



FACT SHEET

SPENT BEDDING FROM PORK FARMS

APRIL 2014

AN ALTERNATIVE SOURCE OF NUTRIENTS FOR BROADACRE CROPS

Increasing costs of cropping fertilisers has many broadacre cropping farmers considering alternative nutrient sources to apply to crops. Phosphorus-based fertiliser prices have been particularly volatile and expensive in some years.

In recent years, spent litter from chicken farms has gained popularity amongst grain farmers in districts with chicken farms close at hand. Reclaimed biosolids from sewage treatment plants have also been utilised on nearby broadacre farms as a cheap source of crop nutrients.

Until recently, spent bedding from pork grower housing has largely been overlooked as an alternative source of crop nutrients.

In 2011 Rural Directions Pty Ltd commenced an Australian Pork Limited-funded project examining the nutrient value of spent pig bedding and its potential utilisation as a broadacre crop fertiliser and soil improvement agent. Findings from the project have been used to develop this information sheet.

What's in spent pig bedding?

Spent bedding from pig housing contains useful quantities of essential macro and micro nutrients required by grain crop and has good potential for use as an alternative fertiliser.

A 2011 survey of 32 batches of spent bedding indicated that, on average, macro nutrients phosphorus, nitrogen, potassium and sulphur were contained in spent bedding in quantities comparable to other organic by-products (chicken litter, reclaimed biosolids). Trace elements, zinc and manganese, were also contained in spent bedding. Copper levels in spent bedding were variable (in some batches copper levels were below detection), due to differences in rations fed to pigs on individual farms.

Table 1: Moisture, Carbon and Macro Nutrient Contents of Spent Pig Bedding

	Average	Range
Moisture %	48	6.40 – 73.7
Carbon %	28	17.3 – 35.7
Nitrogen %dwt	2.93	1.73 – 4.54
Phosphorus %dwt	1.23	0.52 – 2.63
Potassium %dwt	2.02	0.86 – 3.84
Sulphur %dwt	0.6	0.35 – 1.0

Table 2: Micro Nutrient Contents of Spent Pig Bedding

	Zinc (Zn) g/tonne dwt	Copper (Cu) g/tonne dwt	Manganese (Mn) g/tonne dwt
Average	1157	102	370
Range	319 - 4288	<0.05 - 474	191 - 585

NB - %dwt = percentage on a dry weight basis; g/tonne dwt = kilogram of nutrient per tonne of bedding on a dry weight basis.

When calculating appropriate rates of spent bedding application it needs to be remembered that spent bedding products often contain 40% to 50% moisture.

Chicken litter generally contains between 20% and 25% moisture. Due to its higher moisture contents, pig bedding may need to be applied at twice the rate of chicken litter to apply similar quantities of nutrients.

Nutrient contents can vary considerably between sources and batches. Given this variability, it is important to obtain a nutrient content analysis of the product sourced when making decisions on appropriate rates of application.

What about Heavy Metals?

The survey results indicated that most spent bedding batches contained very low levels of the heavy metals arsenic, cadmium, chromium, lead and nickel.

Some batches contained moderate levels of zinc and copper. This presents an opportunity and a risk in utilising spent bedding in broadacre cropping soils.



Zinc and copper, although essential nutrients for broadacre crops and deficient in many cropping soils, are also heavy metals that can accumulate in soils.

Farmers in many broadacre cropping zones would regard the zinc and copper contained in spent bedding advantageous in building fertility in deficient or depleted soils, rather than a risk. Conversely, soil accumulation of zinc and copper will need to be monitored with long term use and high application rates of spent bedding.

How Do I Utilise It?

Where and How Much?

Grain growers will often target paddocks low in fertility with the aim of building soil nutrient reserves. To achieve this aim, the application rates of manure products adopted generally supply more nutrient (phosphorus in particular) than the crop can utilise. In practice, application rates of spent pig bedding range from 5 to 10 tonnes per ha (fresh weight), supplying between 12 and 23kg per ha of phosphorus.

Most growers will spread the bedding prior to sowing a cereal or canola crop, rather than a pulse, so the crop can potentially make use of nitrogen contained in the product.

Nitrogen benefits from applied spent bedding can be mixed as a proportion of the nitrogen in the spent bedding is lost as ammonia between spreading and incorporation. Timing applications as close to seeding or significant rainfall as possible will reduce nitrogen losses, however, this is often not practical.

