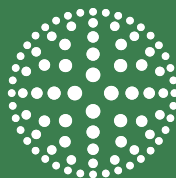




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# Land Application of Chicken Litter: A Guide for Users

*by S.G. Wiedemann (FSA Consulting)*



JULY 2015

RIRDC Publication No. 14/O94





**Australian Government**

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#### Researcher Contact Details

Stephen Wiedemann  
FSA Consulting  
PO Box 2175  
TOOWOOMBA QLD 4350  
Phone: 07 4632 8230  
Fax: 07 4632 8057  
Email: [stephen.wiedemann@fsaconsulting.net](mailto:stephen.wiedemann@fsaconsulting.net)

In submitting this report, the researcher has agreed to RIRDC publishing this material in its edited form.

#### RIRDC Contact Details

Rural Industries Research and Development Corporation  
Level 2, 15 National Circuit  
BARTON ACT 2600  
PO Box 4776  
KINGSTON ACT 2604  
Phone: 02 6271 4100  
Fax: 02 6271 4199  
Email: [rirdc@rirdc.gov.au](mailto:rirdc@rirdc.gov.au)  
Web: <http://www.rirdc.gov.au>

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## Foreword

The Australian chicken meat industry has an ongoing commitment to ensure that chicken litter is utilised in a way that is beneficial, sustainable and safe for end users. Chicken litter is an important fertiliser and soil conditioner for many industries, and the chicken meat industry has completed a large number of research projects that aim to help chicken litter users utilise this resource with best management practices. This user guide compiles the material in an 'easy to access' format for stakeholders across a number of industries, and references the more detailed research projects completed by the industry in recent years. It provides a great entry point into understanding and using chicken litter across a range of industries.

This project was funded from industry revenue which was matched by funds provided by the Australian Government.

This report is an addition to RIRDC's diverse range of over 2000 research publications and it forms part of our Chicken Meat R&D program, which aims to stimulate and promote R&D that will deliver a profitable, productive and sustainable Australian chicken meat industry.

Most of RIRDC's publications are available for viewing, free downloading or purchasing online at [www.rirdc.gov.au](http://www.rirdc.gov.au). Purchases can also be made by phoning 1300 634 313.

**Craig Burns**

*Managing Director*

*Rural Industries Research and Development Corporation*



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# Introduction

Fertilisers are a significant input and expense for all plant industries. Chicken litter is a valuable alternative fertiliser and soil amendment product that is sought after by many industries, including horticulture, hay and forage production, dairy and broadacre cropping.

Chicken litter provides essential macro and micronutrients and is rich in organic carbon, which is good for soil health. There are many benefits associated with the use of chicken litter, which have been proven by research and farmer practice. This guide draws together the most recent Australian research on chicken litter marketing, agronomic value and sustainable utilisation practices.

The guide provides information on:

- General characteristics of chicken litter
- Market characteristics and chicken litter supply
- Gaining maximum value from chicken litter
- Setting appropriate application rates
- Ensuring safe and sustainable utilisation.

The guide covers diverse crop and pasture systems from across Australia, providing information on the suitable practices for litter application based on Australian research.





## Fast facts

Chicken litter is a by-product of meat chicken production, and is a mixture of bedding (usually sawdust or shavings, rice hulls or straw) and manure. Australia's meat chicken production centres are generally located near capital cities and some larger regional centres such as Tamworth and Griffith in NSW, and Bendigo in Victoria. Figure 1 shows the main litter production regions.

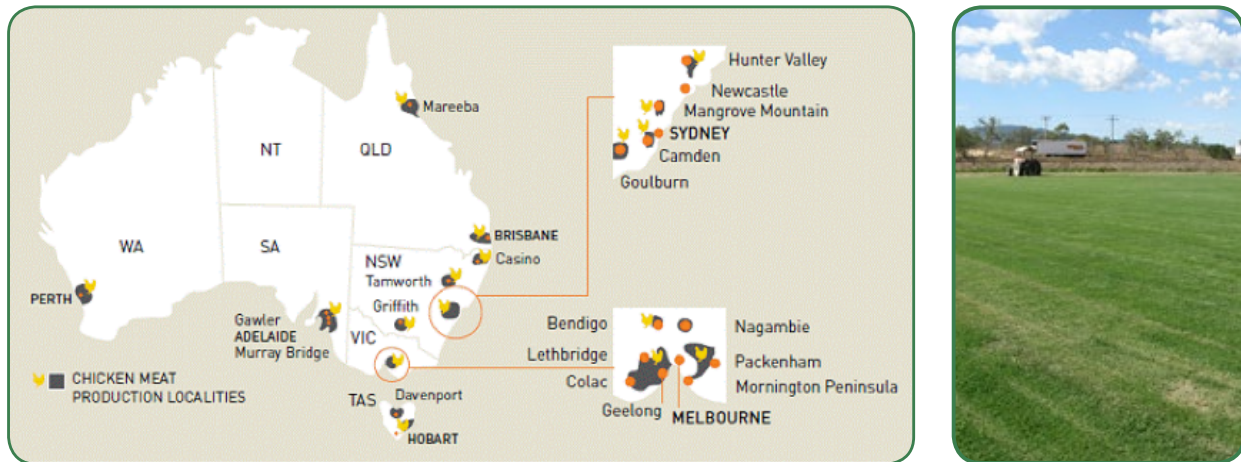


Figure 1. Distribution of meat chicken production in Australia (ACMF 2011).

