

Amending & Improving Gutless Sands in W.A.

This article is to give an unbiased, non-commercial summary of amending sandy soils without favour.

1. Amending soil texture in sands:

Texture is a simple, clinical description of what type of mineral particles a soil is made up of. The best soil is a loam - a mixture of 40% sand, 40% silt and 20% clay, with the optimum clay level being 10-15% of the mineral components (a good soil has 50-60% minerals, the rest is air, water, organic matter and living organisms). Most of Perth's sands have very little if any clay, and are therefore very poor at retaining water, nutrients, and organic matter. So adding clay is the best long-term solution.

You can bring in loams and loam mixtures, but the cheapest way is to incorporate a clay, and any clay will do. Bentonite clays are good and becoming more readily available in retail packages, available in the form of:

- Calcium bentonite is the better type and is available in either a pure form or in an increasing number of mixed products containing other minerals such as Zeolite.
- Sodium bentonite is less favourable, but often more convenient for small areas, such as Clumping/Claying Kitty/Cat Litter ('clumping' or 'claying' the key words as they indicate that it is bentonite). Other litters are attapulgitic or recycled newspaper, though attapulgitic has some benefit in sand. Costs under \$3 for a 4L bag. Kaolin clays such as Soil Solver are also very good.

Clays need to be applied at least 1kg/sqm to be worthwhile, and depending on the type (size) of sand, once you reach 2kg/sqm or more you will find it begins to overcome water repellency and you may not need to use wetting agents again. Maximum rates are as high as 10-15kg/sqm, but I reckon 3-5kg/sqm is practical if you also add Zeolite. It needs to be well mixed into the soil, and the higher the application rate the more important this is to avoid claggy lumps or layers of clay in the soil.

Clays should be mixed in to a minimum of 200mm and ideally up to 300mm, but practically most of us can only effectively dig to 240-260mm (as do most rotary hoes, as little as 180-200mm with small models). You will now have a topsoil that will hold on to water, nutrients and organic matter much better and for much longer, and remember that amending soil texture is a life-long improvement – you'll NEVER have to do it again!

To apply bentonite to existing gardens (where digging destroys plant roots), see the fact-sheet by John Colwill at www.plantsman.com.au/page2/files/Plantsman%20Adding%20clay.pdf.

John also has one on improving soil structure at www.plantsman.com.au/page2/files/Plantsman%20Soil%20Recipe.pdf.

Two other optional minerals for amending soil texture are Spongolite and Zeolite – both are ancient natural minerals with a microscopic honeycomb texture that lock onto water and nutrients, but allow feeder-root hairs to extract these on demand.

Spongolite is hard to obtain. Zeolite is becoming more available (see as for bentonite above), but the cheapest is Zeo-Clor pool filter material available at Bunnings (\$19.86 for a 15kg bag). Most other retail sources may be dearer, so it's reasonable that you may want to restrict its use to vege beds and potting mixes. Apply at least 500gms/sqm (\$0.60/sqm) – the practical range is from 300gms/sqm to 2Kg/sqm. One tonne bulka-bags of Zeolite are available in Perth for \$740.00 + GST (contact nickbell@inet.net.au).

There are some very good pre-mixed proprietary products (such as Sand Remedy and Sand to Soil) that also contain Zeolite and Spongolite, but they may be a bit expensive depending on the application rate, depth of mixing, product size and area to be treated. However, they are convenient for doing smaller areas and save messing around. For soil product website links, see my website.

Table 1. Comparative (minimum) costs of the different products:

(as at 29/05/05 – Note many retailers may charge significantly more)

Table 1	Product Examples:	Cost per Unit:	Cost/Kg
Bentonite (Sodium)	'Truefeed'	\$16/25Kg bag	\$0.62
	Clumping Cat Litter	\$3/4L bag	\$0.69
Bentonite (Calcium)	Watheroo bentonite	\$20/20Kg bag	\$1.00
	Watheroo bentonite	\$550/tonne bulka-bag*	\$0.55
Zeolite	'ZeoClor'	\$18/15Kg bag	\$1.20
	Green Life Soil Co	\$45/20Kg tub	\$2.25
	Bulk from Nick Bell	\$814/tonne bulka-bag*	\$0.81
Bentonite, Spongolite & Zeolite mixes	'Sand Remedy'	\$32/5Kg (Greenlife Soil)	\$6.40
		\$85/20Kg (Greenlife)	\$4.25
	'Sand to Soil'	\$28/15Kg	\$1.87
Other clay products	'Soil Solver'	\$25/10Kg bag (retail)	\$2.50
		Bags (company direct)	\$1.22
		Bulk (company direct)	\$0.80

* NB: You will also have to pay delivery charges for one tonne bulka-bags unless you have access to a vehicle with a sufficient payload rating.

Table 2. Total cost/sqm according to product recommendations:

('Bulk' is for Bentonite, Soil Solver or Zeolite by the tonne.)