“Starter” Fertiliser

Occasionally crops treated with manure products, without conventional fertiliser can exhibit less vigour. In some instances, slight crop yield reductions can occur. This is more likely to occur in soils with low background fertility than more fertile soils and may be due to limited availability of some of the nutrients contained in the manure

Phosphorus in manure-based products occurs in organic and inorganic forms. The organic forms must be mineralised or converted into inorganic forms over time before they can be used by plants. As a result a proportion of the phosphorus contained in spent bedding may be initially unavailable to plants.

Accessibility of nutrients contained in spent bedding is another factor to be aware of.

In modern broadacre cropping systems, the bedding is generally broadcasted prior to crops being sown with low disturbance no-till seeding equipment (knife points and presswheels).

Limited incorporation of the manure occurs during the seeding process and as a result, minimal nutrient ends up in the seed row in close proximity to the roots of germinating crop seedlings. Disc seeding systems result in even less incorporation than knife point/presswheel systems, with potentially greater risks of nutrient accessibility issues.

“Starter” applications of conventional fertiliser applied in the seed row of the crop, in conjunction with the application of spent bedding appear to overcome the issue. Depending on the background levels of phosphorus in the soil, the rates of conventional fertiliser required are often less than standard rates.

Increasing the spent bedding application rate from 5t/ha to 10t/ha also appeared to overcome crop vigour reductions in one SA trial, however, more research is required to evaluate the reliability of this strategy.



Improving Poor Soils

Spent bedding from straw-based pig shelters has considerable potential for use in broadacre farming systems as a soil improvement agent for poor producing or problem soils.

Anecdotally, the application of high rates (10-20 tonnes per ha) of manure products have achieved good results in improving problem soils (i.e. sand hill areas of paddocks).

SA trials conducted in 2011 and 2012 evaluated the potential for spent pig bedding as a soil improvement agent.



Following applications of high rates of spent bedding (up to 20 tonnes per hectare) significant increases in grain yield and crop vigour were sustained for two successive years.

Plant tissue levels of a range of macro and micro nutrients were increased by spent bedding applications for two years following application.

Elevated grain protein levels were also measured in the two seasons following high rates of spent bedding applications.

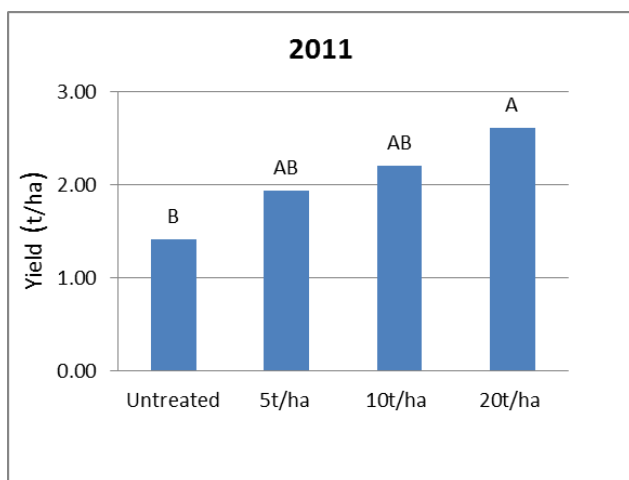


Figure 1: Barley yields immediately following the application of spent pig bedding to a poor producing sandhill

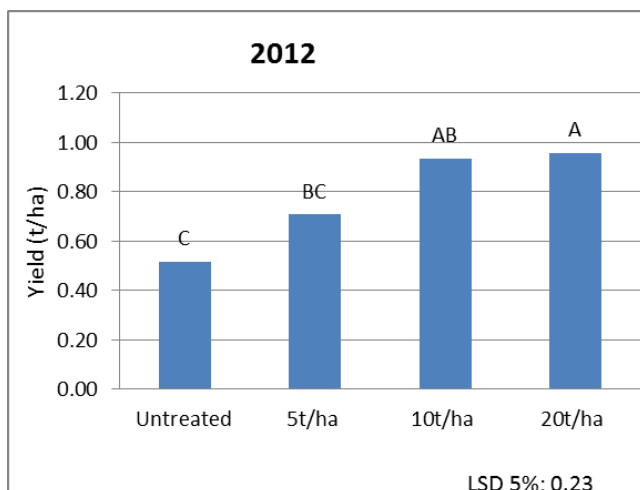


Figure 2: Wheat yields two seasons after the application of spent pig bedding to a poor producing sandhill

In the trials, there were no adverse affects on grain quality resulting from high application rates. It should be noted, however, that there is a risk of excessive crop growth associated with applying high rates of manure products, due to the supply of high amounts of nitrogen. This can reduce yields and grain quality in an abrupt seasonal finish.