In 2013/14, Australia produced 580 million meat chickens. Total chicken litter production is estimated to be over one million tonnes per annum.

Most chicken litter in Australia is used within 150km of its source, though in some regions litter is known to be transported over 300km for higher value crops. The industries that use the largest amount of chicken litter are:

- Horticulture (including field and tree crops).
- Pastures (predominantly dairy, and some beef cattle and sheep).
- Broadacre cropping.
- Turf and viticulture (in some regions).

Over 75% of chicken litter is used without any form of processing<sup>1</sup>. Untreated poultry litter is suitable for many applications and tends to be less expensive, contributing to its popularity. A smaller amount of material is treated by composting or pelletising, and there is interest in using litter as a biomass source for electricity production.

Single-batch litter is the most common source of chicken litter in Australia (from systems where only one batch of chickens is raised on the litter before it is cleaned out and sold), and only a small amount is multi-batch (<10%) (where multiple batches of chickens are raised on the same litter). Multi-batch litter generally has higher levels of nutrients and is consequently more sought after as a fertiliser.



## Composition of chicken litter

Chicken litter consists of manure and bedding material at a ratio of about 55:45. The material is usually quite dry (20-26% moisture) and can be spread easily. The carbon content of chicken litter is usually 30-40%.

Chicken litter contains nitrogen, phosphorus and potassium, as well as a full complement of valuable micronutrients.

Table 1 shows the average characteristics of chicken litter in Australia, and is taken from 123 samples collected around the country with different bedding materials<sup>2</sup>.

Multi-batch litter is a more valuable fertiliser product, because of the higher ratio of manure to bedding. However, multi-batch litter is only available in some regions, and may sell for a premium.

It is important to note that nutrient levels in chicken litter, like all organic materials, are naturally variable. This is important to keep in mind when determining application rates. The best way to determine the nutrient value is to get laboratory analysis taken from the purchased material or to request this when purchasing litter.

**Table 1. Average characteristics of chicken litter in Australia.**

<i>Analysis (% db)</i>	<i>Straw*</i>	<i>Sawdust*</i>	<i>Wood shavings*</i>	<i>Multi-batch</i>
Moisture (%)	20 (14.5–25.1)	25 (20.1–28.8)	26 (20.5–31.2)	21
Total Nitrogen	4.0 (2.0–5.3)	3.8 (2.8–5.9)	3.9 (2.8–5.5)	4.0
Total Phosphorus	1.1 (0.7 – 1.8)	1.2 (0.8–1.5)	1.3 (0.7–1.7)	1.7
Potassium	2.2 (1.6 – 2.8)	1.8 (1.3–2.5)	1.9 (1.1–2.8)	2.4
Sulphur	0.63 (0.5–1.1)	0.5 (0.3–0.6)	0.5 (0.3–0.7)	0.6

*\* Given as an average, with the range shown in brackets.*

*Taken from 123 samples with different bedding materials. Straw (no. of samples = 28), sawdust (no. of samples = 28), shavings (no. of samples = 65), multi-batch litter (no. of samples = 4)<sup>2</sup>.*



*Sawdust used for litter*



*Straw bales*

# Nutrient characteristics

Chicken litter has some nutrients in a readily available form and others that are slow release. Nutrient availability is affected by both physical and chemical factors, and will be different for each nutrient contained in the litter.

## Nitrogen availability

About 25% of the nitrogen contained in litter is in a plant-available form (ammonium), and an additional 25-35% may become plant-available during the first year of application. However, ammonium nitrogen is easily lost to the atmosphere during application if litter is not incorporated. If litter is rapidly incorporated (cultivated or irrigated within 12-24 hrs), the ammonium portion (around 25% of total N) will be readily available. However, if litter isn't incorporated rapidly, the readily available N is likely to be lost, particularly from dry cropping soils. As a simple 'rule of thumb', if the litter is allowed to dry out, the ammonium-N is probably lost.

The remaining nitrogen contained in litter may become available to plants over a longer period of time (2-3 years) or may be incorporated into the pool of total nitrogen in soil.



*Cultivation is used to incorporate litter into paddocks*

## Phosphorus availability

Phosphorus is relatively immobile in the soil (it remains where it is placed), which makes spreading, distribution and incorporation important. When soil phosphorus levels are low, surface application of litter can result in a deficiency for crops. This is less of a concern for pastures. This can be addressed by using a low rate of starter fertiliser in addition to litter, and by building soil fertility over time. Residual phosphorus should become available in following seasons.

