Profitable use of Feedlot Manure

Feedlot manure can provide nutrients for half the cost of mineral fertilisers. At the same time it adds organic matter.

Organic nitrogen supply can help boost yields in a good year because more N is released.

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Nutrients for less price than fertiliser, with added carbon

Feedlot manure is becoming an important fertiliser in northern cropping areas, but needs to be managed carefully to obtain satisfactory crop yields and achieve good value.

With around 450,000 cattle on feed in Queensland, this means there is close to 500,000 tonnes of manure to be utilised as fertiliser each year.

In addition there is around 100,000 tonnes of pig and poultry manure and other recycled organics.

The value of N and P in feedlot manure is around $33/tonne for fresh manure and $38/tonne for aged and composted manure. When the value of K is considered, the manure has a value of $53/tonne for fresh manure and $60/tonne for aged manure. Sulfur and Zinc can add an extra $2/tonne in nutrient value.

Where K is needed, along with N and P, feedlot manure can provide nutrients at less than half the cost of mineral fertilisers (See table).

Poultry manure (from layer hens) has a higher nutrient content than feedlot manure, with a current value of $60-$74 per tonne for NP and NPK. There is less of a bonus from organic matter in poultry manure.

Manure from broiler production is quite variable depending upon the straw or sawdust content of the manure. Much more organic matter may be present in such manures, but nutrient content can be quite low and needs to be evaluated for each case.

Some composted products are now available and more pig manure is being processed in this form. Nutrient content varies and each product needs to be evaluated according to content tests.

Generally, composting adds to the cost of manure without providing significant benefits. It is wasteful with major losses in nitrogen and organic carbon (around 50%) during the composting process.

Advantages of using manures:

1. Lower cost nutrient replacement
2. Added organic matter
3. Slow release N may help produce good crop yields in good seasons
4. Minimal loss of nutrients from leaching and denitrification
5. Lower energy input than artificial N

Problems with manure use

1. Up-front cost is high cf fertiliser.
2. Uncertain rates of N release
3. Uneven distribution from spreader
4. Weed seeds
5. Compaction from spreading

Nutrient content and value of Feedlot & Poultry Manure

	Fresh Manure[1]		Manure aged [1]		Compost Manure[2]		Manure[3] layer hens	
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Water content	34%		26%		30%		35%	
Nitrogen (kg/t)	24	16	22	16	24	16	33	21
Phosphorus (P) (kg/t)	7.5	5	9.5	7	10	7	20	13
Potassium (K) (kg/t)	26	17	25	18	25	17	17	11
Value of N+P/t. (wet)	$33		$38		$37		$61	
Value of NPK/t. (wet)	$53		$60		$57		$74	
Cost at source	$4		$10		$35		$25	
Cost with freight of $10 & spreading $5/t.	$19		$25		$50		$40	

Sources: 1: Powell, 1994. Economic Management of Feedlot Manure, Final Report, (average of 93 samples, 17 stockpiled for more than 12 months)
2: Compost data - Environoganics 3: Average from several poultry farms

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How to use feedlot manure - how much, how often?

Aged manure has a higher concentration of phosphate (P) than fresh manure.

The main reason for aging is so it can be screened to remove rocks and lumps for good distribution.

A relatively simple way to use manure is to apply it as a phosphorus fertiliser and provide additional nitrogen according to crop demand or removal.

One tonne of aged manure contains around 7kg of P, which is enough to replace the P removed in 2 t/ha of grain. An application of 8 tonnes of manure per hectare will supply 56 Kg of P/ha, enough for 16 tonnes of grain per hectare which may be 4 or 5 crops.

Manure screening

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Manure can be easily managed by using aged manure to supply crop P requirements. K is in slight excess at these rates, while some additional N needs to be supplied, unless legume crops are grown.

By example, sorghum yielding 5t/ha would have a removal rate of 16 kg of P per year and aged manure applied at 10 t/ha (70 kg P) would last four years to match this P removal rate. With irrigated cotton yielding 9 b/ha the annual use is 23kg P/year, and 10 tonnes of manure would provide enough P for 3 years.

Potassium: K

There is more than enough K when manure is used to supply P. Sorghum yielding 5 t/ha, has K removal around 22 kg/ha/yr, which means 170 kg of K in 10 t/ha of manure would last 7 years. Because the P would only last 4 years, there is a surplus of K.

Cotton has a high K requirement, with some 54 kg/ha removed in 9 bales/ha. A supply of 170 kg K/ha of K, will supply K for 3 years - the same as for P.

Managing Nitrogen

Most of the nitrogen in feedlot manure is in an organic form and the release is of N is variable, depending upon the soil type and the season.

