

carbon:nitrogen ratio

Old-timers often say ‘oh yes, we used to have those kind of loos when I was a child, so isn’t this a bit of a backward step?’ But old-style pit latrines were not compost toilets because they didn’t balance carbon and nitrogen.

Put simply, this means that bacteria and other micro-organisms like to eat a balanced diet (of carbon and nitrogen). Human waste contains too much nitrogen and not enough carbon necessary to maintain the right balance. This means that the micro-organisms have to give off some excess nitrogen, and they do this by combining it with hydrogen from water to produce ammonia (NH₃), which is smelly and very undesirable in a compost loo. This will also mean that there will not be as much nitrogen in the finished compost, which is therefore less useful for plants.

The ratio of carbon:nitrogen in the compost toilet should ideally be around 30:1. This is the ratio at which bacteria / micro-organisms like to ‘eat’ waste.

Below are the ratios of carbon:nitrogen in human waste:

- C:N ratio in faeces 8:1
- C:N ratio in urine 0.8:1

The first thing to notice is that urine should be kept out of the pile because of the enormous amount of nitrogen compared to carbon. So a permanent drain on the chamber, and facilities for people to wee somewhere else are essential.

The next thing to consider when trying to maintain a carbon:nitrogen balance is a soak. A soak is a carbon-rich material that is put down the toilet after each use. Examples include:

- sawdust / wood shavings is an excellent soak as it covers immediate smells too; it also has a large surface area to make carbon available to the micro-organisms. the C:N ratio of sawdust is around 500:1, so it is an excellent source of carbon, and only a small handful need be dropped into the toilet after each use. Small wood shavings are probably better than sawdust, especially very fine sawdust, as this won’t aerate the pile very much. The carbon in sawdust / wood shavings is in the form of lignin, which breaks down much more slowly than the carbon in (for example) straw and paper (which is in the form of cellulose); we haven’t found this to be a problem though.
- straw and hay aerate the pile better than sawdust, but don’t cover immediate smells so well (C:N ratio of straw – 120:1, of hay – 60:1)
- shredded paper works too, but may contain nasty inks and dyes, and doesn’t cover immediate smells

- compost or soil can be used, but are not as effective as the above materials as they don't contain so much carbon
- lime or wood ash have been used too, and they are good at covering immediate smells, but don't have enough available carbon to balance the nitrogen; actually ash isn't a good idea either in compost toilets or on compost heaps as it is inert (and so doesn't compost) and contains salts that can kill useful micro-organisms
- an unusual but extremely good soak is popcorn. It would work out quite expensive too, but if you have any stale popcorn, it will aerate the pile, and allow oxygen in for the micro-organisms to do their work

It's up to you what your use, and it probably depends on what's available. If you live on a farm / smallholding and you chainsaw firewood, or you live near a sawmill, then sawdust is a good idea. If you live on or close to a farm that has a lot of straw, then straw.

In Romania there is a problem with 'dunnies' overhanging rivers and streams, so that human waste causes pollution problems in watercourses; there is also a problem, now that Western companies have moved in to fell their vast forests, with conifer sawdust leaching into watercourses and causing excess acidity. If only they could combine these two problems, not only would they solve them, they would produce a resource in the process.

We've used sawdust and hay, and found sawdust to be the best soak. Sawdust produced a drier, more compost-like end product, because of its larger surface area, and smaller particles, making more carbon available, and decomposing more quickly and completely.

The soak can be kept next to the toilet in a bucket with a lid, and one handful, or a little scoop is enough. Toilet roll, and the cardboard middle are fine too, although it's probably best to use plain, unbleached paper.

The soak is useful in more ways than just adding carbon:

- it stops the pile becoming anaerobic by aerating it and allowing oxygen in
- it cover immediate smells
- it soaks up excess liquid, and helps stop the pile becoming waterlogged

So to maintain the carbon:nitrogen ratio, and to stop the pile turning anaerobic, it is essential:

- not to have too much urine in the pile
- not to allow the pile to get too wet, although micro-organisms need moisture to work, but not too much.
- to allow air (oxygen) into the pile, so that any excess nitrogen will combine with oxygen to produce nitrates rather than ammonia
- to put carbonaceous material into the toilet
- to have a drain on the chamber