## Potassium availability

Potassium in litter is readily available and is also mobile within the soil. Plant availability should not be problematic regardless of spreading technique.

**Table 2. Estimated nutrient availability in the first year after litter application.**

<i>Nutrient</i>	<i>Nutrient Availability (1<sup>st</sup> year)</i>	<i>Comments</i>
Nitrogen	20-50%	Lower values are for litter that is surface applied, higher values for litter that is rapidly incorporated with ploughing or irrigation
Phosphorus	30-80%	Depends on soil type and physical placement – surface applied litter may be less available, particularly in dry conditions
Potassium	90%	Highly soluble and readily plant-available

*Note: These values are indicative, and will vary with different spreading techniques, crops and soil types.*







## Organic matter and micronutrients

### Organic matter and carbon

Organic matter and soil carbon are increasingly being recognised as critical to soil health and the long term sustainability of farming systems. Soil organic matter (SOM) can be reliably increased using additives like chicken litter if applied regularly at higher rate<sup>3</sup>. Organic matter amendments are particularly valued in horticulture and broadacre cropping systems, where organic matter levels are difficult to maintain. To achieve increases in organic matter, fairly high rates of chicken litter need to be applied regularly. This may be suitable in high input horticultural industries, and may be possible for cropping country that has been run down over time. Chicken litter is ideal for capital inputs to boost fertility and soil health.

Benefits from higher rates of chicken litter applications include: increased water holding capacity, improved soil structure and better infiltration. While the carbon content of chicken litter is valuable, application rates should always be based on nutrient requirements to avoid over-applying nutrients.

### Micronutrients

Another benefit of using chicken litter is that, along with macronutrients and carbon, litter supplies a broad complement of micronutrients. This is particularly important for crops that remove high amounts of biomass (such as hay, forage and some horticultural crops) and for farming land that has been continuously cropped for long periods of time. Litter contains sulphur, calcium, magnesium, manganese, zinc and copper, all of which can be valuable for cropping and pastures.

**Table 3. Chicken litter is a good source of micronutrients that may be valuable for some soil and crop systems.**

<i>Analysis (% db)</i>	<i>Straw</i>	<i>Sawdust / Wood shavings</i>	<i>Multi-batch</i>
Zinc	0.04 (0.02-0.05)	0.04 (0.03-0.06)	0.05
Copper	0.01 (0.01-0.02)	0.01 (0.008-0.03)	0.01
Maganese	0.05 (0.04-0.06)	0.05 (0.03-0.07)	0.06

*Straw (no. of samples = 28), sawdust & shavings (no. of samples = 93), multi-batch litter (no. of samples = 4)<sup>2</sup>.*

## Sourcing and handling chicken litter

Chicken litter is usually bought from contractors who clean the litter out of the chicken sheds and then transport it to users, or is bought directly from a meat chicken farm.

Litter can sell for anywhere from \$5-35/m<sup>3</sup>, with price reflecting demand and the price of synthetic fertilisers at the time. Transport is a large component of the price, and prices are best requested from contractors as 'landed on farm'. Transport costs per kilometre tend to decrease as distance increases, meaning that it can still be economic to use litter transported greater than 200km in some instances.

In regions where demand is high, forward purchasing and on-farm storage is a good way of securing supply. Chicken litter storage should be done using a designated storage area. The storage area should have:

- Bunding (low retaining walls) to reduce moisture build-up and leaching.
- A compacted pad, to improve handling and reduce leaching.
- Fencing, to exclude cattle and sheep, which must not be allowed access to chicken litter.

Covering chicken litter stockpiles is also advisable to minimise wetting and also to minimise ammonia losses and odour during storage.



*Contractor cleaning chicken shed*



*Covered litter stockpile*



## Application rates and valuing chicken litter

As with other fertilisers, application rates are best worked out from crop or pasture requirements.

Chicken litter is usually sold and spread per cubic metre. At usual moisture levels (20-30%) litter is around 350-450kg/m<sup>3</sup>, or 2.5m<sup>3</sup>/tonne. The nutrient content per tonne needs to be worked out taking moisture into account, because chicken litter analyses are done on a dry matter basis.

Using the values from Table 1, the phosphorus (P) in one m<sup>3</sup> of wood shavings chicken litter is calculated as follows:

$$0.013 \text{ (P content)} \times 0.74 \text{ (dry matter content)} \times 400 \text{ kg (litter density)} = 3.8 \text{ kg P}$$

Using the same calculation, the potassium (K) content is 5.6kg/m<sup>3</sup> and the nitrogen (N) content is 11.5kg/m<sup>3</sup>. Because nitrogen losses may be higher if not used promptly, this value could be reduced by 50% to about 5.8kg/m<sup>3</sup>.

