads very well from most spreaders.

The spent bedding rarely needs screening for this reason, and will generally run through most machines provided the moisture level is below about 35%.

Comparing the spent bedding produced at the piggery with commercial fertiliser, the value could be as high as $\$40/m^3$, however in the current market situation the selling price is closer to one quarter of this.

It is hoped that as more farmers become familiar with the product, the value will more closely reflect the nutrient content of the product.

Manure reuse for on-farm profitability

Farmer Case Study 3 — Feedlot

(August 2007)

Key points:

- ***South East Queensland feedlot produces valuable manure by-products.***
- ***Composting can add value to the manure by-product by improving marketability.***
- ***Improved crop yields on areas where compost has been spread.***
- ***Use a controlled drainage system to contain runoff.***

Introduction

Feedlot enterprises in Southern Queensland require effective effluent and solid manure management.

Feedlot manure can be composted to produce a more stable, nutrient rich product. Composting can reduce weed seeds, reduce odour and improve marketability to consumers.

Photograph 1 — Effective manure management is important for smaller feedlots, and can become a sideline for the business.

Property description

The feedlot is currently 400 SCU, but the operators are expanding it to a capacity of 1800 SCU. With the current 400 SCU enterprise, some 400 tonnes of solid manure and about 5.5 ML of effluent is produced annually, but this will increase to about 1800 tonnes of solid manure and about 13 ML of effluent annually with the expansion.

Soils

Soils on the property comprise mainly of alluvial, sandy loam-light clay topsoil on medium-heavy clay subsoil.

While these soils are suitable for most crops, they often lack adequate levels of nitrogen and phosphorus for high production levels and will benefit greatly from manure applications.

Manure management

The operator has trialled several different ways to manage manure from the feedlot, including application of fresh manure to land, stockpiling and in-situ composting. Currently manure from the feedlot is composted in a controlled drainage manure handling area.

Manure is turned, heaped then treated with Zeolite and microbes to accelerate the composting process and reduce odour.

The operator believes the addition of Zeolite to the manure both in the piles and in the pens has definitely reduced odour problems at the feedlot.

Australian Government Department of Agriculture, Fisheries and Forestry National Landcare Programme

Produced by FSA Consulting on behalf of the industries listed and the funding bodies. FSA Consulting has taken all reasonable steps to ensure that the information contained in this case study is accurate at the time of production. FSA Consulting and the funding bodies maintain no responsibility for the accuracy or reliability of information supplied in this case study and accept no responsibility due to the incorrect use of this information.

Burnett Mary Regional Group · Queensland Dairyfarmers' Organisation · Queensland Chicken Growers Association · mla · DAIRYAUSTRALIA · FSA CONSULTING

What are Zeolites?

Zeolites are porous, alumino-silicate minerals that act as a sieve to hold positive ions. They can also absorb liquids, which may be useful for reducing odour in feedlots and composting areas.

Manure applications

While the operators aim to sell most of their manure off farm, they have experimented with reusing some manure on surrounding pasture land.

Initially fresh manure was spread on pasture paddocks, but they found that the weed seeds caused a fairly big problem.

This is one of the reasons the operators looked into composting the manure before use, and it has been observed that the problem has significantly reduced.

Photograph 2 — Lucerne in the area is an ideal crop for manure reuse.

The feedlot operator suggests that people interested in using some manure should run a spreader load up the centre of the paddock and watch the results.

Composting 'tricks of the trade'

The operators sell to clients who bag and resell the manure to gardeners on the coast, with only good reports to date.

Photograph 3 — The manure stockpiles are turned to promote composting.

The operators have had problems with **hard lumps** forming in the middle of his stockpiles after composting. The lumps form after the heating process and are undesirable in the final compost product.

To overcome this, the material is screened prior to sale to remove any lumps or rocks. Another trick that is used to break down lumps in the manure is to stack the piles with the bulldozer, taking thin layers of manure with each pass and allowing the movement of the machine to break down larger lumps and compact the pile at the same time.

The operator is constantly looking to improve the system, but notes that compared to handling fresh manure the composted / stockpiled manure has less moisture, fewer weed seeds and is generally more saleable, which are all positives for his business.

Manure reuse for on-farm profitability

Farmer Case Study 4 — Poultry Litter

(August 2007)

Key points:

- ***Application of stockpiled poultry litter has maintained soil structure and organic matter levels.***
- ***Annual soil testing is important for accurate nutrient management.***
- ***Holding ponds are used to capture runoff from reuse areas.***

Introduction

Southern Queensland is home to a significant horticultural industry, supplying fresh produce to Queensland and eastern Australia. Intensive horticulture requires high inputs of nutrients to maintain yields over a long period of time, and soil condition needs to be managed to avoid structural decline.

When used in the right way, manure can be an ideal component to improve horticultural production in a sustainable way. An intensively farmed 5 ha property in South East Queensland has used spent poultry litter to boost productivity on parsley and radish production areas for a number of years .

Photograph 1 — Parsley production using spent poultry litter.

Property Description

The farm produces parsley and radish in irrigated field and hydroponic systems on the property from where it is marketed extensively throughout eastern Australia.

The field grown produce is harvested about every 8 weeks, allowing for 5-6 crops each year. The property has a strict Quality Assurance program that ensures maximum food safety standards are met.

Soils

Soils on the property consist of light sandy loams with good drainage. Crops are grown in rotation between parsley and radish. With multiple crops being grown per year, maintaining soil health is a challenge.

However, by applying stockpiled poultry litter prior to crop establishment soil structure and organic matter levels have been maintained and improved over time compared to conventional management.

Manure management

The farm has been using spent poultry litter on the crop land for about 20 years, and the operators are great advocates for its usage. Poultry litter is purchased from a local chicken producer and stockpiled on-farm prior to use.

Stockpiling allows the poultry litter to treated by the natural breakdown and heating process.

This, together with careful management that includes pre-crop application and further soil treatment between when litter is applied and when the crop is sown makes poultry litter usage a safe practice that complies with Quality Assurance protocols.

Application

Litter is applied annually, four weeks prior to sowing and is incorporated immediately to avoid losses with rainfall.

According to the operators, one of the benefits of using poultry litter is that the organic matter breaks down slowly throughout the year, providing a longer term benefit to soil structure.

They have found that compared to green manure crops, applying poultry litter takes less time out of the cropping cycle and provides a longer term benefit from the organic matter.

Photograph 2 — This field has been receiving spent litter for many years to maintain soil structure and fertility under intensive parsley and radish crops.

Applications of poultry litter and fertiliser are based on soil tests each year, and even with high litter applications, nutrient loads are not in excess. This is not surprising considering the high yield and multiple crops grown each year.

While litter applications offset some of the crop requirement for nitrogen, phosphorus and potassium, the operators consider the value of the organic matter and trace elements may even be greater than this.

It has been found that the poultry litter has significantly improved the sandy loam soils that are traditionally low in organic matter.

Environmental considerations

Herb production requires intensive land management and inputs to achieve maximum yields. To ensure that nutrients and other chemicals used in production do not become a threat to the environment, the farm has been designed to catch all runoff from the property in properly designed holding ponds.

In the event that heavy rainfall after litter application causes nutrients to be lost in runoff, this is caught by the holding ponds where it can be reused for crop production.

The ponds also catch any soil that is eroded with heavy rainfall prior to crop establishment.

By combining careful management with annual applications of poultry litter, the operators are maintaining soil health and fertility which lead to consistent, sustainable high production. Added environmental and Quality Assurance protocols ensure that no harmful side effects are experienced from the cropping system, making litter application and horticultural production a win-win for both industries.