



Dairy Goat Co-operative

A guide to managing barn manure on dairy goat farms



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Barn manure – storage and use

Barn manure is the solids that accumulates in housed does on indoor farms, and in kid rearing sheds on both indoor and outdoor farms. Most goat farmers use wood chips or shavings as bedding material, although other materials such as straw are also used. As dung and urine build up over time, more bedding material is added to keep the goats in clean, dry conditions.

On average indoor sheds are cleaned out twice per year, but some farmers clean out only once. Often a partial cleanout will be done to remove manure from the dirtiest parts of a shed. Kid sheds are usually cleaned out once per year.

Minimising the amount of shed manure produced may not be possible, but the amount of bedding material required can be reduced by keeping the inside of the sheds dry. The following help to keep moisture out of the sheds:

- Fix any leaky troughs
- Keep the rain out of the shed
- Wilt wet forage before feeding or add dry feed to the rations

Amount of barn manure produced

The amount of barn manure that an indoor farm produces is large. Measurements of barn and kid barn manure indicate that on average:

- An indoor milking doe produces over a tonne of wet barn manure per year.
- A kid raised fully indoors produces about 300 kg barn manure per year.
- A kid raised mostly indoors for two months produces about 35 kg.

So an indoor farm with 500 milking does and 125 kids would accumulate about 537 tonnes of wet barn manure per year (625 m³). An outdoor farm raising 100 kids in sheds for 2 months would accumulate about 3.5 tonnes of kid barn manure (5.2 m³).

Nutrient content of barn manure

Barn manure is a source of the major plant nutrients and trace minerals needed for pasture or crop production. There are good levels of nitrogen (N), phosphorus (P), potassium (K) and sulphur (S), the elements most commonly applied in fertilisers. The organic matter in barn manure is also important for improving soil structure and soil biology. This improves soil water holding capacity, aeration and drainage, and makes soil less prone to compaction and erosion.

The composition of barn manure is variable. This variation is due to differences in the actual nutrient content of the faeces and urine (varies with diet, age and season) and barn management such as frequency of cleaning out and the amount of bedding material used. The nutrient composition of barn manure also changes during storage. The table below shows how the nutrient content is lost during storage over time.

Table 1: Typical nutrient content of dairy goat barn manure over various lengths of storage

Storage time (months)	%DM	Concentration of nutrients kg/tonne wet			
		N	P	K	S
0	34	11.8	2.5	9.1	5.8
1 to 6	33	8.2	2.7	8.8	1.5
6 to 12	37	5.0	2.2	8.2	6.6
>12	30	5.4	2.4	4.0	2.8
Fresh Kid	36	5.0	2.0	11.1	1.1

Nutrient loss during storage

Table 1 (above) indicates that barn manure loses nutrient value during storage. This reduces its value as fertiliser and poses environmental risks.

Nitrogen losses are due to ammonia loss to air, and to nitrate leaching into ground water. Ammonia loss is faster when the manure is disturbed or during warm dry weather. Leaching will occur when rainfall washes the soluble N down through the manure heap into the ground. If the ground surface is impervious then the leachate will run off the ground surface. N leached from barn manure is a serious environmental hazard, either by leaching into and contaminating groundwater or running off with surface water into waterways.

Phosphorus loss from barn manure in storage is relatively small. This is because most of the P is chemically bound within the organic matter and is not readily leached out.

Potassium and sulphur are both soluble elements and are easily leached from the barn manure when there is excess moisture.

Actual nutrient loss is likely to be greater than indicated by just the loss in nutrient concentration. As well there will be losses in the tonnage of manure in the heap due to the breakdown of organic matter over time. These losses are likely to be about 10-20% of mass during 1 to 6 months storage.

Composting barn manure

Composting barn manure is a process that uses aerobic organisms to break down the raw materials to create a product that has a finer, more uniform texture and stable forms of nutrients. The biological activity produces a lot of heat, which helps to speed up the process.

Heaped storage of barn manure is not composting. For real composting to take place the material must be well aerated. For a heap of barn manure this would involve mechanical mixing and turning. An unturned heap of manure is anaerobic, and biological activity inside is slow. Less heat is likely to be produced, so it is not so good for killing weed seeds or pathogens. Ideally for composting the raw material should have a carbon to nitrogen ratio of about 25-30:1. The carbon to nitrogen ratio of barn manure is usually 10-20:1, meaning that more carbon should be added for ideal composting.

Advantages of composting barn manure include:

- Heating in the compost heap will destroy weed seeds and may reduce the levels of pathogens and internal parasites
- Increased palatability of feed when spread on pasture compared to barn manure
- There is less bulk to cart and spreading characteristics are better
- N is in stable organic forms that are released slowly – there is less ammonia loss and less possibility of nitrate leaching after spreading on the paddock
- It is claimed that nutrients are more plant available but this has not been proven in research

Disadvantages of composting barn manure include:

- Loss in nutrient content, especially N
- Remaining N is in organic form that is not immediately plant available
- There is less carbon to return to paddocks to improve soil structure
- Investment in facility and equipment is required
- Time to manage composting operation
- Environmental risks of leaching and run off to waterways if not done properly
- Resource consent required for even a small sized operation (EW more than 20 m³ per year)
- Must be on sealed pad and covered

Fertiliser value of barn manure

The nutrients in barn manure can be used as a direct replacement for bought in solid fertiliser. Table 2 below shows the dollar value of the barn manure from 500 does housed indoors where the manure is spread fresh, and when the manure has been stored in a heap outside for 6 months. The value of kid barn manure from 125 kids raised indoors for a year is shown in Table 3.