Once the nutrient content has been determined, the basic value of nutrients can be worked out by comparing the value of synthetic fertiliser values. The total value is highly dependent on what nutrients contained in the litter are required. For example, where potassium is not required, the value of litter declines by at least 30%.

Other trace elements, such as sulphur and copper, are also valuable. Organic matter is also valuable, but is quite difficult to value. Where litter use is cost effective on the basis of macronutrients, the added value of these other components can be seen as a bonus to general fertility and soil health.



*Litter spreader from behind*



*Litter being loaded for transport*

**Table 4. Litter value based on NPK and zinc.**

	<i>kg/m<sup>3</sup> (as spread)</i>	<i>Nutrient value</i>	<i>\$/m<sup>3</sup> (as spread)</i>
Available Nitrogen*	5.8	\$1.10	\$6.30
Phosphorus	3.8	\$3.20	\$12.30
Potassium	5.6	\$1.60	\$9.00
Zinc	0.1	\$4.40	\$0.50
Total value (\$/m <sup>3</sup> )			<b>\$28.20</b>

*Value will depend on what nutrients are required. Additional nutrients of value for some soils and crops include sulphur and copper. Dollar values based on urea at \$500/t, MAP at \$800/t, potash at \$800/t and zinc sulphate at \$1000/t.*



## Spreading chicken litter

Spreading efficiency is very important when using chicken litter. There are two main considerations; distribution and incorporation.

If using a belt spreader, chicken litter can be spread at rates down to a minimum of about  $2\text{m}^3/\text{ha}$ . However, in general, rates in the order of  $4\text{--}5\text{m}^3/\text{ha}$  allow for better distribution. Spreading distribution can be assessed by laying plastic strips across the spreading path, and weighing  $1\text{m}^2$  quadrants at different distances from the centre of the spreader. Spreading distribution should be discussed with your spreading contractor, or considered when buying a new spreader.



*Chicken litter can be applied from belt spreaders provided moisture levels are not too high ( $<30\%$ ). The spreader pictured above, is providing an even, 7m spreading pattern.*

Incorporation is another important consideration when spreading litter. Rapid incorporation of litter (i.e. same day and best at  $< 4\text{hrs}$  post spreading in hot conditions) results in higher nitrogen retention and gives crops better access to the nutrients. However, in pasture or no-till situations where this is not practical, litter can be surface applied. The downside to surface application is that up to 25% of nitrogen may be lost, and phosphorus may be difficult for crops to access. This is less of a concern with pastures.

Application rates are best worked out starting with the P requirements of a crop or pasture. As an indication, a  $50\text{kg}/\text{ha}$  application of di-ammonium phosphate (DAP) is fairly comparable to the N and P supplied by  $2.5\text{m}^3$  of chicken litter. When compared to an NPK fertiliser,  $2.5\text{m}^3$  of chicken litter is similar to a  $70\text{kg}/\text{ha}$  application of CK 66.



*Disc spreader*



## Chicken litter use for pastures

Chicken litter is an ideal fertiliser replacement for high production pastures and is particularly suited to higher rainfall or irrigated pasture regions. Chicken litter is valued as a multi-analysis fertiliser, providing slow release nitrogen, phosphorus and potassium, and has been found to maintain soil nutrient levels as well as conventional fertilisers<sup>3</sup>.

### Summary

- Litter is suitable as a regular fertiliser replacement for pasture systems or as a 'capital input' to boost soil fertility and productivity. Litter can provide similar improvements in soil fertility and pasture yield to conventional fertilisers when applied at the same rate of nutrients.
- For high yielding dairy pastures, a 4-8m<sup>3</sup>/ha spreading rate can replace 1-3 applications of urea, and provide P and K for one year.
- Capital applications will depend on soil conditions and production goals. As an indication, 10m<sup>3</sup>/ha will provide about the same amount of P as 400kg/ha single super, with an added production boost from N and K.

Chicken litter can be used as an annual or bi-annual top dressing fertiliser replacement. Recommended rates range from 2m<sup>3</sup>/ha to 6m<sup>3</sup>/ha. Depending on soil type and fertility requirements, this range of application rates are expected to adequately meet the annual requirement for phosphorus, potassium, sulphur and micronutrients for high performance pastures, and can replace around 1-3 applications of urea for dairy pastures.