Somewhere between 30 and 50% of the N in manure may become available in the first year, provided that:

1. The manure is incorporated into the top 10 cm of soil,
2. Application is made several months before the first crop is planted.
3. There is a reasonable rainfall during this time and during crop growth.

Very little N would become available to the first crop from manure where:

1. Manure is applied to the surface just before planting a crop, or
2. There is no rain between application and planting a crop.
3. If the planter has a disc opener and manure is not mixed in by the planter.

Depending upon conditions in the first year, around 30% of the N is likely to become available in the second year, and 15 % in the third year, requiring an appropriate top-up of N to grow good crops in the second and third years.

More N will be released in summer than in winter. For a first year sorghum crop, around 50% of N release is expected in a good season, which means a supply of 80 kg N/ha from an application of 10t/ha of manure. Around 50 kg N might be expected to be available from the manure in a second summer of sorghum and more supplementary N would be needed.

This second year supply will depend upon what happened in the first crop. If there was considerable release of N in the first year then less than 30% would be expected to be released in the second year. If it was dry with little uptake, then the second year release of N could move up towards 50%.

Yield and removal of nutrients in some crops

	Wheat	Grain sorghum	Cotton dryland	Corn silage (Irrigated)	Cotton Irrigated
Yield: t/ha, bales/ha	3	5	3.75	15	10
Protein content	12%	10%		10%	
Nitrogen : kg/t	20	16	11.6	16	11.6
Removal of N: kg/ha	60	80	44	240	116
Phosphorus kg/t or b.	3.4	3.2	2.5	2.5	2.6
Removal of P kg/ha	10	16	9	38	26
Potassium kg/t. or b.	4.5	4.5	4.2	7	6
Removal of K (kg/ha)	14	22	15	100	60

Application and spreading of manure

Good application is needed for good results if manure is to replace mineral fertilisers. Fresh manure is lumpy because the yard scrapers tear up manure compacted by many hooves. Spreaders will feed lumpy manure out in bursts and it will not spread evenly across the swath.

This is why manure should be aged and screened for good distribution, particularly if low application rates - of less than 6t/ha are being used.

Evenness of distribution depends upon the product, the spreader and the width of application. Generally an overlap of around 30% is needed to produce even spreading. Spread is prone to being affected by wind and calm conditions are preferrable.

One way to check on the distribution of manure behind a spreader, is using pizza boxes or other containers spread out over the width of the spreader runs. This can highlight the variability in spread of the manure, which usually consists of both lumps and powder.

If manure is to be used as a phosphate fertiliser, it needs to be evenly distributed and it is worth paying extra for screened manure. Screened manure is not only more evenly spread, it can be spread with swath widths up to 9 metres which can be used on tramlines and/or greatly reduces compaction.

Some spreaders used for unscreened manure put out large quantities in a 2-3 metre swath width which is unsuitable for fertiliser management and causes a lot of compaction.

Incorporation of manure

Incorporation of the manure by cultivation will mix the manure into the soil, and encourage faster breakdown. It will also better distribute the nutrients for uptake by crop roots, rather than them being on the surface of the soil which is dry for much of the year.

The availability of immobile nutrients: P and K is particularly reduced if they remain stranded on the surface.

However, manure applied to cracking clay soils may not need incorporation, particularly if the soil is cracked open. This is because some manure will fall down cracks and some washed down when it rains. If the soil has a reasonable P level, the manure will keep it topped up as it is mixed naturally.

Incorporation on the same day as application will reduce the loss of the ammonium N in the manure, but with aged manure there is only 1-2 kg of ammonium N in a tonne of manure and it is not serious if this is lost through volatilisation.

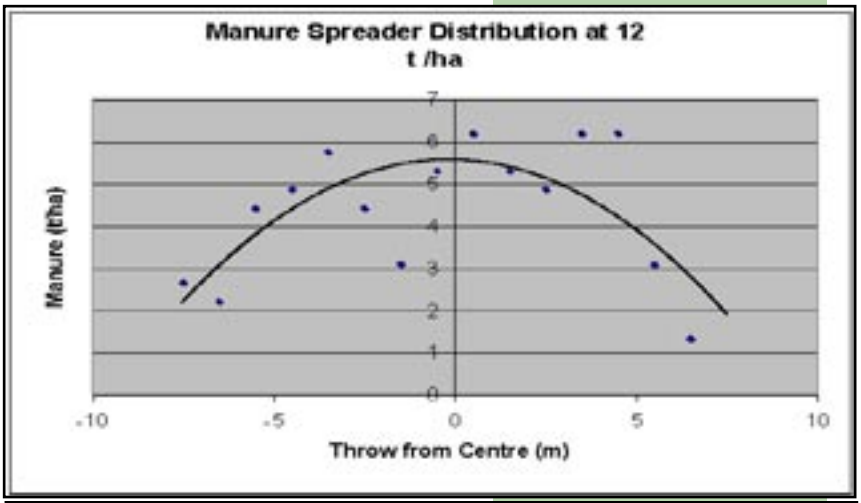
Cultivation is a drawback with zero-tillage programs, but mixing soil to stop nutrients building up on the surface may be desirable every 5 to 10 years. On some cracking clay soils, mixing may not be needed, but gilgais start to develop with zero tillage, and these may benefit from levelling. If the cultivation is timed with pupae busting after cotton, a chickpea fallow, or when there is a low stubble level then it is not such a big disadvantage.