Table 2

Nutrient	Cost of nutrient as fertiliser \$/kg	Barn manure value for 500 does housed indoors - fresh		Barn manure value for 500 does housed indoors -6 months storage	
		Barn manure value \$/tonne wet	Value of fresh barn manure - 500 tonnes	Barn manure value \$/tonne wet	Value of fresh barn manure - 425 tonnes (15% loss in weight)
N	\$1.51	\$18	\$8910	\$8	\$3225
P	\$3.34	\$8	\$4215	\$7	\$3106
K	\$2.05	\$19	\$9370	\$17	\$7111
S	\$0.89	\$5	\$2561	\$6	\$2511
Mg	\$1.70	\$3	\$1679	\$4	\$1561
Total dollar value		\$54	\$26911	\$42	\$17691

Table 3

Nutrient	Cost of nutrient as fertiliser \$/kg	Barn manure value \$/tonne wet	Value of fresh barn manure - 37 tonnes
N	\$1.51	\$7	\$277
P	\$3.34	\$7	\$242
K	\$2.05	\$23	\$839
S	\$0.89	\$1	\$35
Mg	\$1.70	\$2	\$88
Total dollar value		\$40	\$1480

Barn manure storage recommendations

Clearly spreading manure fresh from the barn cuts out storage losses. When it is possible, timing barn cleanout to allow for immediate spreading on paddocks makes best use of the nutrients available. But it is not always practical to spread all barn manure directly from the barns. Timing of cleanout is related to animal welfare and hygiene and may not occur at a time that suits immediate spreading.

Reasons for delaying spreading barn manure include:

- Weather too wet for carting and spreading on paddocks
- Weather too dry for nitrogen to be utilised
- Feed acceptability to goats – when on a short harvest rotation spreading barn manure will cause goats to refuse feed

If barn manure cannot be used straight away it must be stored properly to minimise nutrient losses and to protect the environment. If it is stored in the open, it must be on a sealed surface, and any runoff must not be allowed to enter surface water or leach into groundwater.

A very practical, cheap and easy method of storage is to simply cover the heap the same way that you cover a silage stack. Recycled silage film and half the number of tyres used on a silage stack will do the job.



Covering the manure heap is an effective method of reducing nutrient loss.

Spreading barn manure

The key to getting the most out of barn manure is to spread it at the right rate, in the right place at the right time.

The right rate will depend on the nutrient content of the barn manure, and the nutrient status of the soil. We recommend sampling and laboratory analysis to give you this information. Your fertiliser company technical sales rep should be able to help you with this. Use a nutrient budget, such as OVERSEER™, to help you balance manure and fertiliser applications for efficient use. Again, your fertiliser company technical sales rep can help with this.

In most cases the barn manure application rate will be guided by the amount of nitrogen to be applied. The upper limits of N application are restricted by regulation. Permitted activity rules set the following upper limits for N application per hectare per year: grazed pasture 150 kg, cut and carry pasture 600 kg, maize silage 200 kg. Best use of N is made by applying little and often. Single application rates of fertiliser N at 50-100 kg N per hectare are normally recommended to make efficient use of the N and to minimise the risk of nitrate leaching. However, barn manure has a lot of its N tied up in organic matter, which is not immediately plant available. Only about 10-20% of the total N in fresh barn manure is readily plant available mineral N, the rest is organic N which over time is released slowly to the mineral N pool. Because of this a higher rate of N application in barn manure is acceptable.

Table 4 below calculates the barn manure spread at rates in terms of tonne/ha and m³/ha, and shows the land area required for spreading at different rates for an indoor farm producing 500 tonnes per year of barn manure.

Table 4

N application rate kg N/ha	Manure application rate (tonnes/hectare)		Area spread with 500 tonnes (hectares)	
	Fresh (11.8 kg N/tonne)	Stored Outside 6 months (5.4 kg N/tonne)	Fresh	Stored Outside 6 months
100	8.5	18.5	59	33
200	16.9	37.0	29	16
300	25.4	55.6	19	11
400	33.9	74.1	14	8

When applying barn manure based on N levels it is important to be aware of potassium levels in the manure and in the soil. Excessive K can lead to metabolic imbalances in milking goats. Use soil testing to monitor soil K levels and keep within the target range.

Crops like maize silage have the ability to use large quantities of N and K. Maize paddocks provide an excellent opportunity for spreading barn manure without the problems associated with spreading manure on pasture or other forage crops. The table below shows how well the nutrient content of barn manure matches the requirements of a maize silage crop.

Table 5

Nutrient	N	P	K
Nutrient required for maize silage crop 20 tonne/ha yield	220	40	240
Nutrient available in 17 tonne/ha fresh barn manure	200	42	154



Growing a crop makes good use of the nutrients in barn manure.

For spreading barn manure on pasture the problem of manure contamination of feed can be minimised by spreading at a time when the harvest or grazing rotation is longest, allowing more time for the manure to break down. Another option is to put manure on paddocks that are being shut up for silage, especially if the silage can be fed out to dry goats or other stock that can be forced to clean up the silage.

Efficient use of barn manure nutrients also requires that the manure is uniformly spread in the paddock. Because of the nature of the manure this is not easily done. Some farmers use a tipping trailer and spreading bar, but this is not likely to give a good even spread. You would not buy urea or superphosphate and then tip it onto the paddock in little piles, so why do this with barn manure. When you consider the potential value of the manure, it is worthwhile employing a contractor with the right gear to do a proper job of spreading it.



Even spreading of barn manure makes best use of nutrients.

The main points

- **Barn manure is a valuable resource, so don't waste it**
- **Best spread fresh – minimise storage**
- **If you can't spread it straight away – cover it!**
- **Spread where and when you get the most value from it**
- **Do a proper job of spreading- or hire a contractor to do it**