Spreading Spent Bedding

Aged and partially composted pig bedding can be bulky and often lumpy. As a result, spent pig bedding is difficult to spread using conventional fertiliser spreaders.

Ideally, high volume manure spreaders equipped with floor chains that deliver product to beaters/spinners should be used to spread the product evenly and efficiently. Contractors with suitable spreading equipment can often be sourced in districts where manure-products are produced in sizable quantities.

Is it Good Value?

Whether pig bedding represents good value for broadacre grain growers or not depends on a range of factors. The initial purchase price of the bedding, its nutrient content, the cost of transport to the paddock and contract spreading will all influence the cost-effectiveness of spent bedding as an alternative nutrient source.

An Excel-based Organic By-Product Value Calculator has been developed by Rural Directions Pty Ltd to evaluate the economics of utilising manure-based products compared to conventional fertilisers after taking purchase price, transport and spreading costs into account.

The calculator can be accessed as a free download from the Rural Directions website at www.ruraldirections.com/pages/farm-and-regional-business/agronomic-services/resources.php

Poo Calc

A calculator for estimating the value of nutrients in chicken litter and other by-products

Inputs required:

1. The nutrient composition of the by-product, including moisture content and bulk density
2. The price per tonne of conventional fertiliser
3. The cost of the organic by-product, freight and spreading

Instructions:

1. Click on the Organic By-Product Calculator tab to begin
2. Enter data into the yellow cells only
3. Enter the analysis details of the By-Product into **Table 1**
4. Enter the Price per tonne of conventional fertiliser (delivered to farm) into **Table 2**
5. Enter the intended application rate of the by-product into the **Additional Assumptions** table
6. Enter the estimated percentage loss of nitrogen from the organic by-product into the **Additional Assumptions** table
7. Nominate the nutrients to be valued in **Table 3** by entering 1 in the nutrients to be valued, and 0 in nutrients not valued
8. Enter the purchase cost of the by-product, freight and spreading per cubic metre into **Table 4**

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CASE STUDY

USER CASE STUDY: ANDREW HANSEN, COOMANDOOK, SA

Annual Rainfall: 400m

Farming System

The Hansen's farm 8300ha, 75 per cent of which is cropped annually with a mixture of wheat, barley, canola, lupins, domestic and export hay together with a self replacing merino flock, prime lamb breeding flock and cattle for veal production.

In previous years, Andrew has applied chicken litter sourced from Murray Bridge to some of his poorer sandy soils. After doing some sums, factoring in the purchase price of the chicken litter, transport to his property and spreading costs, the chicken litter has worked out to be a relatively expensive source of nutrients.

After identifying a nearby source of spent bedding from straw based pig shelters, the Hansen's trialed spent pig bedding in 2012, in an attempt to supply nutrients more economically.

"We have a piggery close by where we can source the spent bedding and transport it ourselves, making it a cheaper alternative," Andrew said.

The Hansen's have significant areas of deep sandy soils associated with their property, which are less productive and produce low amounts of biomass each season.

"We have tried spreading clay on the deeper sands in the past, however, we found that the clay here is not suitable for treating sand hills and can be uneconomical, so we are looking for other methods to increase productivity," Andrew added.

"It all comes down to economics and we are still justifying the use of spent bedding," Andrew said.

The Hansen's apply the spent bedding at rates between 5t/ha and 7t/ha, however in 2013 rates are likely to be increased, particularly on the poorer soils.

"We would ideally like to target the sandy rises and levelled ground, which are prone to wind erosion with higher rates," Andrew said.

"The straw and organic matter in the product helps to hold the soil."

The spent bedding is applied using a 40 cubic metre capacity, European-built manure spreader designed to handle the bulky, light material.