Table 2	Rate / square metre:	By the bag:	Bulk:
Minimum to make it start working	2Kg Calcium Bentonite + 300gms Zeolite	\$2.36	\$1.46
Pete's basic mix – cheap but good	4Kg Calcium Bentonite + 600gms Zeolite	\$4.72	\$2.92
Ideal – best benefits	5-8Kg Calc. Bentonite + 2-3Kg Zeolite	\$7.40 to \$11.60	\$5.15-\$6.80
'Sand Remedy' at recommended rates	320gms * see note	\$1.36 - \$2.36	N/A
	1Kg * see note below	\$4.25 - \$7.39	N/A
'Sand Remedy' at better rates	3kg (by a 20Kg tub)	\$12.75	N/A
	5Kg (by a 20Kg tub)	\$21.25	N/A
'Sand to Soil'	4.5Kg	\$8.42	N/A
'Soil Solver' at rates recommended (7.5-10Kg/sqm)	Small retail bags	\$18.75 - \$25.00	N/A
	Direct from company	\$9.15 - \$12.20	\$6.00 - \$8.00

* NB: This is to 100-200mm soil depth, the lower rate/soil depth great for lawns. Clays &/or zeolite really need to be mixed at least 2Kg/sqm, 200-300mm deep.

Soil Texture (amendments) cont'd:

So you can permanently turn gutless sand into a real soil, starting as low as \$2/sqm. Practically, you need to budget \$4-5/sqm, and up to \$9/sqm to do it really well.

When preparing areas larger than 200sqm it pays to get Watheroo Bentonite by the one tonne bulka-bag, and purchase the Zeolite by the bag.

2. Improving soil structure (in all soil types):

Soil structure describes how a soil behaves, ie, how it holds together and how it operates as a living medium for plant growth. What is described below is true of ALL soil types, but even more so on sands (where hopefully you have added mineral amendments such as clay & Zeolite). Soil structure is a complicated and inexact science, but it can be simplified with two words – **organic matter**.

Organic matter is broken down plant or animal material that once again becomes the nutrients plants need. Its benefits are many, such as:

- Greatly improving both the water and nutrient holding ability of the soil.
- Vastly improving soil structure, even buffering soil pH problems.
- Feeding the amazing array of soil organisms that convert and/or convey organic nutrients to plants.

It's widely accepted that soils should have a minimum of 5% organic matter for successful/sustainable gardening and food growing, with 10-15% being ideal. Our sands naturally have levels of as little as 1.5%, so the more we can add the better. However, don't go much above 15% as it can cause unwanted anaerobic conditions.

Organic matter is best sourced as the various 'compost' or 'soil improver' products, either in bulk or by the bag. One 30L bag dug in 300mm deep over a square metre will raise the organic matter content by nearly 10%. Only buy bagged products with the Australian Standards logo (white ticks on a red or black background). These better products generally cost \$5 - \$7 per bag.

Bulk organic-certified compost can be purchased for \$84/cu.metre plus freight (\$24-\$85/cu.metre depending on volume and distance) from Gardeners Direct. This equals 33 x 30L bags! I believe this is the best way to go.

Soil conditioners are also available for as little as \$50/m. Check if they contain loam that you really don't need if you have added the higher rates of clay and/or Zeolite. Also, soil blends such as 'landscape' mixes contain up to 60% sand (may be good to raise soil levels if necessary).

Animal manures can also be used, but sparingly as too much contributes to nutrient leaching into our waterways. I suggest no more than 3-4L/sqm per year of richer manures such as chicken or sheep, up to 7-9L for courser products like stable sweepings.

It's then simply a matter of keeping up the levels of organic matter once or twice a year by adding compost. You may still have to apply some supplementary fertilisers and trace elements to heavy feeding plants (especially food crops), but probably less than half the amount you used to. The best ways to continually top up organic matter is to use organic mulches (50-75mm thick).

3. Keep it all working – the magic of mulch:

a) Bare soil is dead soil. In summer the scorching sun can heat soils up so much that 50-70% of beneficial soil organisms are killed, and remember how much great work they do in keeping plants fed and healthy.

A good layer of mulch is as good to the soil as a SPF30+ sunscreen is to us. A good mulch also buffers diurnal temperature changes which can interrupt root activity and sap-flow.

b) Bare soil is dry soil. Up to 70% of soil moisture is actually lost to surface evaporation (not from draining, etc). Water moves to the surface of the soil through capillary rise only to be lost, especially on hot, windy days. A water-wise mulch can reduce this loss by as much as 70%, so together with soil improvement the amount you need to water can be reduced by up to a staggering 60%.

Q: So what is a good water-wise mulch?

A: One that has coarse, large, irregularly-shaped particles that effectively stop or greatly reduce capillary rise, thus keeping the moisture in the topsoil where you want it. Stones or pebbles are the best, but they don't add any organics to the soil. The next best are your own prunings, street tree prunings or from arborists (and it can be free – go to www.mulchnet.com). For some serious reading, see John Colwill's article at www.plantsman.com.au

4. When is enough enough? – do a simple soil test:

Using a piece of 20mm pvc pipe, remove mulch and surface trash and collect five or more representative core samples of your soil to at least 200mm deep. Thoroughly mix them together, then one-third fill a large glass jar with some of that total sample of soil. Then fill up to two-thirds with water and shake vigorously for a few minutes until everything is in suspension. Leave undisturbed for a day or two, and the ingredients will settle out in fairly distinct layers (soils with higher levels of dispersible clay may take some days to settle out).

Sand & gravel will sink to the bottom, followed by silt and then clay, though often a layer of humus will settle before the clay. Most of the raw organic matter will settle last or even float on the top. Then with a ruler you will be able to measure the proportions of the different materials and convert them to a percentage.

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