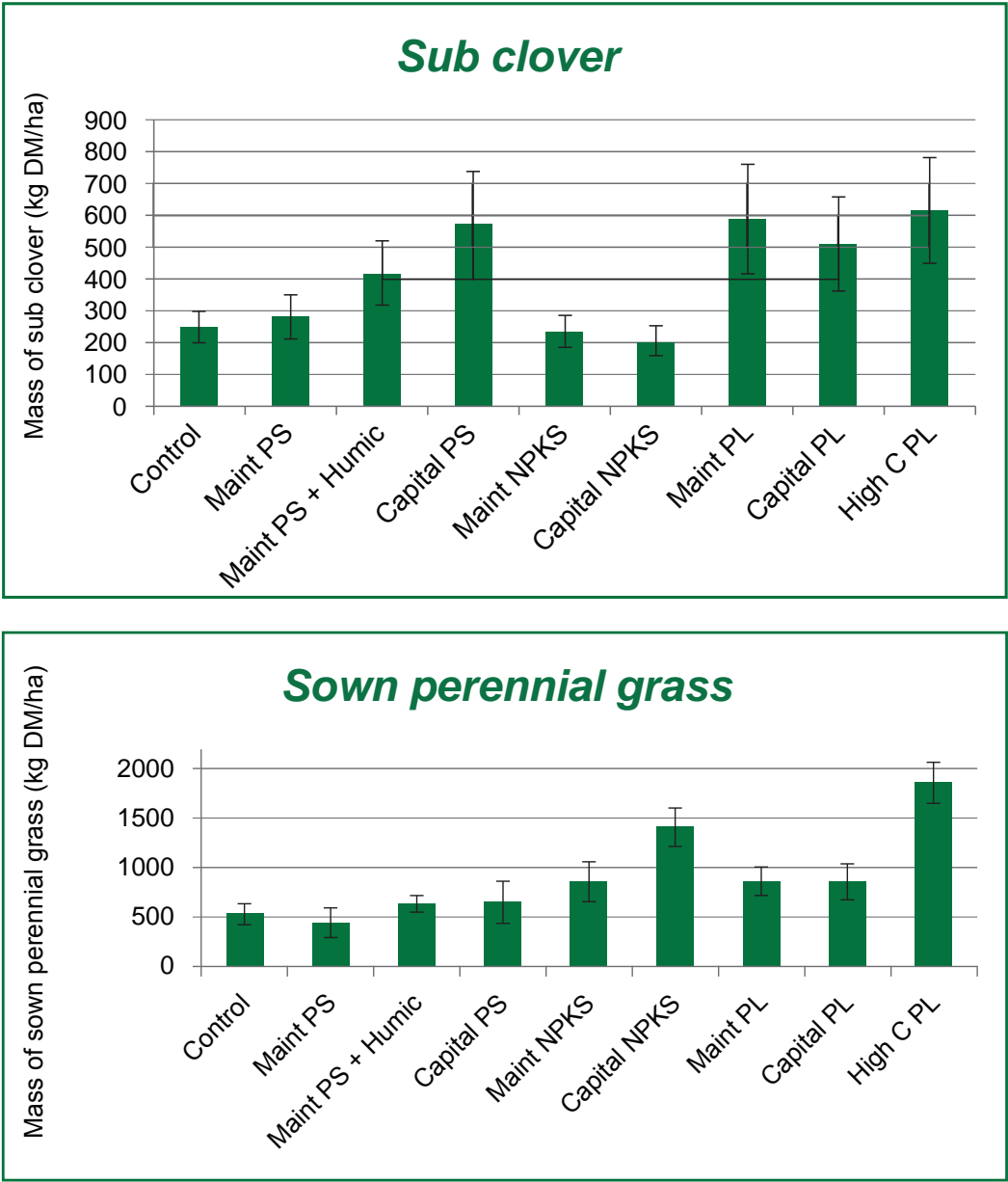
Litter can also be used successfully as a capital input to improve soil nutrient and organic matter levels for pasture<sup>3</sup> or cropping. This is relevant in areas that have been run down over long periods of time, or naturally nutrient deficient pasture land. One advantage of litter is that it can often be applied for a similar cost as single superphosphate, but also contains potassium, nitrogen, micro-nutrients and carbon, which build soil health and fertility rapidly and boost short term pasture yield from the additional nitrogen. Research in southern Australia showed higher pasture yield and higher pasture quality after litter applications compared with a control<sup>3</sup> (Figure 2). This research also showed higher levels of soil organic carbon after three years of high rate litter applications.



*Dairy cattle*



It should be noted that, when using chicken litter on a grazing farm, care must be taken to **ensure livestock do not have access to litter**. This is because ruminant animals may voluntarily consume litter, leading to health risks such as botulism. To minimise risks, **all litter must be stored in fenced off areas, and a period of at least three weeks should also be maintained between application of litter and grazing**.



**Figure 2. Species composition.**

*In response to control, three rates of super phosphate (PS), two rates of NPKS fertiliser or three rates of chicken litter (maintenance P application, capital P application, high carbon application)<sup>3</sup>.*



*Clover pasture*



## Chicken litter use for forage and hay crops

Chicken litter is ideal for forage and hay cropping for boosting soil fertility and replacing macro and micronutrients.