"We aim to spread between 75 and 100ha per season, however this will depend on cost and availability of product" Andrew said.

The Hansen's are not using the spent bedding as a conventional fertiliser replacement, and plan to stick to their normal fertiliser regime in addition to the spent bedding applications.

"We see the pig bedding as complimenting conventional fertilisers and don't intend to use it alone", Andrew said

"This is why we need to watch the costs of the product", Andrew added.

"Over time, if we see changes in the soil tests from the spent bedding additions, we may reduce conventional fertiliser applications."

Another reason for Andrew applying spent bedding is to build soil levels of phosphorus, potassium, zinc and sulphur.

"We don't target nitrogen, as the benefits are variable due to ammonia losses", Andrew said.

Andrew mentioned that he would like to conduct trial strips so he can see what effects the spent bedding is actually having.

"One of my biggest issues is quantifying the benefits from eco-shelter bedding."

"It is hard to put a value on the product to see if we are getting an economic return as we are new to using it," Andrew said.

"Ideally we would like to set up our own trials on some of our better ground to see if we get economic returns."

Andrew's Tips

"Because of the size of the spreader you need a big loader or telehandler to fill it, any old tractor with a loader kit will not work."



“We also require a tractor with a minimum of 200hp to pull the spreader once loaded,” Andrew said.

“Ideally the manure should be composted before use as this will reduce the volume being applied and may be suitable for application with a conventional spreader,” Andrew mentioned.



CASE STUDY

USER CASE STUDY: PETER COOK, LONG PLAINS, SA

Annual Rainfall: 350m

Farming System

1000 ha of mixed cropping and livestock producing bread wheat, barley, canola, field peas and lentils together with a prime lamb breeding flock and a small cattle feedlot.

History of Spent Bedding Use

Peter started using spent bedding from straw-based pig shelters in 2007 after commencing a share-farming arrangement on a block of cropping land associated with a piggery grow-out facility.

Peter spreads spent pig bedding on approximately 70ha of the 200ha block each year, depending on supply.

According to Peter, “It’s a win-win situation - the piggery owners are getting the manure moved, and spread over their land, while I gain benefits in my crops.”

Peter uses the eco-shelter bedding primarily to improve the soils associated with the property, with sandhills a priority.

“We target a lot of the sandy rises to try and build their fertility as well as to prevent drift.”

“By spreading sandhills we are convince that we see better production from the soil,” Peter said.

“At the same time, the piggery produces a large amount of waste, which is effectively dealt with, whilst hopefully achieving an economic return for both parties,” Peter added.

Peter applies the spent bedding at rates of between 8t/ha and 9t/ha, however in 2012 rates increased to 12t/ha due to an increase in supply.

The spent bedding is applied in March or April prior to seeding using a hired 30 cubic meter, high volume Rolland spreader.



“We have a good arrangement, where I supply the tractor and labour, and the cost of the spreader hire is split 50:50 with the land owner,” Peter said.

“The spreader that we use is great however, there are a few issues with the lumpiness of the product,” he added.

“We always use DAP and urea at seeding in conjunction with the eco-shelter bedding.”

“Last year I cut back the amount of urea applied to crops treated with bedding by 20kg/ha and reduced the rate of DAP at sowing to 50kg/ha without any yield penalties,” Peter mentioned.



“We try to target paddocks being sown to barley on the share farming block, so all paddocks are getting a spread every couple of years,” Peter said.

“At this stage we don’t transport the manure to other areas of the farm due to logistics and trying to keep costs down,” Peter added.

“We expect to spread the manure over a larger area next year because the piggery owner is putting up additional shelters so there will be more bedding to use”, he added

Peter’s Tips

“From my experience the manure needs to be aged for a period of at least 12 months,” Peter said.

“Composted or semi composted product helps with the spreading process as it reduces the lumpiness,” Peter said.

“Having the infrastructure or machinery to be able to turn the heaps would also be a huge advantage,” Peter added.

Depending on the type of spreader used Peter would not recommend spreading on crops that need to be harvested close to the ground (i.e. lentils, peas) or at high rates.

“We found that when we spread a lumpy batch at 12t/ha we had to reap our crop higher to avoid picking up the manure in the grain sample, which lowered the overall paddock yield,” Peter said.

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