Even spreading is important for manure to be used as a fertiliser. Manure should be aged for 6-12 months to allow screening and spreading using spinner spreaders.

Spreaders should be tested to determine the appropriate swath width.

With some 'powder' and some 'nutty lumps' spinners can distribute manure up to 8-9 metres.

Powdery manure or compost will not spread as far.



Testing of manure distribution is important. In this calibration using aged manure, there was a concentration of 'powder' 2 metres either side of the spinners. Note the drop off in spread on the left side of the spread due to wind blowing from left to right. 'Nutty lumps' spread out to 6 metres either side. A 9 metre spread would provide 60% overlap for good distribution. The spread would be better with less wind.

Some pros and cons of using manure

Feedlot manure can increase the yield potential of sorghum

Extra nitrogen will be mineralised in summer seasons with high rainfall, boosting yield.

Very few weed seeds survive the feedlot grain processing and manure pad. Marshmallow and Blackberry nightshade are tough seeds which have been reported as occasional problems.

1. Boosting sorghum yields

Improvement in sorghum yield requires making the most of good years (3 in 10) when rain allows the yield potential to reach 8-10t/ha. It is not possible to put on enough N fertiliser for these years (8 t/ha requires 200 kg N/ha in total), but if feedlot manure is used on a regular basis there will be an improved reserve of 'organic N' from which more will be released in good years to help sorghum reach higher yields.

2. Organic matter bonus

Application of between 6 and 10 tonnes of manure provides an addition of carbon to the soil equivalent to an 'extra' high yielding sorghum crop. It is an extra bonus which can help to maintain or improve organic matter. This is important where dryland cotton is grown on long fallows, and the carbon input is not sufficient to maintain soil organic matter levels

3. Potassium (K) bonus

K is not generally deficient on clay soils in the northern grain belt, however continued removal at close to 4 kg K/tonne of grain has depleted soil reserves by 600-900 kg/ha over the past 50 to 80 years of cropping. It is starting to run low and sensitive crops like cotton are showing some responses. Manure will maintain K.

4. Sulfur and zinc

Manure contains around 5 kg of S and 180 gms of zinc per tonne - enough to maintain soil levels of these nutrients if manure is used as a P fertiliser.

5. Greenhouse gases

Manures not only add nutrients more cheaply than mineral fertilisers, they do not require the same energy for production and distribution.

With a reduced chance of N_20 release from denitrification, there is an overall reduction in greenhouse gas emissions.

5. Weed seeds

Most weed seeds do not survive the feed processing, the animal gut or the feedlot manure pad. Only a few instances of weed seeds in manure have been encountered, and these are often from weeds growing around yards or on manure stockpiles.

Studies on weed seed survival have shown that some weed seeds can even survive composting, but overall weed seeds are not a major issue.

6. Health and ammenity concerns

There have been no health concerns with the use of animal manures which have been 'manually' spread on farms for hundreds of years. Aged feedlot manure does not cause significant odour issues when spread.

7. Nitrogen immobilisation, compost

Some suggestions have been made that manure will tie up N in the soil, with less N being available to crops. The carbon to nitrogen ratio of manure is below the level for organic materials to immobilise N in the soil (C:N of 20:1)

Compost manure has been promoted as 'biologically stable', but this can be a disadvantage because N is released slowly from the 'stable' organic matter.

Composting manure wastes around half the carbon and the N content and produces more greenhouse emissions. It should only be used in special situtations where other products, such as wet pig manure, cotton trash or sewage sludge need to be 'sanitised'.

8. Salt and nutrient buildup

Some increase in P and salt levels have occurred when manure has been used annually at high rates on farming land owned by feedlots. The salt content of manure is not high enough to increase soil salt levels when used at rates of manure application which balance P application with removal.