Hay and forage are nutrient intensive crops, particularly in high yielding irrigation regions. Chicken litter is an ideal fertiliser because it supplies large quantities of phosphorus, potassium, sulphur and micronutrients, in addition to nitrogen. Litter can be applied annually to forage crops or more frequently to perennial crops such as lucerne. Irrigated forages yielding 20t/DM/ha may annually remove 350kg of N, 50kg of P and 230kg of K. For these crops the best option is to apply litter as a P fertiliser 1-2 months prior to crop establishment at around 14-18 m<sup>3</sup>/ha, and 'top up' with nitrogen and potassium fertiliser as required. On low fertility soils starter fertiliser may still be required at lower rates to maintain early crop growth.



*Irrigated cereal hay crop*



*Cereal hay crop ready to bale*

Ideally, litter should be incorporated with ploughing or irrigation immediately after spreading, to maximise nitrogen capture. For perennial hay crops, litter is best applied soon after cutting. Indicative nutrient replacement rates per tonne for hay crops are provided in Table 5. Chicken litter is also ideal for re-building soil fertility on run-down hay production country, where higher rates can be used to build fertility at lower cost than using synthetic fertilisers.

Where high rates of litter are used on irrigated crops or pastures, care should be taken to avoid excessive nutrient losses. The best way to avoid this is to balance nutrient additions with crop requirements<sup>4</sup>. It is also beneficial to minimise runoff and deep leaching. Providing vegetated buffers between cropping areas and nearby waterways will reduce nutrient loss into waterways<sup>4</sup>. Litter use is best avoided altogether on steep slopes, where runoff will be greater, and close to waterways.

**Table 5. Indicative nutrient removal rates from hay production.**

	<i>Lucerne (per t DM)</i>	<i>Forage sorghum (per t DM)</i>	<i>Cereal hay (per t DM)</i>
Nitrogen removal	31 <sup>a</sup> kg	17 <sup>a</sup> kg	21 <sup>a</sup> kg
Phosphorus removal	3 kg	3 kg	3 kg
Potassium removal	16 kg	12 kg	23 kg
Chicken litter to replace P	1 m <sup>3</sup> (replaces approx. 50% K)	1 m <sup>3</sup> (replaces approx. 50% K, 30% <sup>b</sup> N)	1 m <sup>3</sup> (replaces approx. 25% <sup>b</sup> N & K)

<sup>a</sup>N removal can vary widely with plant protein content and is largely met by N fixation in legumes.

<sup>b</sup>N application with litter will vary – assumes 50% available in first year.

# Chicken litter use for horticulture and turf production

Chicken litter can be a very useful fertiliser for horticultural industries because of the combination of nutrients and organic matter. The horticultural industries are the largest annual consumer of litter in the country<sup>1</sup>.

Litter can be readily applied to tree crops and turf, and, with some precautions, can be applied to most horticultural crops as well.

For tree crops and turf, litter can be surface applied and irrigated to incorporate. On turf farms, litter is often applied twice annually at moderate to high rates (sometimes > 10m<sup>3</sup>/ha). Because of the high removal rates of plant matter and soil with turf, litter is an ideal fertiliser and soil additive.



*Horticulture crop*

For vegetable crops, litter must be applied with caution to avoid risk of contamination with pathogens. While the risks are not high<sup>5</sup>, pathogen risks must still be carefully managed. The main options are to incorporate litter into the soil and provide a period of time for biological breakdown in the soil prior to planting<sup>6</sup>, or to compost litter prior to application<sup>6</sup>. When done correctly, composting will kill pathogens effectively, making the resulting material safe for most horticultural applications<sup>6</sup>.

Despite the need for careful management, litter is a popular fertiliser replacement and soil amendment for a range of horticultural crops. One of the benefits of litter is the carbon content which can help to maintain soil structure in heavily cultivated soils.

Care should also be taken when applying chicken litter to avoid dust contamination and odour complaints, particularly in closely settled areas. Recommendations are provided at the end of the guide for reducing amenity issues, such as dust and odour.



*Turf*



*Olive tree crop*





# Chicken litter use for broadacre cropping

Chicken litter is a valuable fertiliser replacement for broadacre cropping, particularly in regions where chicken sheds are located near cropland.

## Summary

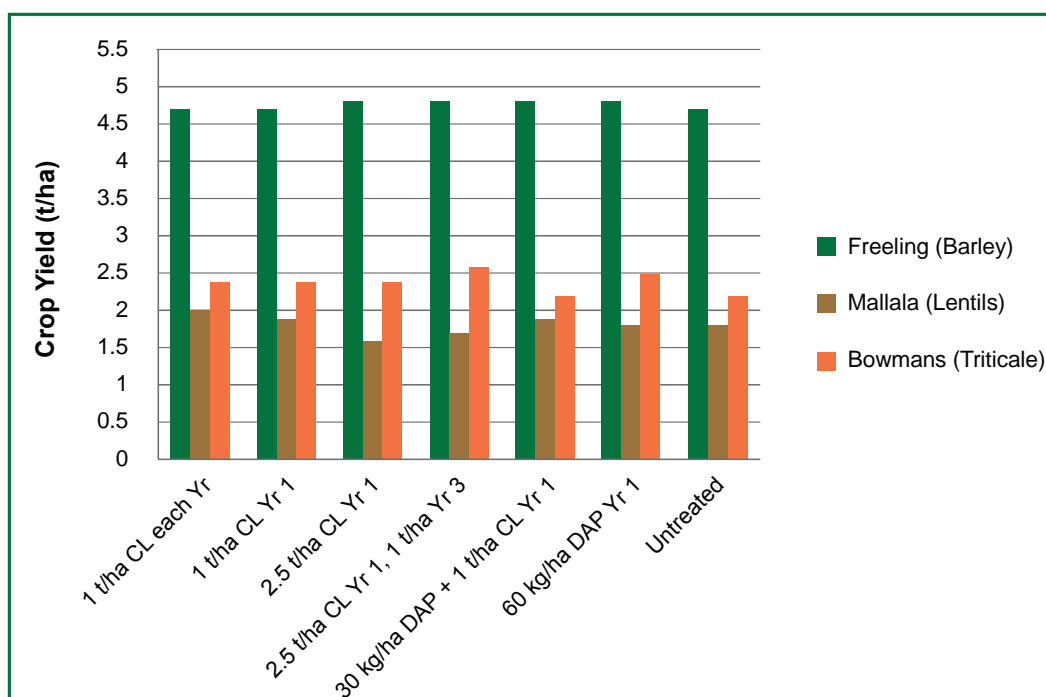
- Chicken litter is a useful fertiliser for cropping systems, and is best used as a P fertiliser replacement.
- Where yields are high and stubble is baled, the potassium in chicken litter is also valuable.
- Some N is likely to be supplied in the first year of application.

Chicken litter can be applied annually or in a rotation (up to three years) to supply cropping nutrients. Two to three year rotations can be used to maximise nitrogen return from litter in the first year, and to minimise application expenses. Provided soil fertility is reasonable, applying litter in a rotation will maintain soil P levels and may provide N over two seasons. It is ideal to apply litter when cultivation is required for other reasons (i.e. weed control). One approach is to apply litter 1-3 months prior to planting, then soil test immediately prior to planting, before making sowing fertiliser decisions.



Annual chicken litter application trials in South Australia have shown crop yields can be maintained by replacing DAP with chicken litter at 1-2.5t/ha (2.5–5m<sup>3</sup>/ha). These trials, done over three consecutive seasons, showed that chicken litter could be successfully used to maintain yields either through annual applications or applications every second or third year.

**Figure 3. Lentil, Triticale and barley yields at three South Australian sites in 2009.**



Comparing standard fertiliser rates (60kg DAP/ha) with chicken litter at 1t/ha or 2.5t/ha<sup>2</sup>.



## Safe and sustainable use

### Odour and dust

Odour and dust complaints are sometimes raised as a problem with using chicken litter, particularly in closely settled horticulture or dairying regions. Spreading chicken litter will create odour for a short period of time after spreading. Likewise, spreading will generate dust, particularly if the litter is very dry. Minimising odour and dust is important for maintaining good relations with neighbours. Adverse effects can be minimised by applying litter on weekdays, taking prevailing winds into account when planning applications, incorporating litter rapidly or irrigating after application, and informing neighbours when spreading is likely to occur and that odour is likely to last a few days.



*Dust caused by litter spreading*

### Salinity and sodicity

Chicken litter contains low levels of chloride and sodium, and at recommended application rates there is no risk of salinity from using it. For example, the amount of sodium added with a high rate of chicken litter (10m<sup>3</sup>/ha) is 12kg/ha, which will not influence salinity levels. In some instances, chicken litter has actually been used to revegetate saline scalds by providing a good nutrient source and by improving soil structure with the added organic matter.

### Weed seeds

Weed seeds are a minor risk with chicken litter. Recent trials in South Australia<sup>2</sup> failed to identify any viable weed seeds in the litter samples tested, though weed seed contamination from birds has been noted on some occasions. The risk of weed seeds passing through their digestive tract is much lower than with other animal manures (i.e. feedlot manure). However, there may be a risk of weed seed contamination where straw bedding is used. Weed seed tests can be performed on litter prior to use if this is a concern.



*Chicks using straw bales made available for perching*



## Heavy metals

Heavy metals are sometimes identified as a potential risk when using chicken litter. However, this risk is very low provided application rates are managed to meet crop or pasture nutrient requirements. A recent survey of 123 litter samples in Australia found heavy metal contamination to be well below thresholds for concern (see Table 6). The highest levels of heavy metals present in chicken litter are from zinc and copper. These elements are essential for plant production and are deficient in some Australian soils (as noted in the section on micronutrients). Considering this, the slightly elevated levels are more of a benefit than a concern when chicken litter is used as a sustainable fertiliser resource.

**Table 6. Heavy metal levels.**

<b>Contaminant</b>	<b>Units</b>	<b>Chicken Litter*</b>	<b>NRMMC limit**</b>
Arsenic	mg/kg	4.3	60
Cadmium	mg/kg	0.05	20
Chromium	mg/kg	2.6	500-3,000
Copper	mg/kg	161	2500
Lead	mg/kg	0.8	420
Nickel	mg/kg	5.8	270
Zinc	mg/kg	404	2500

*\*These are very low in chicken litter and do not represent a concern provided application rates are based on crop and soil nutrient requirements*

*\*\*Limits for contaminants in compost, soil conditioners and mulches for land application<sup>9</sup>.*

## Food safety pathogens

Pathogen risks from applying chicken litter to most crops are low<sup>2</sup>. While a range of pathogens have been found in fresh litter<sup>7</sup>, stockpiling has been found to achieve effective pathogen destruction<sup>8</sup>. For most crops and pastures, simple precautions will reduce any health or food safety risk associated with chicken litter application<sup>8</sup>.

Chicken litter should be managed to minimise risks to personnel handling the material during spreading. The main risk is via ingestion of material contaminated by litter. Risks can be minimised by ensuring high standards of personal hygiene when handling litter and avoiding very dusty conditions.

There is also a risk that food produced on farm and sent for human consumption may be contaminated by pathogens from litter. While these risks are very low<sup>2</sup>, a number of precautions are recommended. These mainly aim to reduce the level of pathogens and to limit its contact with produce.

Reducing the level of pathogens can be achieved by exposing litter to UV light, dry conditions and heat. Stockpiling litter for even a short period of time (4-6 days) has been found to greatly reduce pathogen levels<sup>8</sup>.

The other method to reduce pathogen risks is to avoid direct contact between fresh produce and litter. For cereal crops, applying litter prior to planting will minimise pathogen risks<sup>2</sup>. Maintaining withholding periods of at least 60 days between application and sale of any product from a field where litter has been applied is also recommended. For fresh horticultural produce, further precautions should be taken in accordance with health standards. In some situations, composting of litter may be required to lower pathogen levels.

## Avoiding nutrient losses to the environment

For chicken litter use to be sustainable in the long term, environmental risks need to be minimised. Valuable nutrients for crop and pasture production such as nitrogen and phosphorus may cause environmental harm when they are lost into surface or ground water sources. Losing nutrients also represents a loss of fertiliser value and therefore should be avoided for economic reasons.

The first step to avoid nutrient losses is to target application rates to meet crop or pasture requirements<sup>4</sup> while taking soil nutrient levels into account. This will reduce the amount of excess nutrients in the system.

When using chicken litter regularly, it is beneficial to take annual or bi-annual soil tests to check for increases in soil nutrient levels. This will help in making decisions about application rates. Some other practices that will also reduce the risk of nutrient losses include:

- Avoiding application of litter close to open waterways and keeping a grassed buffer between cropping areas and water ways<sup>4</sup>.
- Avoiding application on steep slopes where the material may be carried with runoff, particularly when these areas are near open waterways.
- Avoiding over-application on permeable soils, particularly in groundwater recharge areas.

These practices will minimise risks to the environment and will help to maintain the long term sustainability of litter use.



*Steep hill near water, unsuitable for litter use*





## Summary

Chicken litter is a valuable fertiliser replacement for crops and pastures, providing essential macro nutrients for plant production, together with valuable micro nutrients and organic matter. Australian research has provided a good benchmark of the characteristics of litter, and of the agronomic value for crops and pastures. Experimental data show chicken litter to be effective in maintaining soil nutrient levels under pasture, and for use as a replacement starter fertiliser for cropping.

The value of chicken litter as a fertiliser is maximised when soils are nutrient depleted and the crops grown require high fertility. For this reason, horticulture and hay producers benefit greatly from using litter, as do land managers where soil health has been depleted after many years of farming.

Chicken litter is safe and sustainable when applied at rates suitable for crop and pasture requirements.

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*Wiedemann, SG, Bielefeld, EN, McGahan, EJ, Valentine, JG and Murphy, CM 2012, Grower Options for Spent Litter Utilisation – User Guide Development Final Report, RIRDC Project No PRJ-006440.*



# Land Application of Chicken Litter: A Guide for Users

by S.G. Wiedemann of FSA Consulting  
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**RURAL INDUSTRIES**  
Research & Development Corporation

Phone: 02 6271 4100

Fax: 02 6271 4199

Bookshop: 1300 634 313

Email: [rirdc@rirdc.gov.au](mailto:rirdc@rirdc.gov.au)

Postal Address: PO Box 4776  
Kingston ACT 2604

Street Address: Level 2, 15 National Circuit,  
Barton ACT 2600

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